Curly-leaf Pondweed (*Potamogeton crispus*) and Eurasian Water-milfoil (*Myriophyllum spicatum*)

Pre/Post Herbicide and EWM Bed Mapping Surveys

Long Trade Lake – WBIC: 2640500

Polk County, Wisconsin

Curly-leaf pondweed – 5/12/20

2020 Final Treatment Areas

Yellow iris – a new exotic species

Project Initiated by: Round-Trade Lakes Improvement Association Inc., Lake Education and Planning Services, LLC, and the Wisconsin Department of Natural Resources (Grant ACEI21618)

Eurasian water milfoil (Berg 2007)

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 12, June 18, and August 29, 2020

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INTRODUCTION:

Long Trade Lake (WBIC 2640500) is a 150 acre drainage lake in northwest/north-central Polk County, Wisconsin in the Town of Laketown (T36N R18W S4 SE NE). It reaches a maximum depth of 13ft in two spots in the south basin and has an average depth of approximately 8ft. The lake is eutrophic bordering on hypereutrophic in nature with summer Secchi readings from 1986 to 2020 ranging from 1.2-3.3ft and averaging 2.2ft (WDNR 2020). This very poor water clarity produced a littoral zone that extended to approximately 7ft in 2020. The bottom substrate is primarily sand and gravel in the main basin with organic muck in sheltered bays (Miller et al. 1965).

Figure 1: 2020 CLP Treatment Areas

BACKGROUND AND STUDY RATIONALE:

In 1995, the Wisconsin Department of Natural Resources (WDNR) identified the presence of Hybrid Water-milfoil – a cross between Northern and Eurasian Water-milfoils (*Myriophyllum sibiricum* X *Myriophyllum spicatum*) in Long Trade Lake. However, a 2006 WDNR point-intercept survey found no milfoil of any kind in the lake. By 2011, the situation had changed again with milfoil that morphologically looks like and grows like Eurasian Water-milfoil (EWM) having taken over most of the lake's summer littoral areas. Following the development of a WDNR approved Aquatic Plant Management Plan (APMP) that outlined strategies to control EWM and Curly-leaf pondweed (*Potamogeton crispus*) (CLP) – another invasive exotic species that dominates the lake's spring littoral zone, the Round-Trade Lake Improvement Association, Inc. (RTLIA) began treating the lake with herbicides to control these species.

The RTLIA – under the direction of Dave Blumer (Lake Education and Planning Services, LLC - LEAPS) – applied for and was awarded a WDNR Aquatic Invasive Species control grant (ACEI21618) to help cover the costs associated with management. In 2020, these funds were used to chemically treat 8.69 acres (5.79% of the lake's surface area) for CLP and/or EWM (Figure 1). On May 12th, we conducted a pretreatment survey to gather baseline data from the proposed treatment areas and to allow LEAPS/RTLIA to finalize treatment plans. After the May 19th CLP treatment and the May 22nd EWM treatment, we completed a June 18th posttreatment survey to evaluate the effectiveness of the herbicide application. We also conducted an August 29th EWM bed mapping survey to determine where control might be considered in 2021. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Surveys:

LEAPS provided treatment shapefiles, and we generated pre/post survey points based on the size and shape of the proposed areas that covered 7.51 acres (1.18 acres were treated for both CLP and EWM). The requested 115 point sampling grid approximated to 15 pts/acre – well over the minimum of 4-10 pts/acre required by WDNR protocol for pre/post treatment surveys (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 and CLP were noted if they occurred within 6ft of the point; however, visuals of other species were not recorded as they do not figure into the pre/posttreatment calculation. In addition to plant data, we recorded the lake depth using a metered pole and the 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). Data was analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet. For pre/post differences of individual plant species as well as count data, we used the Chi-square analysis on the WDNR pre/post survey worksheet (UWEX 2010). For comparing averages (mean species/point and mean rake fullness/point), we used t-tests. Differences were determined to be significant at $p<0.05$, moderately significant at $p<0.01$ and highly significant at $p<0.001$.

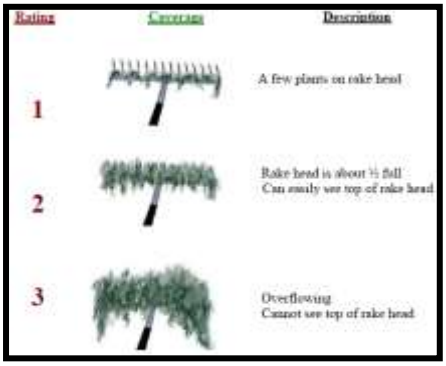


Figure 2: Rake Fullness Ratings

Late Summer Eurasian Water-milfoil Bed Mapping:

During the late summer survey, we searched the 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 both the range and mean rake fullness rating of EWM within the bed (Figure 2). Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we plotted these coordinates to generate bed shapefiles and determine the acreage to the nearest hundredth of an acre. We also took waypoints of EWM plants outside these beds as they were generally few in number.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat three beds totaling 6.30 acres for Curly-leaf pondweed using liquid Endothall (Aquathol K) and two beds totaling 2.39 acres for Eurasian water-milfoil using liquid 2,4-D (Shredder Amine) (Figure 3). Following the pretreatment survey that found CLP and EWM were present in each of these areas, the total acreage was left unchanged (Table 1) (Appendix I).

Northern Aquatic Services (Dale Dressel – Dresser, WI) carried out the CLP treatment on May 19th and the EWM treatment on May 22nd. During the initial treatment, the reported water temperature was 57°F and the ambient air temperature was 64°F with winds out of the northwest at 6mph. The follow-up treatment reported a water temperature of 57°F, an air temperature of 49°F, and winds from the southeast at 0-2mph.

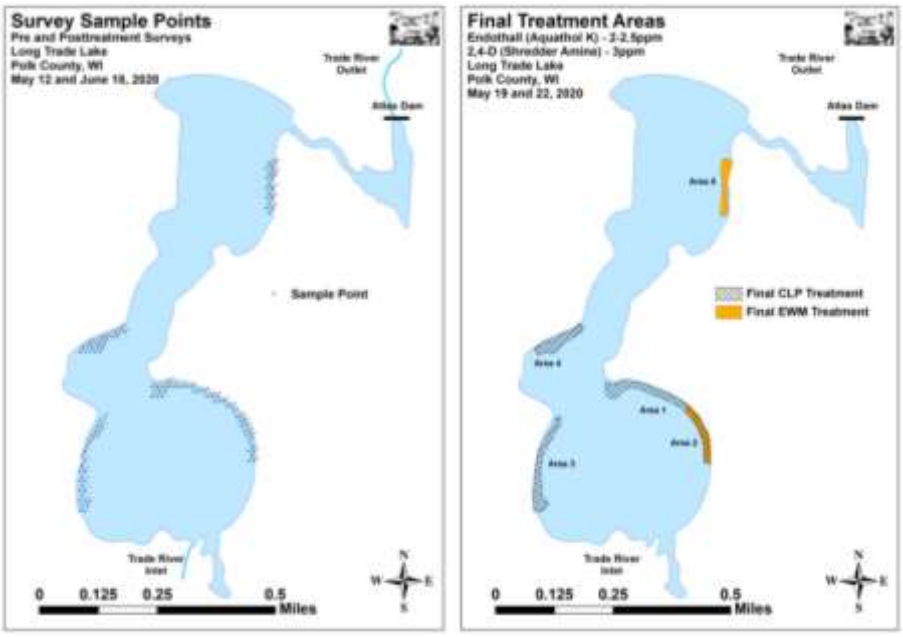


Figure 3: Survey Sample Points and Final Treatment Areas

Table 1: Spring CLP/EWM Treatment Summary
Long Trade Lake, Polk County
May 19 and 22, 2020

Treatment Area	Proposed Acreage	Final Acreage	Difference +/-	Chemical(s) – Dosage – Total Gallons
1	3.01	3.01	0.00	Endothall – 2.5ppm – 20.10gal.
2	1.18	1.18	0.00	2,4-D – 3ppm – 10.05gal.
3	1.92	1.92	0.00	Endothall – 2ppm – 10.20gal.
4	1.37	1.37	0.00	Endothall – 2ppm – 7.30gal.
5	1.21	1.21	0.00	2,4-D – 3ppm – 10.31gal.
Total Acres	**8.69**	**8.69**	**0.00**	

Pre/Post Herbicide Surveys:

All survey points occurred in areas between 1.0ft and 7.5ft of water. The mean and median depths of plant growth were almost unchanged from 3.3ft/3.0ft respectively pretreatment to 3.0ft /3.0ft posttreatment (Table 2). We found most CLP and EWM plants were established in a thin layer of muck over sand or rock (Figure 4) (Appendix III).

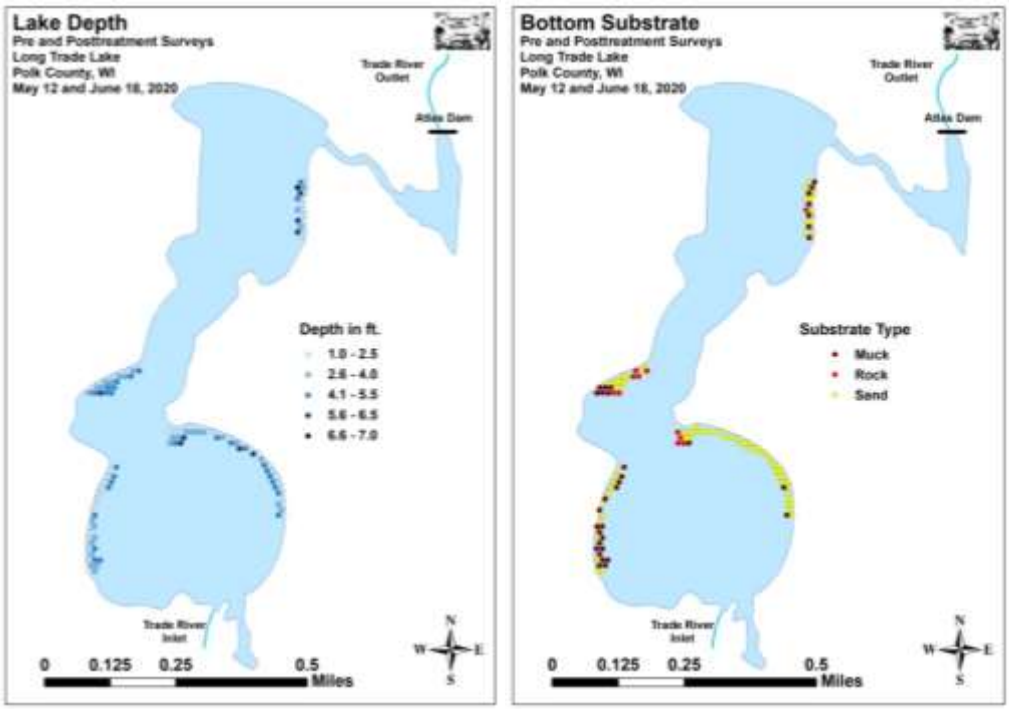


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Surveys Summary Statistics
Long Trade Lake, Polk County
May 12 and June 18, 2020

Summary Statistics:	Pre	Post
Total number of points sampled	115	115
Total number of sites with vegetation	104	73
Total number of sites shallower than the maximum depth of plants	115	113
Freq. of occur. at sites shallower than max. depth of plants (in percent)	90.4	64.6
Simpson Diversity Index	0.54	0.84
Mean Coefficient of Conservatism	4.3	4.6
Floristic Quality Index	8.5	14.5
Maximum depth of plants (ft)	7.0	6.0
Mean depth of plants (ft)	3.3	3.0
Median depth of plants (ft)	3.0	3.0
Average number of all species per site (shallower than max depth)	1.24	1.35
Average number of all species per site (veg. sites only)	1.38	2.10
Average number of native species per site (shallower than max depth)	0.41	1.23
Average number of native species per site (sites with native veg. only)	1.18	2.14
Species richness	6	12
Mean rake fullness (veg. sites only)	1.92	1.66

The littoral zone within the beds declined from 7.0ft pretreatment to 6.0ft posttreatment – presumably due to the loss of CLP plants that dominated the deep water edge. Frequency of occurrence also fell from 90.4% pretreatment to 64.6% posttreatment (Figure 5) (Appendix IV). Total richness doubled from six species pretreatment to 12 species posttreatment. The Simpson's Diversity Index also increased sharply from a moderate pretreatment value of 0.54 to a high posttreatment value of 0.84. The Floristic Quality Index (another measure of native plant community health) climbed from 8.5 pretreatment to 14.5 posttreatment.

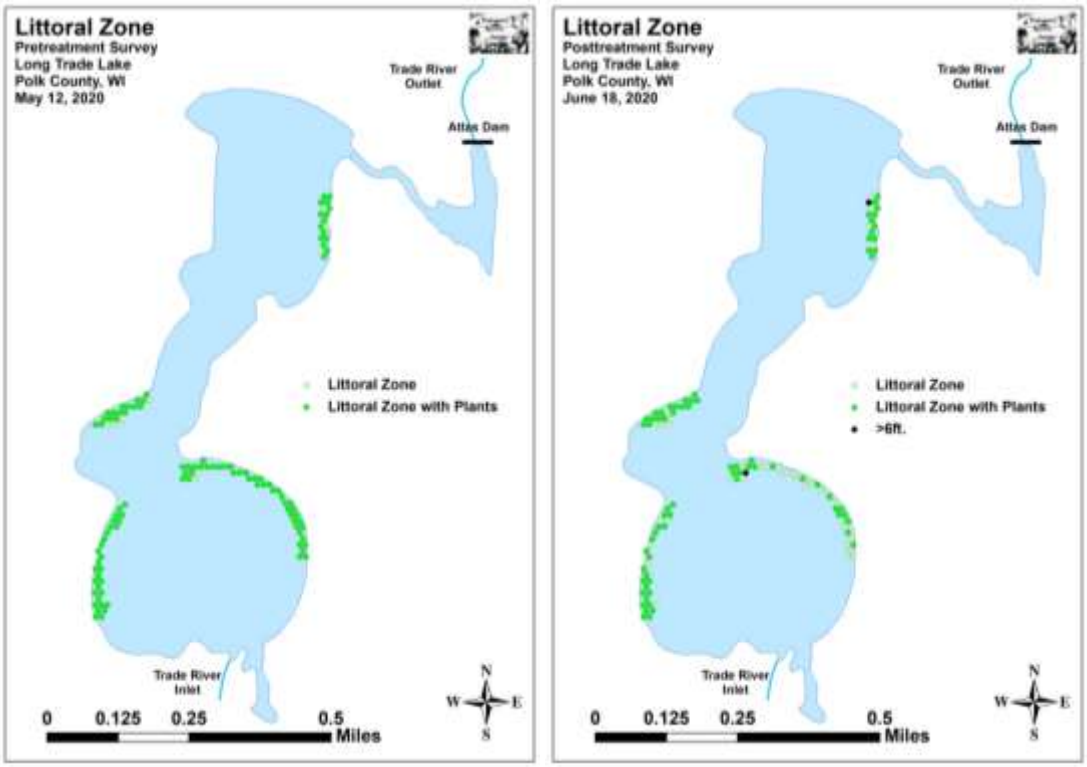


Figure 5: Pre/Post Littoral Zone

Mean native species richness at points with native vegetation increased from 1.18 species/point pretreatment to 2.14 species/point posttreatment (Figure 6). Although this increase in localized richness was highly significant **(p<0.001)**, it can largely be attributed to the rise in "duckweeds". Conversely, total mean rake fullness saw a moderately significant decline **(p=0.008)** from a moderate 1.92 pretreatment to a low/moderate 1.66 posttreatment (Figure 7) (Appendix IV).

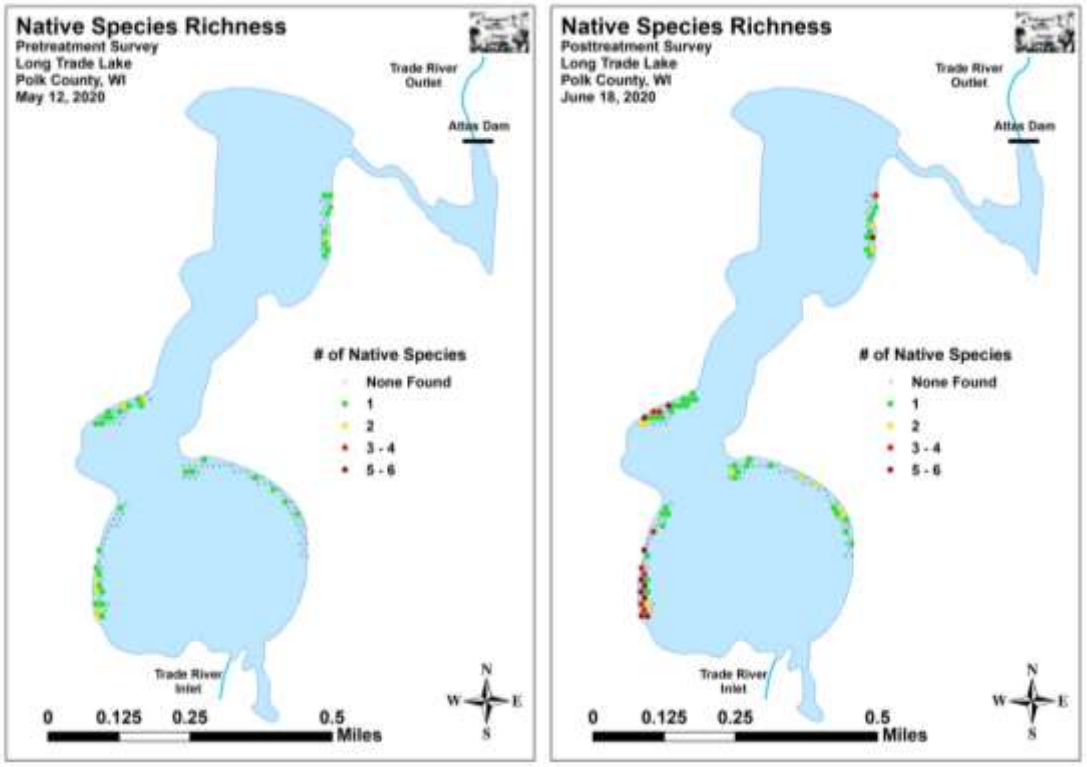


Figure 6: Pre/Post Native Species Richness

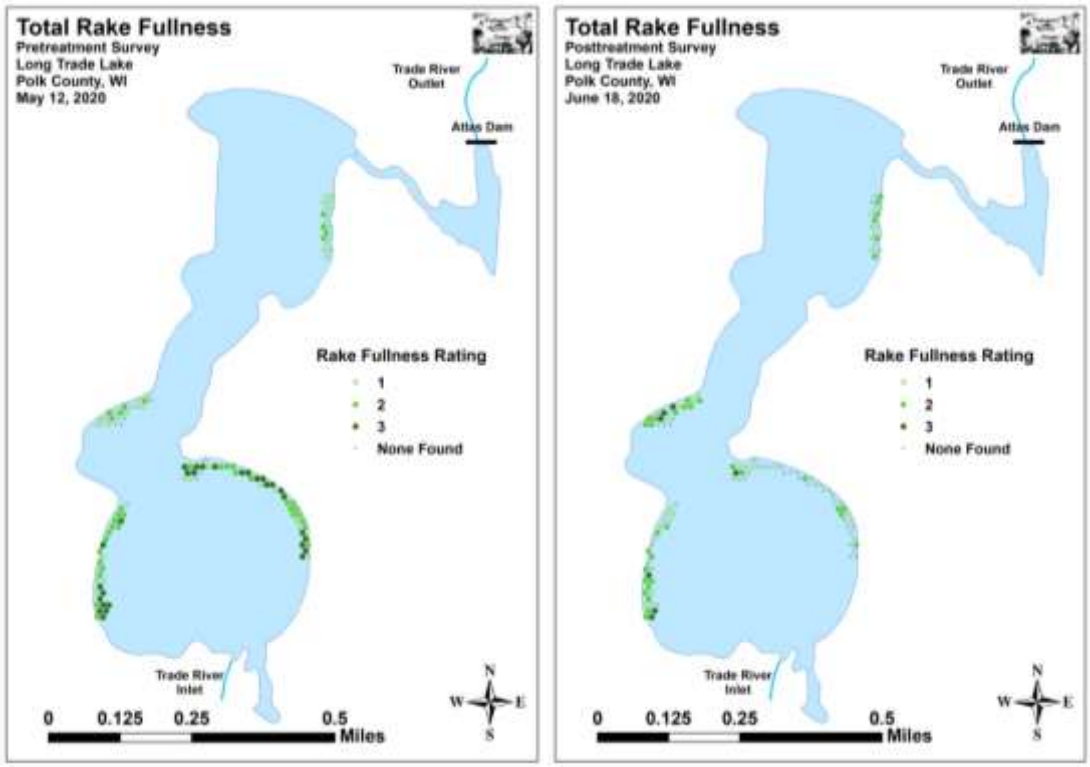


Figure 7: Pre/Post Total Rake Fullness

We found Curly-leaf pondweed at 90 of 115 sites during the pretreatment survey (78.3% coverage) with six additional visual sightings (Figure 8) (Appendix V). Of these, 28 had a rake fullness rating of 3, 32 rated a 2, and the remaining 30 were a 1. This produced a mean rake fullness of 1.98 and suggested that 52.2% of the treatment areas had a significant CLP infestation (rake fullness 2 and 3).

During the posttreatment survey, we found CLP at 11 points (9.6% coverage) (Figure 8). Of these, none rated a 3, two were a 2, and nine were a 1 for a mean rake fullness of 1.18. The two nuisance points suggested that just 1.7% of the beds still had a significant CLP infestation posttreatment. **Our results demonstrated a highly significant decline ($p<0.001$) in total CLP density, distribution, and rake fullness 3, 2, and 1; and a significant decline ($p=0.01$) in visual sightings** (Figure 9).

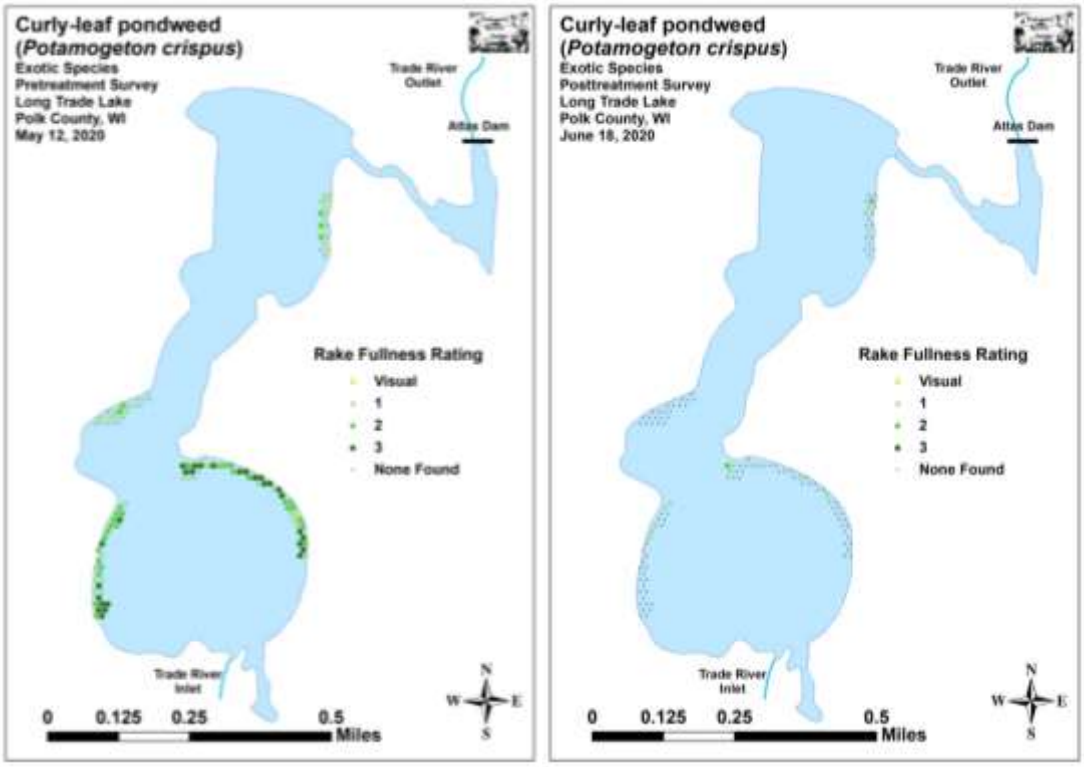
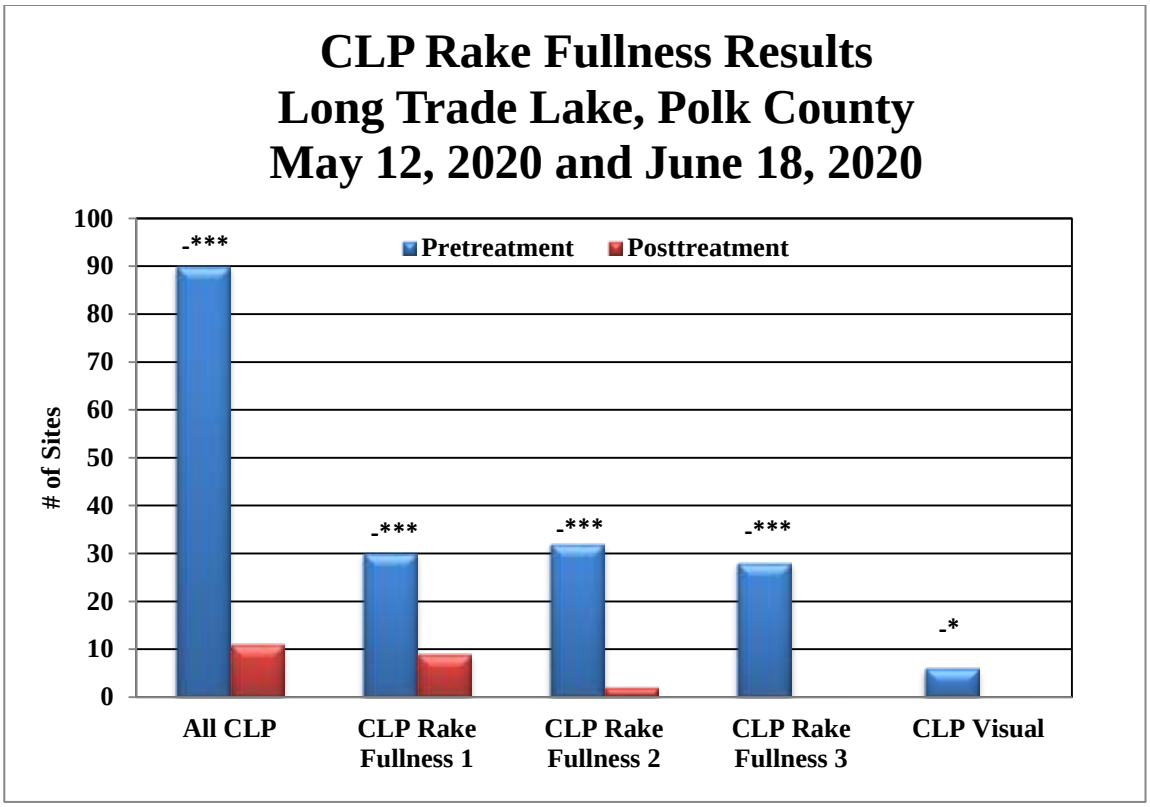


Figure 8: Pre/Post CLP Density and Distribution



Significant differences = * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 9: Pre/Post Changes in CLP Rake Fullness

Eurasian water-milfoil was present at six of 115 sites during the pretreatment survey (5.2% coverage) with six additional visual sightings (Figure 10) (Appendix V). Of these, none had a rake fullness rating of 3, three rated a 2, and the remaining three were a 1. This produced a mean rake fullness of 1.50 and suggested that just 2.6% of the treatment areas had a significant EWM infestation (rake fullness 2 and 3).

During the posttreatment survey, we found EWM at three points (2.6% coverage) with one additional visual sighting (Figure 10). None rated a 3, one was a 2, and two were a 1 for a mean rake fullness of 1.33. The single nuisance point suggested 0.9% of the beds still had a significant EWM infestation posttreatment. **Due to the low number of detections, none of these changes were statistically significant, although the decline in visual sightings was nearly significant (p=0.05)** (Figure 11).

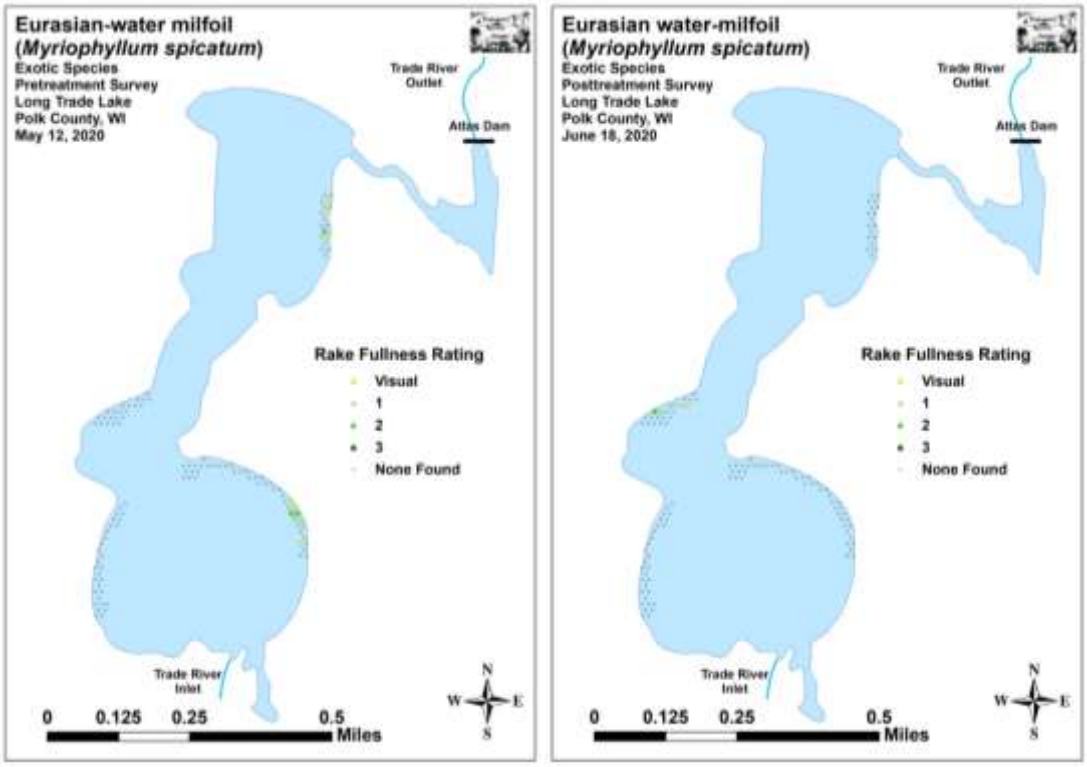
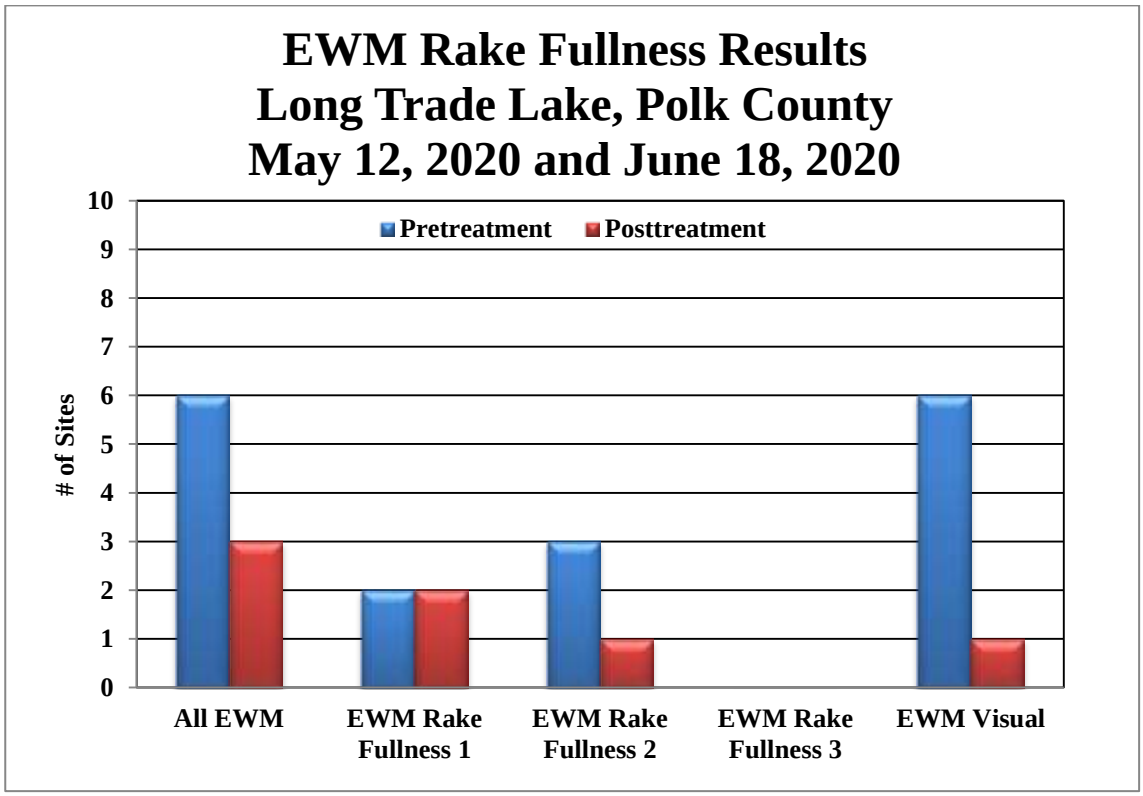


Figure 10: Pre/Post EWM Density and Distribution



Significant differences = * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure11: Pre/Post Changes in EWM Rake Fullness

Coontail (*Ceratophyllum demersum*) and White water lily (*Nymphaea odorata*) were the most common native species during both the pretreatment (Table 3) and posttreatment surveys (Table 4). Coontail was present at 34 points with a mean rake fullness of 1.24 before undergoing a significant increase **(*p*=0.03)** in distribution and a highly significant increase **(*p*<0.001)** in density posttreatment (50 sites/mean rake 1.66) (Figure 12).

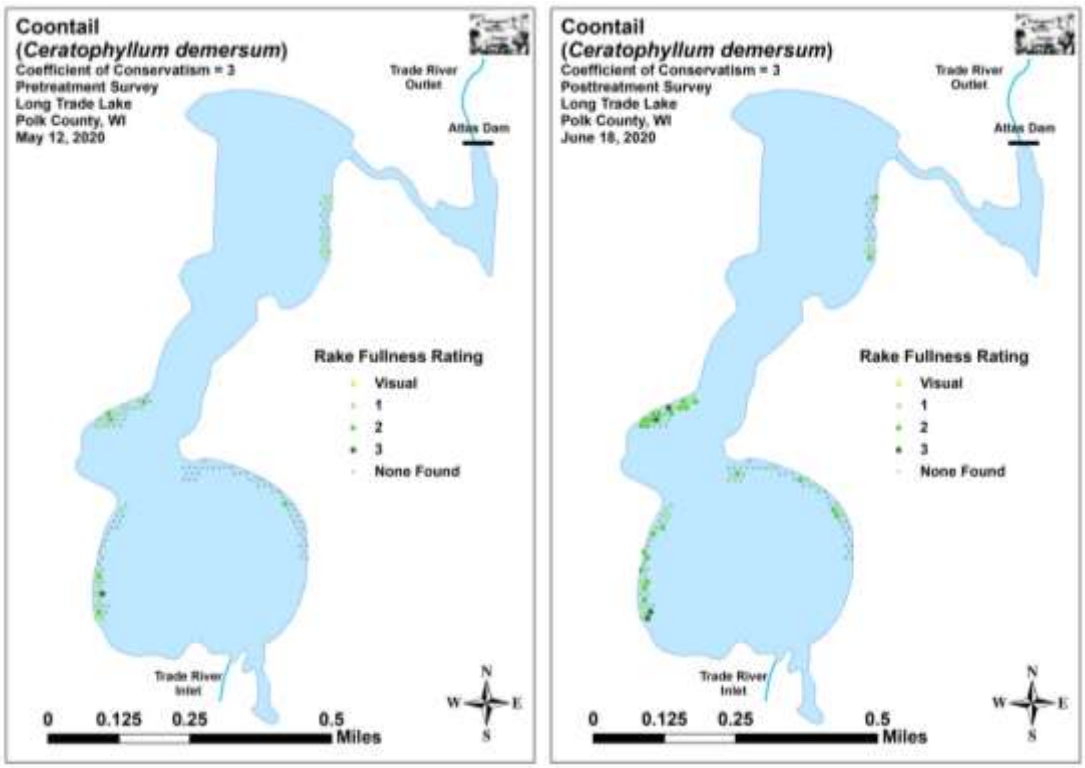


Figure 12: Pre/Post Coontail Density and Distribution

We found White water lily at seven points with a mean rake of 1.14 pretreatment (Figure 13). Posttreatment, this late-growing species also underwent a significant increase **(*p*=0.03)** in distribution (19 points) and a moderately significant increase **(*p*=0.007)** in density (mean rake of 1.68).

In addition to Coontail and White water lily, we documented highly significant increases **(*p*<0.001)** in Small duckweed (*Lemna minor*), Large duckweed (*Spirodela polyrhiza*), and Common watermeal (*Wolffia columbiana*); and a significant increase **(*p*=0.01)** in Slender naiad (*Najas flexilis*). Other than CLP, EWM, and filamentous algae, no species declined posttreatment (Figure 14) (Maps for all native species from both the pre and posttreatment surveys are available in Appendixes VI and VII).

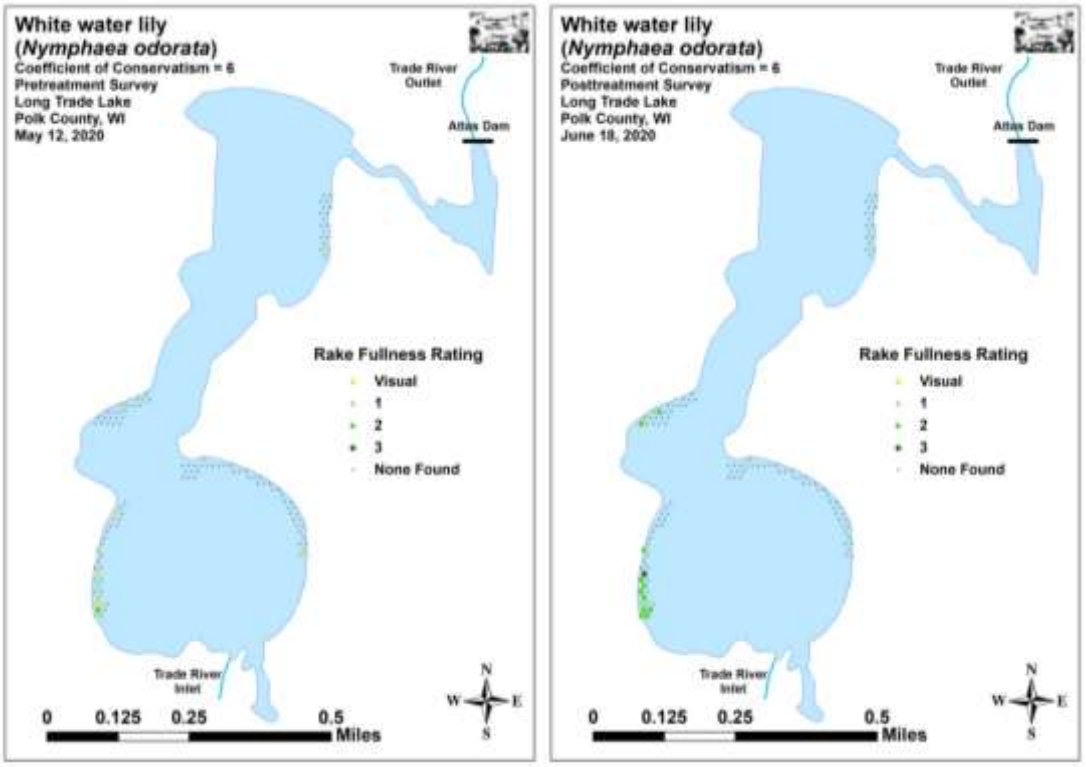


Figure 13: Pre/Post White Water Lily Density and Distribution

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Pretreatment Survey – Long Trade Lake, Polk County
May 12, 2020

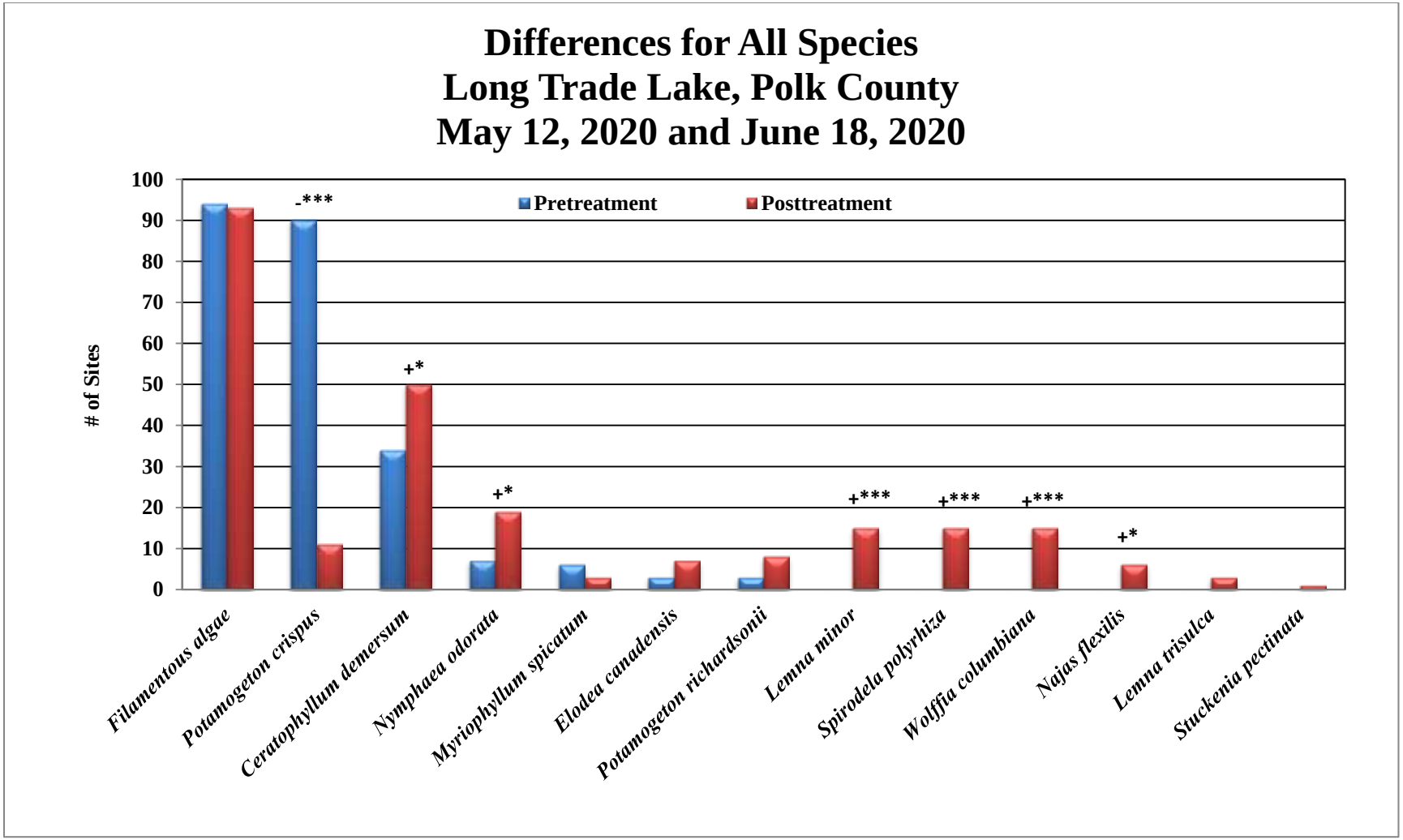
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
	Filamentous algae	94	*	90.38	81.74	1.84	0
Potamogeton crispus	Curly-leaf pondweed	90	62.94	86.54	78.26	1.98	6
Ceratophyllum demersum	Coontail	34	23.78	32.69	29.57	1.24	0
Nymphaea odorata	White water lily	7	4.90	6.73	6.09	1.14	6
Myriophyllum spicatum	Eurasian water milfoil	6	4.20	5.77	5.22	1.50	6
Elodea canadensis	Common waterweed	3	2.10	2.88	2.61	1.00	0
Potamogeton richardsonii	Clasping-leaf pondweed	3	2.10	2.88	2.61	1.00	0

* Excluded from relative frequency analysis

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes Posttreatment Survey – Long Trade Lake, Polk County June 18, 2020

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
	Filamentous algae	93	*	**127.40	82.30	1.73	0
Ceratophyllum demersum	Coontail	50	32.68	68.49	44.25	1.66	0
Nymphaea odorata	White water lily	19	12.42	26.03	16.81	1.68	0
Lemna minor	Small duckweed	15	9.80	20.55	13.27	1.73	0
Spirodela polyrhiza	Large duckweed	15	9.80	20.55	13.27	1.73	0
Wolffia columbiana	Common watermeal	15	9.80	20.55	13.27	1.67	0
Potamogeton crispus	Curly-leaf pondweed	11	7.19	15.07	9.73	1.18	0
Potamogeton richardsonii	Clasping-leaf pondweed	8	5.23	10.96	7.08	1.38	0
Elodea canadensis	Common waterweed	7	4.58	9.59	6.19	1.57	0
Najas flexilis	Slender naiad	6	3.92	8.22	5.31	1.33	0
Lemna trisulca	Forked duckweed	3	1.96	4.11	2.65	1.00	0
Myriophyllum spicatum	Eurasian water milfoil	3	1.96	4.11	2.65	1.33	1
Stuckenia pectinata	Sago pondweed	1	0.65	1.37	0.88	1.00	0

* Excluded from relative frequency analysis **Frequency is greater than 100% because filamentous algae are not considered in the vegetation calculation



Significant differences = * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 14: Pre/Post Macrophyte Changes

Late Summer Eurasian Water-milfoil Bed Mapping Survey:

Eurasian water-milfoil continues to occupy a relatively low percentage of the lake's macrophyte community. Our late summer survey found two microbeds that totaled 0.20 acre (Table 5). Outside of these locations, we found and rake removed a total of just six additional plants. This represented a sharp decline (-79.38%) in coverage from the 0.97 acre and 19 additional plants we documented in 2019 (Figure 15) (Appendix VIII). It was, however, still above the 0.02 acre we found in 2018 (Table 6).

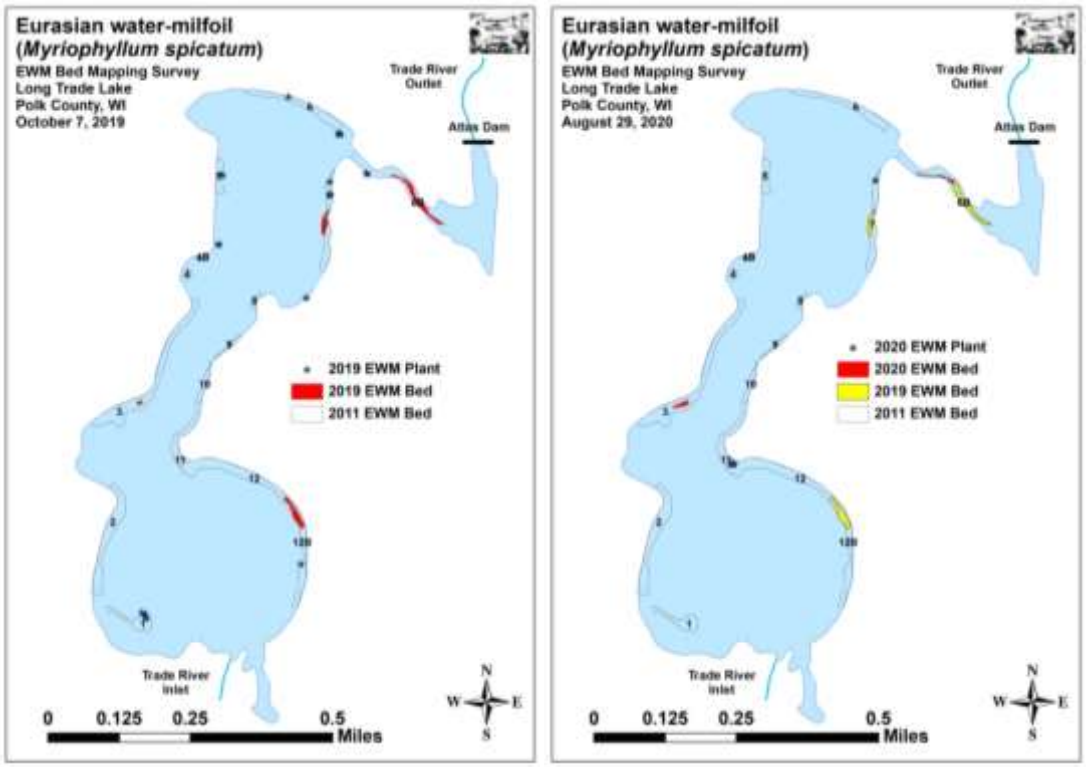


Figure 15: Fall 2019 and Late Summer 2020 EWM Bed Maps

Table 5: Late Summer Eurasian Water-milfoil Bed Mapping Summary
Long Trade Lake, Polk County
August 29, 2020

Bed Number	2020 Area in Acres	2019 Area in Acres	2020 Change in Acreage	Rake Range and Mean Rake Fullness	Depth Range and Mean Depth	Navigation Impairment	2020 Field Notes
1	0	0	0	-	-	-	No EWM found
2 and 2A	0	0	0	-	-	-	No EWM found
3, 3A, and 3B	0.11	0.04	0.07	<<1-1, 1	2-5; 4	Minor	Perhaps 100 plants scattered among WWL
4	0	0	0	-	-	-	No EWM found
4B	0	0.02	-0.02	-	-	-	No EWM found
5	0	0	0	-	-	-	No EWM found
6	0	0	0	-	-	-	No EWM found
6B	0.09	0.44	-0.35	<1-3; 3	1-2; 2	Moderate	100s of plants – canopied mat in outlet
Mill Pond	0	0	0	-	-	-	No EWM found
7	0	0.16	-0.16	<<<1	1-2; 2	None	Single EWM plant – rake removed
8	0	0	0	-	-	-	No EWM found
9	0	0	0	-	-	-	No EWM found
10	0	0	0	-	-	-	No EWM found
11	0	0	0	-	-	-	No EWM found
12 and 12A	0	0.31	-0.31	<<<1-2; <<<1	1-2; 2	None	Five small towers – rake removed
13	0	0	0	-	-	-	No EWM found
Total Acres	**0.20**	**0.97**	**-0.77**				

Table 6: Historical Late Summer/Fall Eurasian Water-milfoil Bed Mapping Summary
Long Trade Lake, Polk County
2011-2020

Bed Number	2020 Area in Acres	2019 Area in Acres	2018 Area in Acres	2017 Area in Acres	2016 Area in Acres	2015 Area in Acres	2014 Area in Acres	2013 Area in Acres	2012 Area in Acres	2011 Area in Acres
1	0	0	0	0.02	0	0.36	0	0	0.45	0.70
2 and 2A	0	0	0	0.05	0	0.54	0	0	0	1.89
3, 3A, and 3B	0.11	0.04	0	0.26	0	2.24	0	0	0.02	2.69
4	0	0	0	0	0	0	0	0	0	0.13
4B	0	0.02	0	0.01	0	0.12	0	0	0.03	0
5	0	0	0	0	0	0	0	0	0	0.51
6	0	0	0	0.23	0	1.52	0	0	0.13	1.23
6B	0.09	0.44	0.02	0.29	0	2.18	0.22	0	0.76	0
Mill Pond	0	0	0	0	0	0	0	0	0	0
7	0	0.16	0	0	0	0.73	0	0	0.21	1.03
8	0	0	0	0	0	0.01	0	0	0	0.11
9	0	0	0	0.01	0	0	0	0	0	0.16
10	0	0	0	0.02	0	0	0	0	0	0.29
11	0	0	0	<0.01	0	0.48	0	0	0	0.88
12 and 12A	0	0.31	0	0.09	0	3.05	0	0	0	3.35
13	0	0	0	0.02	0	0.09	0	0	0	0
Total Acres	**0.20**	**0.97**	**0.02**	**1.00**	**0.00**	**11.33**	**0.22**	**0.00**	**1.60**	**12.97**

Descriptions of Current and Former Eurasian Water-milfoil Beds:

Beds1and 2 – We saw no evidence of Eurasian water-milfoil in either of these former beds.

Bed 3 – The Endothall treatment did not knock out EWM in this area. Plants were mixed in with Coontail and White water lily. Although several areas were canopied, because they weren't directly in front of any residence, it seems unlikely it would be more than a minor impairment.

Beds 4, 4B, 5, and 6 – We saw no evidence of EWM anywhere in these former beds along the lake's west-central, northwest, or northern shorelines.

Bed 6B and Mill Pond – A narrow but moderate to high density EWM bed again covered the shallow areas near the old bridge in the lake outlet. This spot seems to naturally filter out fragments as it's always the first place in the channel to reestablish. With the exception of a few floating fragments, we saw no evidence of EWM in the Mill Pond.

Bed 7 – In the treatment area north of the public boat landing, we rake removed a single EWM plant.

Beds 8-11 – We didn't find any EWM plants along the eastern shoreline midlake in these former beds.

Beds 12 and 12A – A small micro-cluster of five towers occurred on the western edge of Bed 12 in an area that was treated for CLP but not EWM in 2020. Plants occurred in shallow water near a dock, and they appeared to be newly established as they had only a few stems.

Bed 13 – We found no sign of EWM anywhere near the river inlet or in the slough inlet on the lake's south/southeast shoreline.

LITERATURE CITED

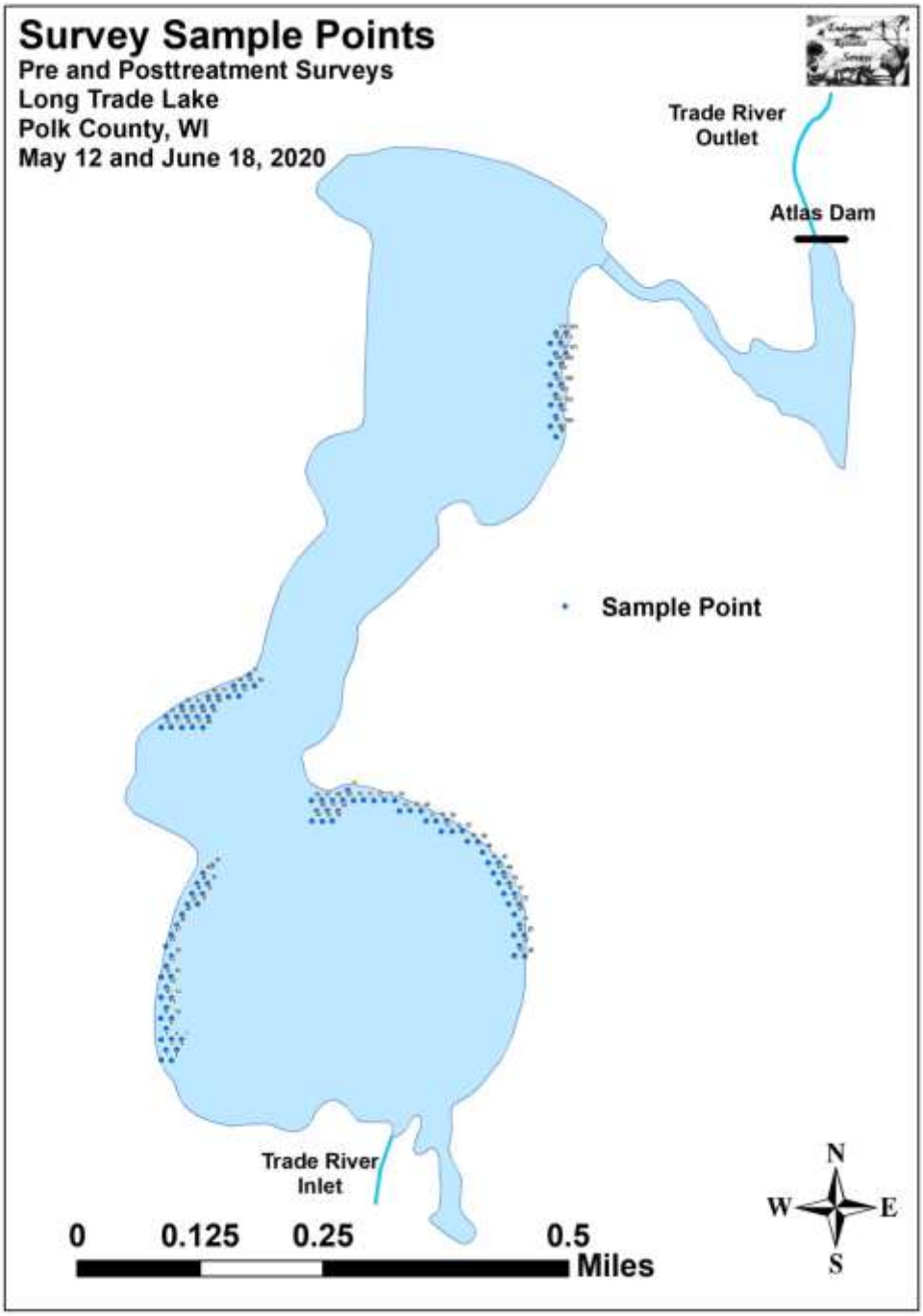
Miller, G., M. Perkins, L. Sather, and E. Eaton [online]. 1965. Long Trade Lake Bathymetric Map. http://dnr.wi.gov/lakes/maps/DNR/2640500a.pdf (2020, October).

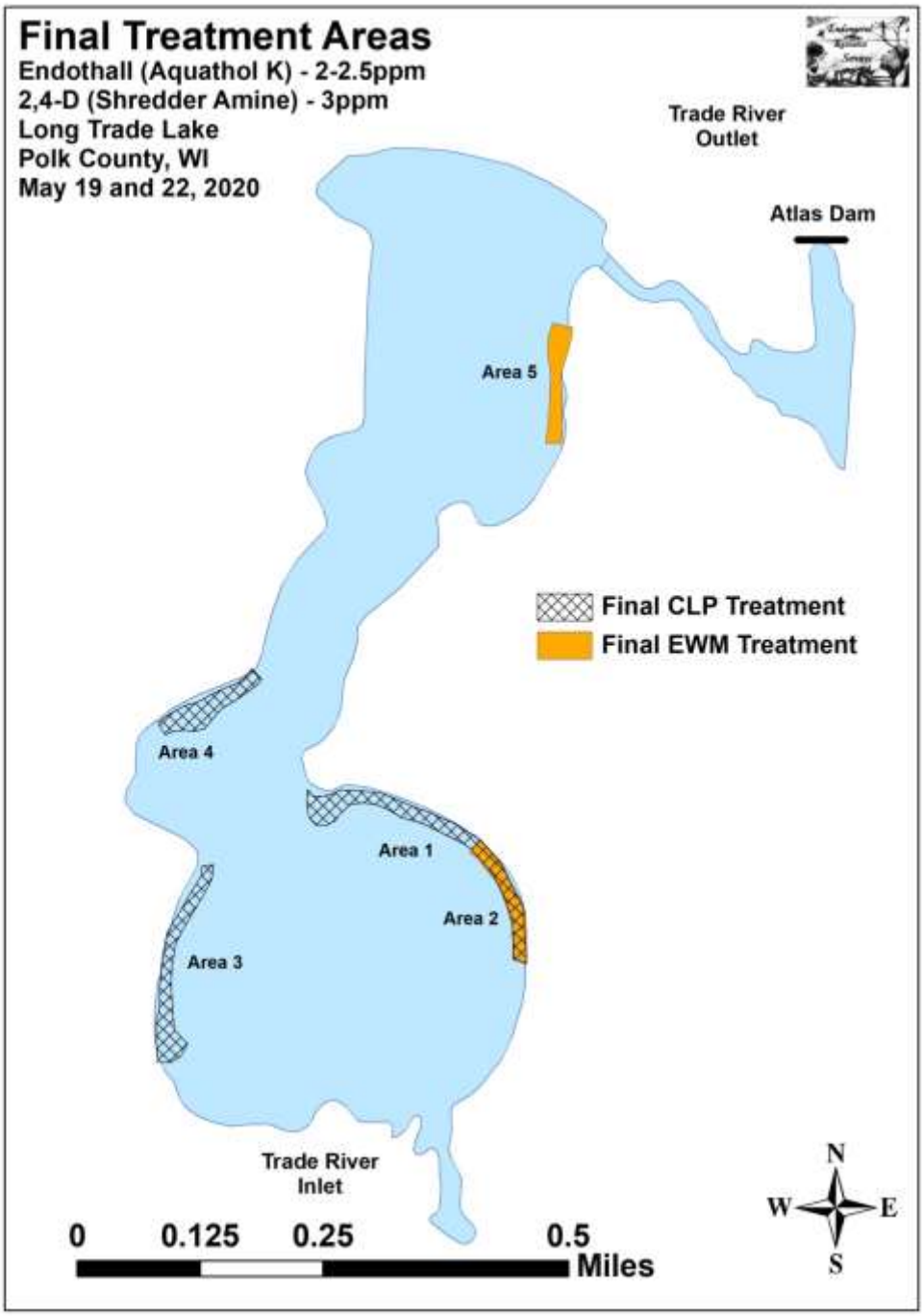
UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/ecology/aquaticplants/default.aspx (2020, October).

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 (2020, October).

WDNR. [online]. 2020. Long Trade Lake - Citizen Lake Water Quality Monitoring Database. Available from http://dnr.wi.gov/lakes/waterquality/Station.aspx?id=493080 (2020, October).

Appendix I: Survey Sample Points and Final Treatment Areas

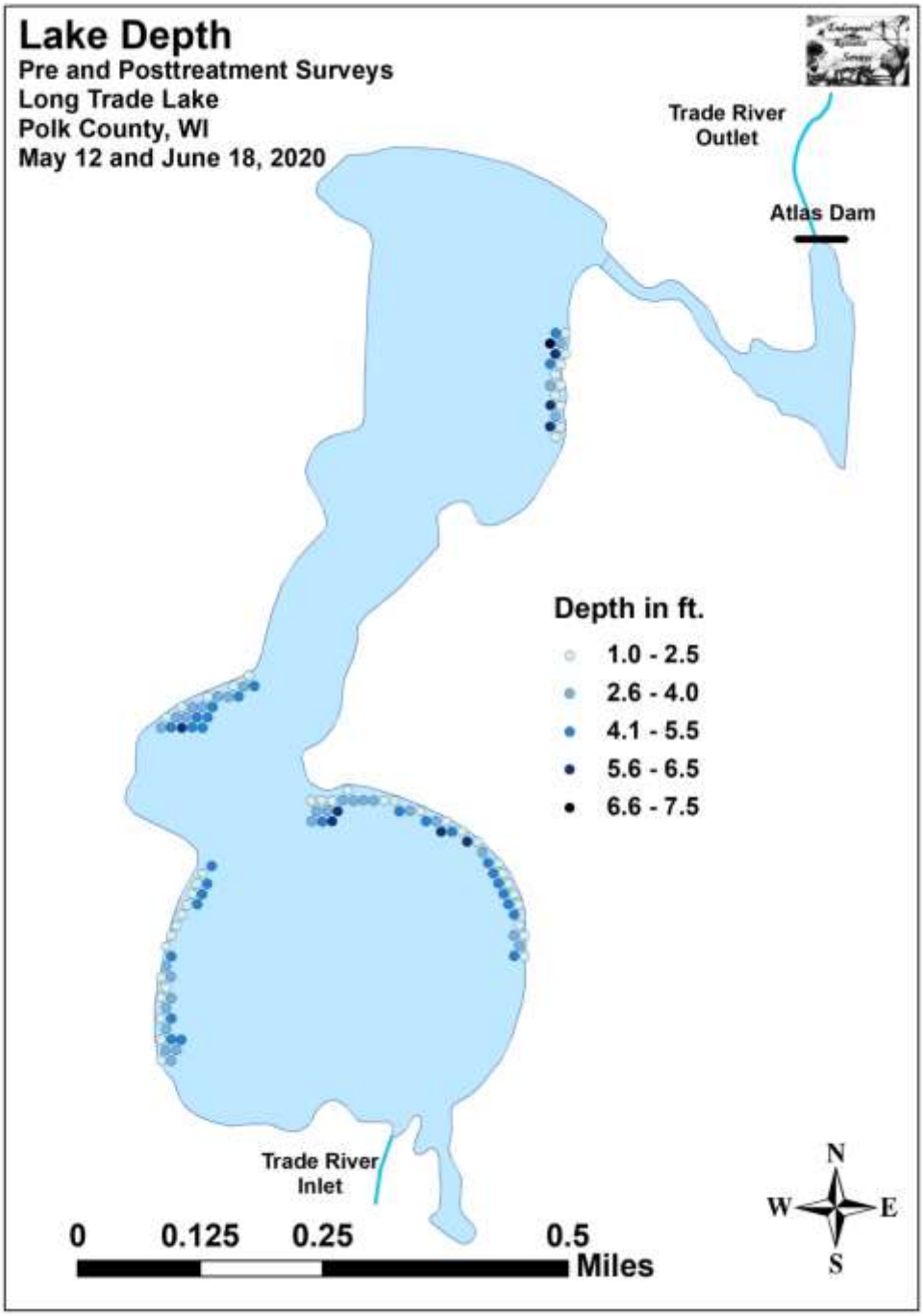

Survey Sample Points
Pre and Posttreatment Surveys
Long Trade Lake
Polk County, WI
May 12 and June 18, 2020
Trade River
Outlet
Atlas Dam
Sample Point
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

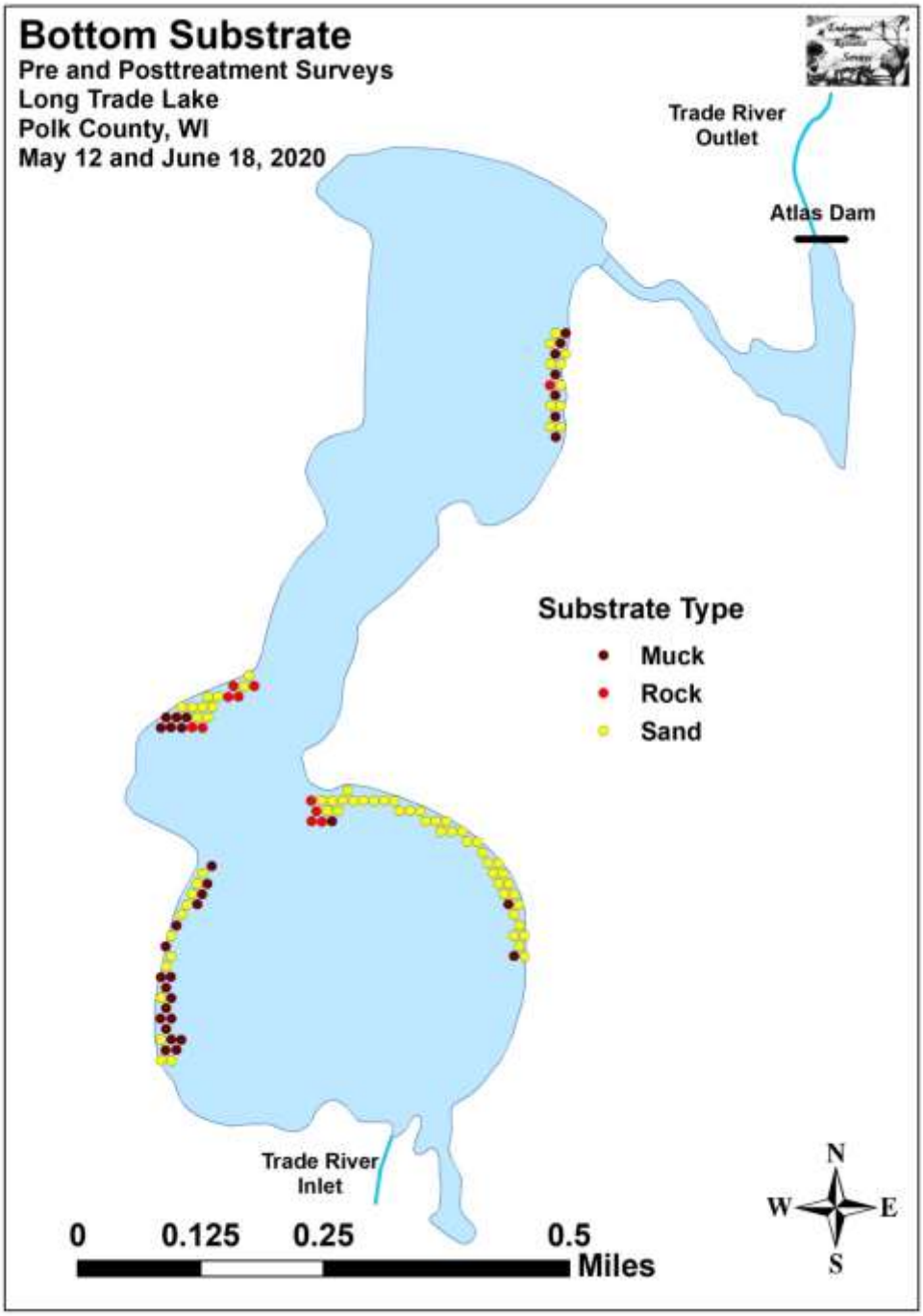

Final Treatment Areas
Endothall (Aquathol K) - 2-2.5ppm
2,4-D (Shredder Amine) - 3ppm
Long Trade Lake
Polk County, WI
May 19 and 22, 2020
Trade River Outlet
Atlas Dam
Area 5
Final CLP Treatment
Final EWM Treatment
Area 4
Area 1
Area 2
Area 3
Trade River Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

Appendix II: Vegetative Survey Datasheet

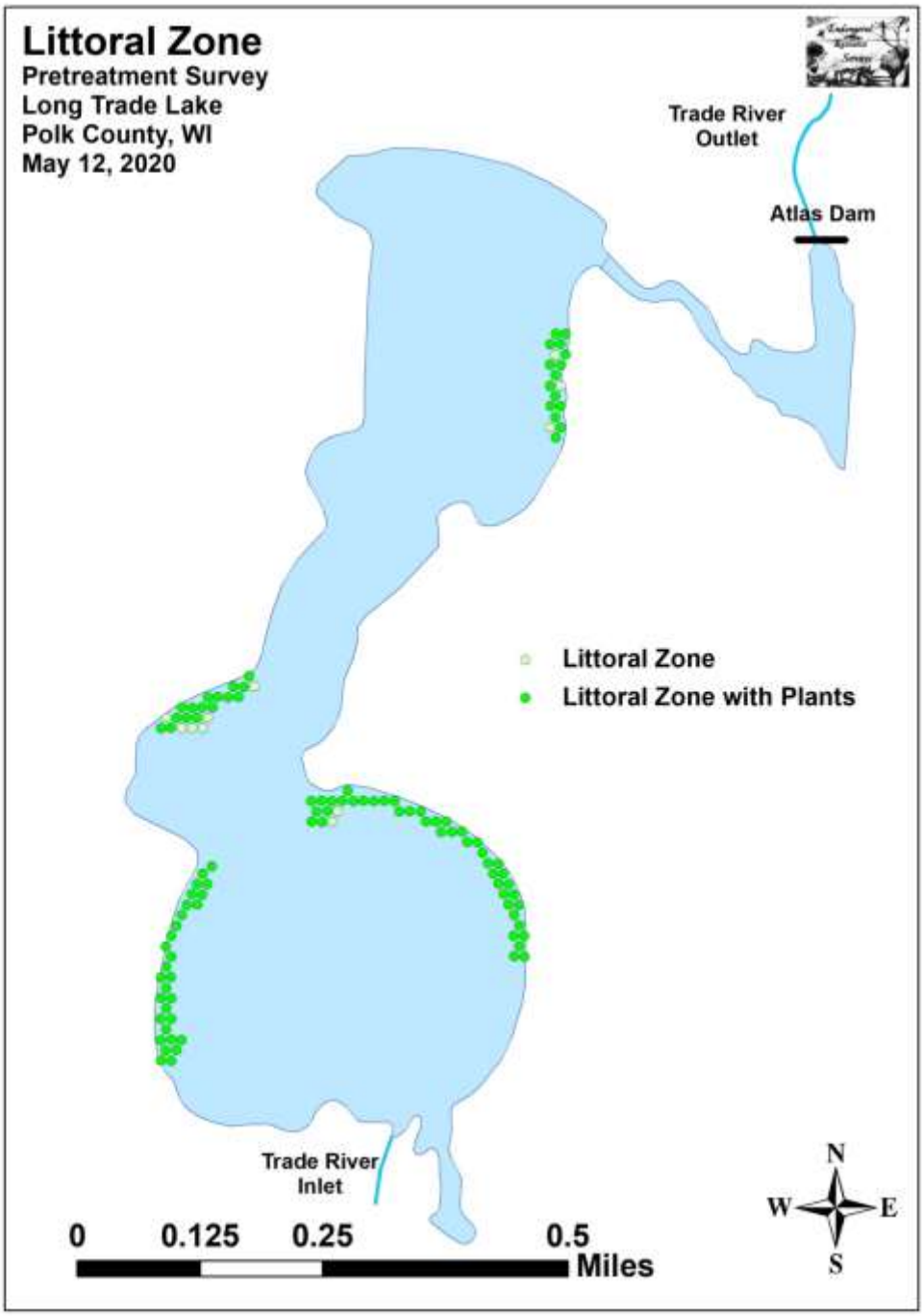
Observers for this lake: names and hours worked by each:																										
Lake:									**WBIC**									**County**						**Date:**	
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**CLP**	**1**	**2**	**3**	**4**	**5**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

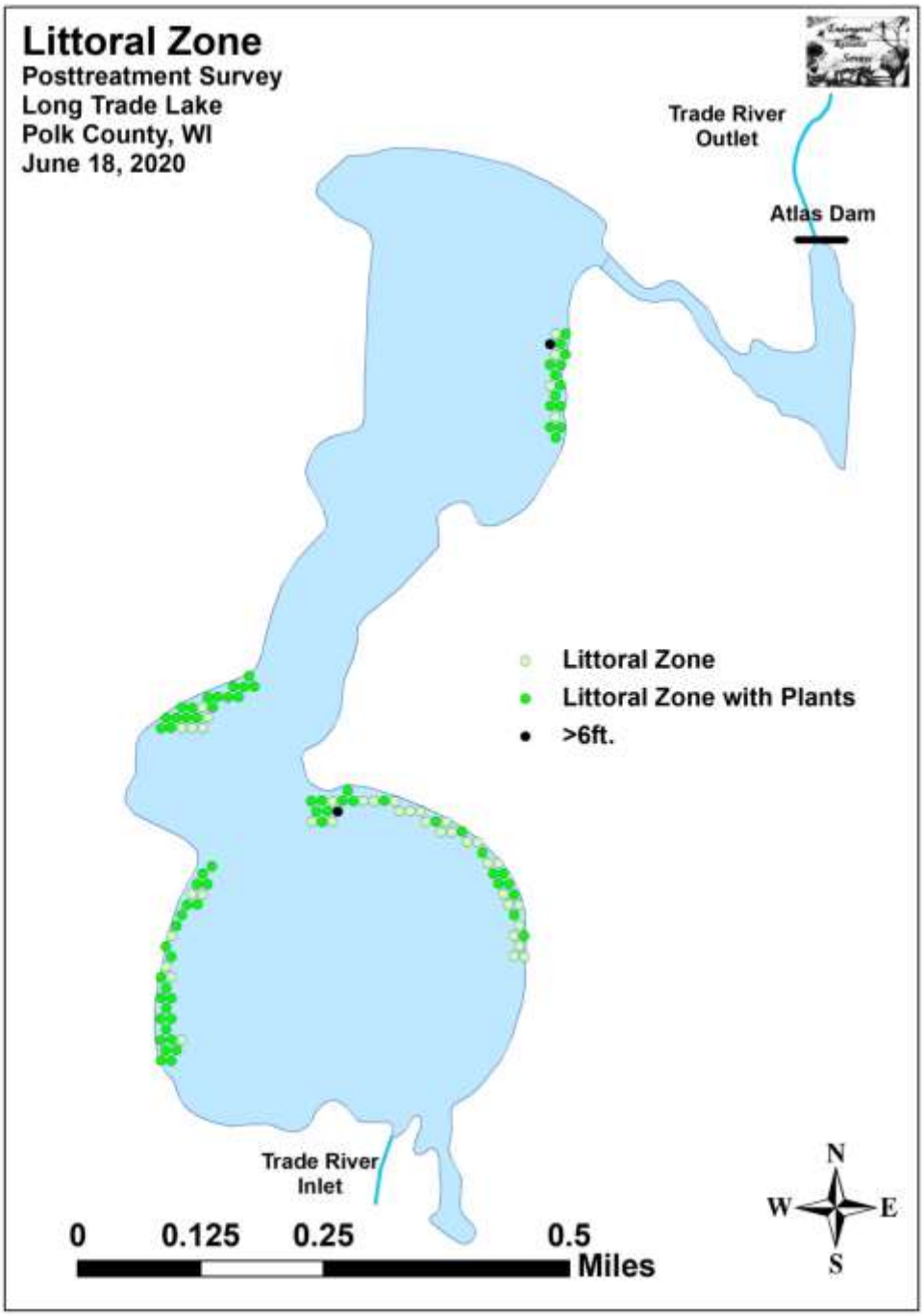
Appendix III: Pre/Post Habitat Variable Maps

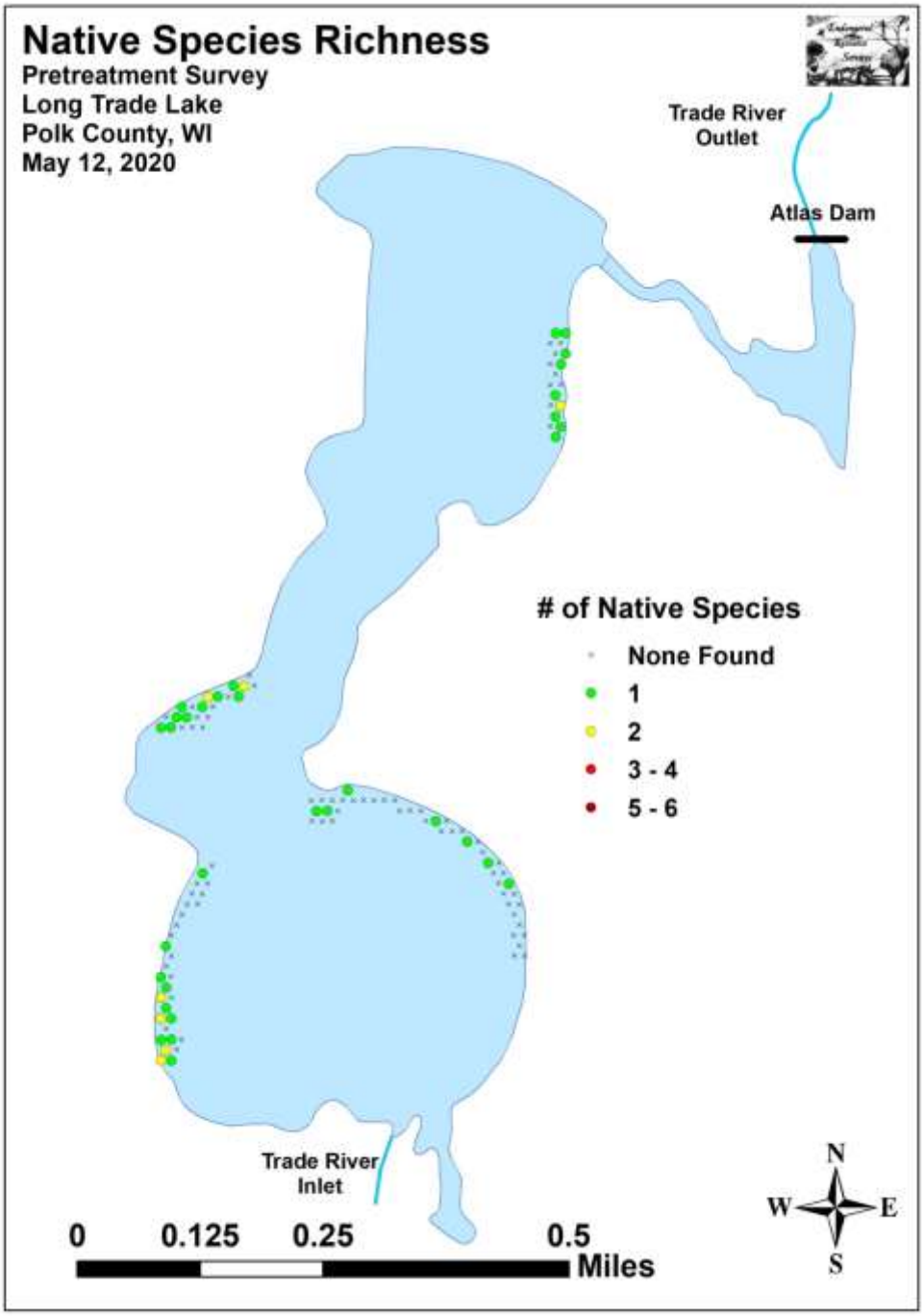

Lake Depth
Pre and Posttreatment Surveys
Long Trade Lake
Polk County, WI
May 12 and June 18, 2020
Trade River
Outlet
Atlas Dam
Depth in ft.
1.0 - 2.5
2.6 - 4.0
4.1 - 5.5
5.6 - 6.5
6.6 - 7.5
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

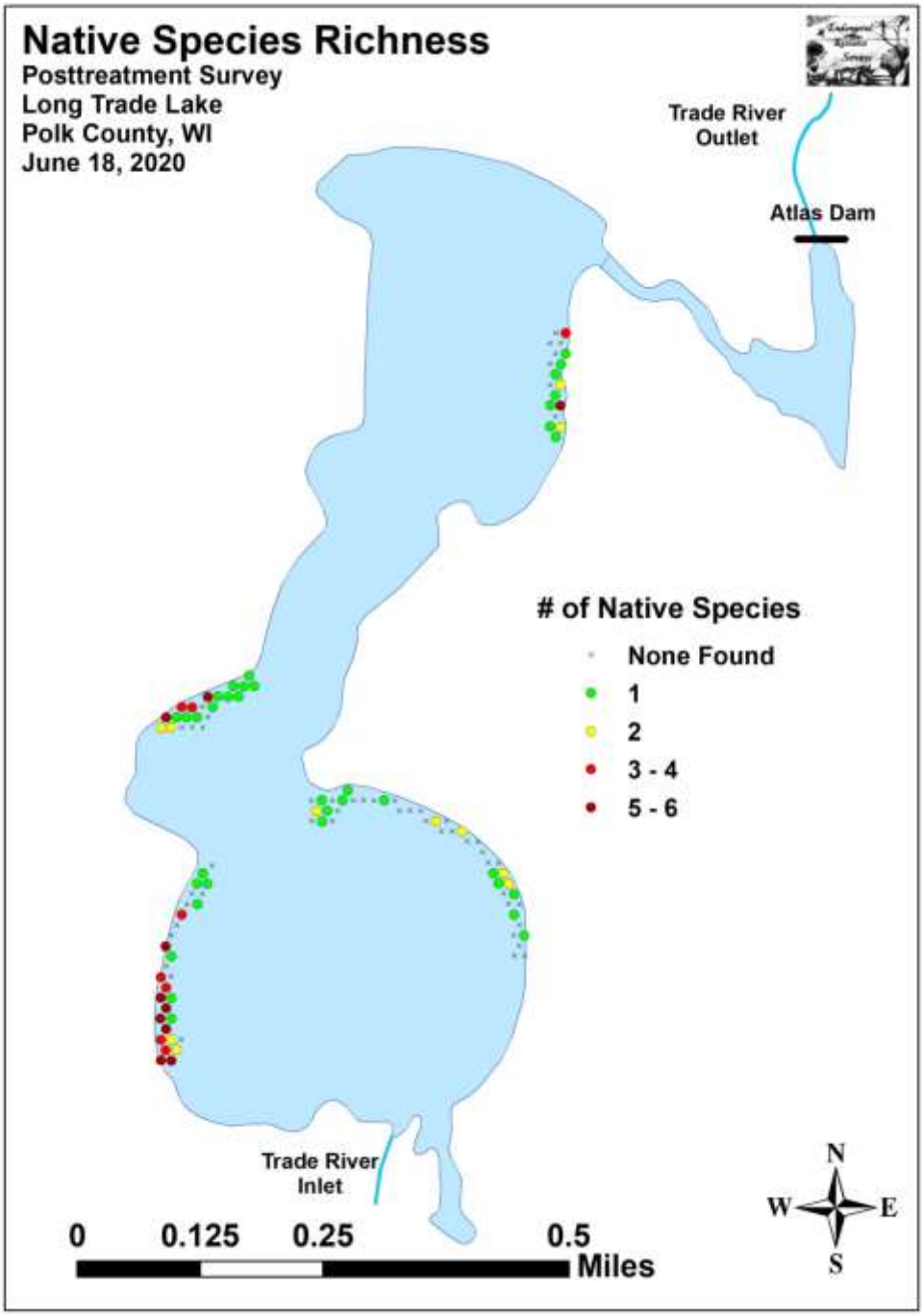

Bottom Substrate
Pre and Posttreatment Surveys
Long Trade Lake
Polk County, WI
May 12 and June 18, 2020
Trade River
Outlet
Atlas Dam
Substrate Type
Muck
Rock
Sand
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

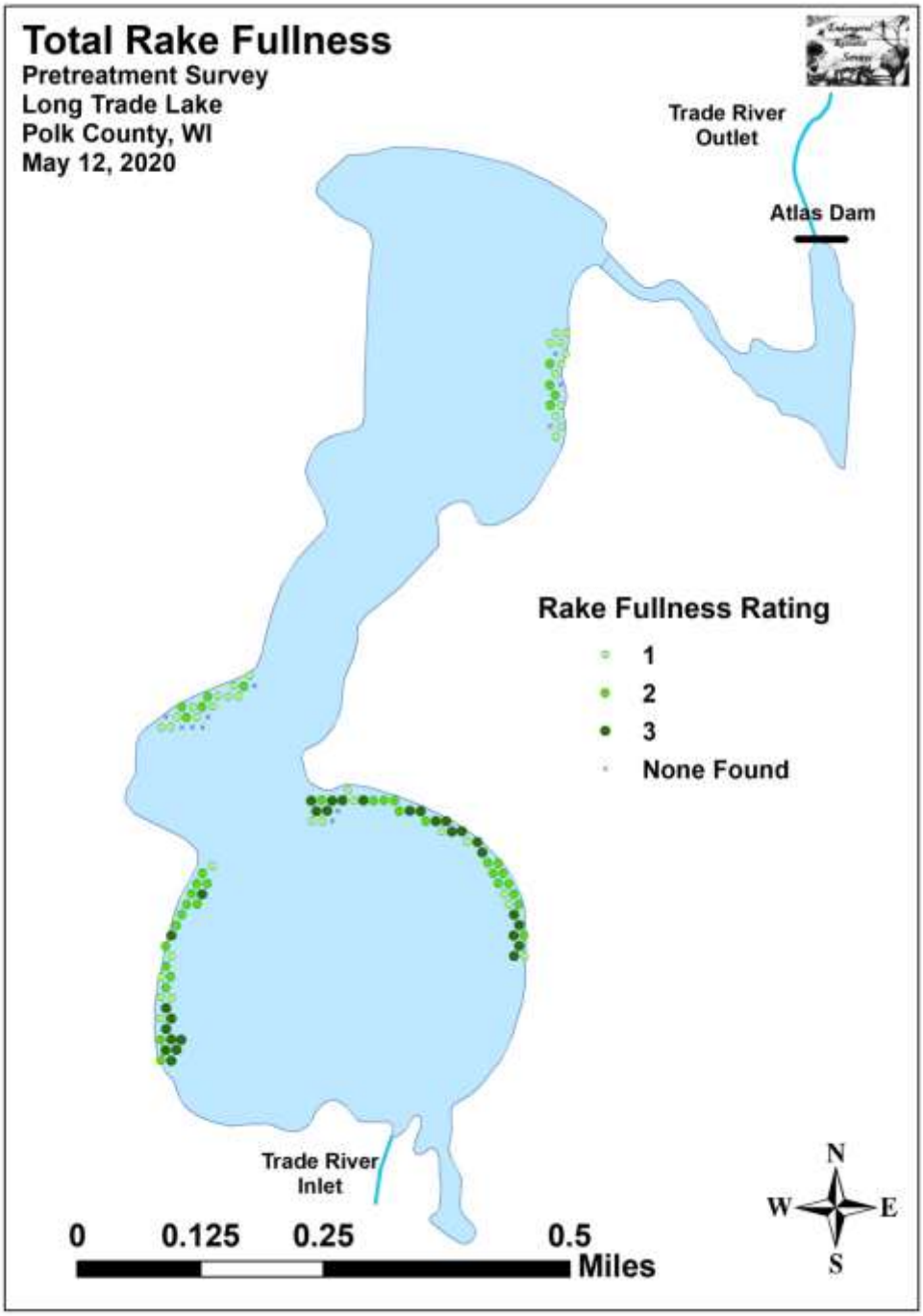
Appendix IV: Pre/Post Littoral Zone, Native Species Richness and Total Rake Fullness

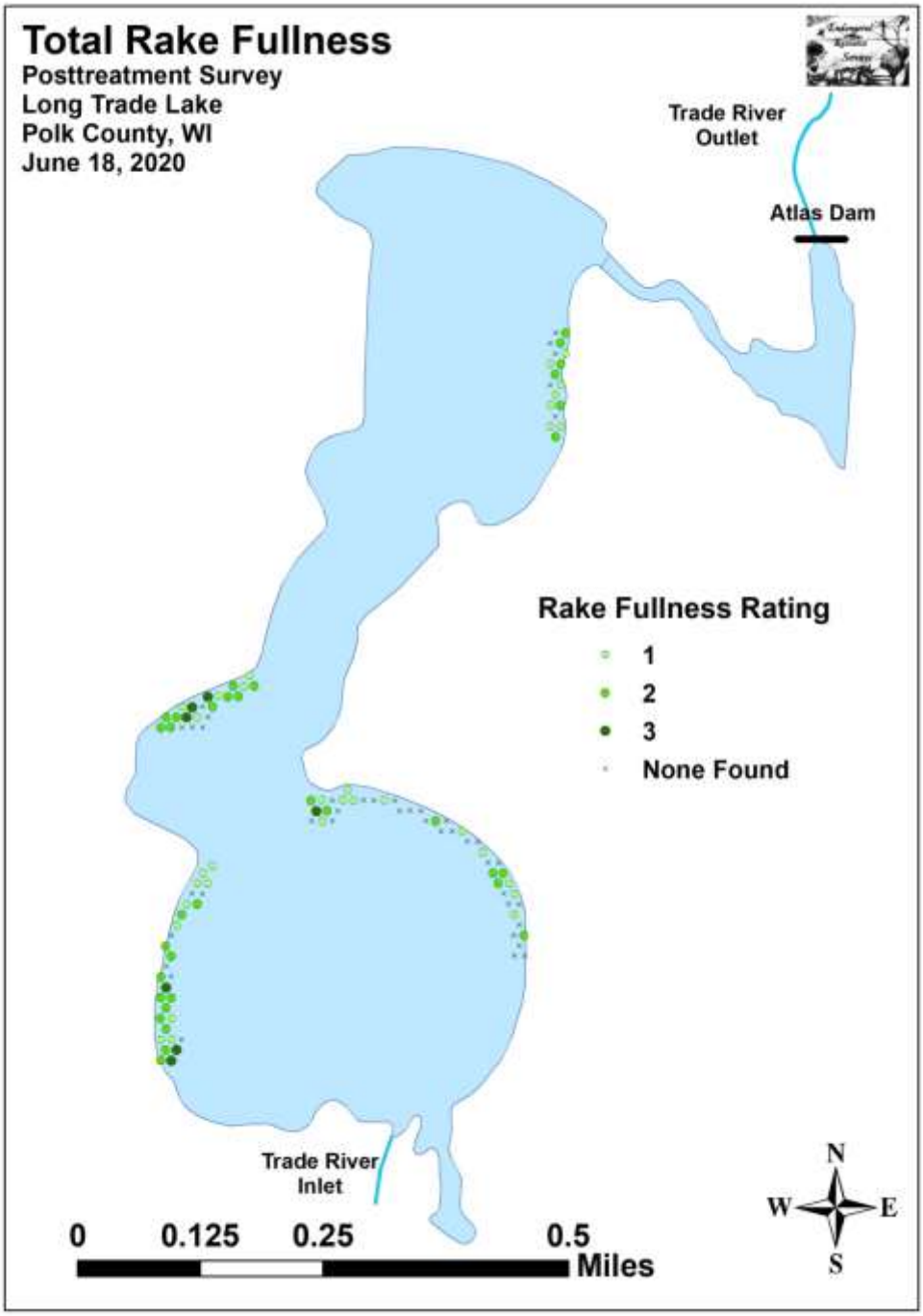

Littoral Zone
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Littoral Zone
Littoral Zone with Plants
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S


Littoral Zone
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Littoral Zone
Littoral Zone with Plants
>6ft.
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

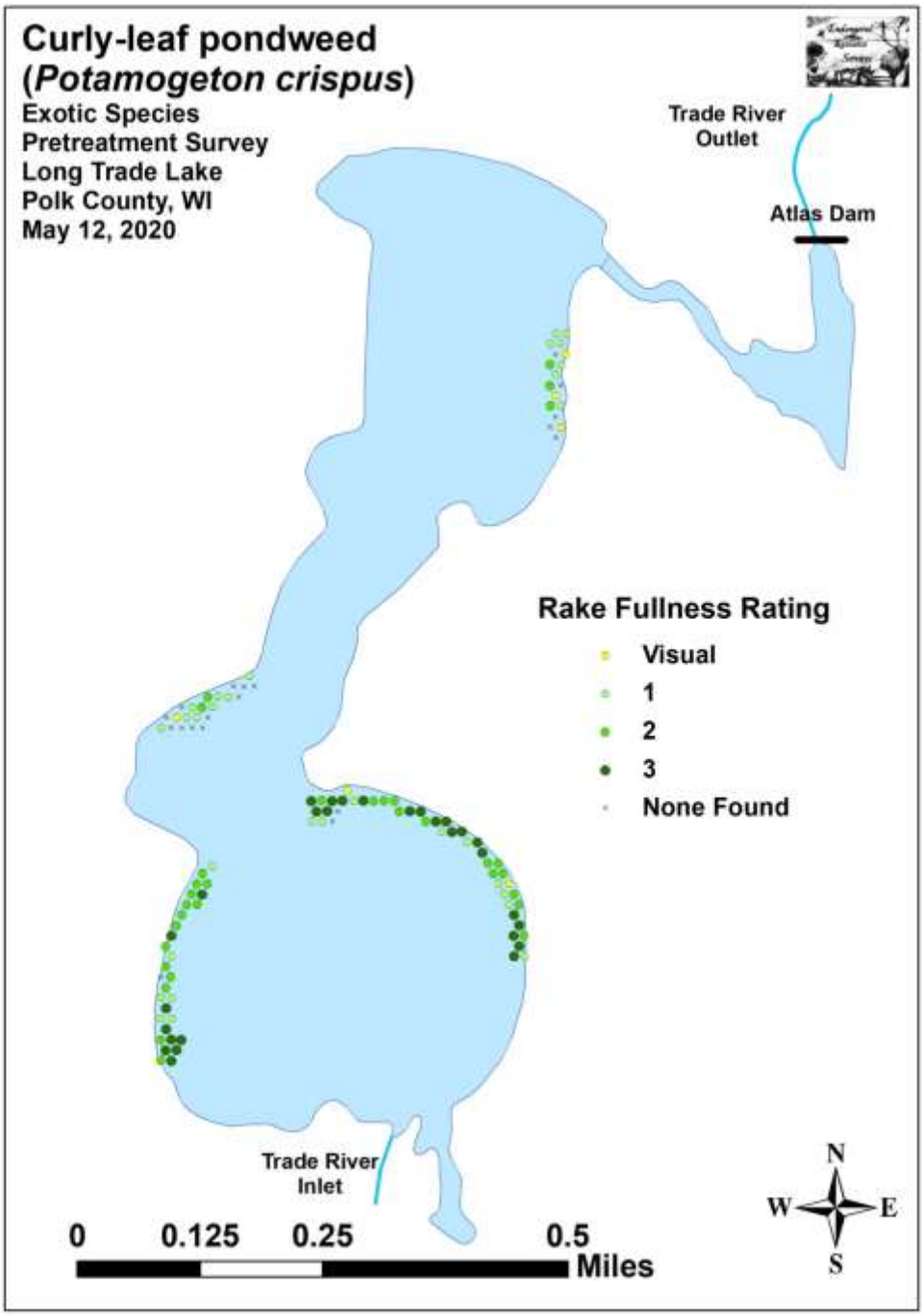

Native Species Richness
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
# of Native Species
None Found
1
2
3 - 4
5 - 6
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

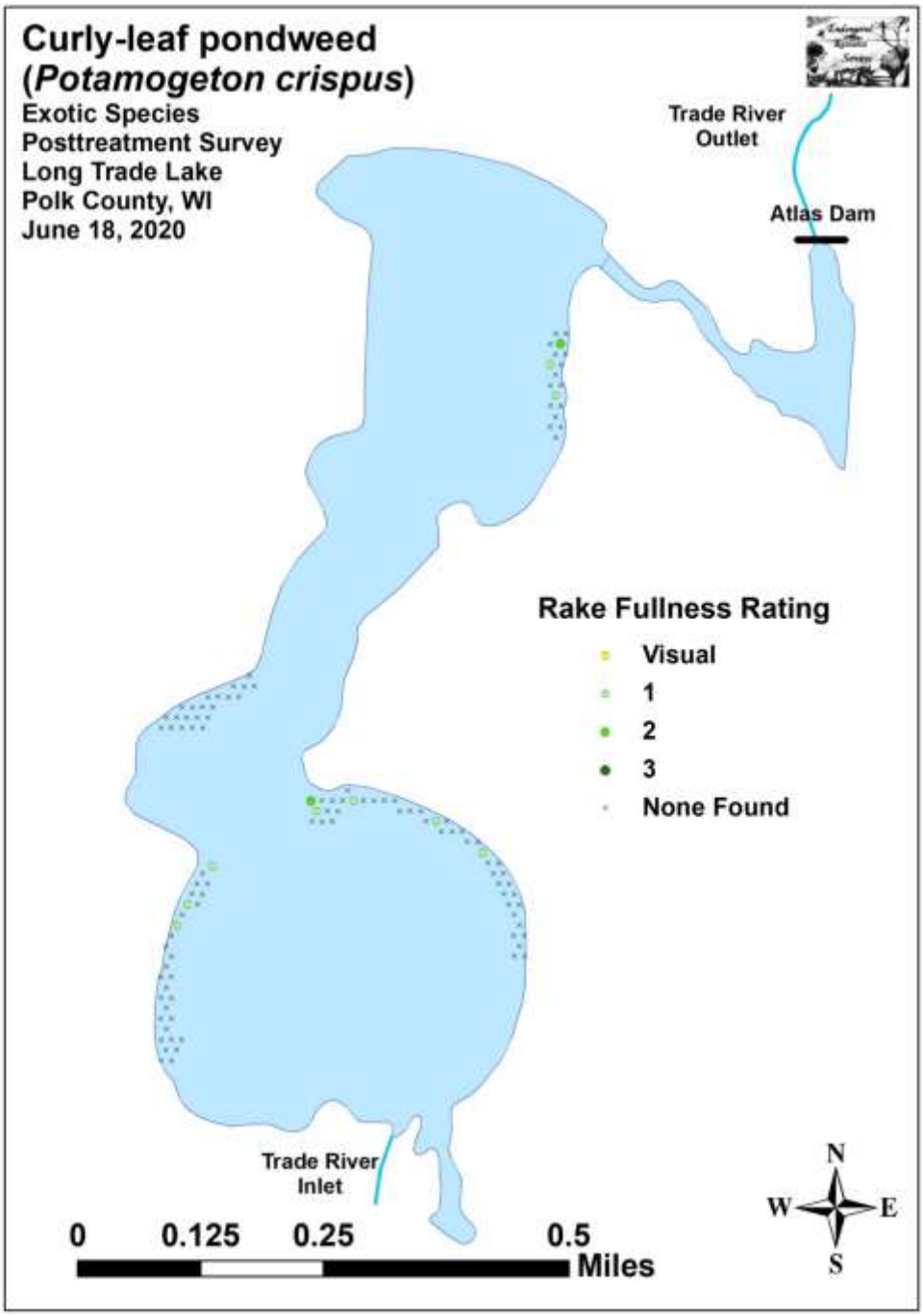

Native Species Richness
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
# of Native Species
None Found
1
2
3 - 4
5 - 6
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

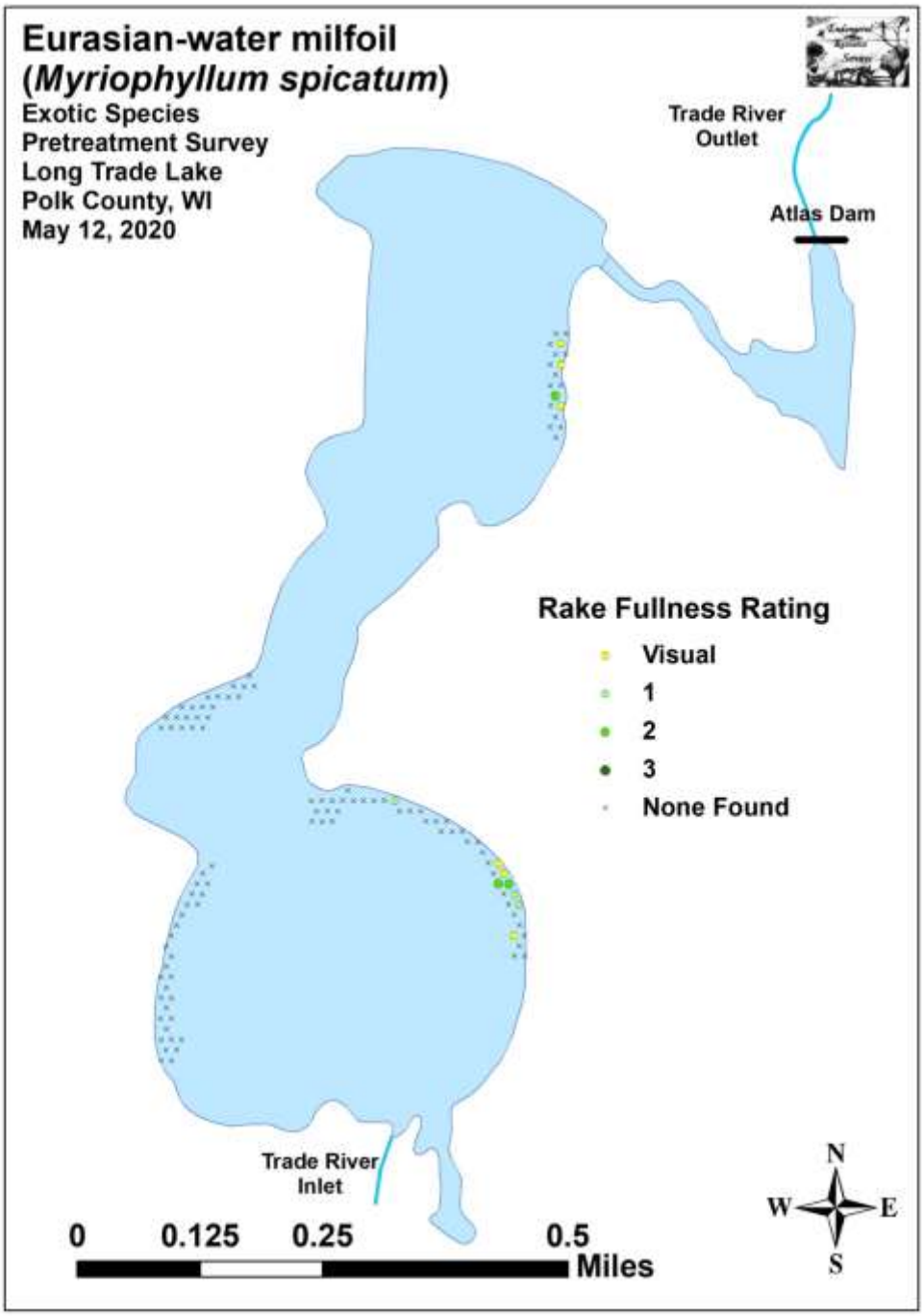

Total Rake Fullness
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

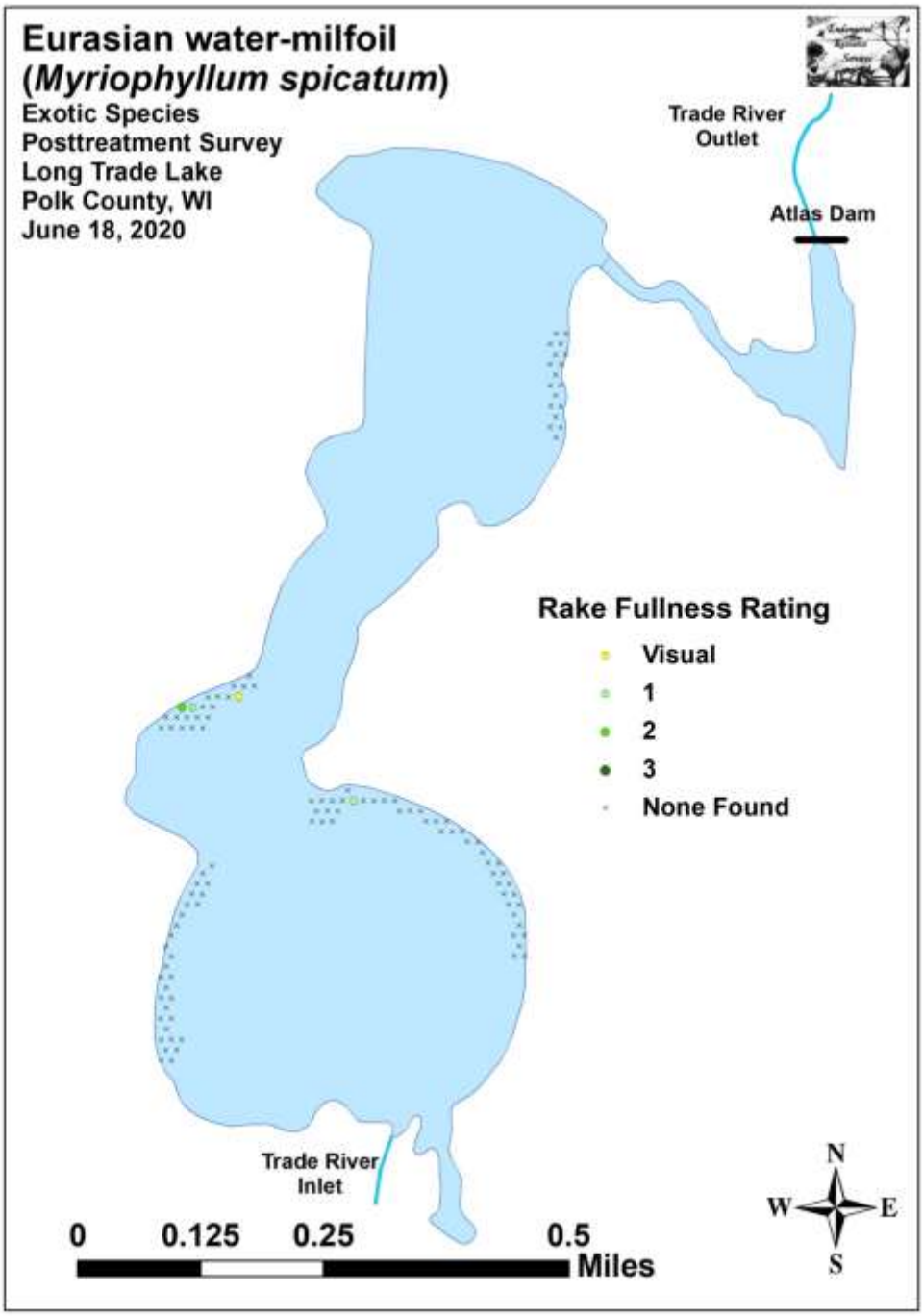

Total Rake Fullness
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

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

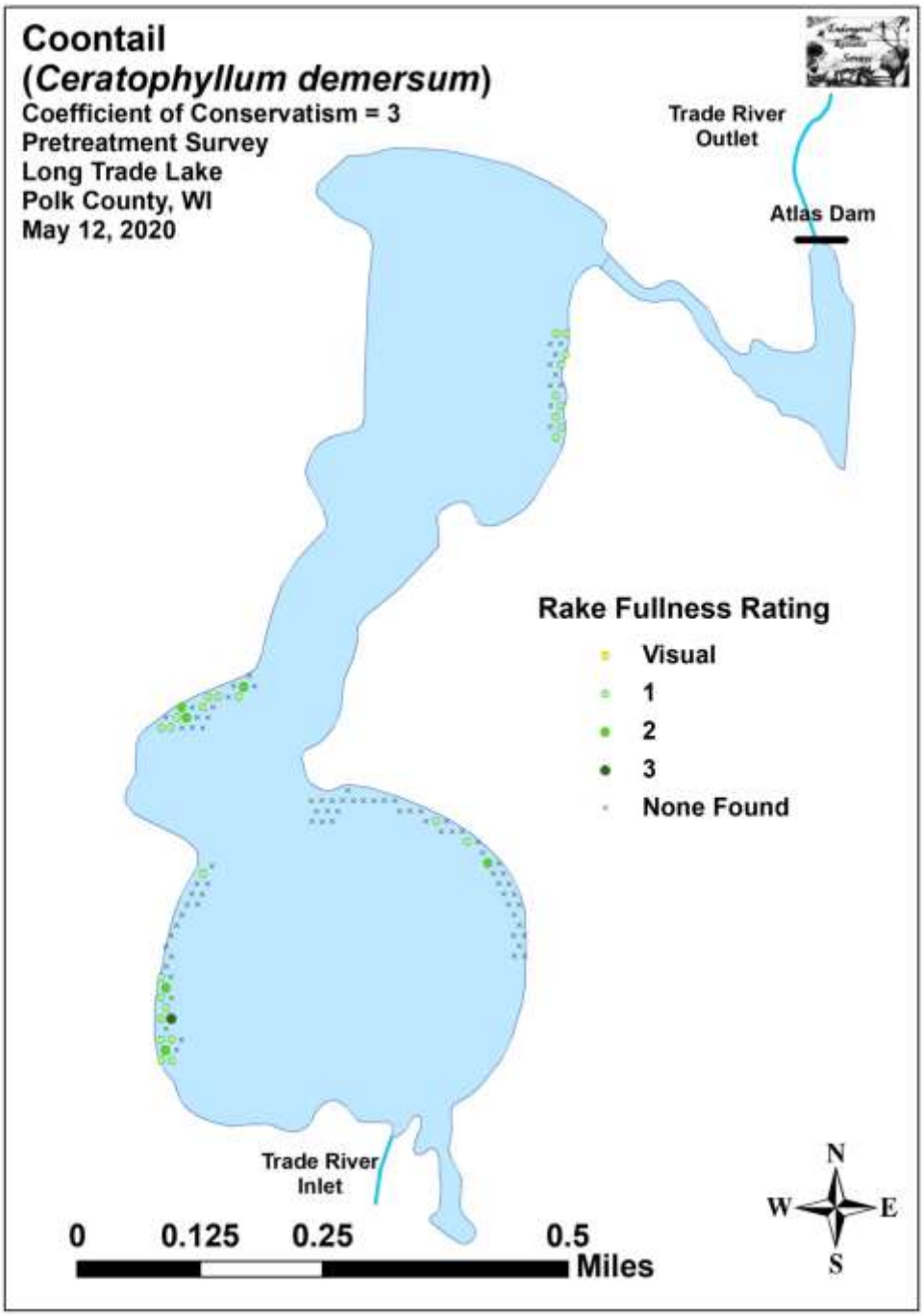

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

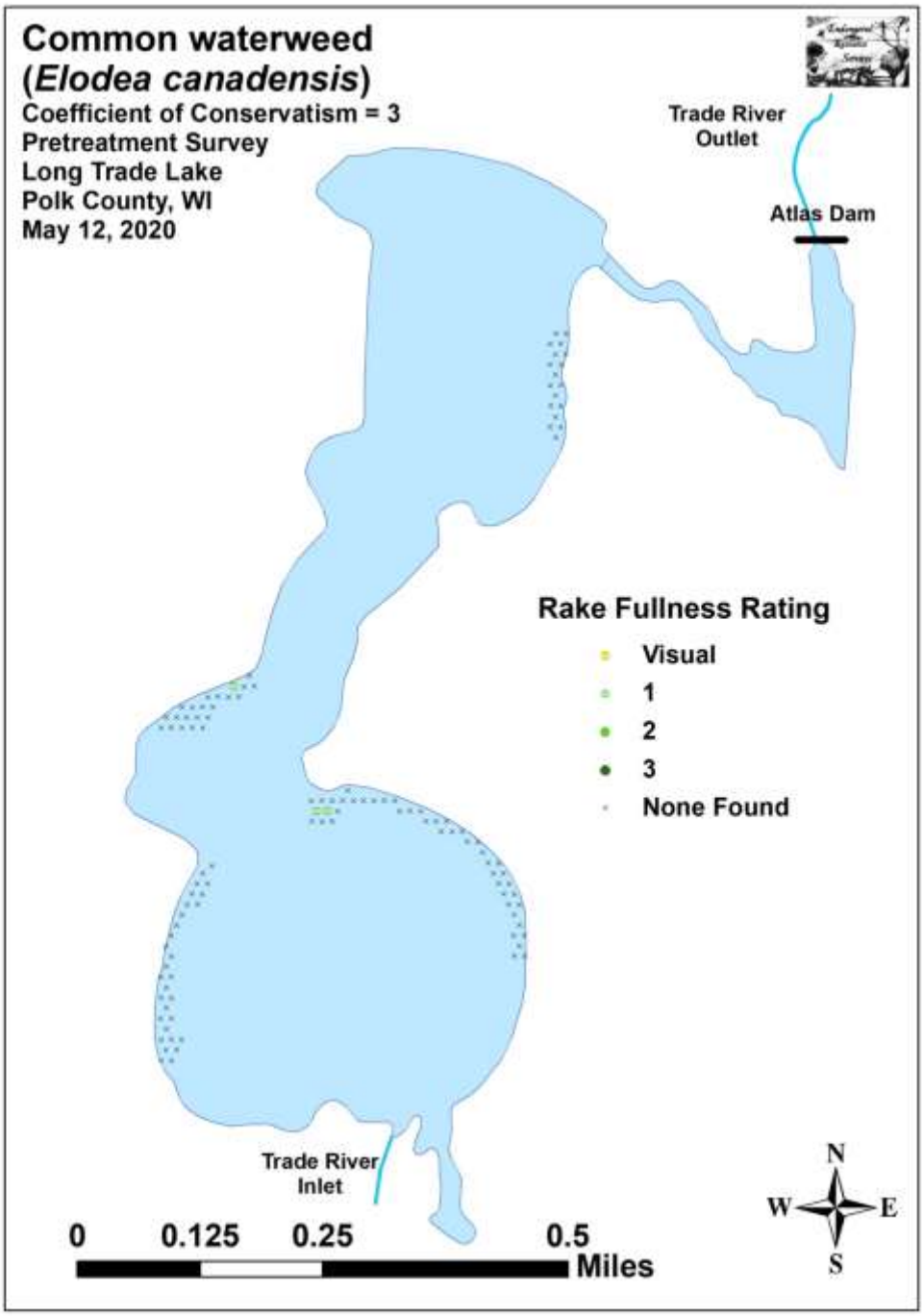

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

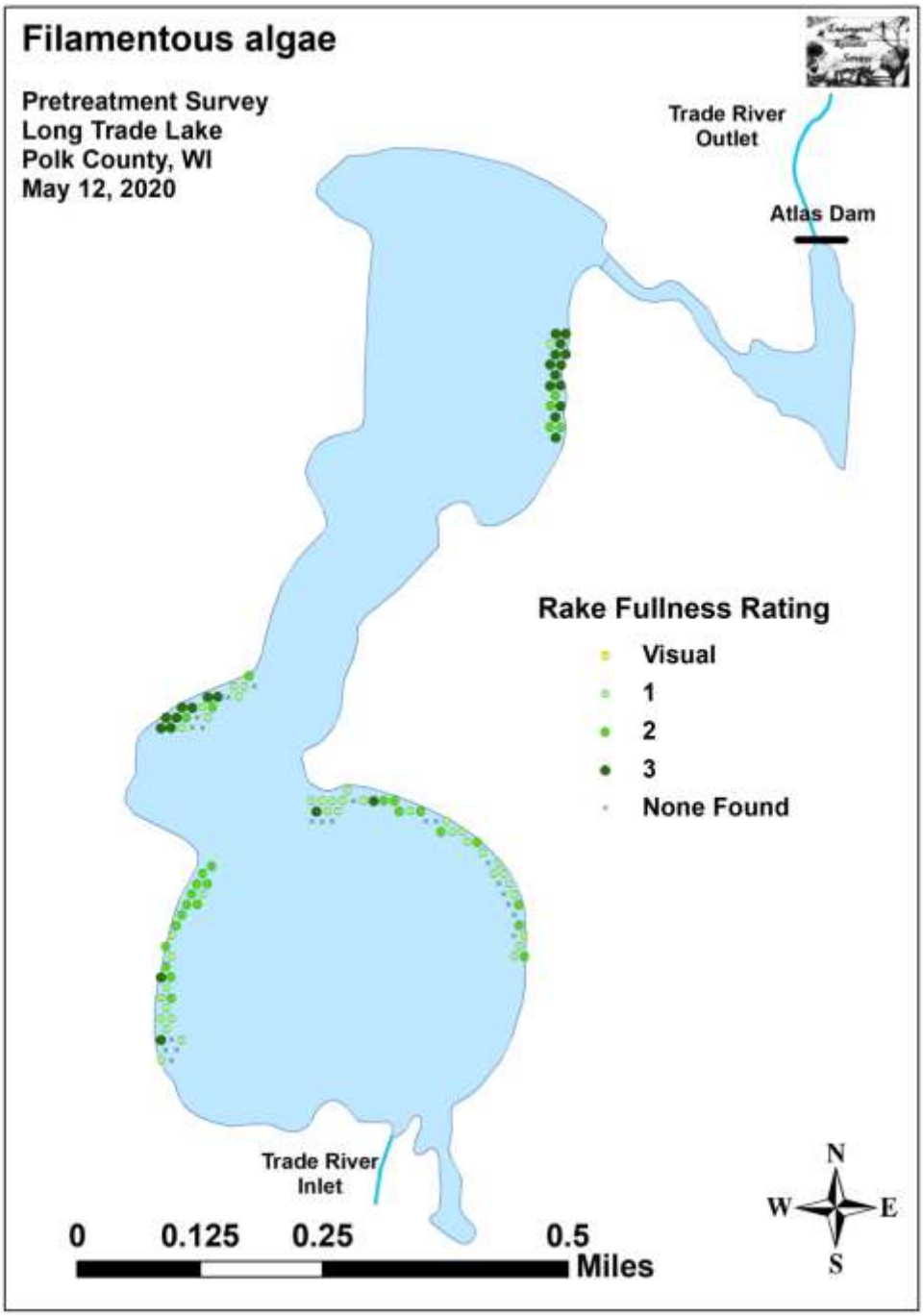

Eurasian-water milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

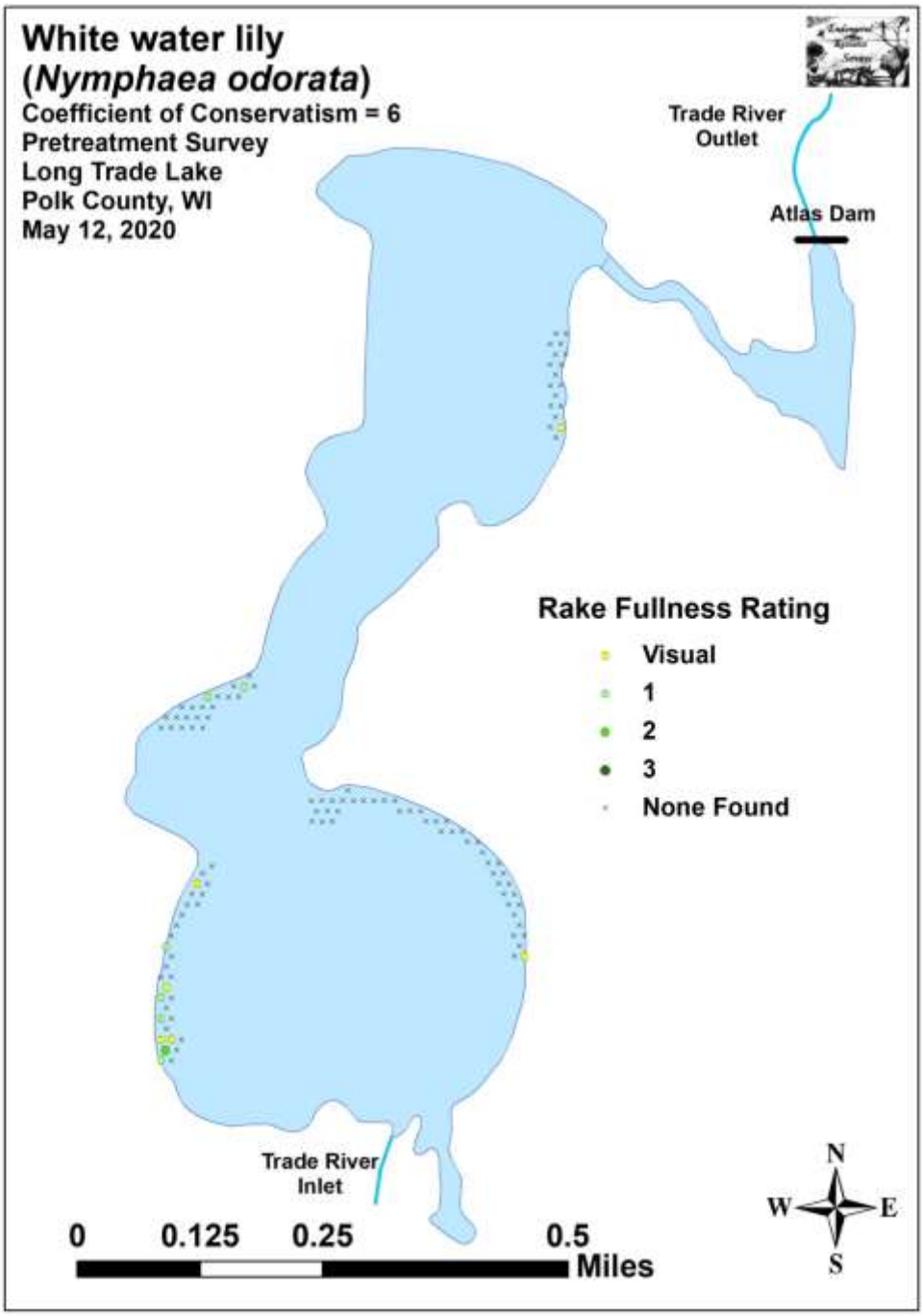

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

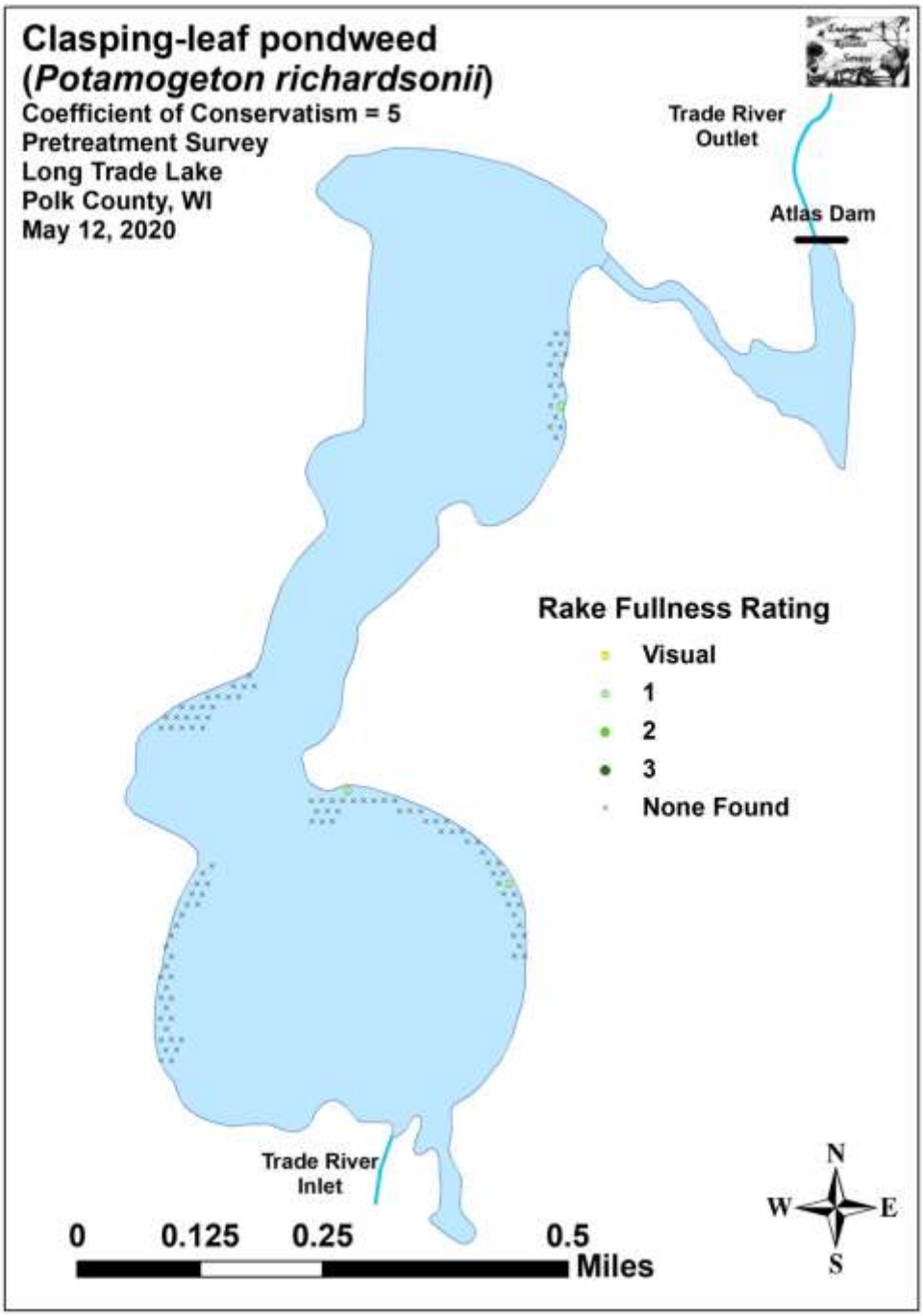
Appendix VI: Pretreatment Native Species Density and Distribution


Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

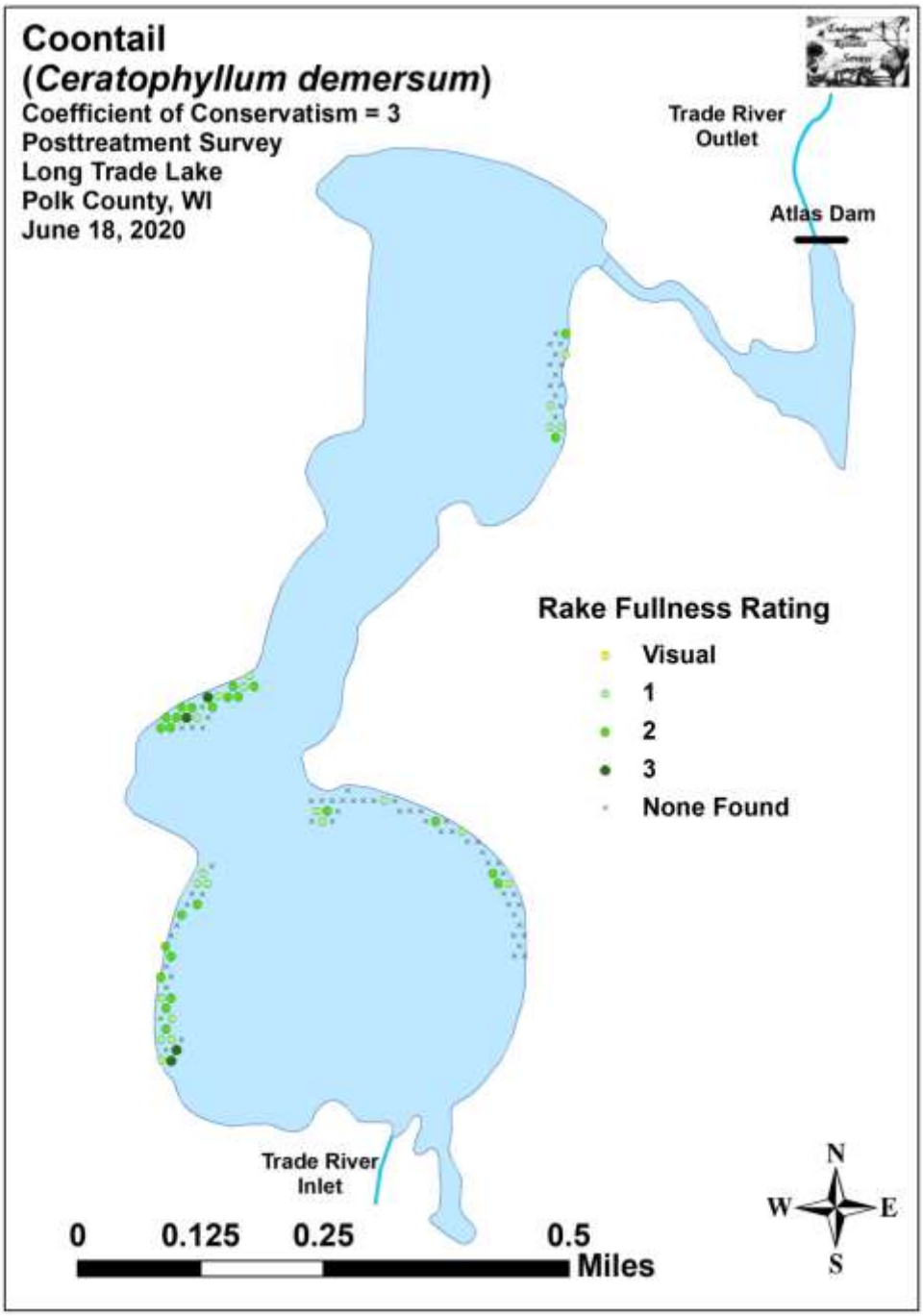

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

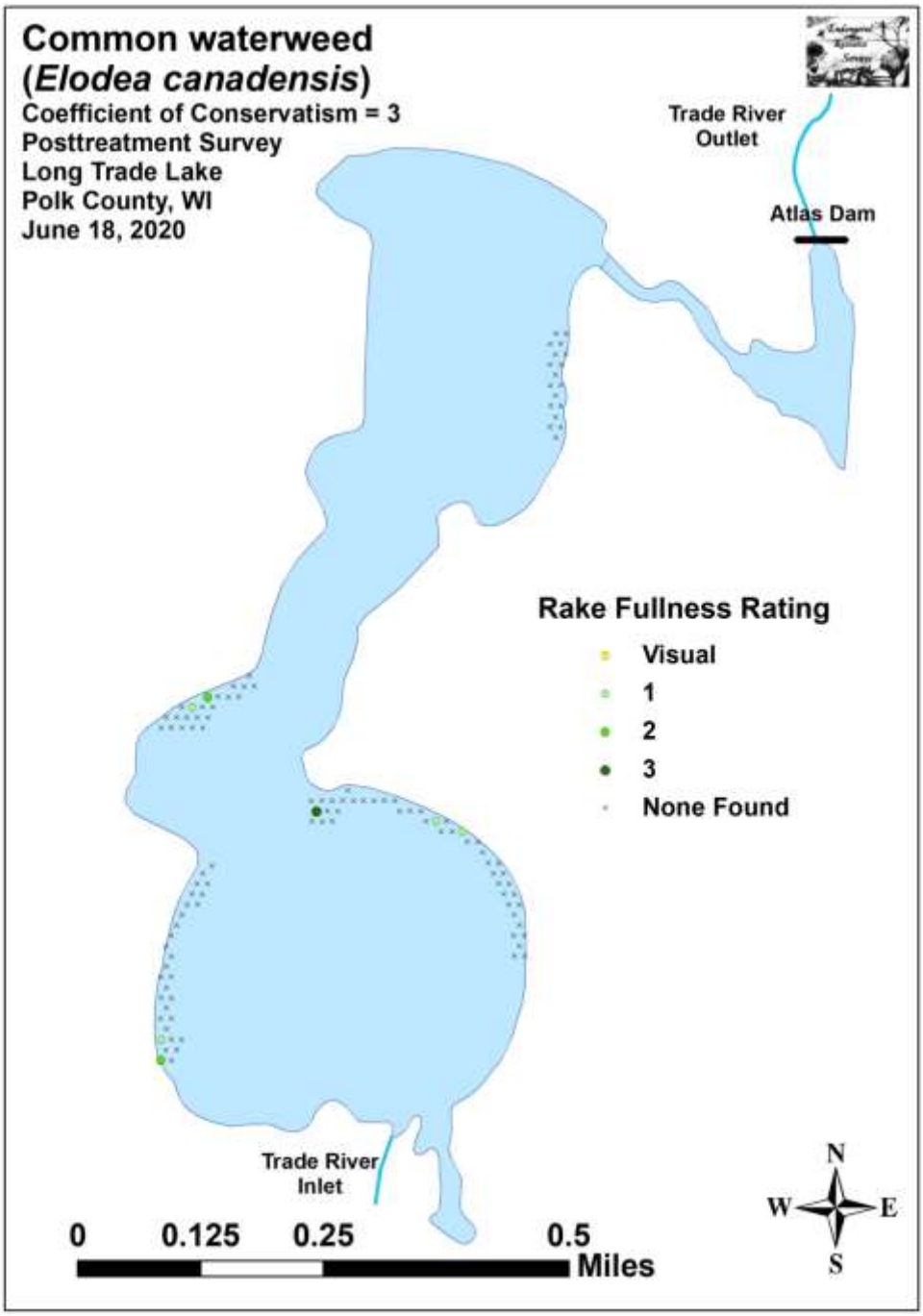

Filamentous algae
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

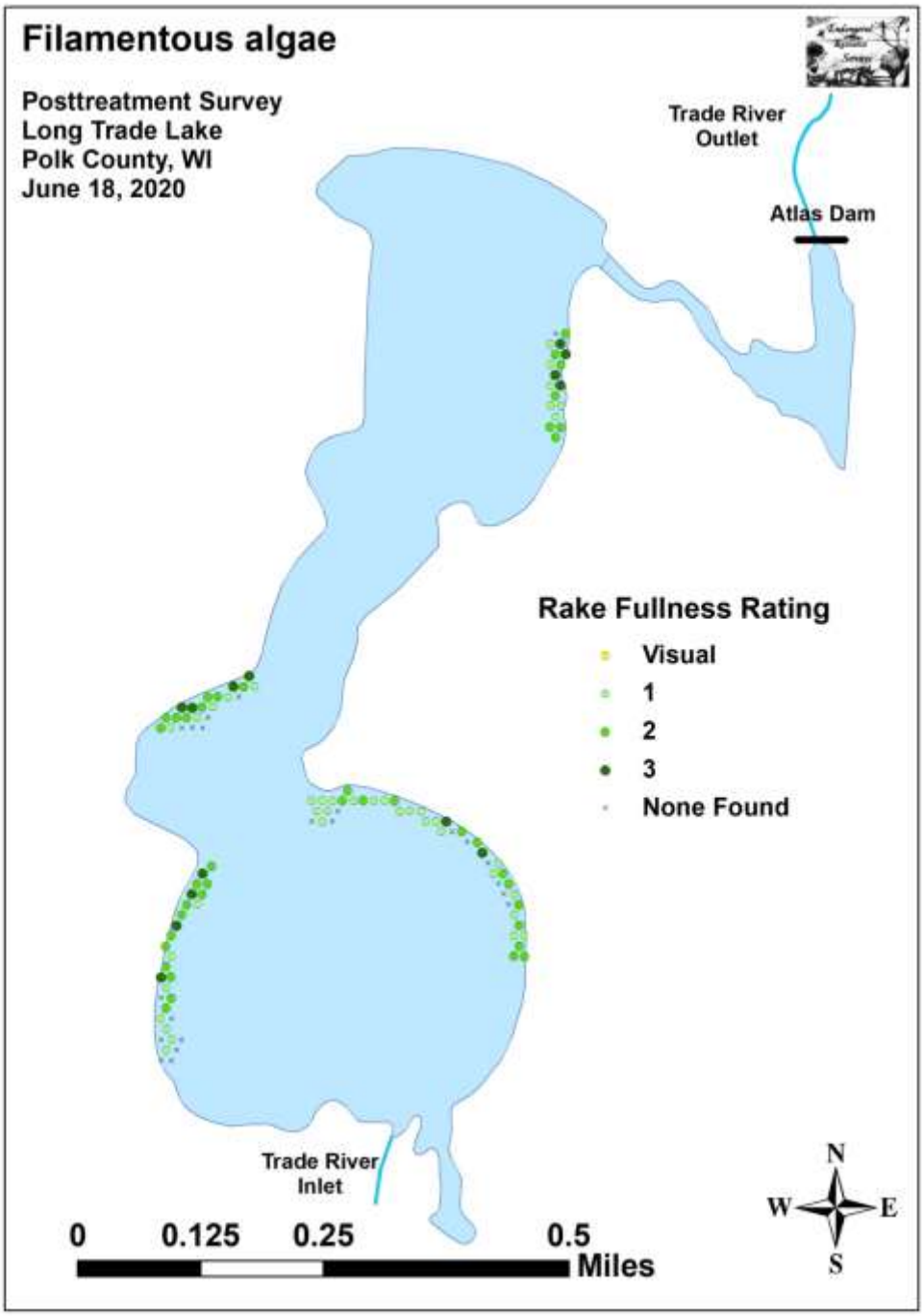

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

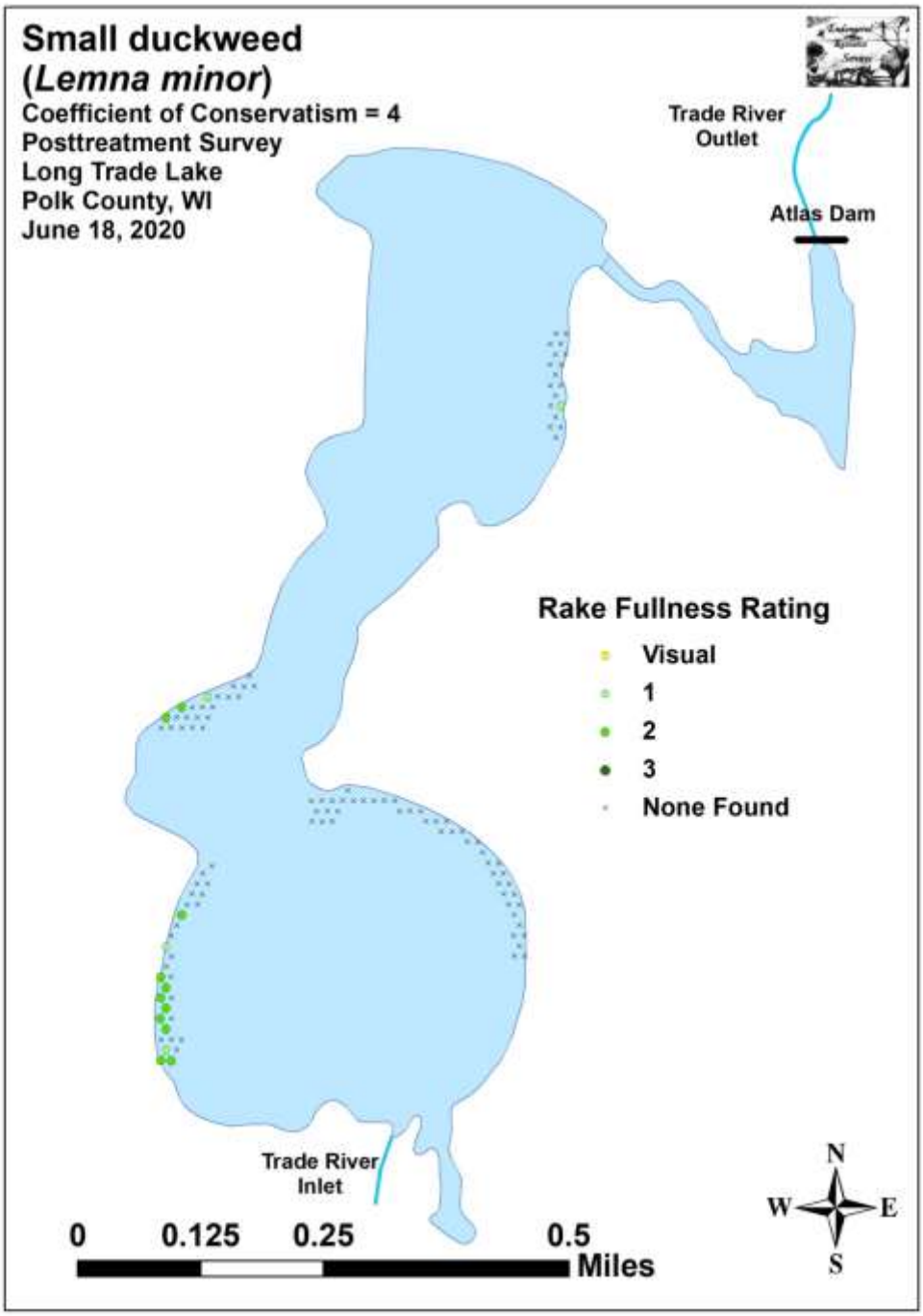

Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Pretreatment Survey
Long Trade Lake
Polk County, WI
May 12, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

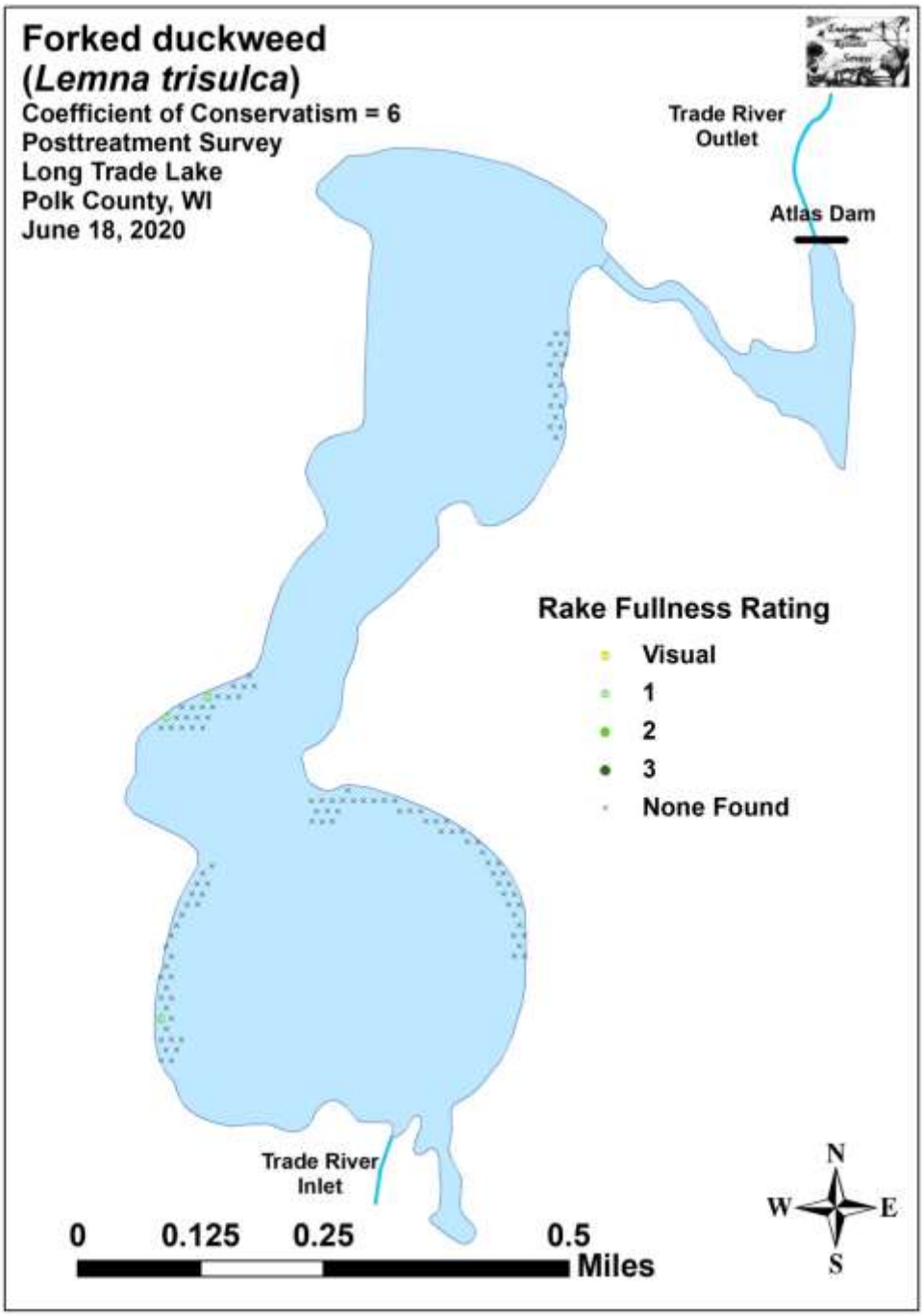
Appendix VII: Posttreatment Native Species Density and Distribution

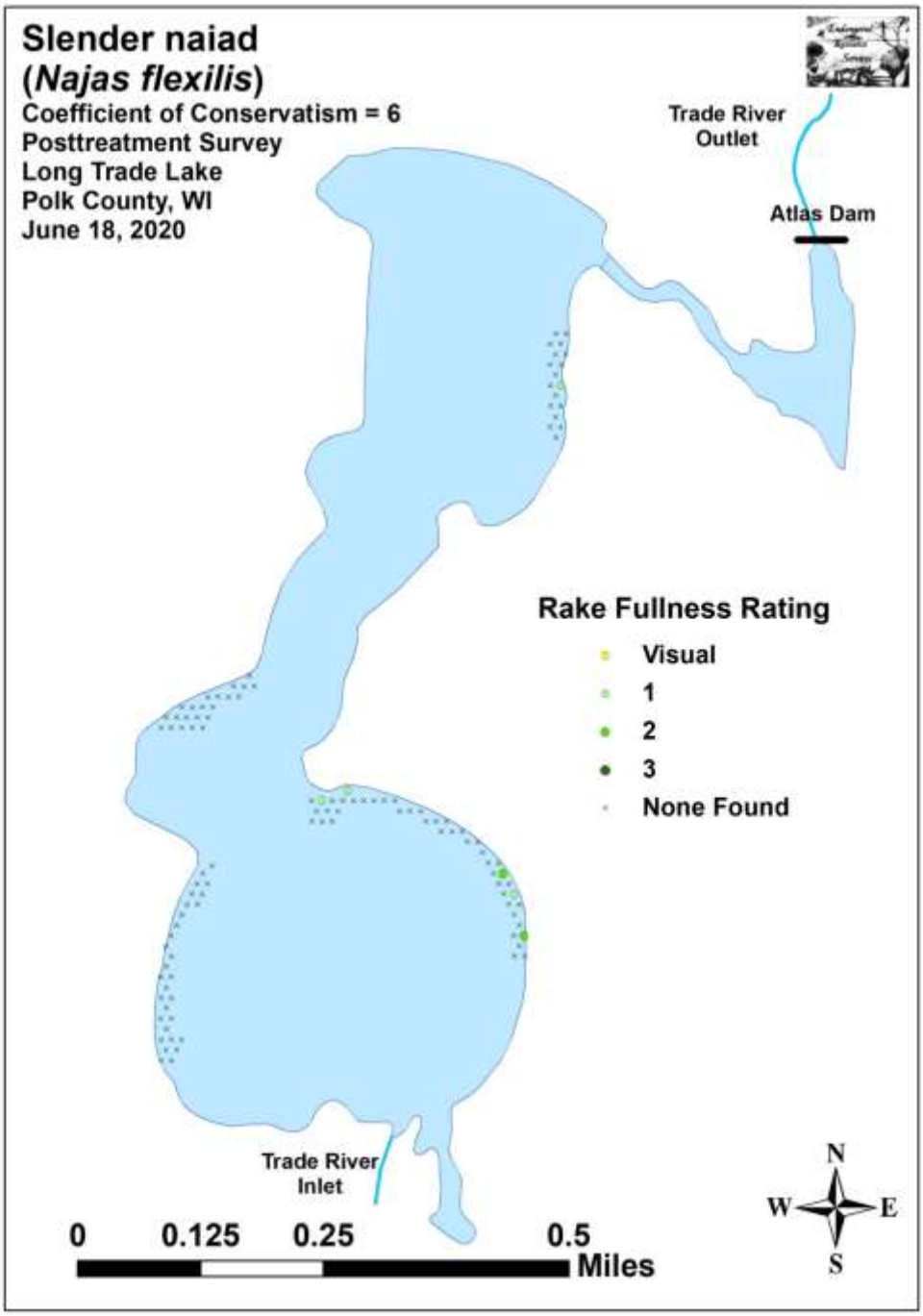

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

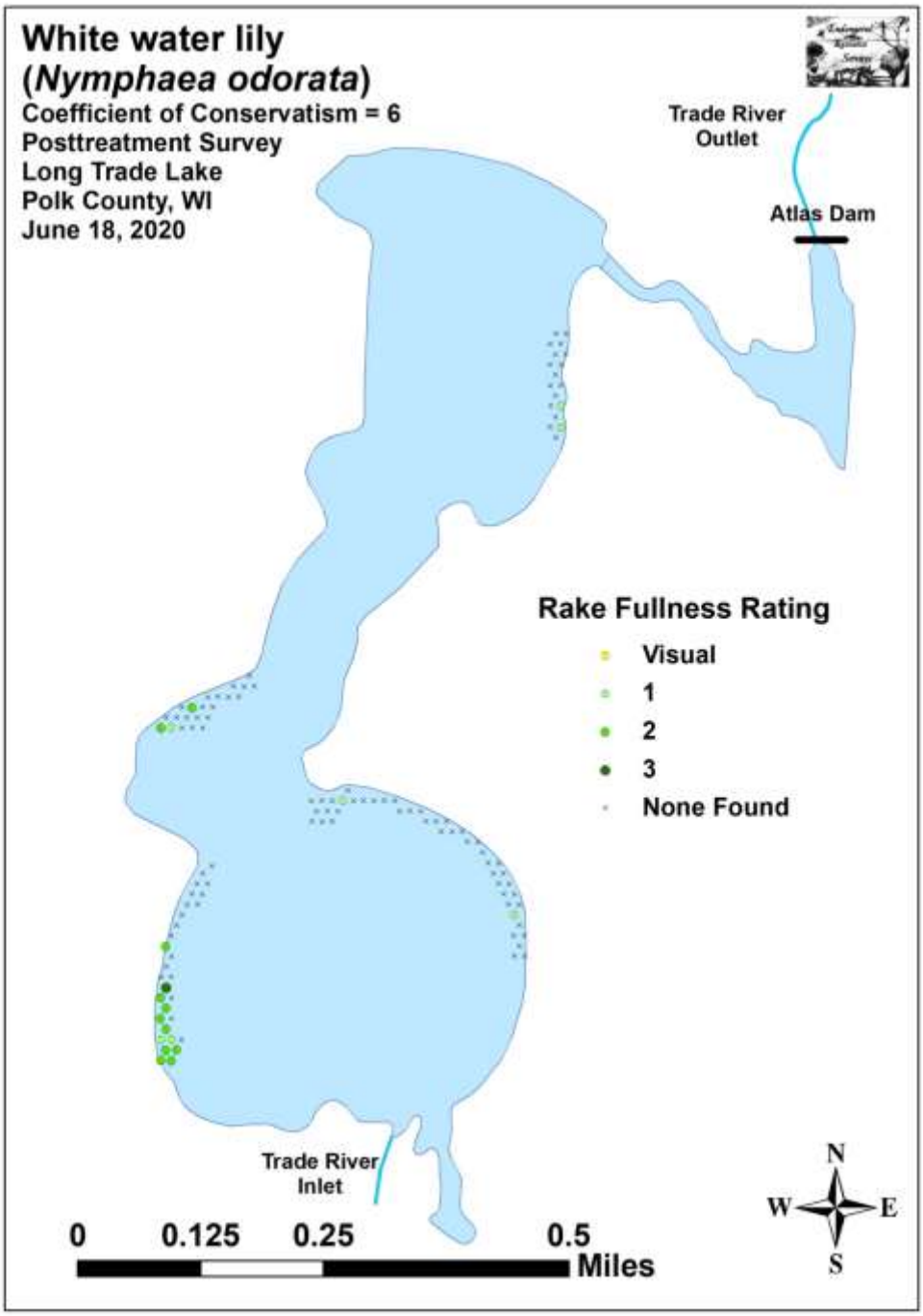

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

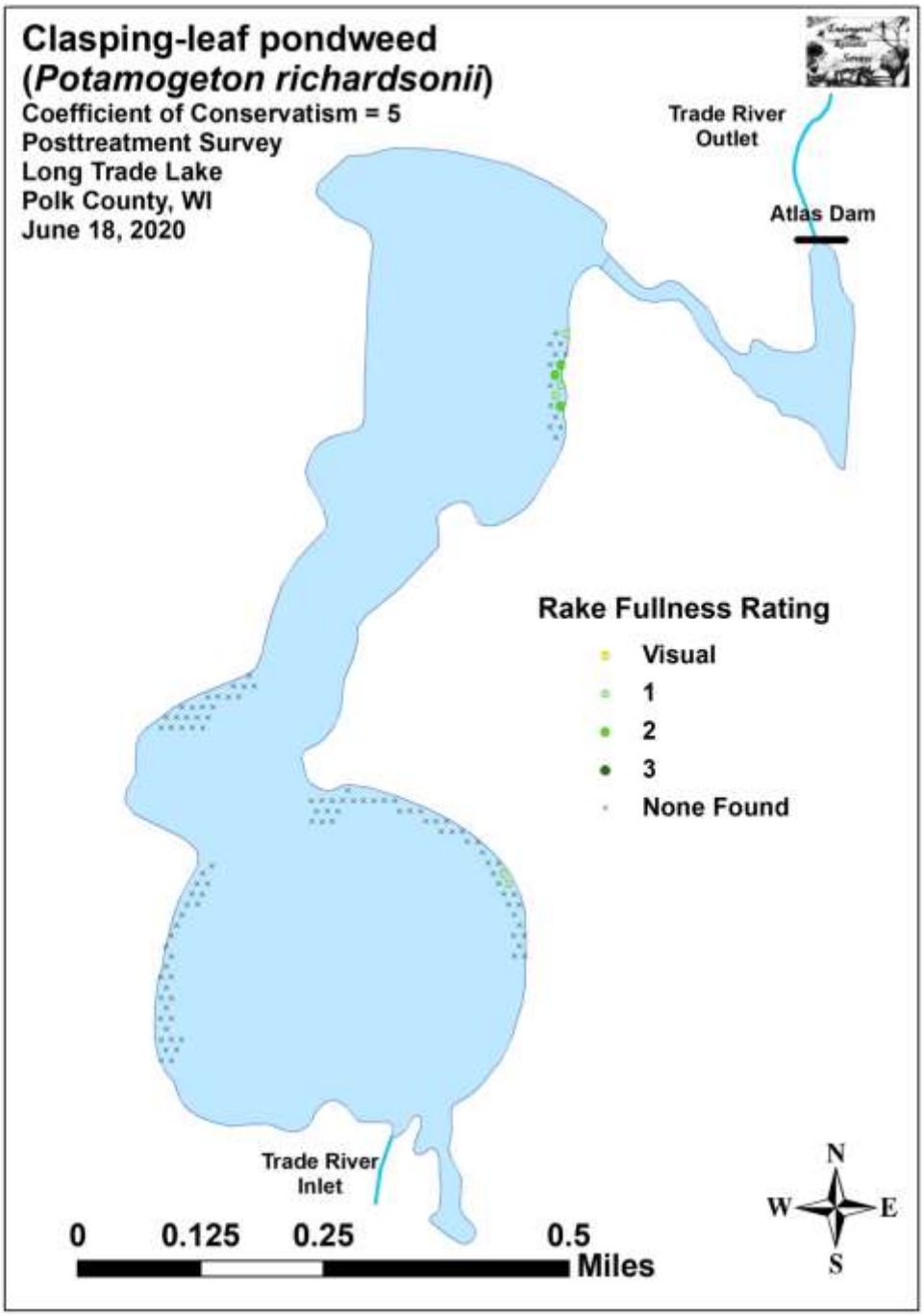

Filamentous algae
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

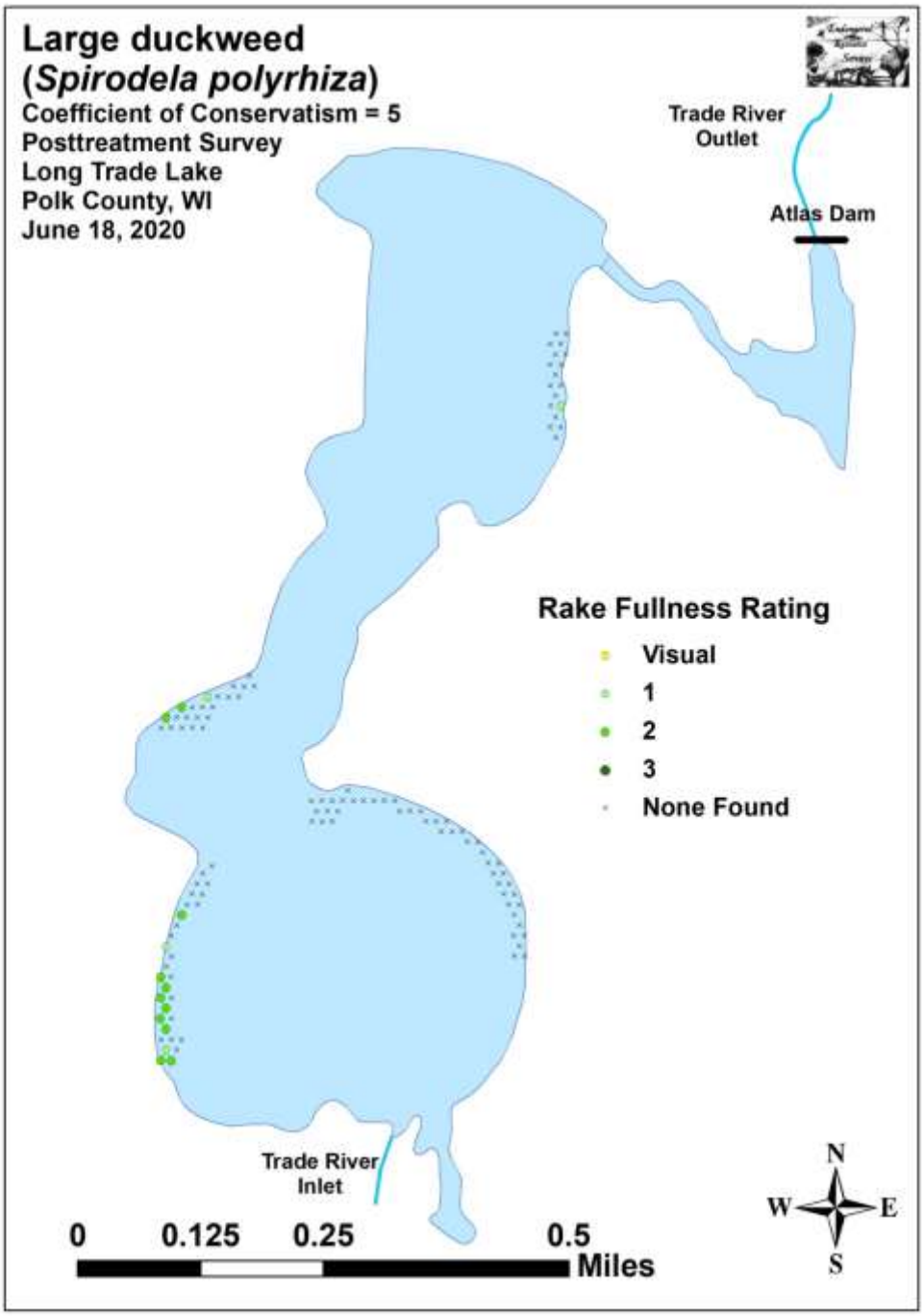

Small duckweed
(Lemna minor)
Coefficient of Conservatism = 4
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

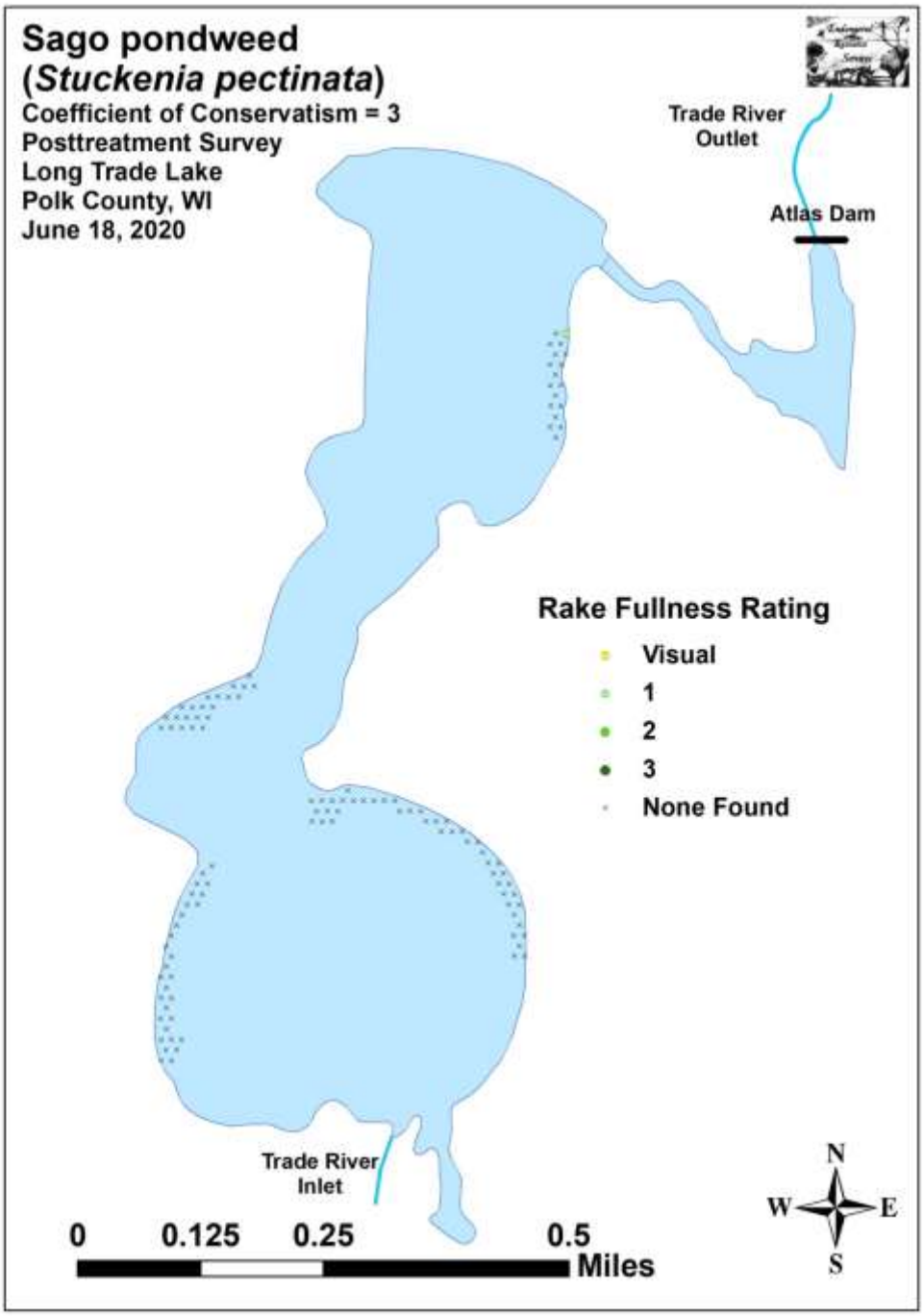

Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

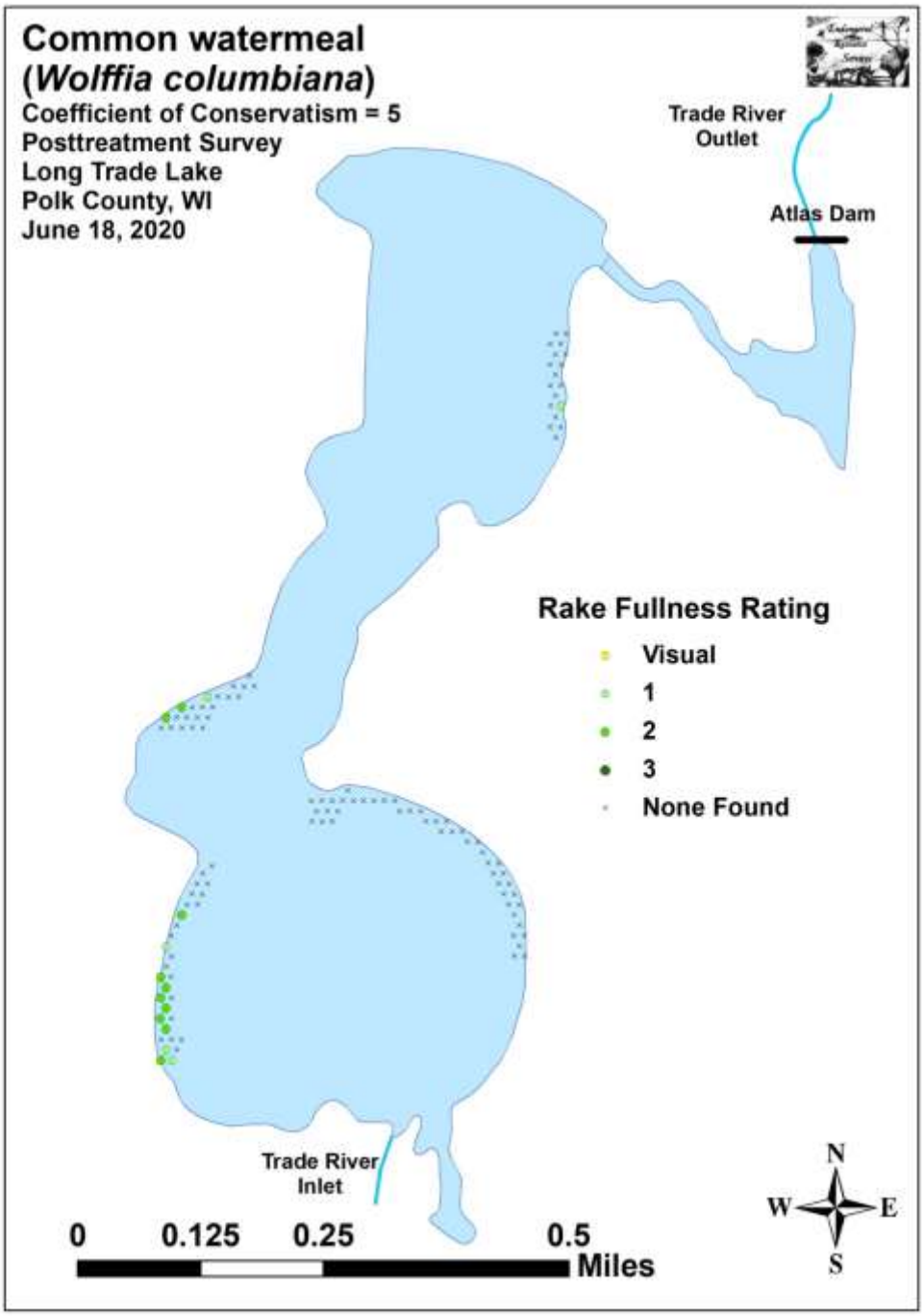

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

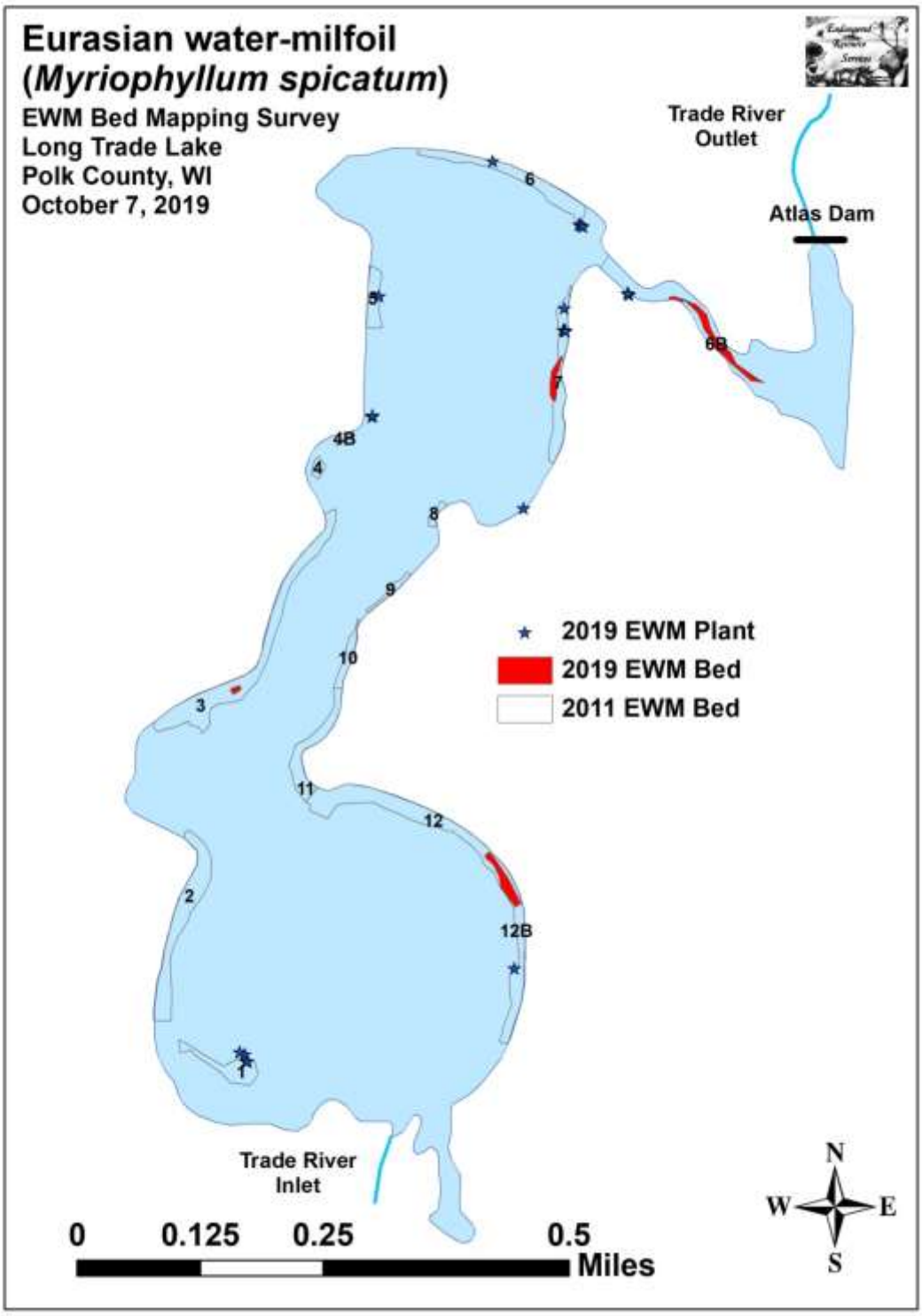

Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S

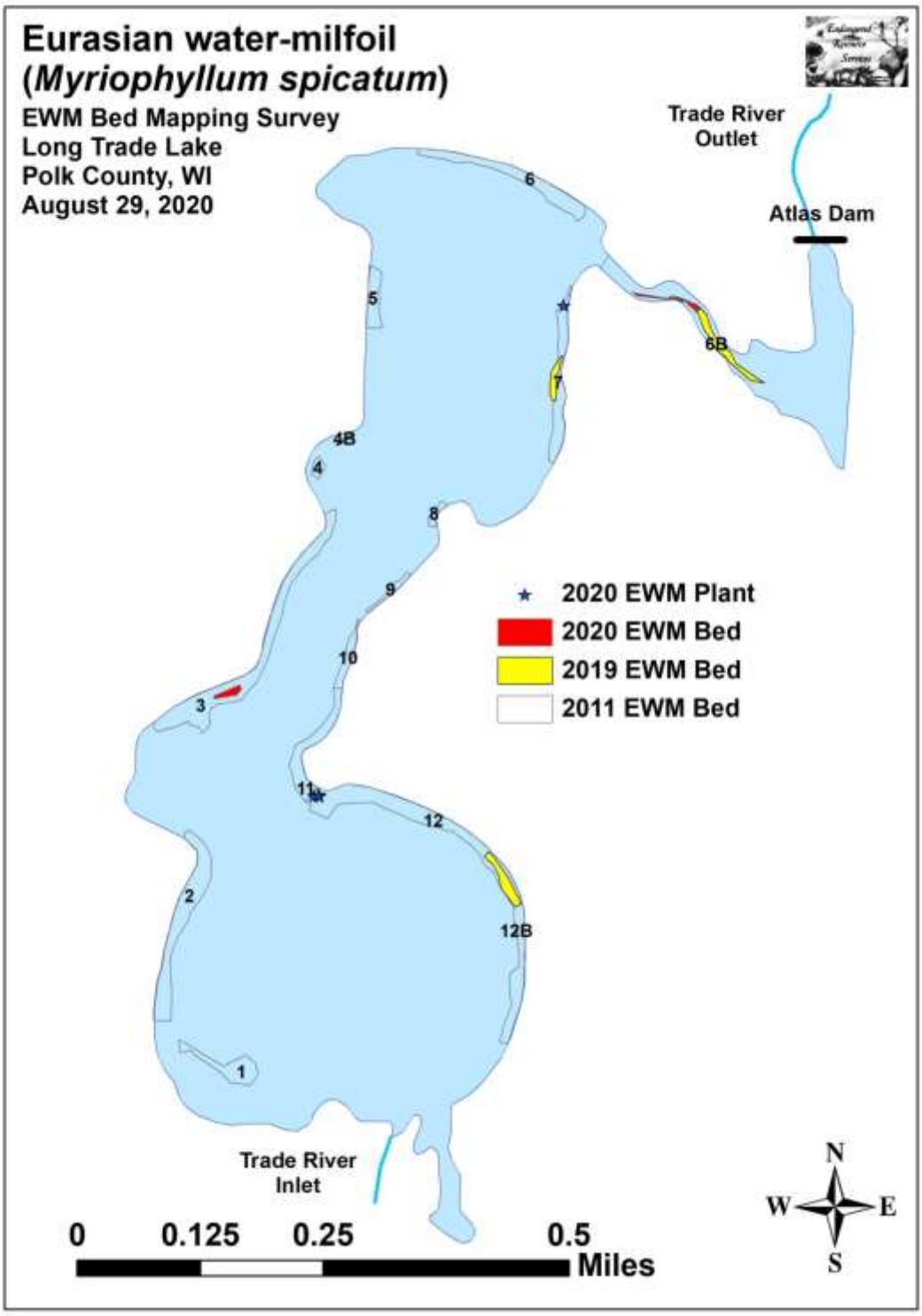

Large duckweed
(Spirodela polyrhiza)
Coefficient of Conservatism = 5
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S


Common watermeal
(Wolffia columbiana)
Coefficient of Conservatism = 5
Posttreatment Survey
Long Trade Lake
Polk County, WI
June 18, 2020
Trade River
Outlet
Atlas Dam
Rake Fullness Rating
Visual
1
2
3
None Found
Trade River
Inlet
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix VIII: Fall 2019 and Late Summer 2020 EWM Bed Maps


Eurasian water-milfoil
(Myriophyllum spicatum)
EWM Bed Mapping Survey
Long Trade Lake
Polk County, WI
October 7, 2019
Trade River Outlet
Atlas Dam
6
5
6B
7
4B
4
8
9
10
3
11
12
2
12B
1
2019 EWM Plant
2019 EWM Bed
2011 EWM Bed
Trade River Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S


Eurasian water-milfoil
(Myriophyllum spicatum)
EWM Bed Mapping Survey
Long Trade Lake
Polk County, WI
August 29, 2020
Trade River Outlet
Atlas Dam
6
5
6B
7
4B
4
8
9
10
3
11
12
2
12B
1
2020 EWM Plant
2020 EWM Bed
2019 EWM Bed
2011 EWM Bed
Trade River Inlet
0
0.125
0.25
0.5
Miles
N
W
E
S