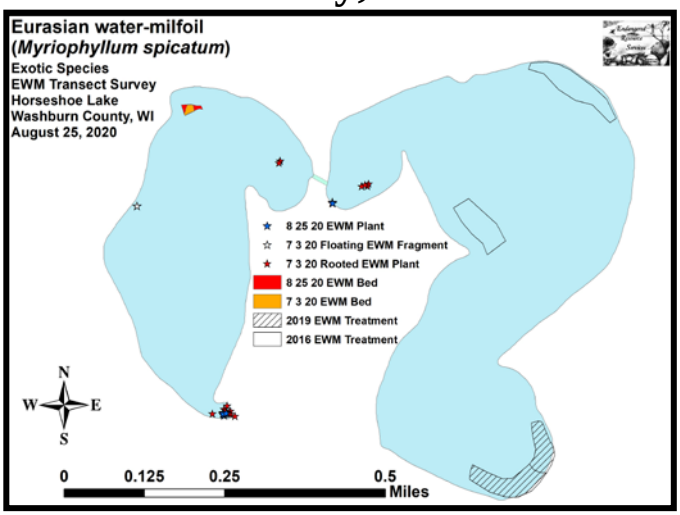
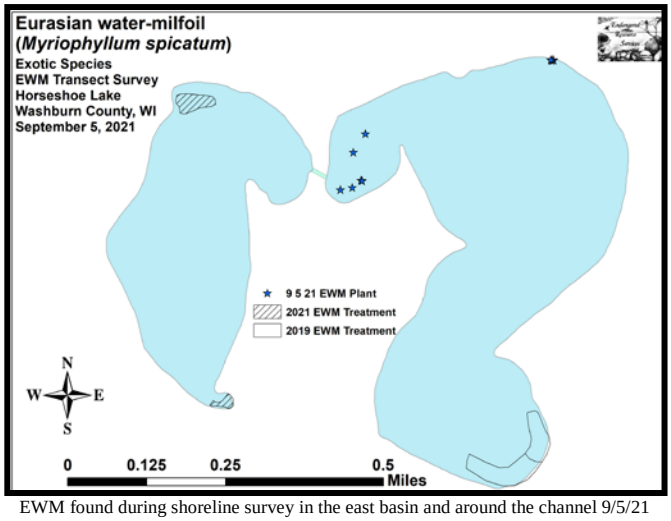
Eurasian water-milfoil (*Myriophyllum spicatum*) Pre/Posttreatment and Meandering Shoreline Surveys Horseshoe Lake (WBIC: 2470000) Washburn County, Wisconsin



EWM found during previous year's final survey 8/25/20
EWM treatment areas 6/1/21

Project Initiated by:

The Horseshoe Lake Property Owners Association, Lake Education and Planning Services, LLC and the Wisconsin Department of Natural Resources (WDNR Grant # AEPP 61320)



EWM found during shoreline survey in the east basin and around the channel 9/5/21

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 22, July 7, and September 5, 2021

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION:

Horseshoe Lake (WBIC 2470000) is a 177-acre seepage lake in north-central Washburn County, Wisconsin in the Town of Minong (T42N R12W S30 SW SW). It reaches a maximum depth of 21ft in the northeast corner of the eastern basin and has an average depth of approximately 7ft (WDNR 2021). Secchi disc readings from 2014-2020 have averaged 12ft in the west basin and 14ft in the east basin. This suggests the lake is mesotrophic in nature with good to very good water clarity (WDNR 2021). The lake's bottom substrate is predominately sand along the shoreline, but this gradually transitions to sandy muck at most depths over 6ft (Figure 1). The only organic muck occurs in the tiny "nook" bay on the southeast end of the lake's west basin (Sather et al. 1971).

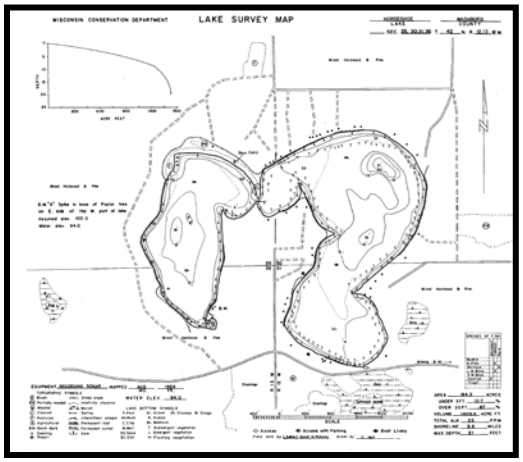


Figure 1: Horseshoe Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) is an exotic invasive plant species that is a growing problem in the lakes and rivers of northwestern Wisconsin. Present in nearby Nancy Lake since 1991, the Minong Flowage since 2002, and Gilmore Lake since 2009, EWM was first found in Horseshoe Lake in May 2011. Under the direction of Lake Education and Planning Services, LLC (LEAPS), the Horseshoe Lake Property Owners Association (HLPOA) conducted herbicide treatments to control EWM in 2011, 2012, 2016, and 2019. They have also authorized annual meandering shorelines surveys of the lake to look for surviving/new EWM plants/beds since 2013. These surveys have helped to rapidly identify and manage pioneer beds thus limiting the need for large-scale or annual treatments.

Using our 2020 July and August survey results, Lake Education and Planning Services, LLC (LEAPS – D. Blumer) and the HLPOA decided to treat two areas totaling 1.16 acres in 2021 - a bed along the north shoreline and an area in the "nook" bay that has continually produced new plants since 2018 despite regular rake removal. In order to gather baseline data on the density and distribution of both EWM and native species in the beds, and to determine the effectiveness of the treatment, the HLPOA and LEAPS requested pre and posttreatment surveys of these areas. They also requested a late-summer meandering shoreline survey to look for new EWM areas. This report is the summary analysis of these three field surveys conducted on May 22, July 7, and September 5, 2021.

METHODS:

Pre/Post Herbicide Surveys:

LEAPS provided treatment and buffer area shapefiles, and we generated pre/post survey points based on the size and shape of these areas. The 60-point offset sampling grid at 14m resolution approximated to over 20 pts/acre – well above the minimum of 4-10 pts/acre required by WDNR protocol for pre/post treatment surveys (Appendix I).

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

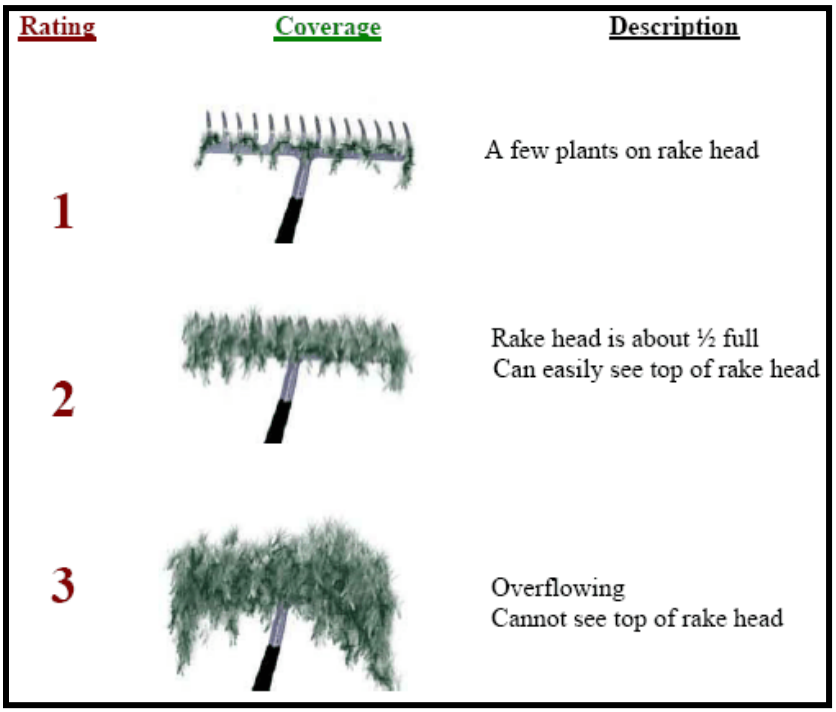


Figure 2: Rake Fullness Ratings

We entered all data collected into the standard WDNR APM spreadsheet (Appendix II). Data was analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). 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. 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 $p<0.001$.

EWM Littoral Zone Rake Removal and Bed Mapping Survey:

During the September survey, we searched along the lake's entire shoreline spacing transects close enough that our field of view overlapped from one transect to another. We paid special attention to the areas around docks as this is where Eurasian water-milfoil brought in on props is most likely to establish. We also spent extensive time motoring around, through, and between the 2016, 2019, and 2021 treatment areas to look for surviving EWM. When found, we used a telescopic rake to remove EWM plants by their roots and logged the location with a GPS waypoint. We also took extra care to gather any fragments that broke off of the plants. If we found a "bed" where we estimated that EWM made up >50% of the plants and was generally continuous with clearly defined borders, we motored around the perimeter of the area and took GPS coordinates at regular intervals. We also estimated the rake density range and mean rake fullness of the bed (Figure 2), the range and mean depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (**none** – easily avoidable with a natural channel around or narrow enough to motor through/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – multiple prop clears and difficult to impossible to row through). These data were then mapped using ArcMap 9.3.1, and we used the WDNR's Forestry Tools Extension to determine the acreage of each bed to the nearest hundredth of an acre.

RESULTS AND DISCUSSION:

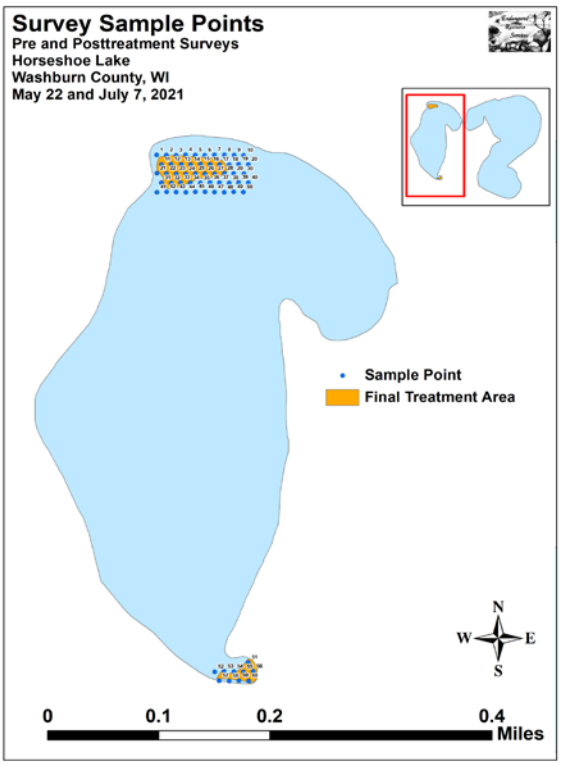
Finalization of Treatment Areas:

Initial expectations were to treat two areas covering 1.16 acres (0.66% of the lake's surface area). After the pretreatment survey found Eurasian water-milfoil in each area, it was decided to maintain the treatment as originally planned (Figure 3) (Appendix I).

Application occurred on June 1st with Northern Aquatic Services (Dale Dressel - Dresser, WI) applying ProcellaCor at a rate of 0.0058-0.0096ppm (43.3 total pdu) (Table 1). At the time of treatment, the reported water temperature was 69°F, and the air temperature was 63°F. Wind speeds were clocked at 2-3mph out of the west.

Table 1: Early-season EWM Treatment Summary
Horseshoe Lake, Washburn County
June 1, 2021

Bed Number	Proposed Treatment Area (acres)	Final Treatment Area (acres)	Change in Acreage (+/-)	Chemical, Rate, and Total Volume
1	0.89	0.89	0.00	ProcellaCor – 0.0096ppm – 40.1pdu
2	0.27	0.27	0.00	ProcellaCor – 0.0058ppm – 3.2pdu
Total	**1.16**	**1.16**	**0.00**	**ProcellaCor – 43.3pdu**



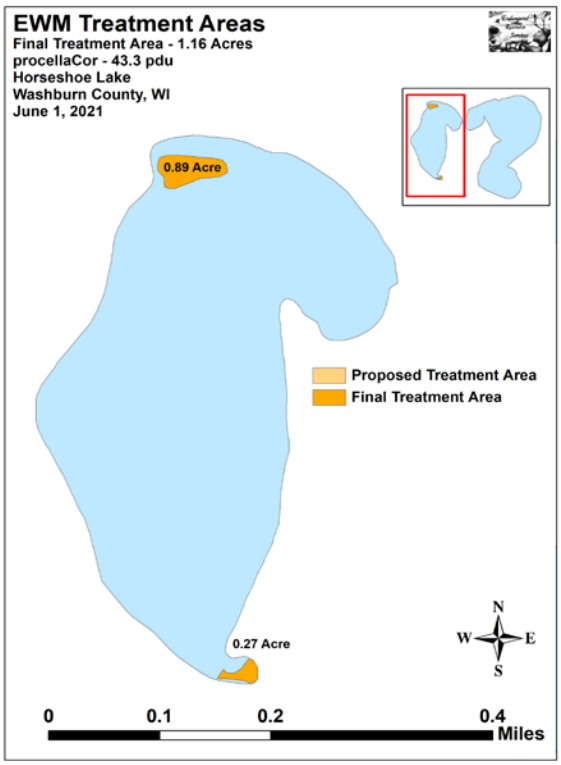


Figure 3: Pre/Post Survey Points and EWM Treatment Areas

Eurasian Water-milfoil Pre/Post Herbicide Survey:

All survey points occurred in areas between 4.0ft and 10.5ft of water. Within the beds, plants grew at a mean depth of 8.9ft and a median of 9.5ft during the pretreatment survey. These values both declined to 8.4ft and 9.0ft respectively posttreatment (Table 2). Most plants were established over a thin sandy muck (Figure 4) (Appendix III).

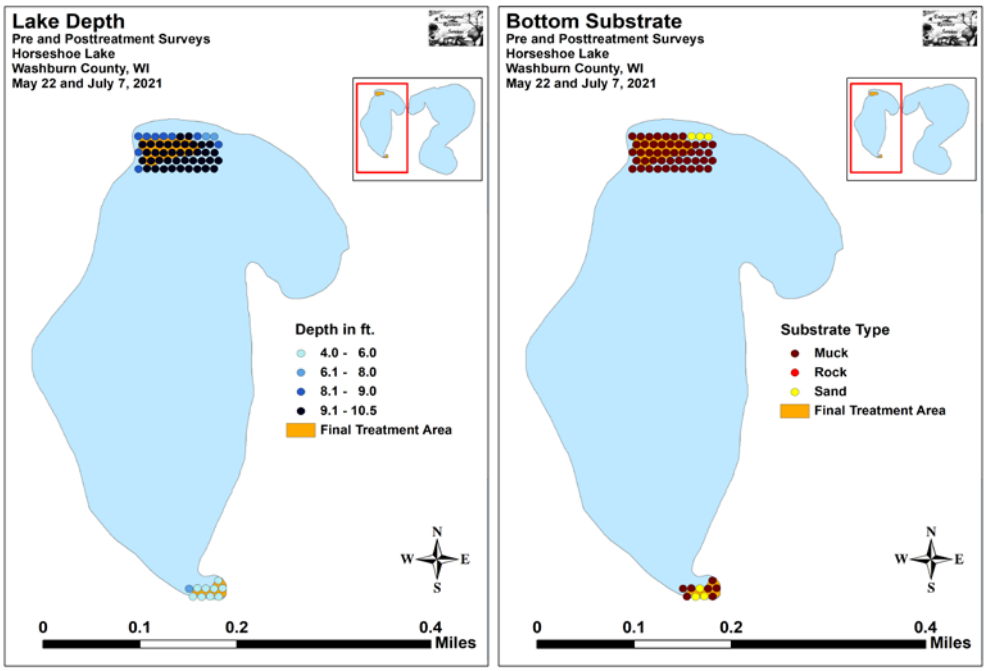


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Posttreatment Surveys Summary Statistics
Horseshoe Lake, Washburn County
May 22, 2021 and July 7, 2021

Summary Statistics:	Pre	Post
Total number of points sampled	60	60
Total number of sites with vegetation	51	57
Total number of sites shallower than the maximum depth of plants	60	60
Freq. of occur. at sites shallower than max. depth of plants (in percent)	85.0	95.0
Simpson Diversity Index	0.80	0.80
Mean Coefficient of Conservatism	7.3	6.6
Floristic Quality Index	28.4	25.6
Maximum depth of plants (ft)	10.5	10.5
Mean depth of plants (ft)	8.9	8.4
Median depth of plants (ft)	9.5	9.0
Average number of all species per site (shallower than max depth)	1.35	1.98
Average number of all species per site (veg. sites only)	1.59	2.09
Average number of native species per site (shallower than max depth)	1.28	1.98
Average number of native species per site (sites with native veg. only)	1.54	2.09
Species Richness	16	15

Mean Rake Fullness (veg. sites only)	1.63	1.70

The entire treatment area fell within the littoral zone. Pretreatment, plants were present at 51 of 60 points (85.0% coverage), and this increased to 57 of 60 points (95.0% coverage) posttreatment (Figure 5) (Appendix IV).

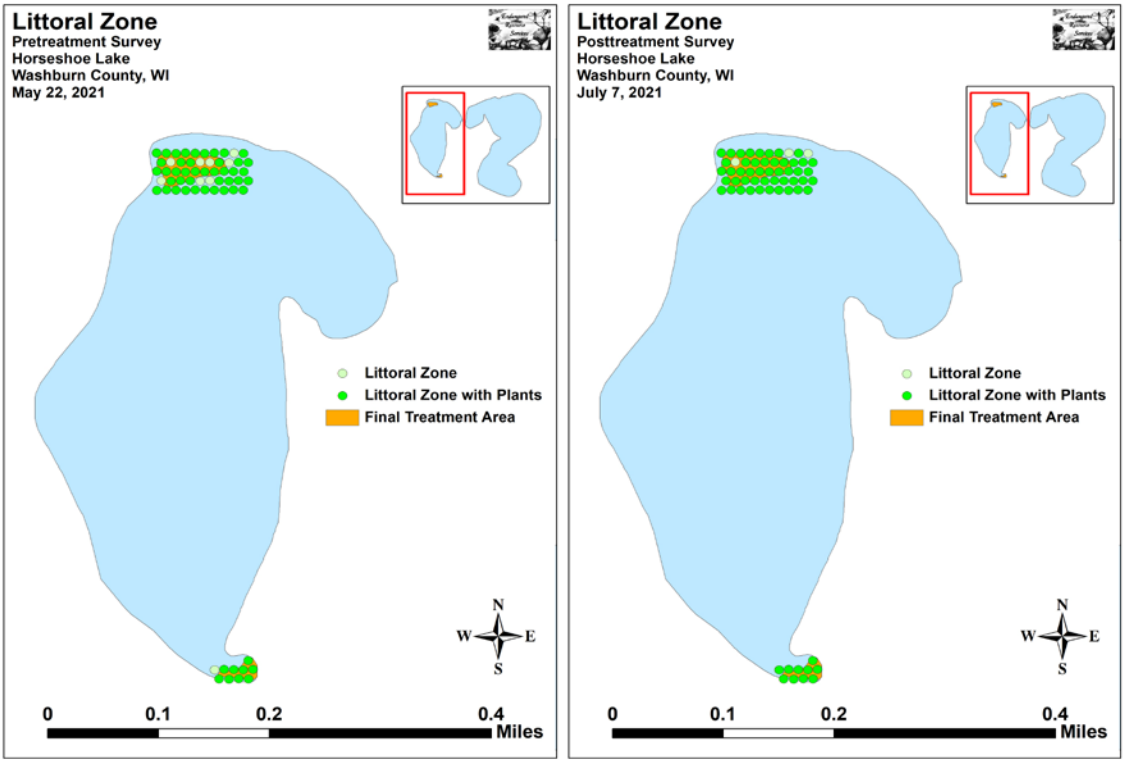


Figure 5: Pre/Posttreatment Littoral Zone

Total richness was almost unchanged at 16 species pretreatment and 15 species posttreatment. Similarly, the Simpson's Diversity Index was unchanged at a high value of 0.80 during each survey. The Floristic Quality Index (another measure of native plant community health) declined slightly from 28.4 pretreatment to 25.6 posttreatment.

Mean native species richness at points with native vegetation demonstrated a highly significant increase **($p<0.001$)** from 1.54 species/point pretreatment to 2.09 species/point posttreatment (Figure 6). Total mean rake fullness also increased from a moderate 1.63 pretreatment to 1.70 posttreatment; however, this was not significant (p=0. 62) (Figure 7) (Appendix IV).

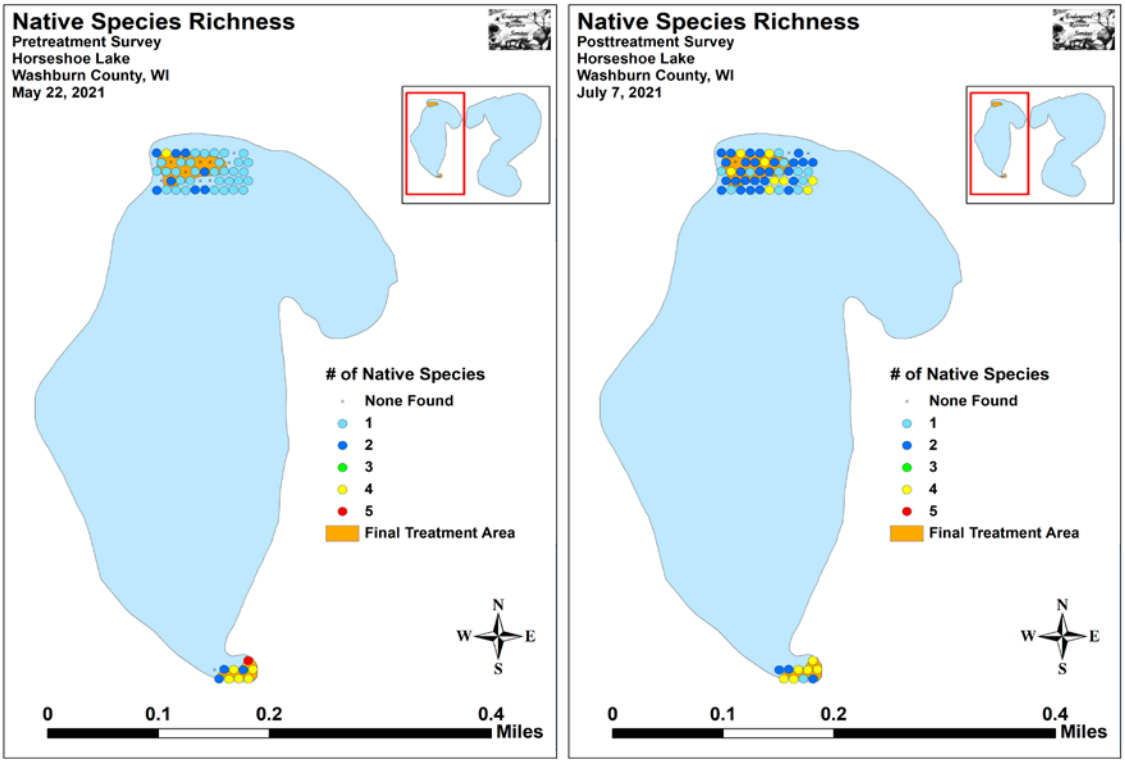


Figure 6: Pre/Posttreatment Native Species Richness

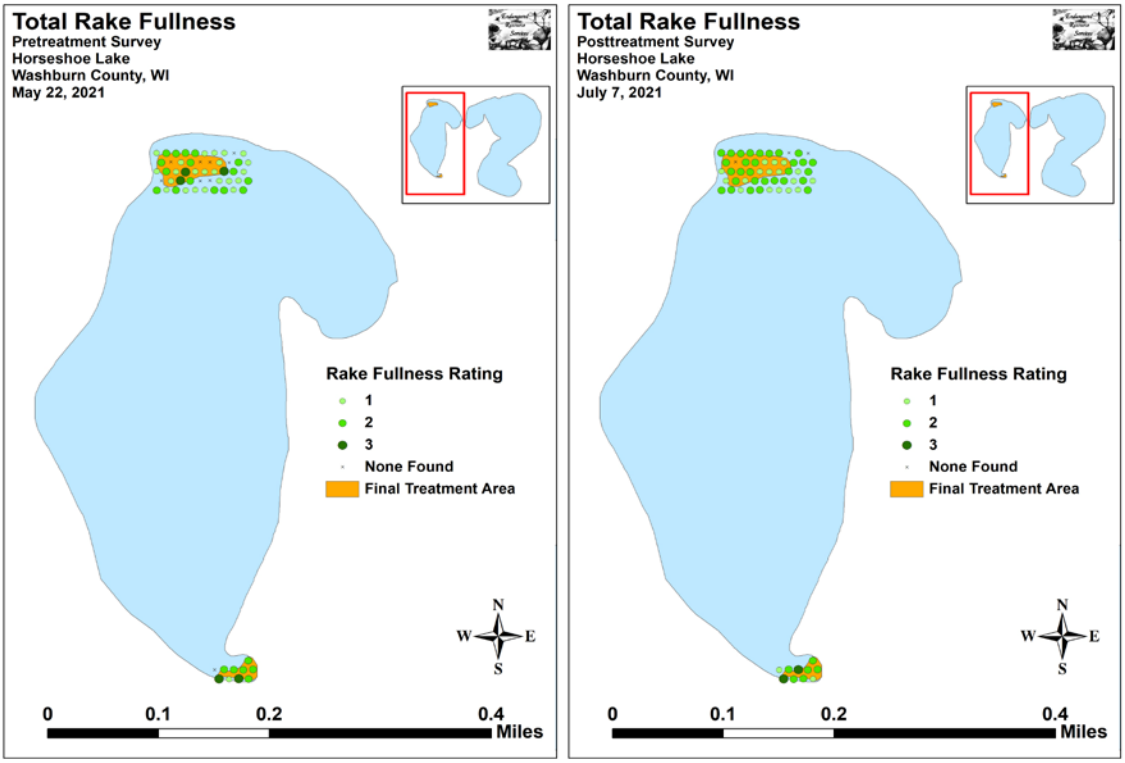


Figure 7: Pre/Posttreatment Total Rake Fullness

We found Eurasian water-milfoil at four points (6.67% coverage) with one additional visual sighting during the pretreatment survey. We rated one point a rake fullness of 3, two a 2, and one a 1 for a mean rake of 2.00. The three points with a rake fullness of 2 or 3 suggested 5.00% of the study area had a significant infestation (Figure 8) (Appendix V).

Posttreatment, we saw no evidence of EWM anywhere in the treatment areas or anywhere else in the west basin. Statistically, this suggested the treatment resulted in a significant decline **(*p*=0.04)** in total distribution (Figure 9).

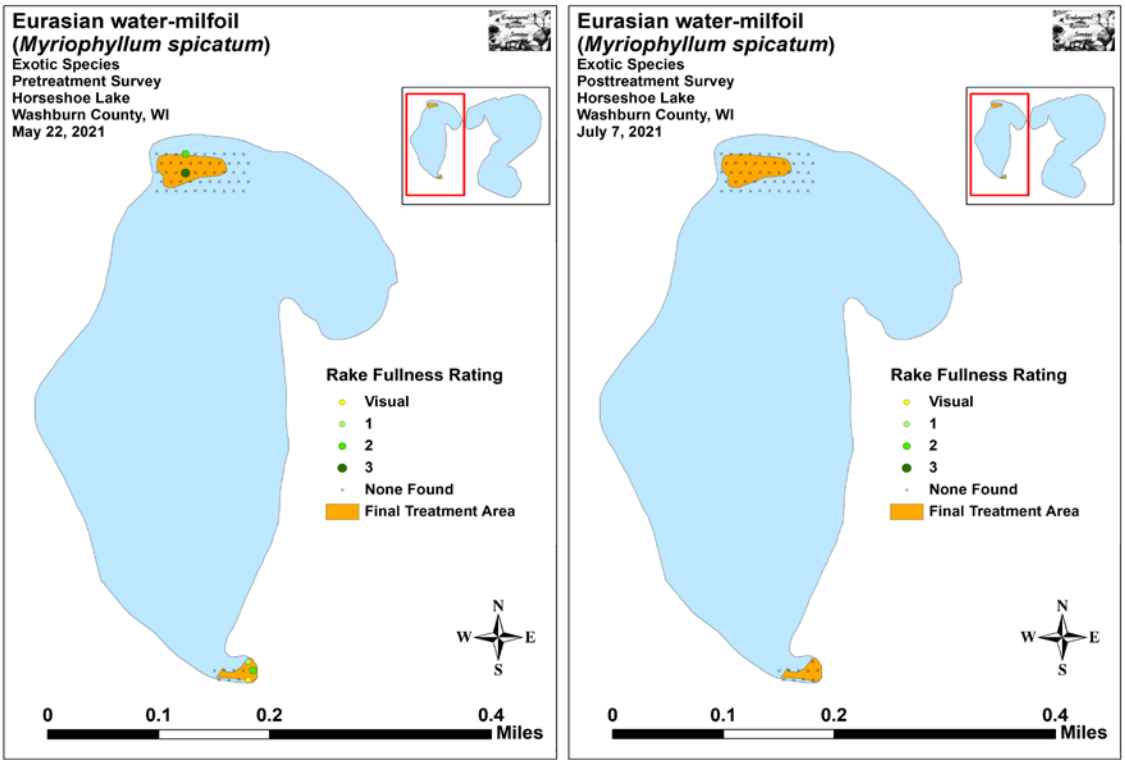
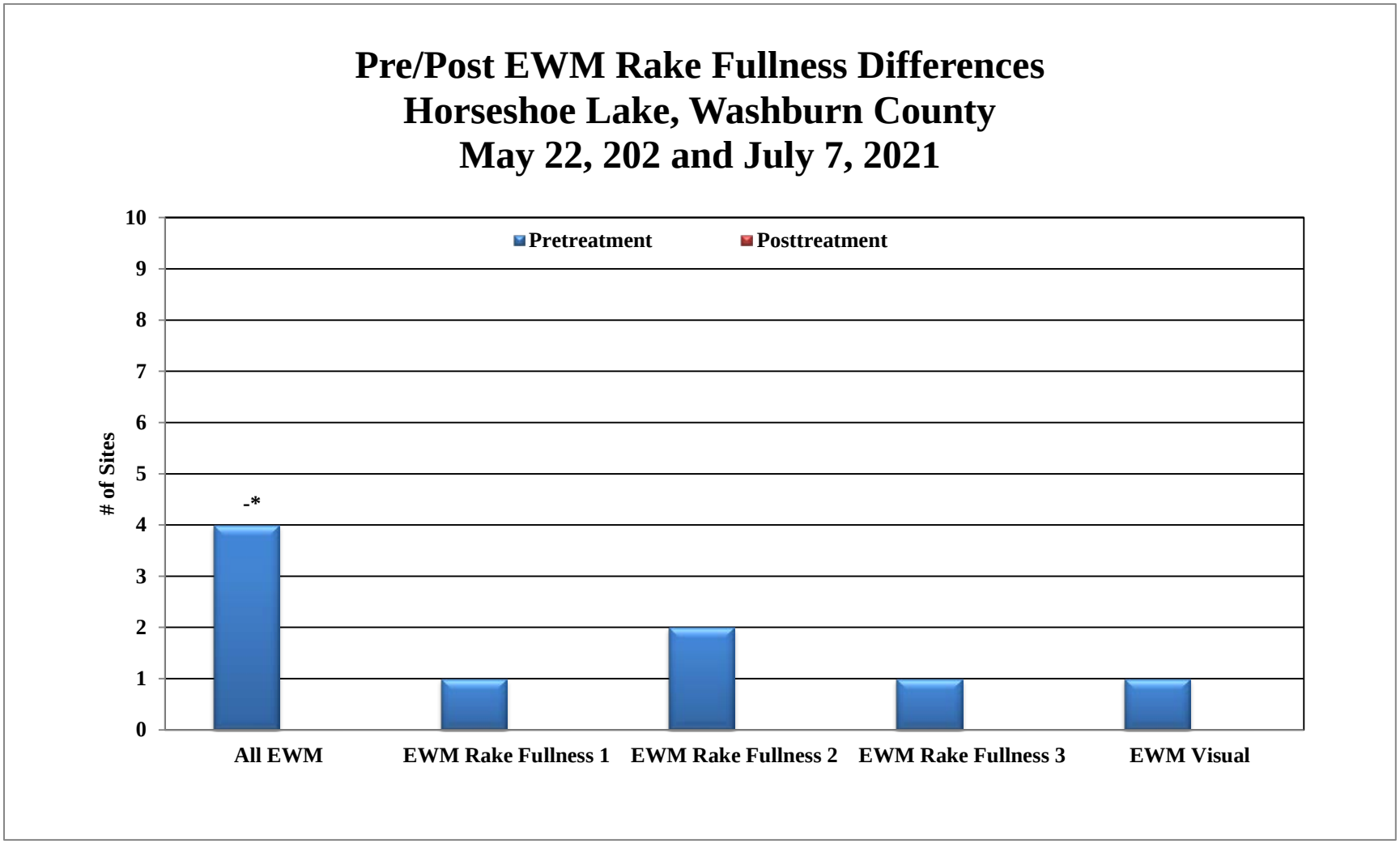


Figure 8: Pre/Posttreatment EWM Density and Distribution



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

Figure 9: Changes in EWM Rake Fullness

Crested arrowhead (*Sagittaria cristata*) was the most widely-distributed native species during the pretreatment survey (Figure 10) (Table 3). Present at 31 sites, it underwent a non-significant decline (p=0.58) in distribution to 28 sites posttreatment when it was the second most common species (Table 4). Similarly, its increase in density from a mean rake fullness of 1.29 pretreatment to 1.39 posttreatment was not significant (p=0.21).

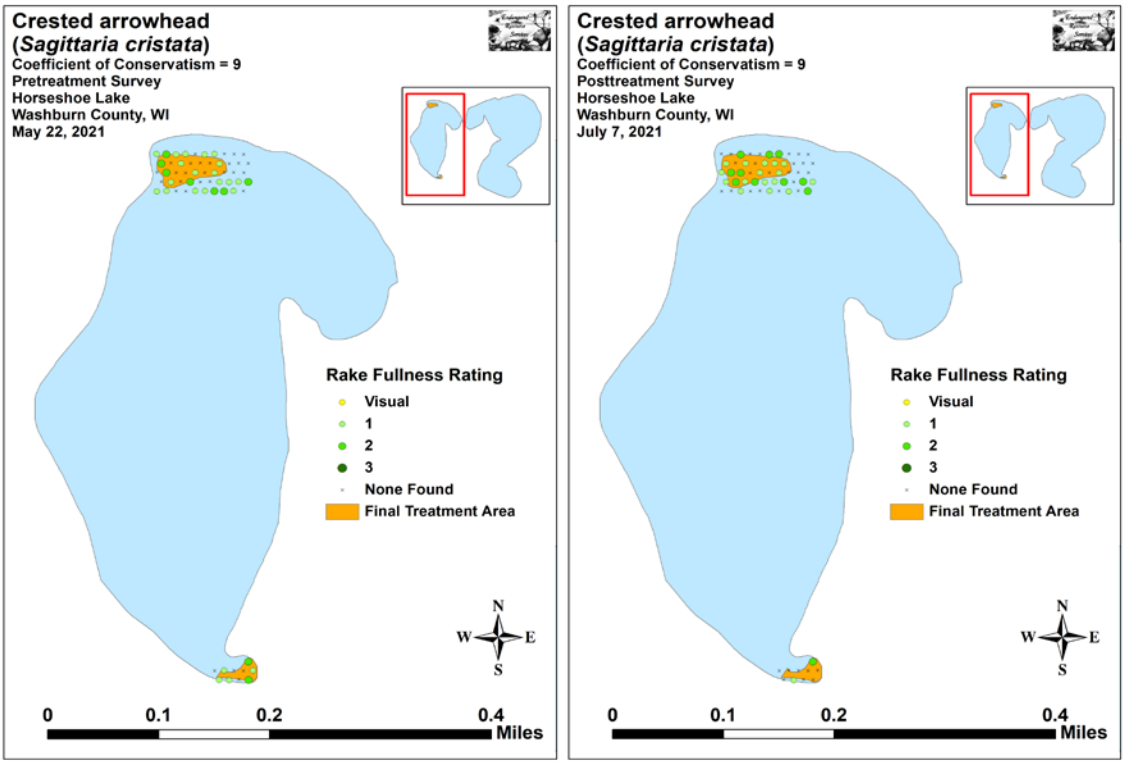


Figure 10: Pre/Posttreatment Crested Arrowhead Density and Distribution

We identified Fern pondweed (*Potamogeton robbinsii*) as the second most common species pretreatment. In May, it was located at 16 sites with a mean rake fullness of 1.75 (Figure 11). By July, it was just the fourth most common species, but neither its decline in distribution (14 sites) nor density (mean rake of 1.50) were significant (p=0.67/p=0.13).

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Pretreatment Survey - Horseshoe Lake, Washburn County
May 22, 2021

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Sagittaria cristata	Crested arrowhead	31	38.27	60.78	51.67	1.29	0
Potamogeton robbinsii	Fern pondweed	16	19.75	31.37	26.67	1.75	0
Eleocharis acicularis	Needle spikerush	5	6.17	9.80	8.33	1.40	0
Elodea canadensis	Common waterweed	4	4.94	7.84	6.67	1.75	0
Myriophyllum spicatum	**Eurasian water-milfoil**	**4**	**4.94**	**7.84**	**6.67**	**2.00**	**1**
Chara sp.	Muskgrass	3	3.70	5.88	5.00	1.33	0
Nitella sp.	Nitella	3	3.70	5.88	5.00	1.33	0
Potamogeton pusillus	Small pondweed	3	3.70	5.88	5.00	1.00	0
Myriophyllum tenellum	Dwarf water-milfoil	2	2.47	3.92	3.33	3.00	0
Potamogeton gramineus	Variable pondweed	2	2.47	3.92	3.33	1.00	0
Utricularia resupinata	Small purple bladderwort	2	2.47	3.92	3.33	1.00	0
Vallisneria americana	Wild celery	2	2.47	3.92	3.33	1.00	0
Eriocaulon aquaticum	Pipewort	1	1.23	1.96	1.67	2.00	0
Nuphar variegata	Spatterdock	1	1.23	1.96	1.67	1.00	0
Potamogeton praelongus	White-stem pondweed	1	1.23	1.96	1.67	1.00	0
Utricularia gibba	Creeping bladderwort	1	1.23	1.96	1.67	1.00	0

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey - Horseshoe Lake, Washburn County
July 7, 2021

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Najas flexilis	Slender naiad	30	25.21	52.63	50.00	1.43	0
Sagittaria cristata	Crested arrowhead	28	23.53	49.12	46.67	1.39	0
Vallisneria americana	Wild celery	21	17.65	36.84	35.00	1.38	0
Potamogeton robbinsii	Fern pondweed	14	11.76	24.56	23.33	1.50	0
Najas gracillima	Northern naiad	5	4.20	8.77	8.33	1.20	0
Chara sp.	Muskgrass	4	3.36	7.02	6.67	1.00	0
Nitella sp.	Nitella	4	3.36	7.02	6.67	1.75	0
Nymphaea odorata	White water lily	4	3.36	7.02	6.67	2.00	0
Brasenia schreberi	Watershield	2	1.68	3.51	3.33	2.00	0
Elodea canadensis	Common waterweed	2	1.68	3.51	3.33	2.00	0
Eleocharis acicularis	Needle spikerush	1	0.84	1.75	1.67	1.00	0
Myriophyllum tenellum	Dwarf water-milfoil	1	0.84	1.75	1.67	2.00	0
Nuphar variegata	Spatterdock	1	0.84	1.75	1.67	1.00	0
Potamogeton natans	Floating-leaf pondweed	1	0.84	1.75	1.67	1.00	0
Potamogeton praelongus	White-stem pondweed	1	0.84	1.75	1.67	1.00	0

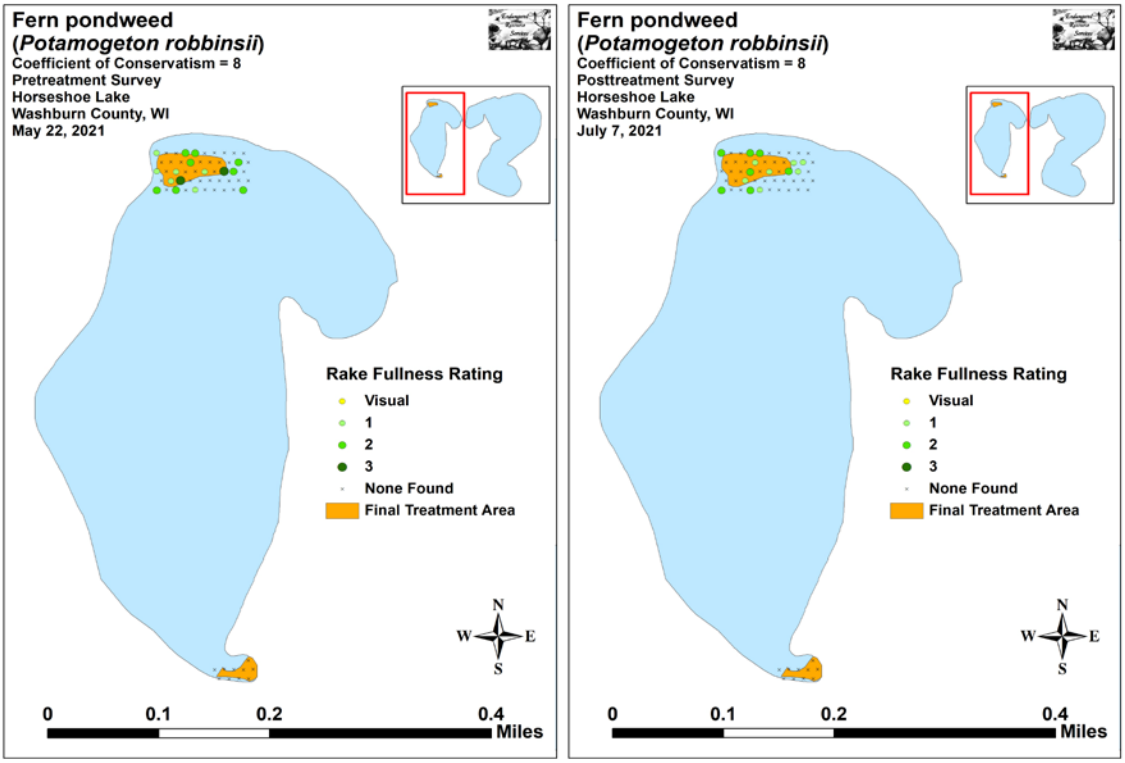
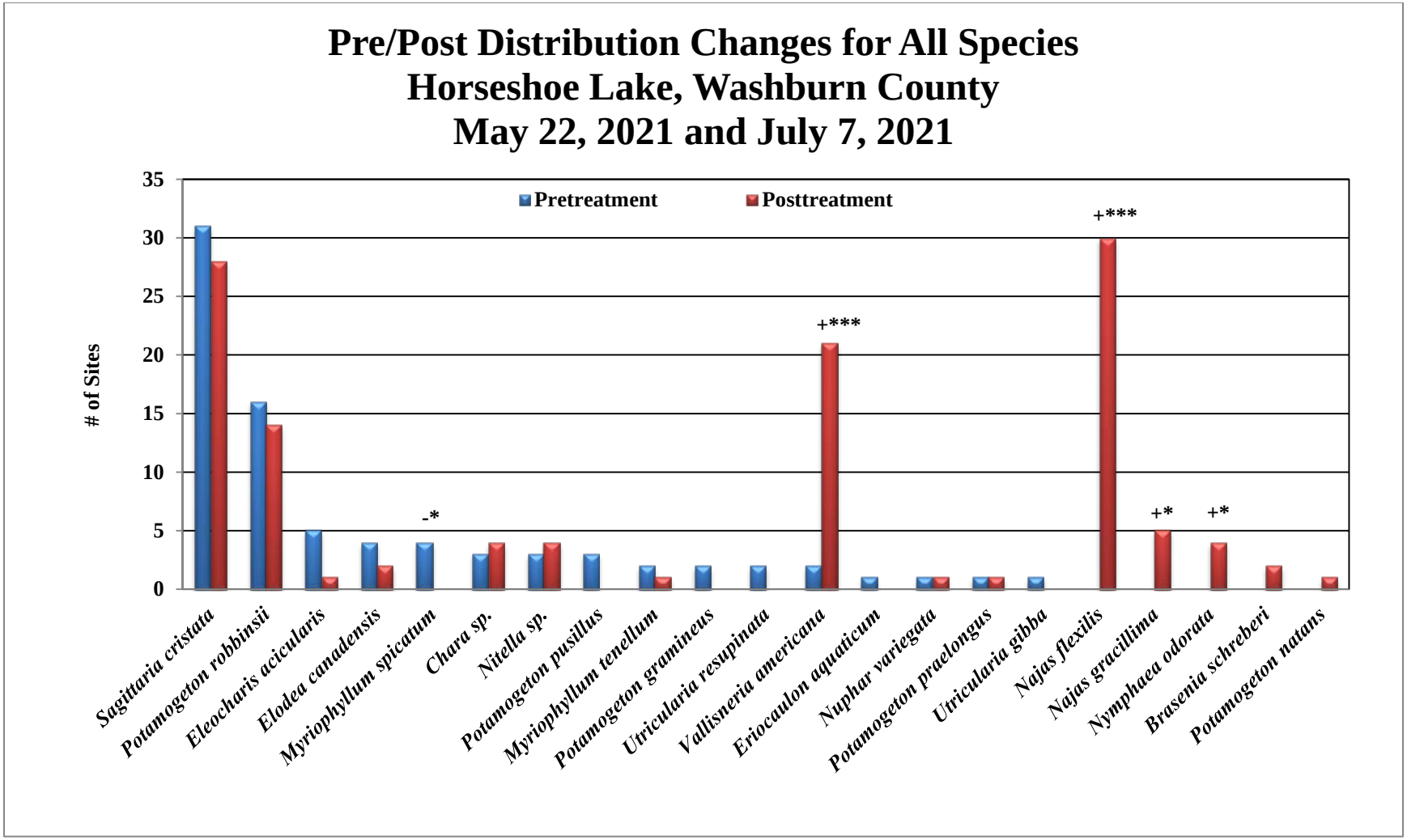


Figure 11: Pre/Posttreatment Fern Pondweed Density and Distribution

Eurasian water-milfoil was the only species that showed a significant decline in distribution posttreatment. Conversely, Slender naiad (*Najas flexilis*) and Wild celery (*Vallisneria americana*), two late-growing species that were just germinating during the pretreatment survey, each enjoyed highly significant expansions **($p<0.001$)** to become the most common and third most common species posttreatment. Northern naiad (*Najas gracillima*) and White water lily (*Nymphaea odorata*) also demonstrated significant increases **($p=0.02$/$p=0.04$)** in distribution (Figure 12) (Maps for all native species from the pre and posttreatment surveys can be found in Appendixes VI and VII).



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

Figure 12: Pre/Posttreatment Macrophyte Changes

September EWM Rake Removal and Bed Mapping Survey:

On September 5th, we returned to the lake to look for evidence of surviving EWM. Water clarity continued to be good, and, with calm conditions, we could see down approximately 10ft. We covered transects totaling 24.3km (15.1 miles) (Figure 13).

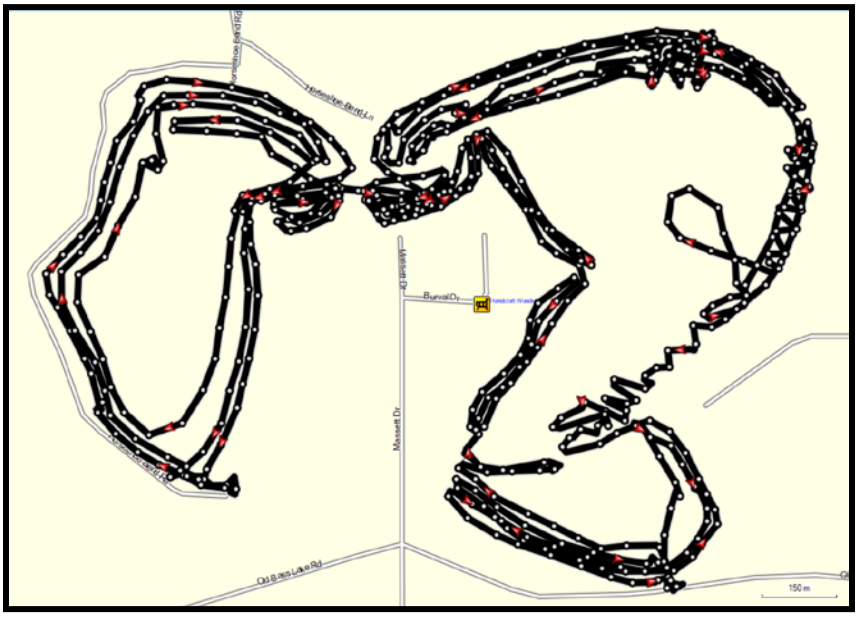


Figure 13: September 5, 2021 Shoreline Survey Tracks

We found no evidence of EWM anywhere in the 2021 treatment areas or anywhere else in the west basin. We also didn't find any EWM in the former treatment areas from 2019 or 2016 in the east basin. Just east of the narrows, in the same area we rake removed plants in 2020 and where the HLPOA used SCUBA to manually remove EWM in the summer of 2021, we found and eliminated seven mature plants that were canopied or near canopied and actively fragmenting. We also found a dense cluster of seven plants off the edge of a dock on the north shoreline. Despite exhaustive searching, we saw no other evidence of EWM anywhere in this area. This could mean a fragment drifted in from the canopied plants near the narrows or was carried here by a motor prop. It could also mean there is a yet to be discovered bed in the area that wasn't large enough to be detected (Figure 14) (Appendix VIII).

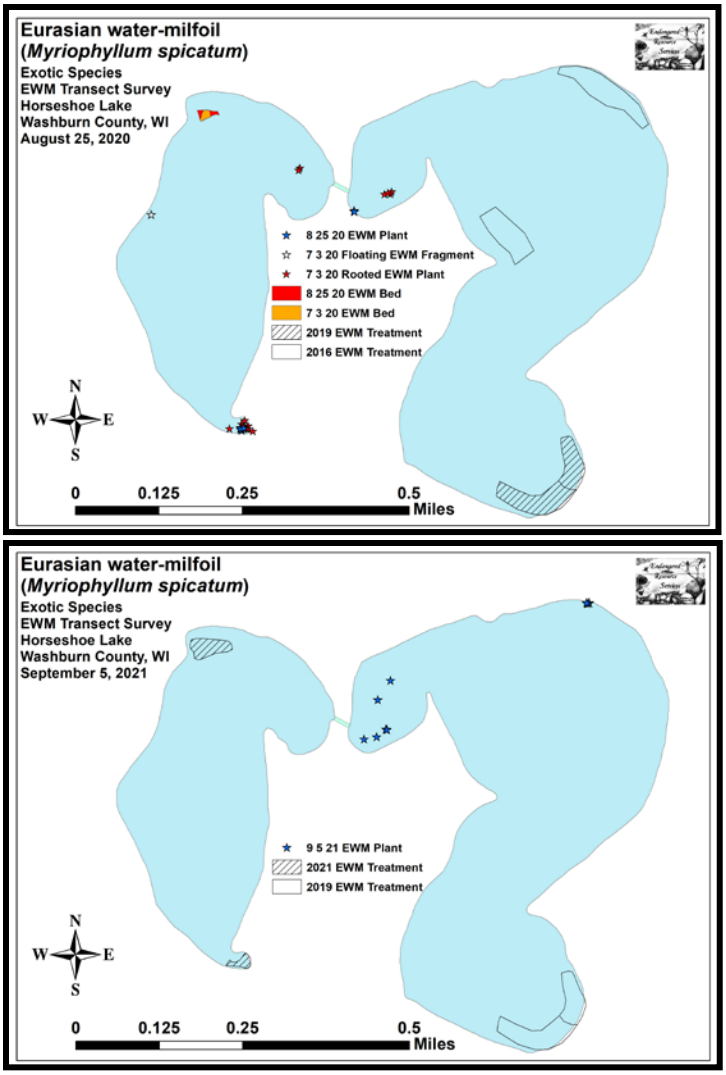


Figure 14: August 25, 2020 and September 5, 2021, EWM Bed Maps

CONSIDERATIONS FOR MANAGMENT:

Following the 2021 treatment, Eurasian water-milfoil again occurs at very low levels in Horseshoe Lake. Although the plants found and raked out during our final survey in 2021 were few in number, their proximity to the channel in an area that gets regular boat traffic might make a very limited chemical treatment in 2022 a consideration. Conversely, waiting to see how things look in the spring and continuing with manual removal is also a plausible management option. Ultimately, the HLPOA, LEAPS, and the Wisconsin Department of Natural Resources will have to decide what, if any, management and monitoring will occur on the lake in 2022. In the meantime, lake residents should remain on the lookout for any signs of EWM. If they discover a plant they even suspect may be EWM, we strongly encourage them to **immediately** contact Matthew Berg, ERS, LLC Research Biologist at 715-338-7502 for identification confirmation. If possible, a specimen, a jpg, and the accompanying GPS coordinates of the location should be included. Texting pictures from a smartphone is ideal as it allows for immediate feedback. Likewise, we are happy to identify ANY plant a lake resident may want identified.

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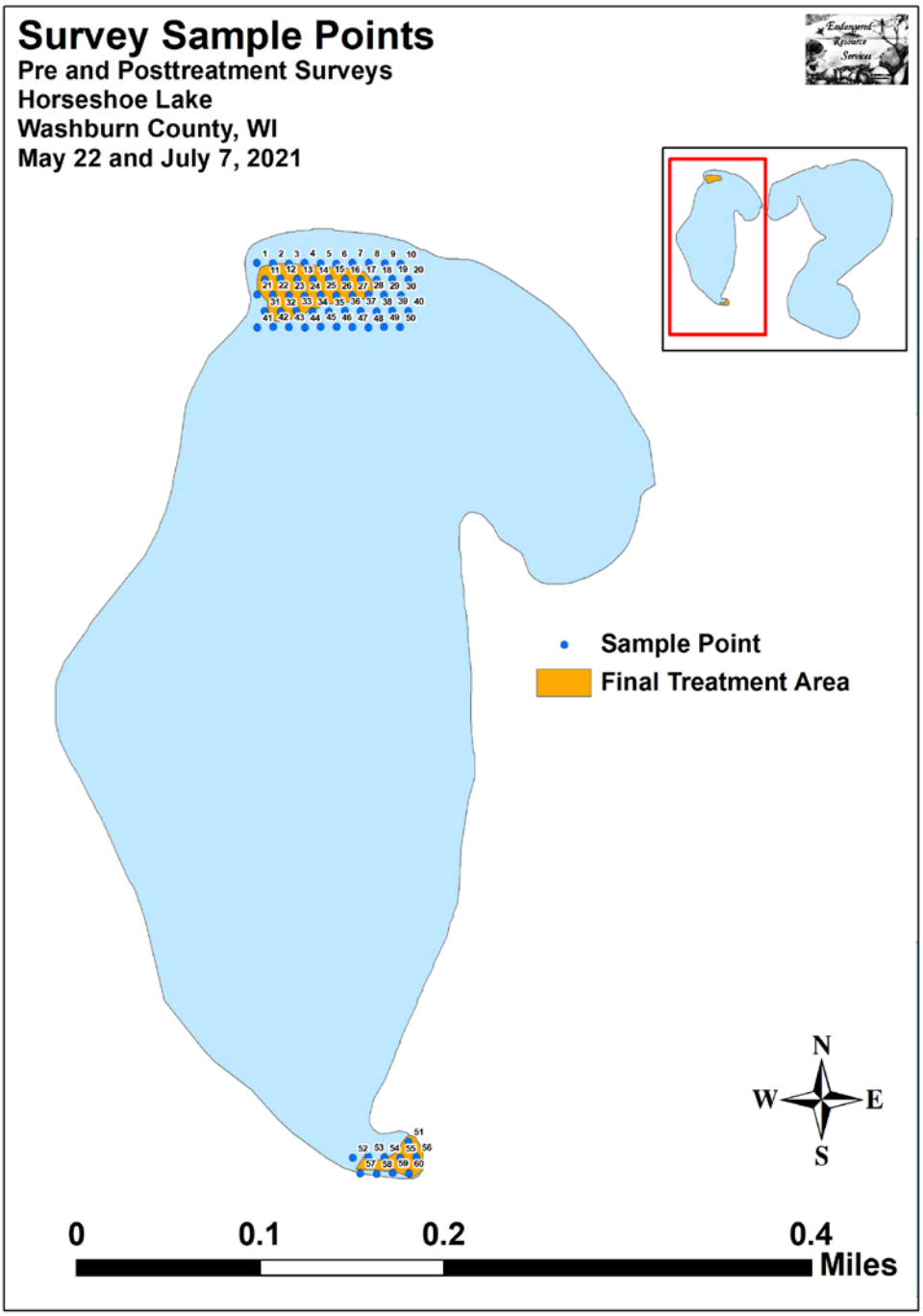
Appendix I: EWM Pre/Post Survey Sample Points and Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Horseshoe Lake
Washburn County, WI
May 22 and July 7, 2021
Endangered Resource Services
Sample Point
Final Treatment Area
N
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S
0
0.1
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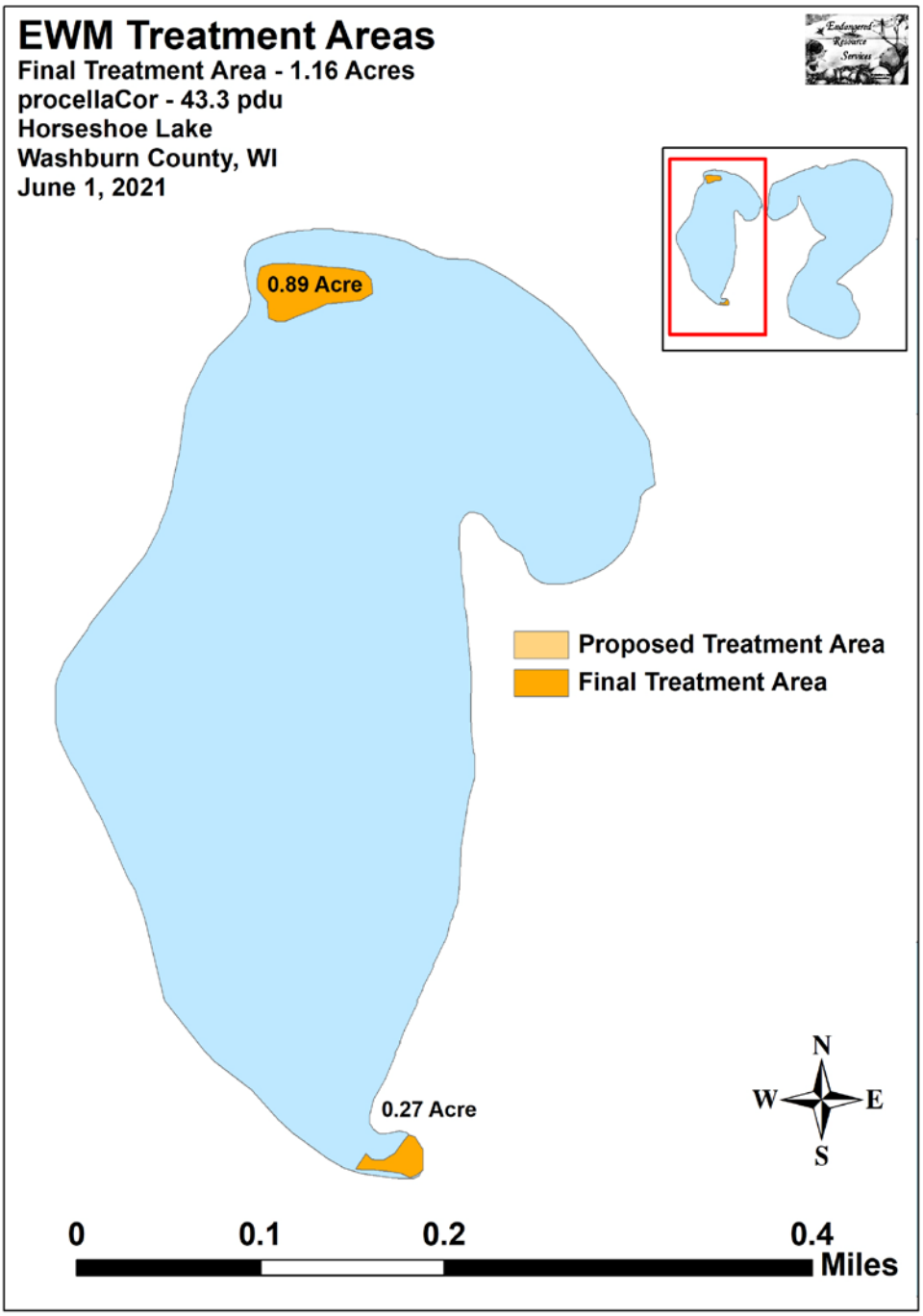
0.4
Miles


EWM Treatment Areas
Final Treatment Area - 1.16 Acres
procellaCor - 43.3 pdu
Horseshoe Lake
Washburn County, WI
June 1, 2021
0.89 Acre
0.27 Acre
Proposed Treatment Area
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

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	EWM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																									
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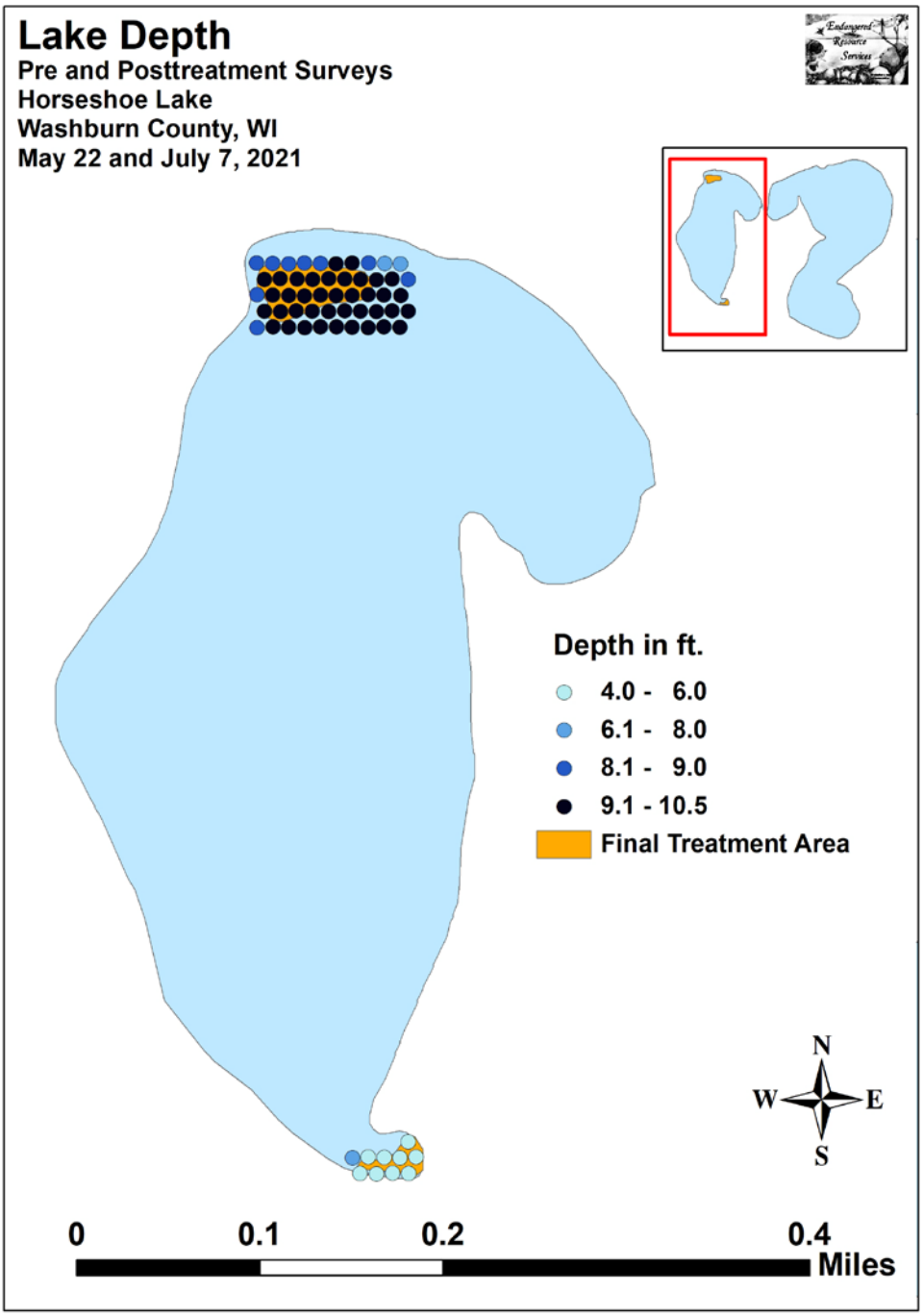
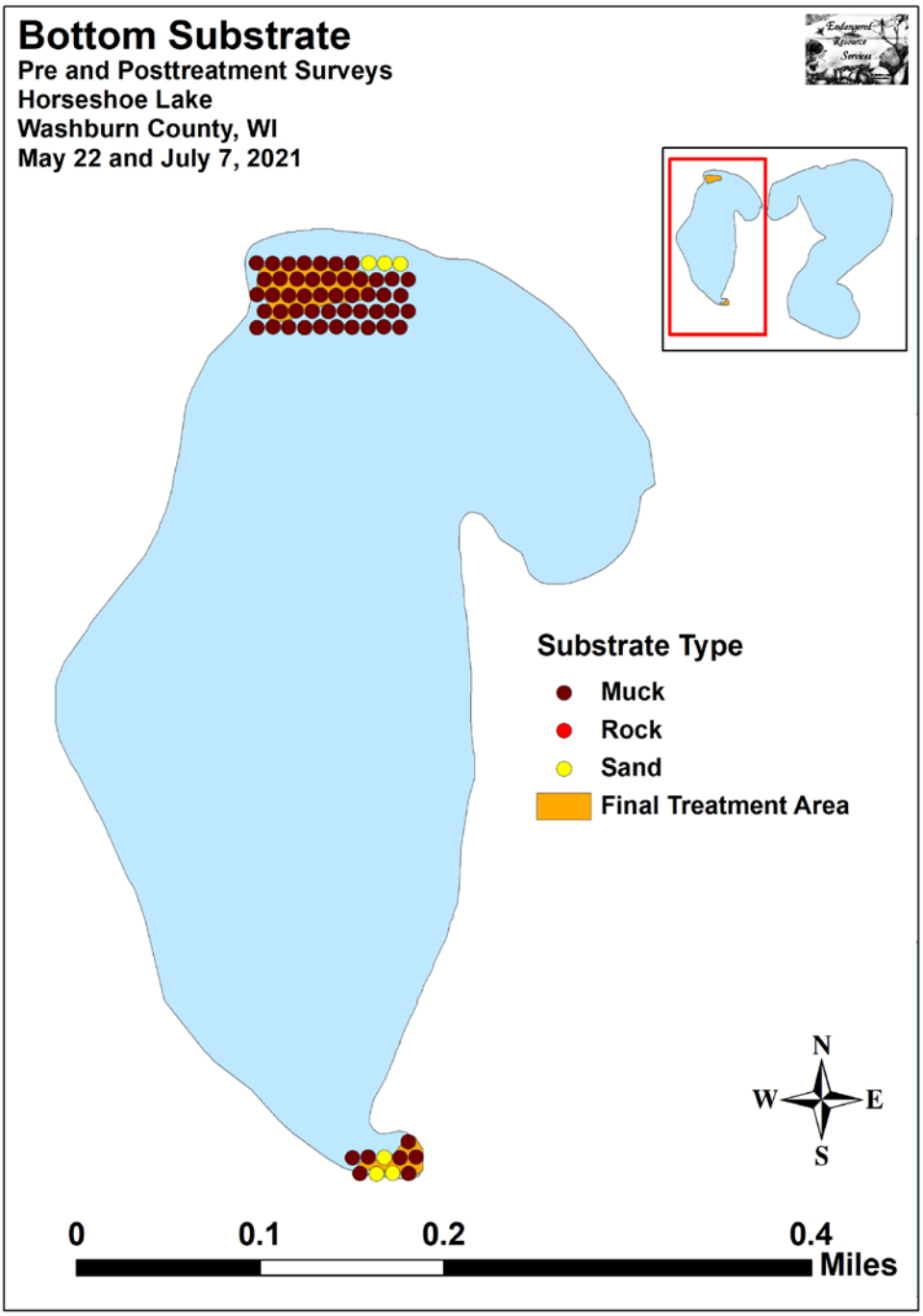
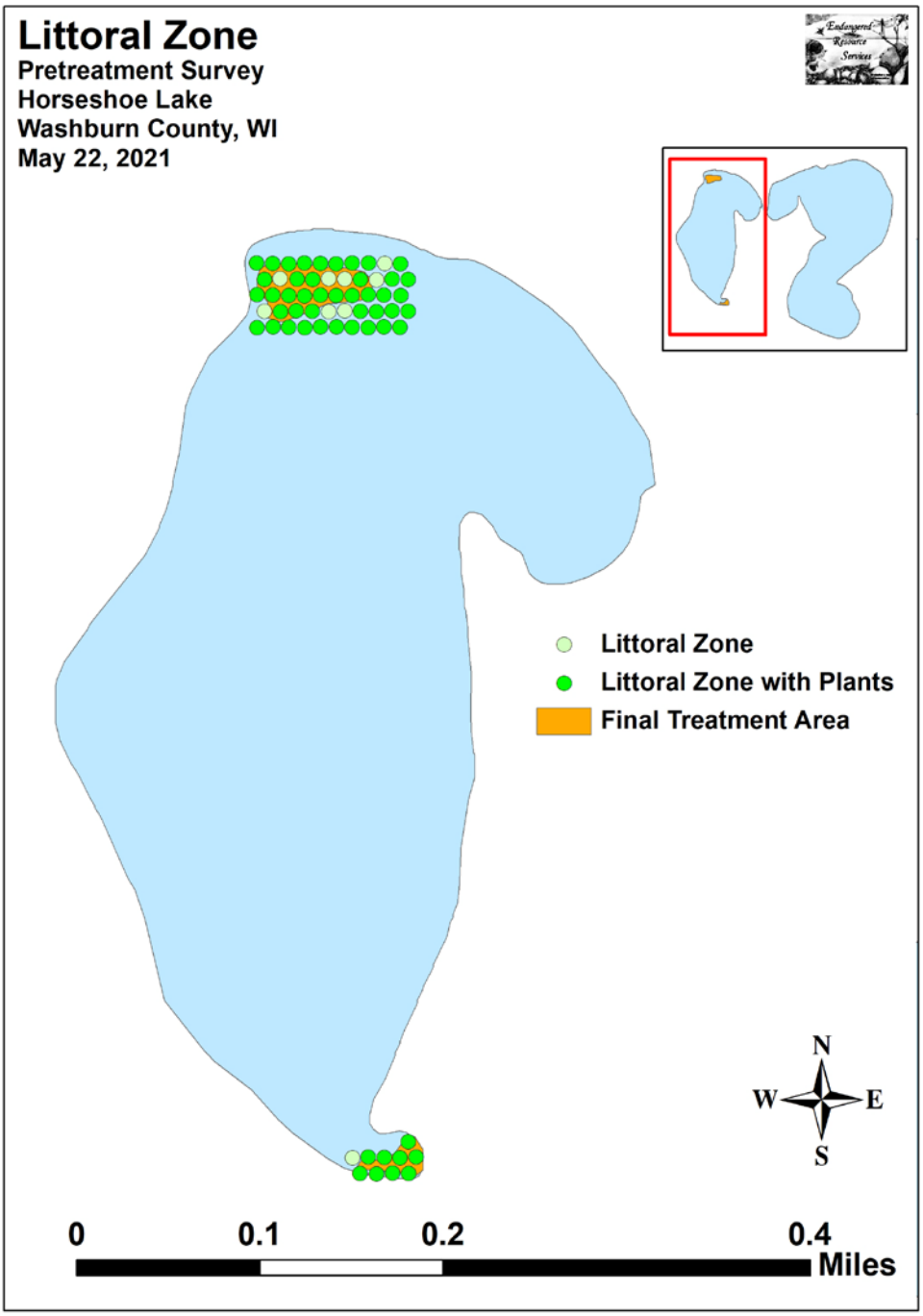
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

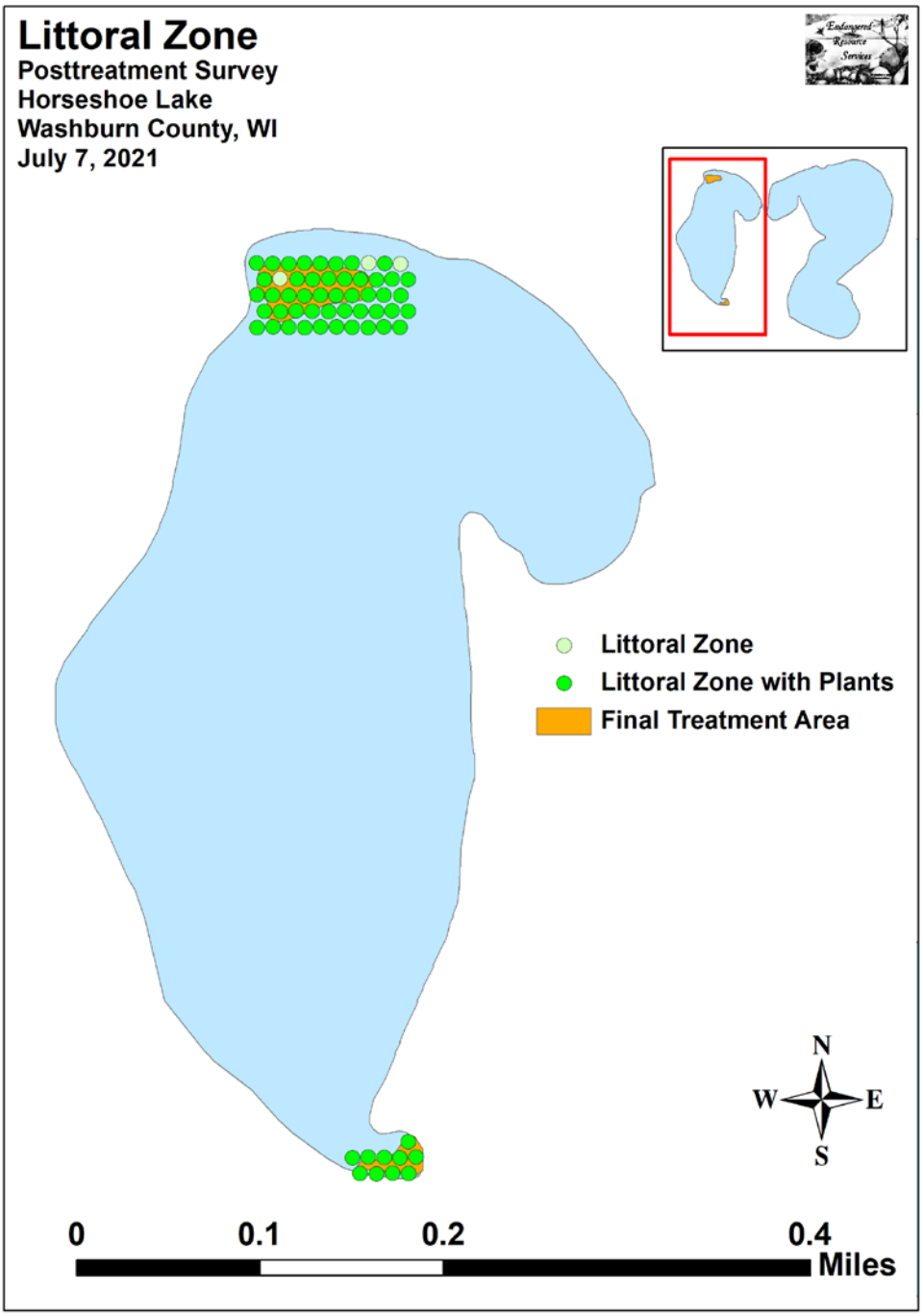
Appendix III: Pre/Post Habitat Variables

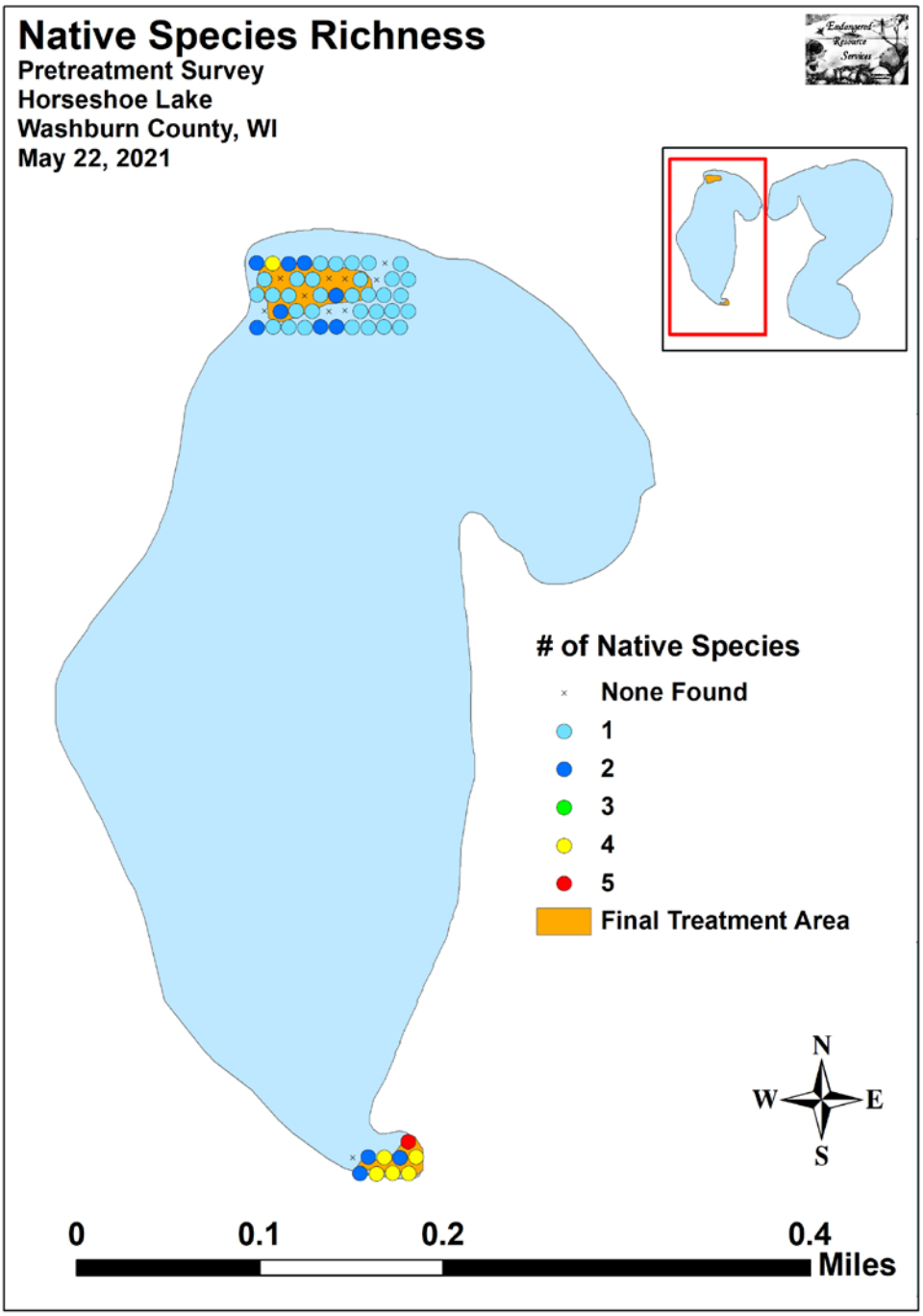

Lake Depth
Pre and Posttreatment Surveys
Horseshoe Lake
Washburn County, WI
May 22 and July 7, 2021
Depth in ft.
4.0 - 6.0
6.1 - 8.0
8.1 - 9.0
9.1 - 10.5
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

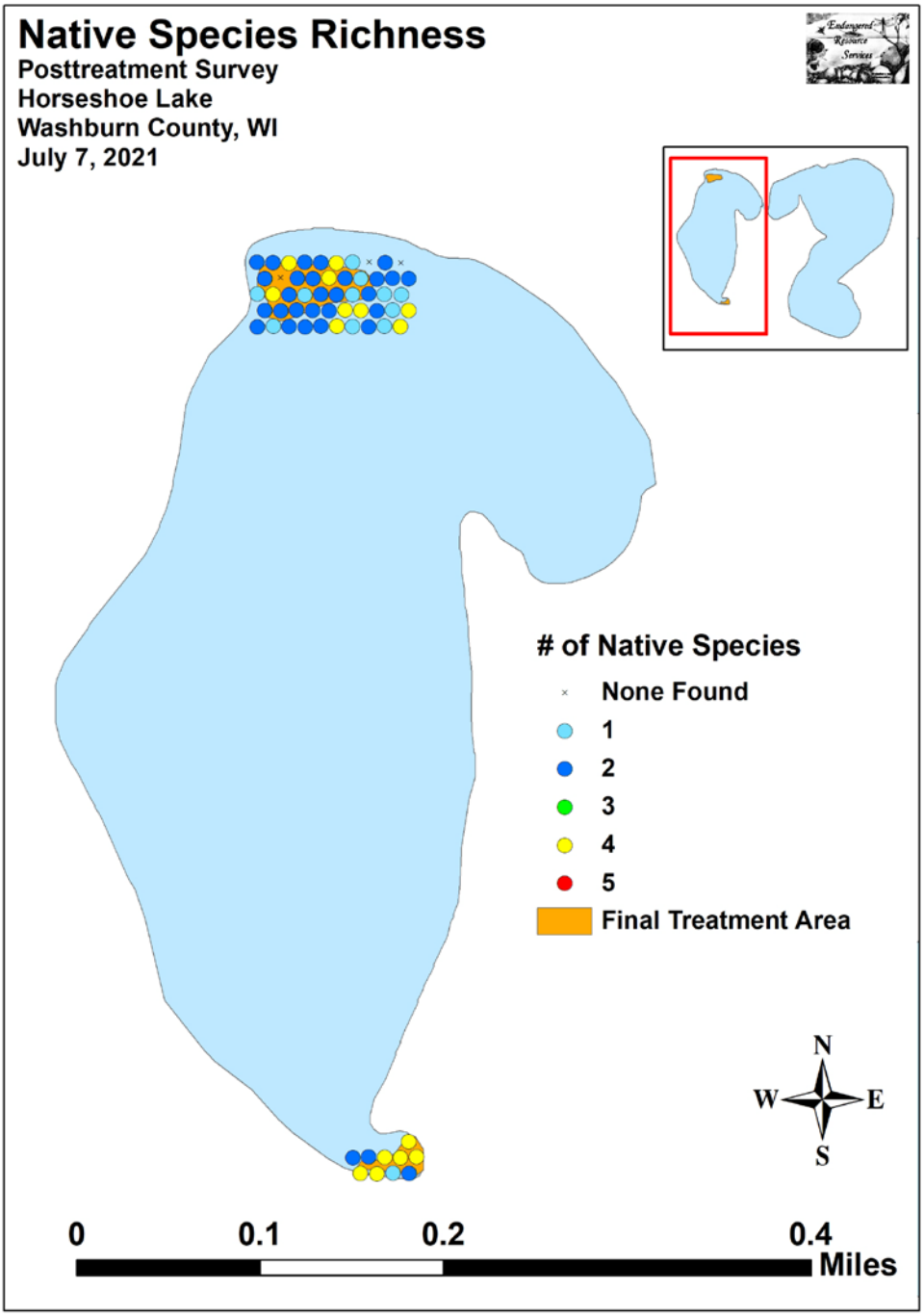

Bottom Substrate
Pre and Posttreatment Surveys
Horseshoe Lake
Washburn County, WI
May 22 and July 7, 2021
Substrate Type
Muck
Rock
Sand
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

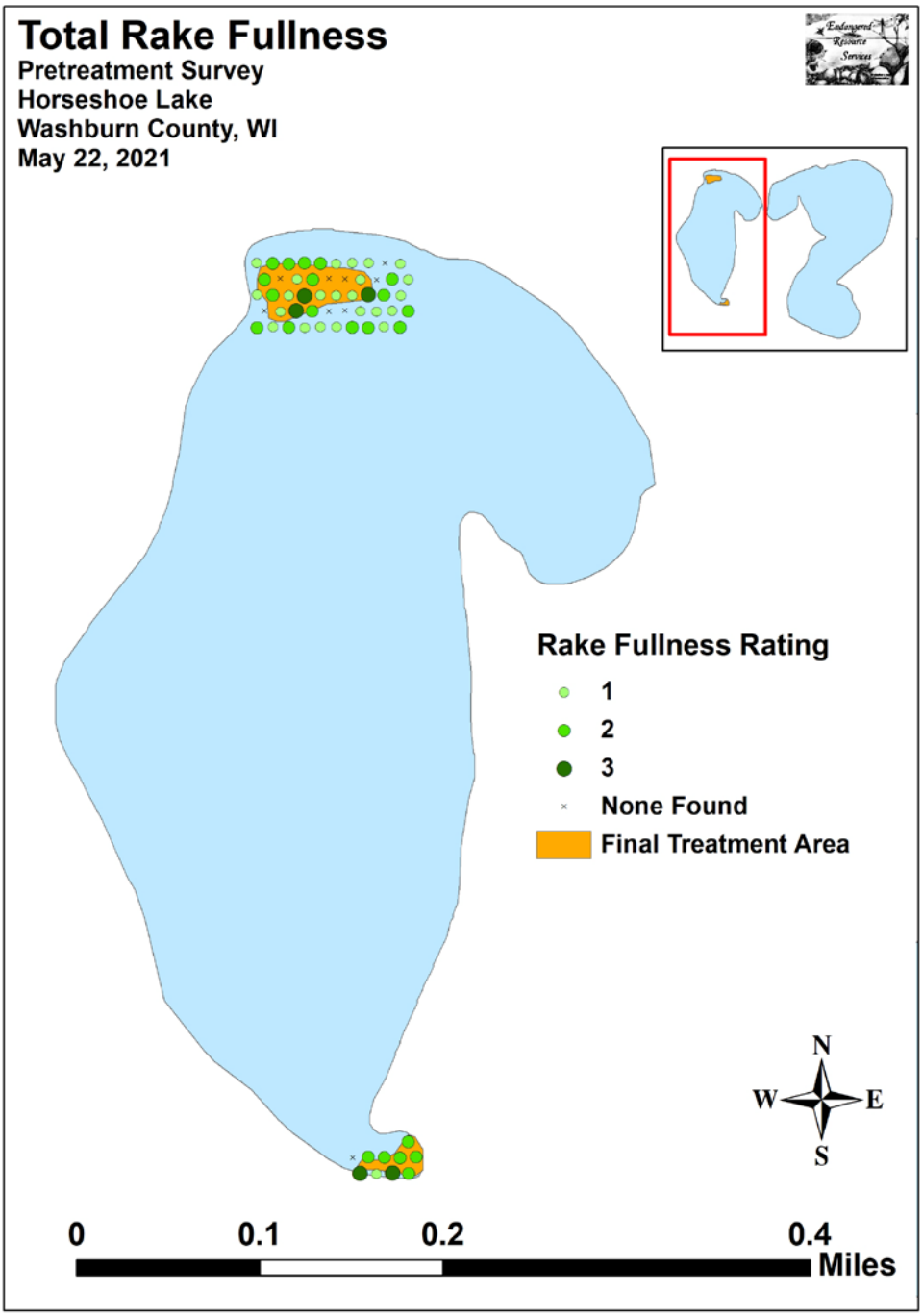
Appendix IV: Pre/Post Littoral Zone, Native Species Richness and Total Rake Fullness

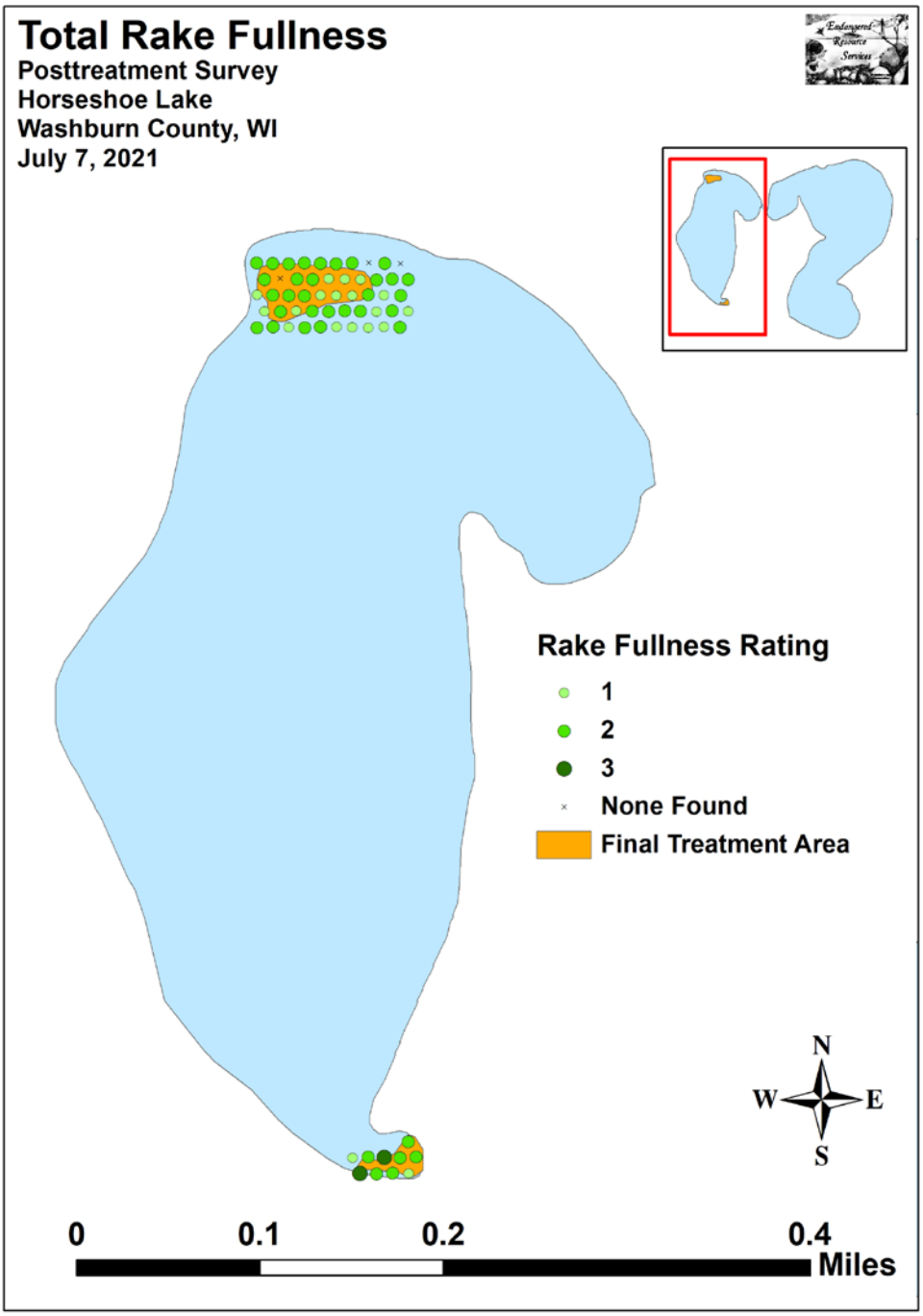

Littoral Zone
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Littoral Zone
Littoral Zone with Plants
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Littoral Zone
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Littoral Zone
Littoral Zone with Plants
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

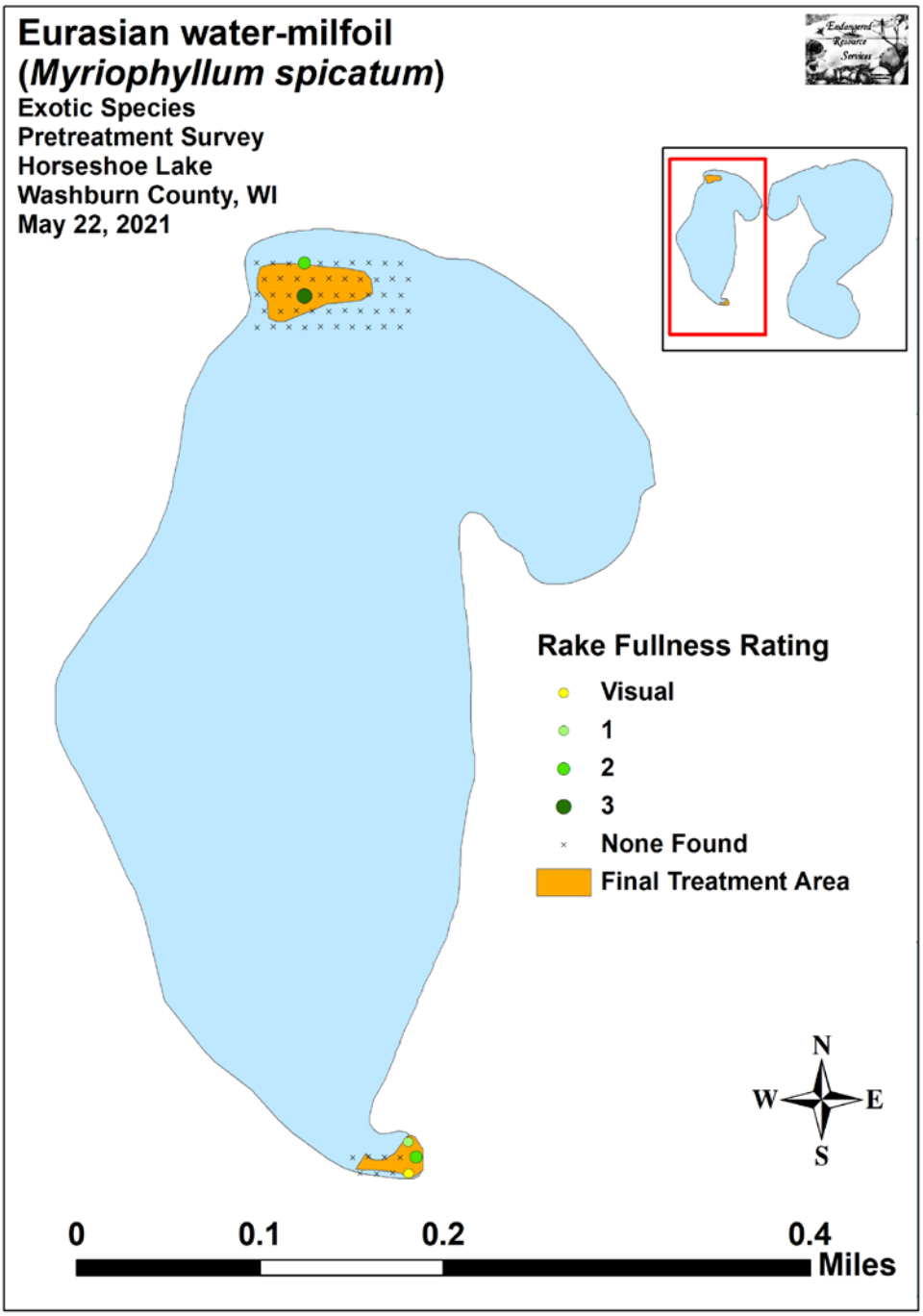

Native Species Richness
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
# of Native Species
None Found
1
2
3
4
5
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

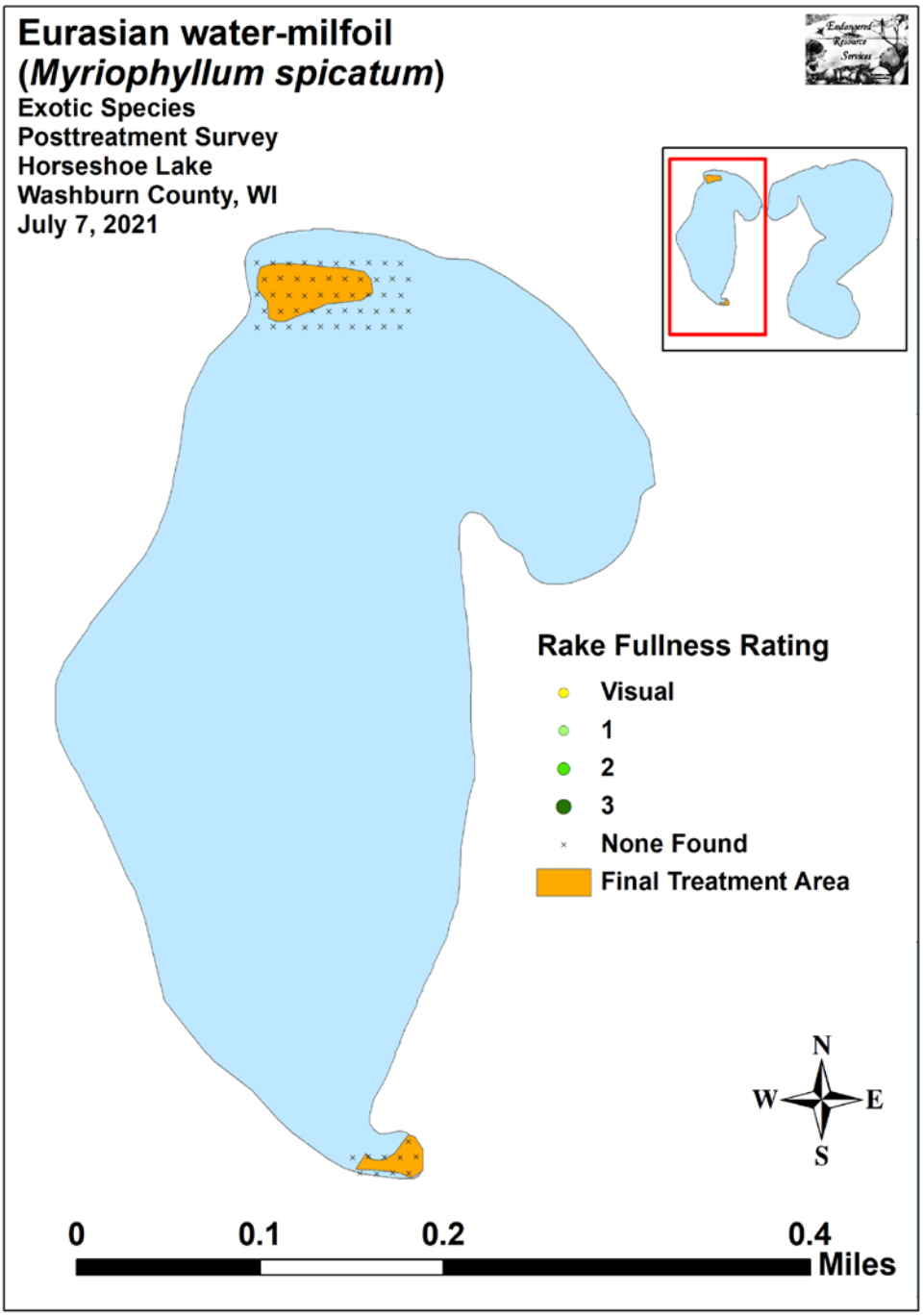

Native Species Richness
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
# of Native Species
None Found
1
2
3
4
5
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Total Rake Fullness
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

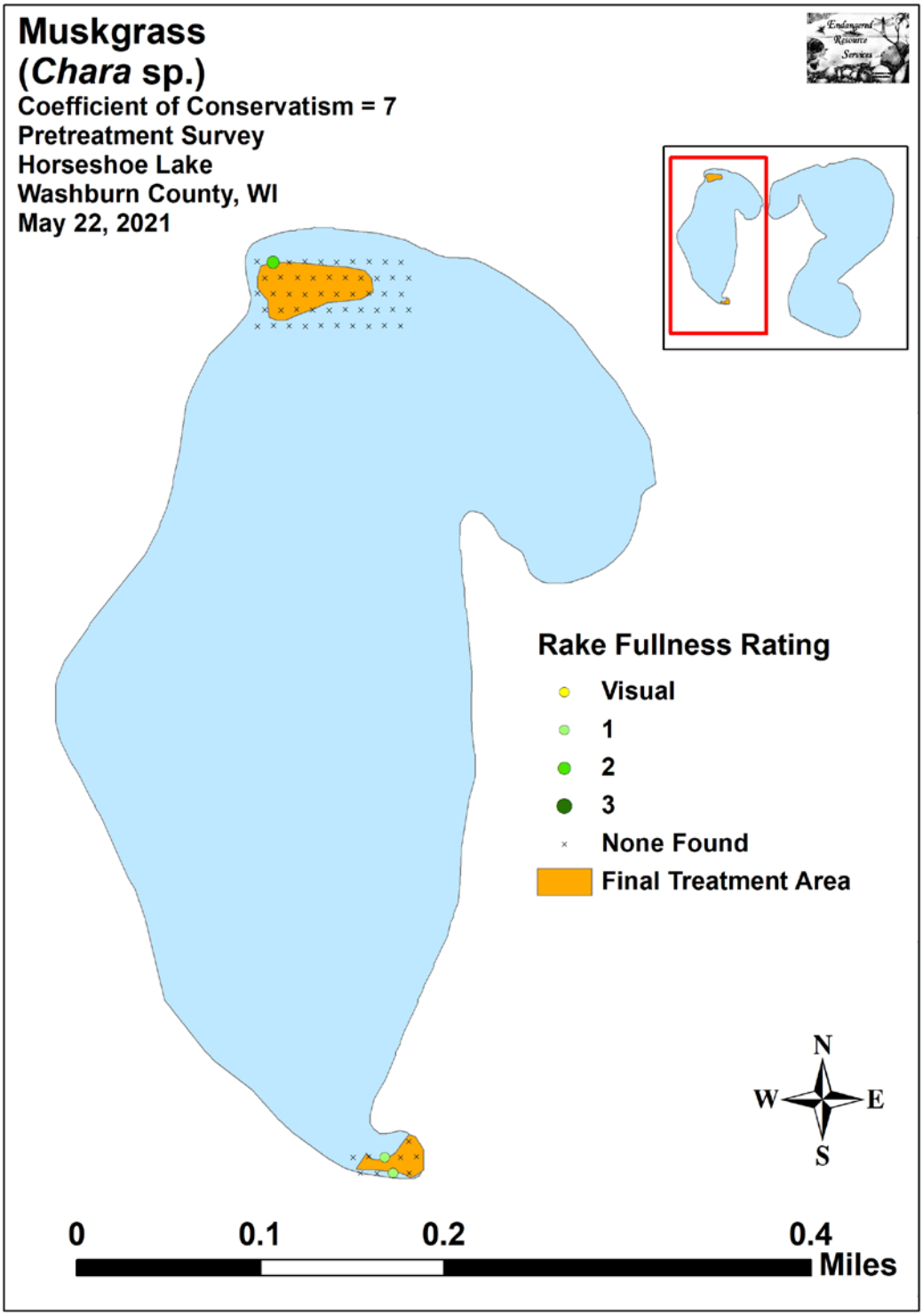

Total Rake Fullness
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

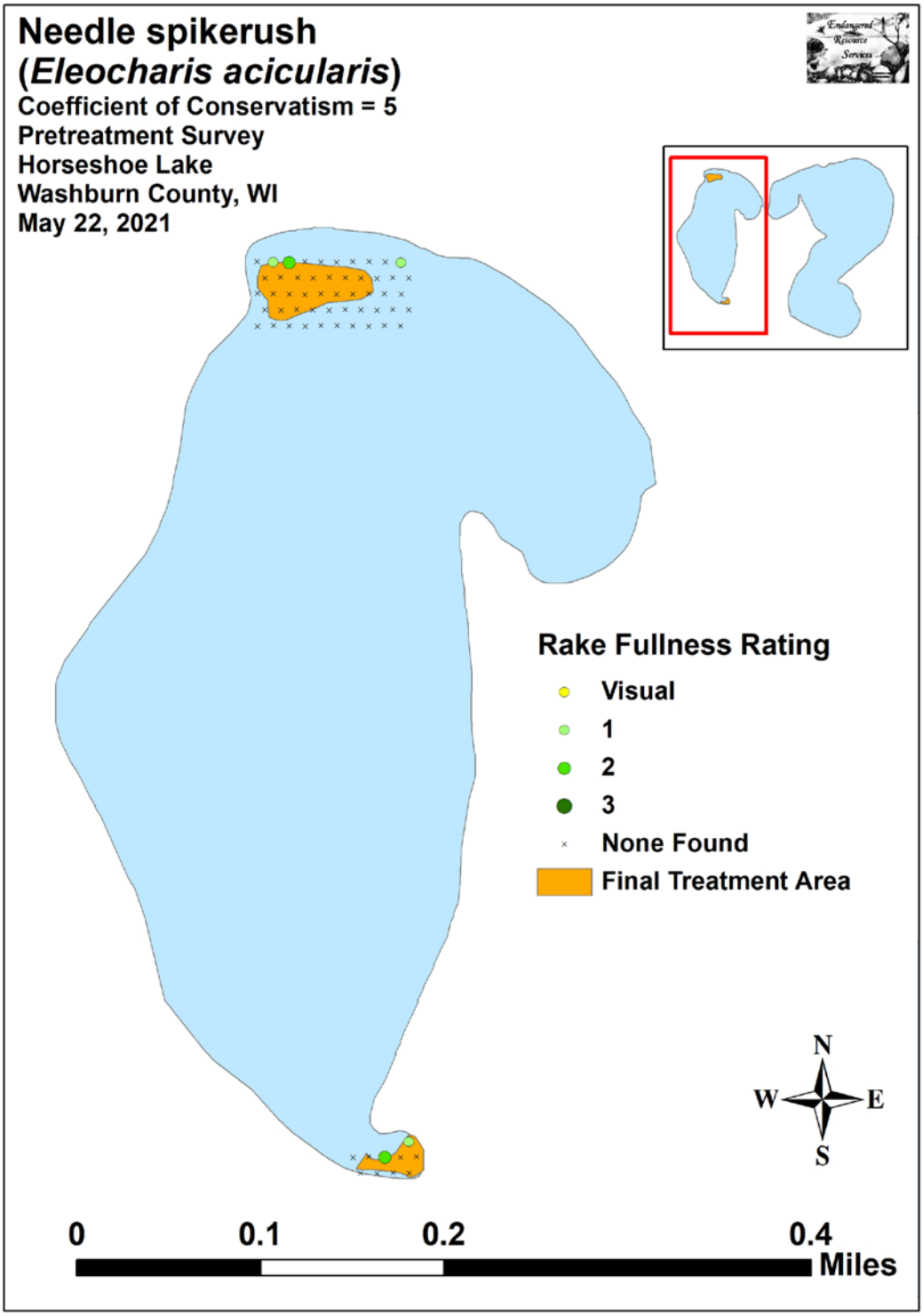
Appendix V: EWM Pre/Posttreatment Density and Distribution

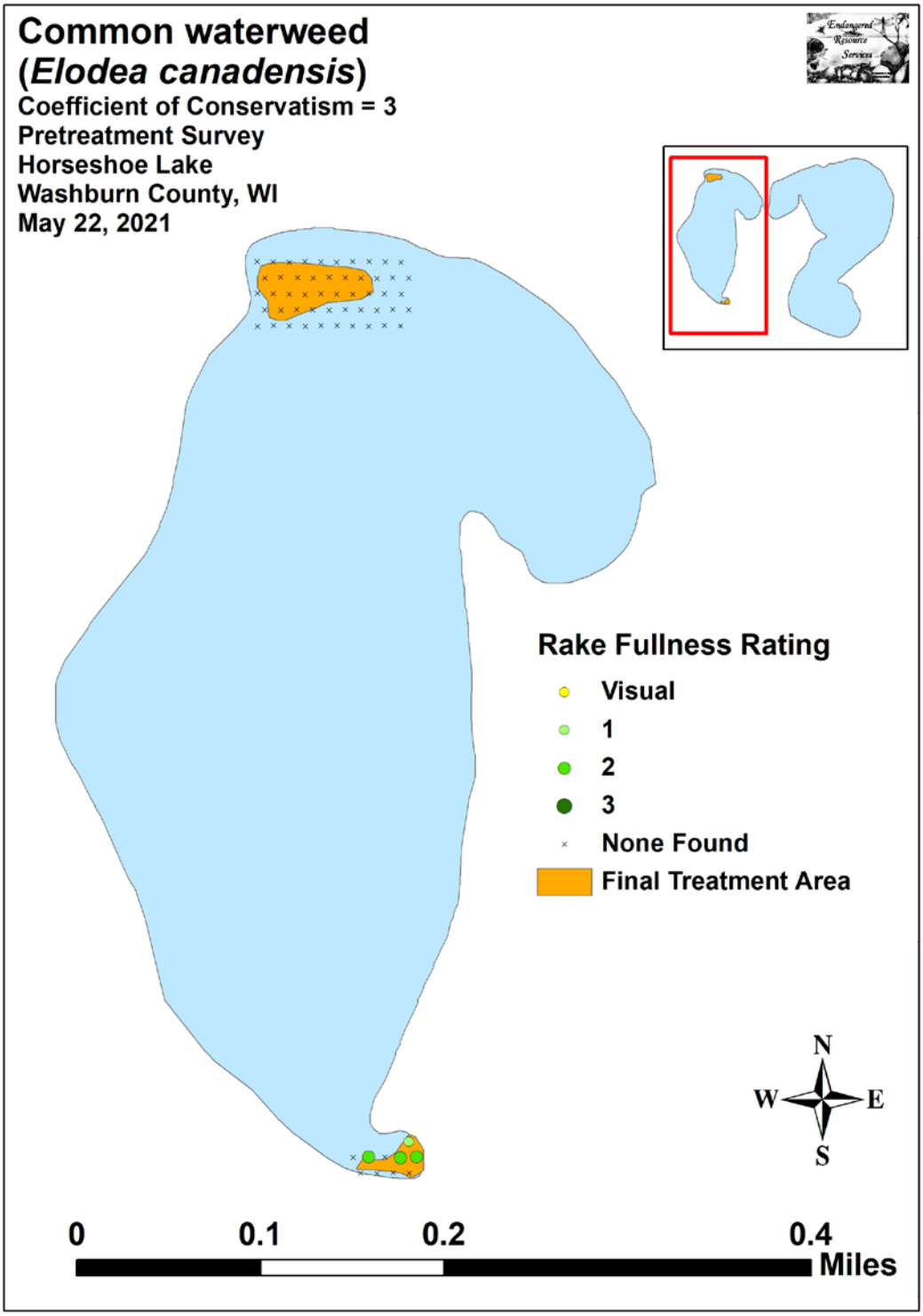

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

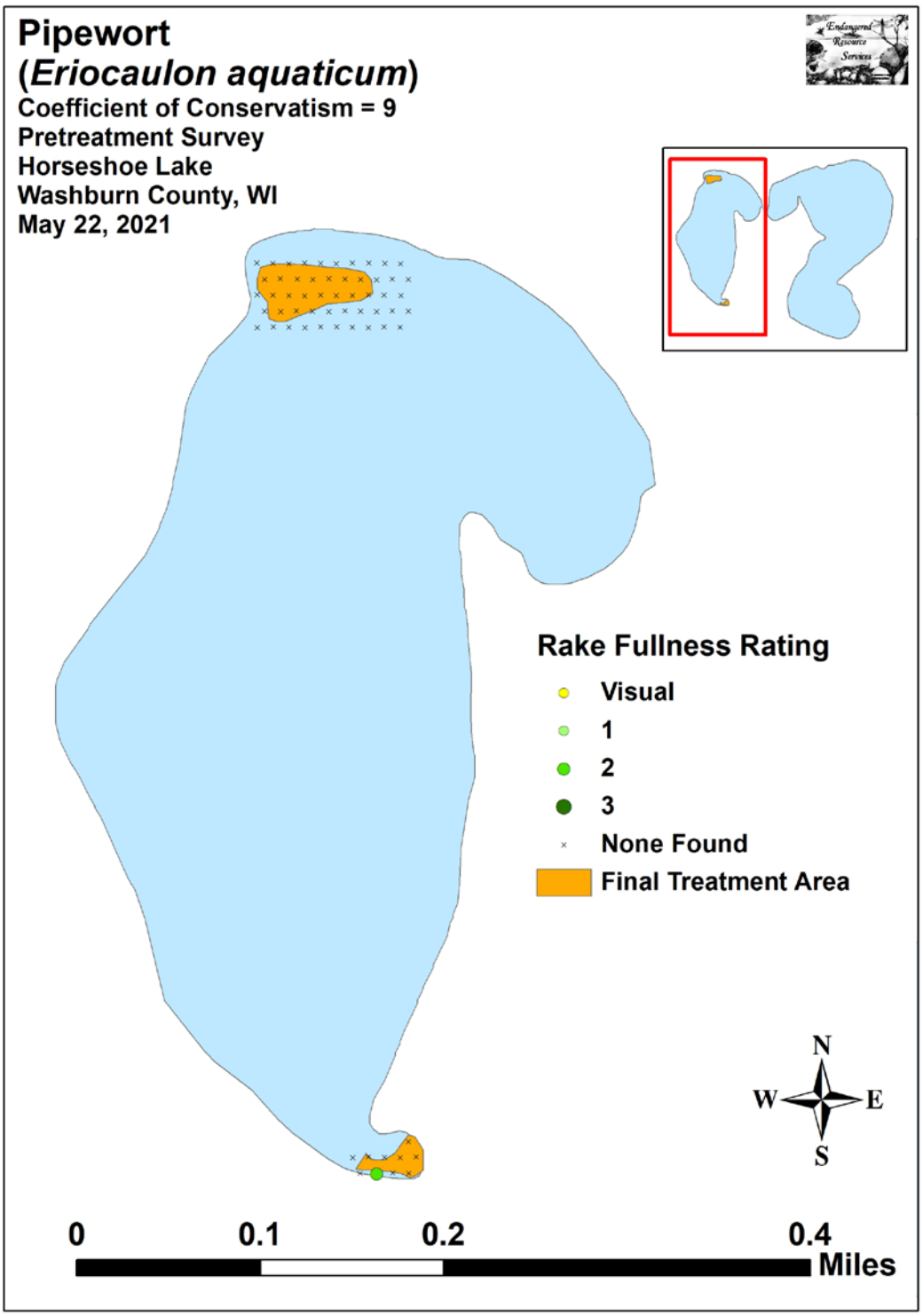

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

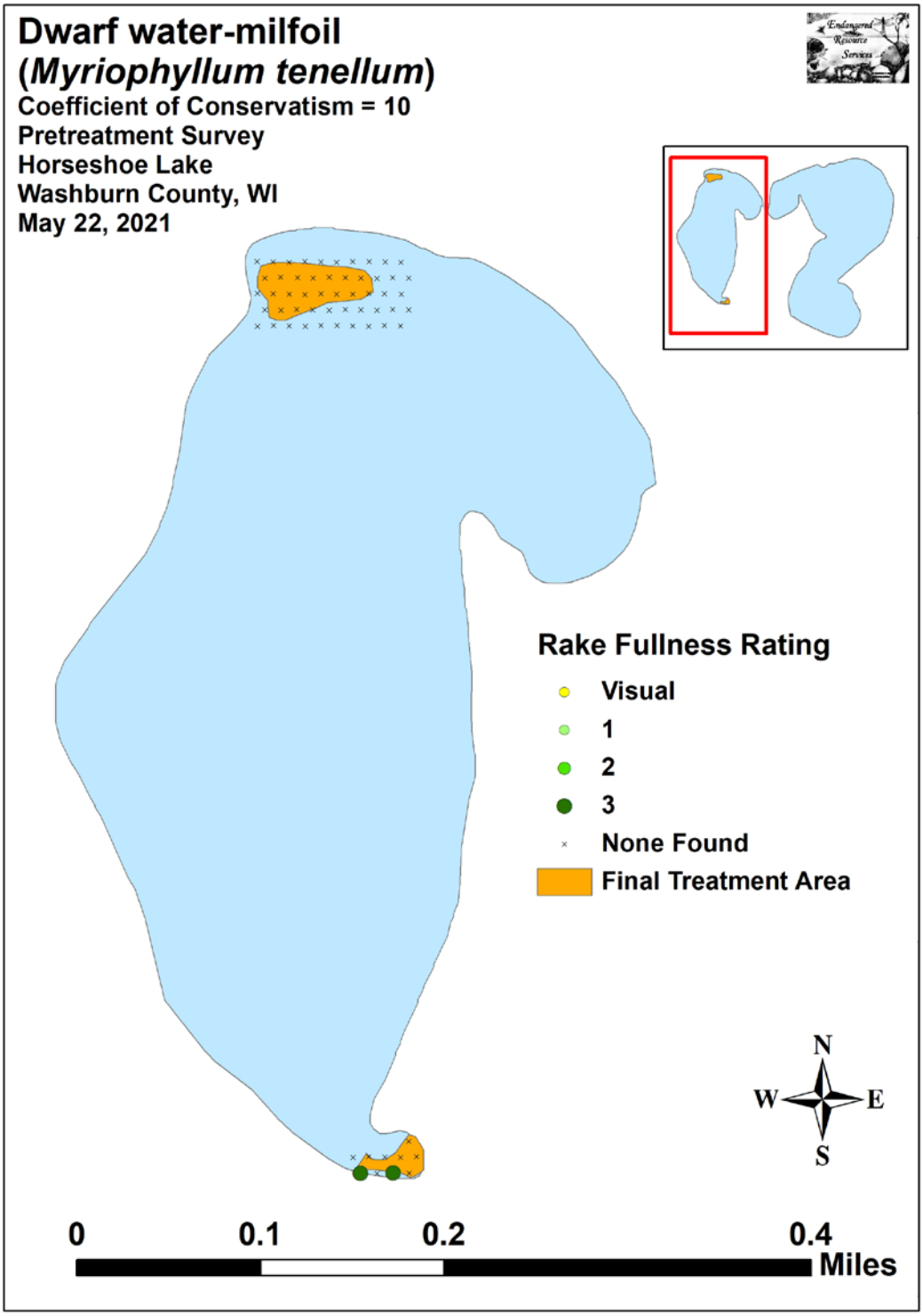
Appendix VI: Pretreatment Native Species Density and Distribution

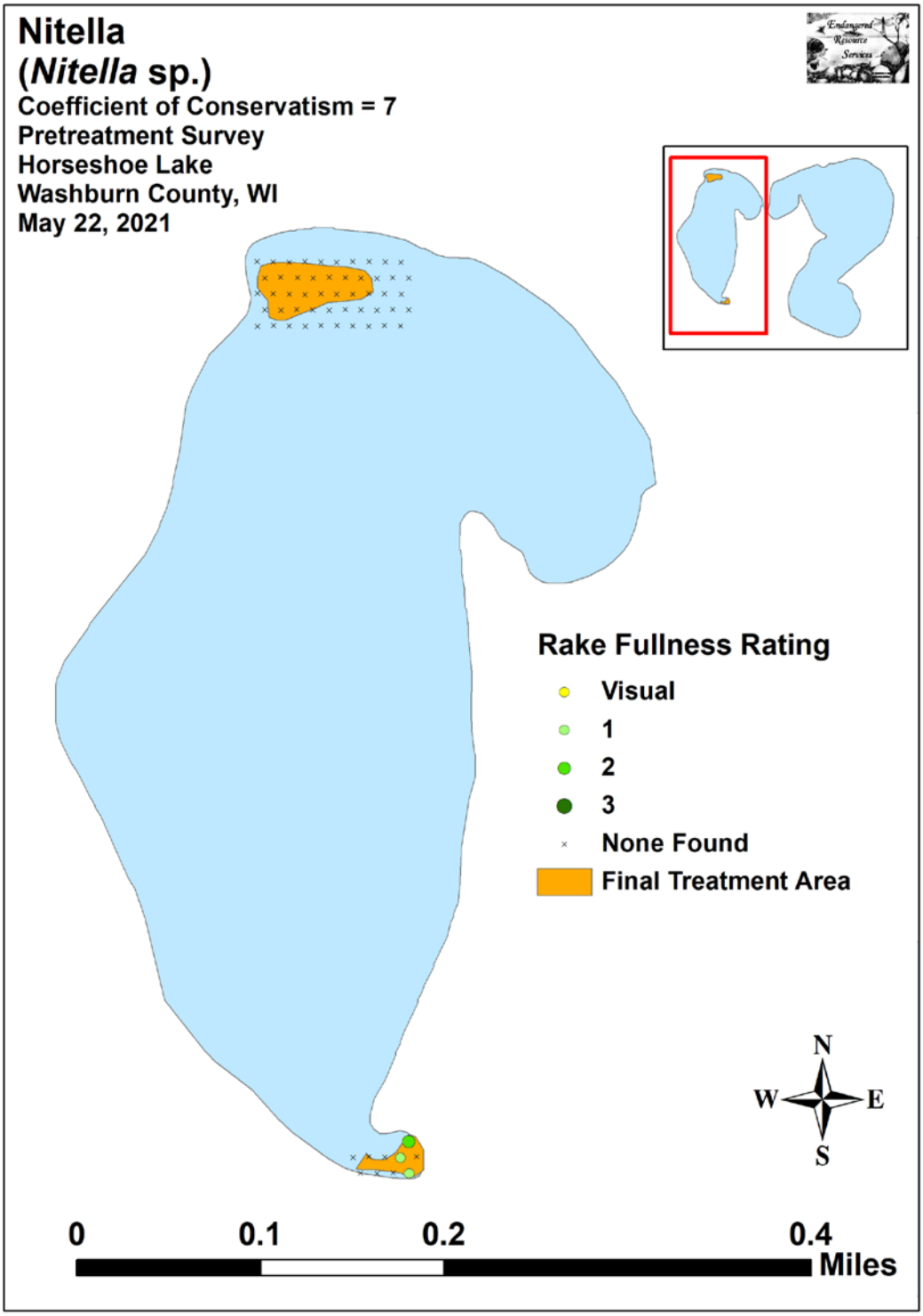

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

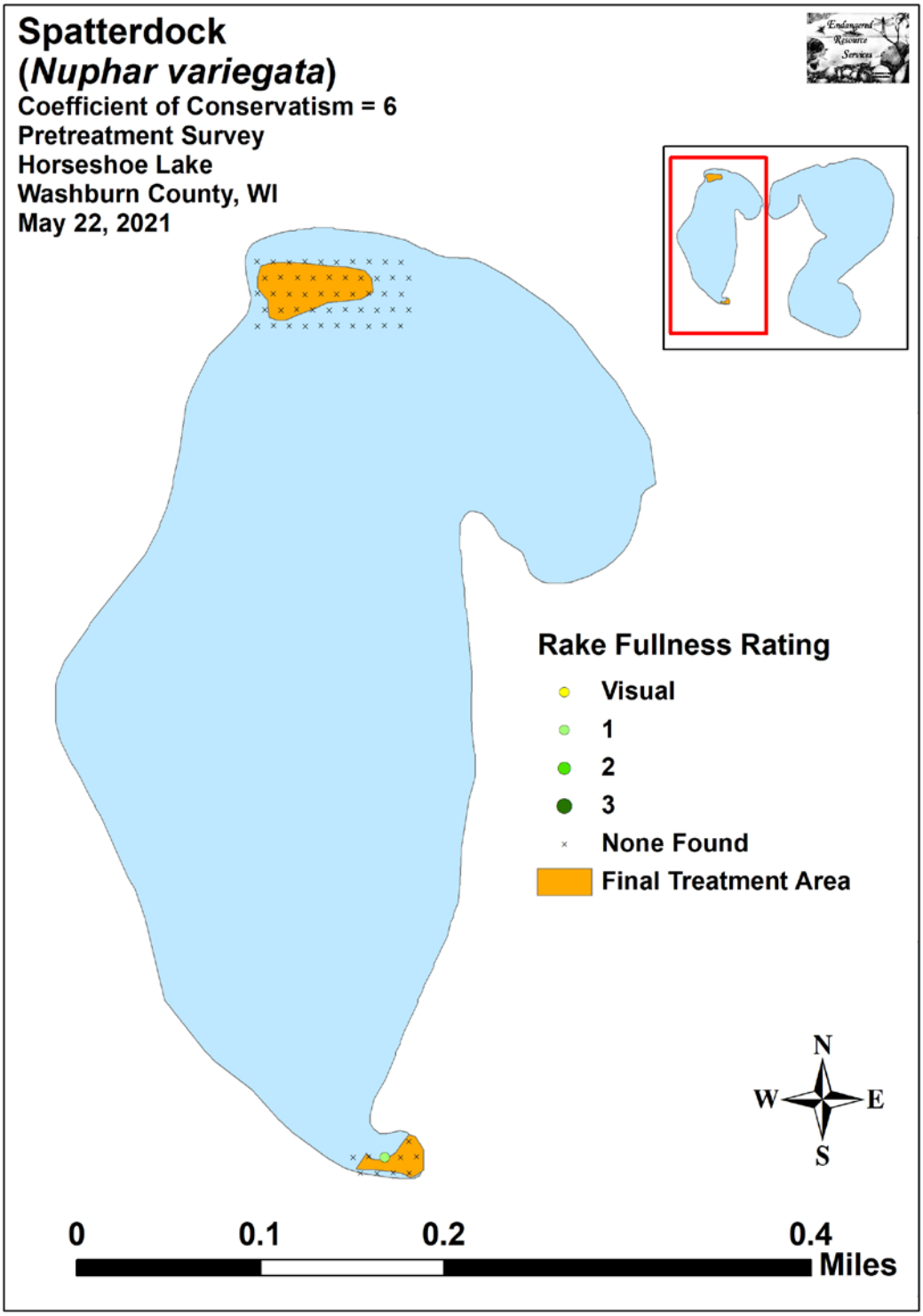

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

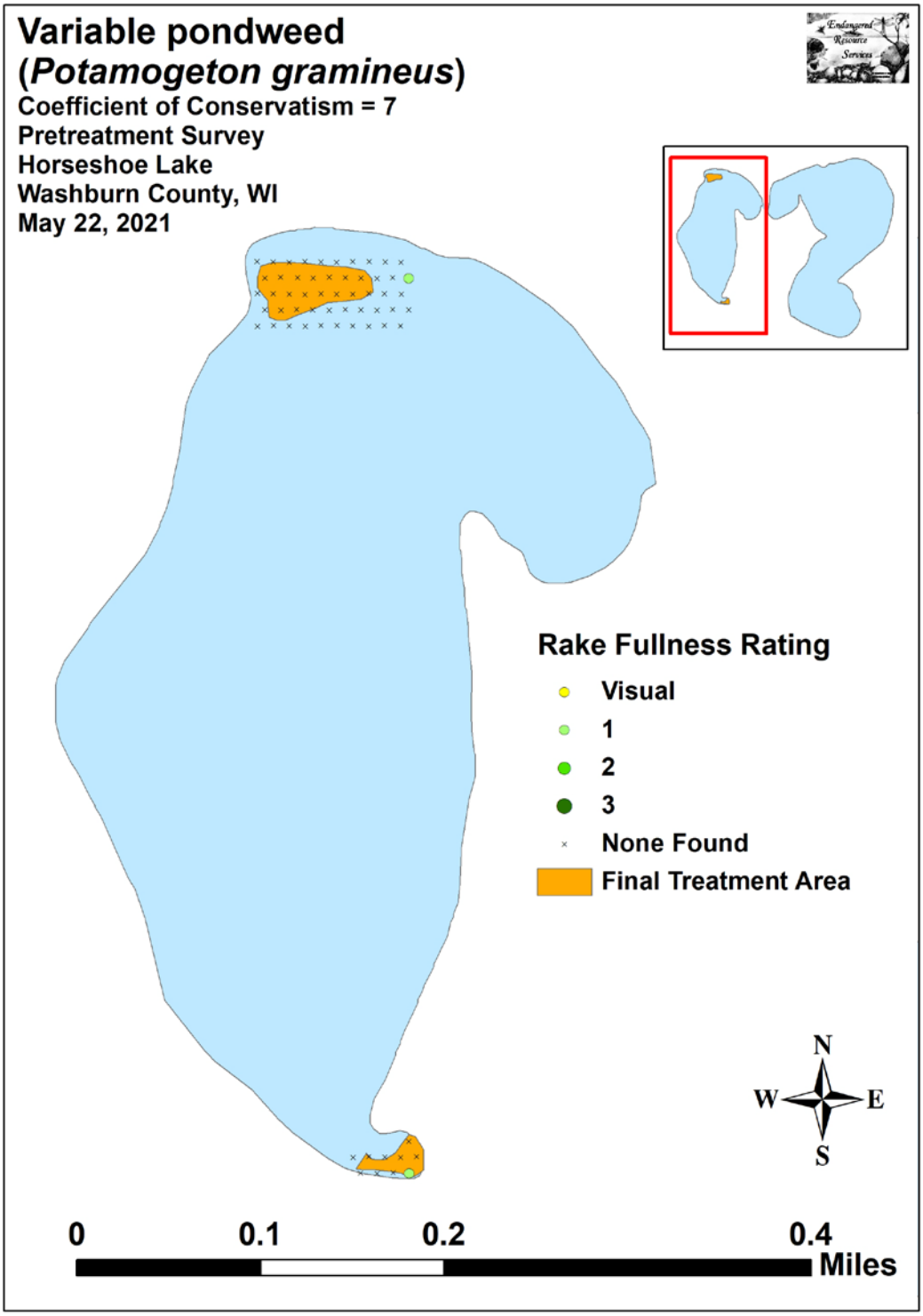

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

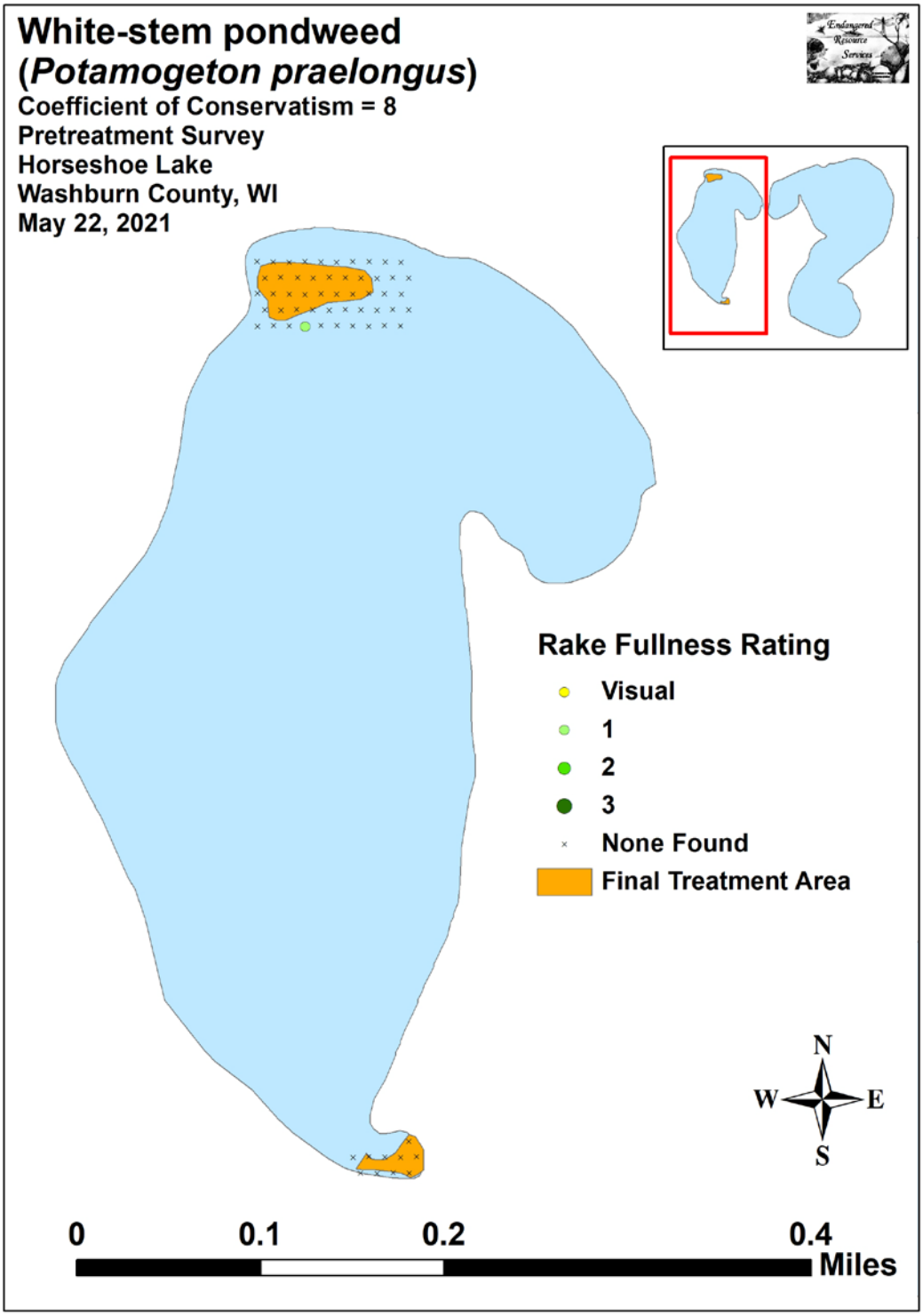

Pipewort
(Eriocaulon aquaticum)
Coefficient of Conservatism = 9
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

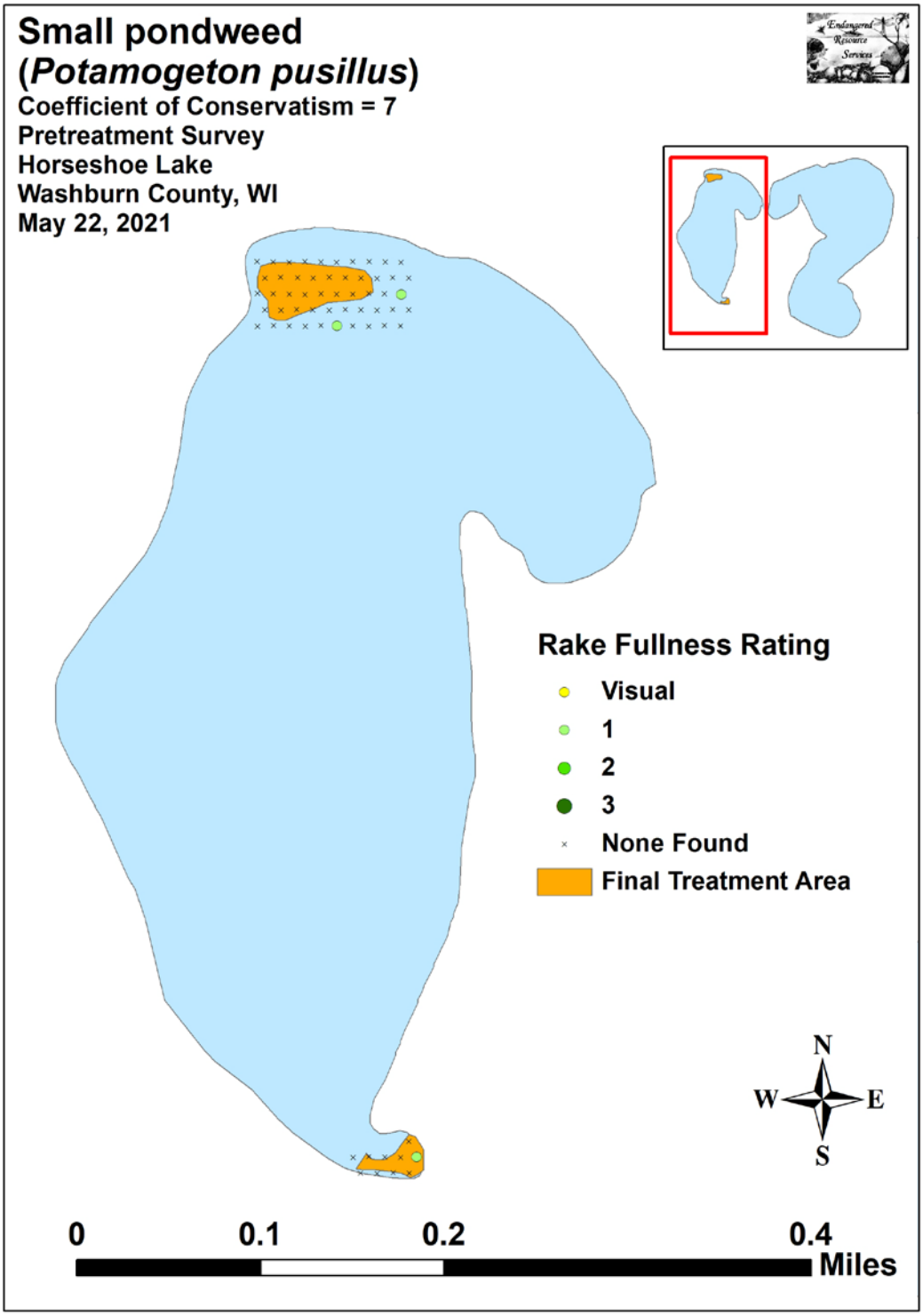

Dwarf water-milfoil
(Myriophyllum tenellum)
Coefficient of Conservatism = 10
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

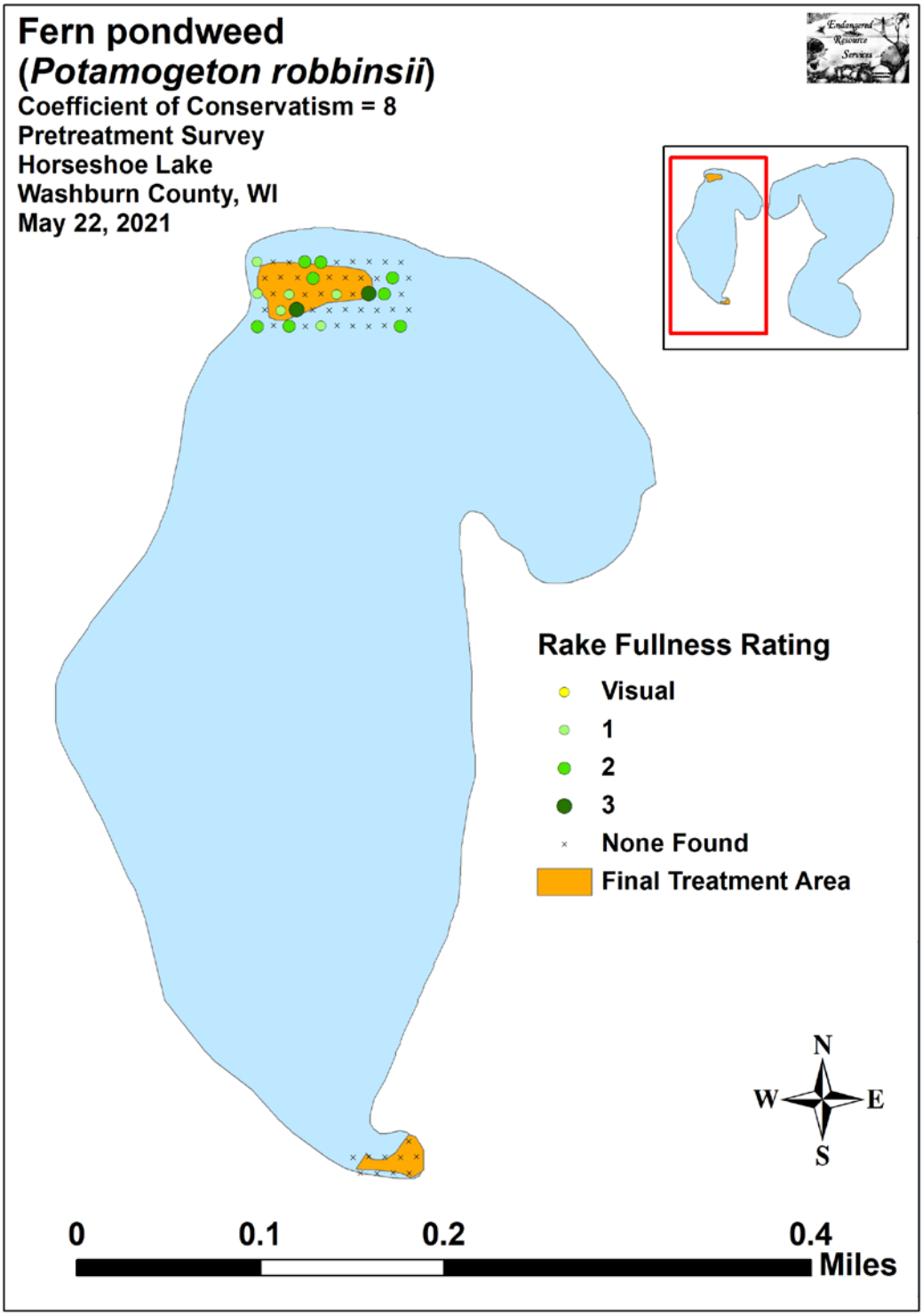

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

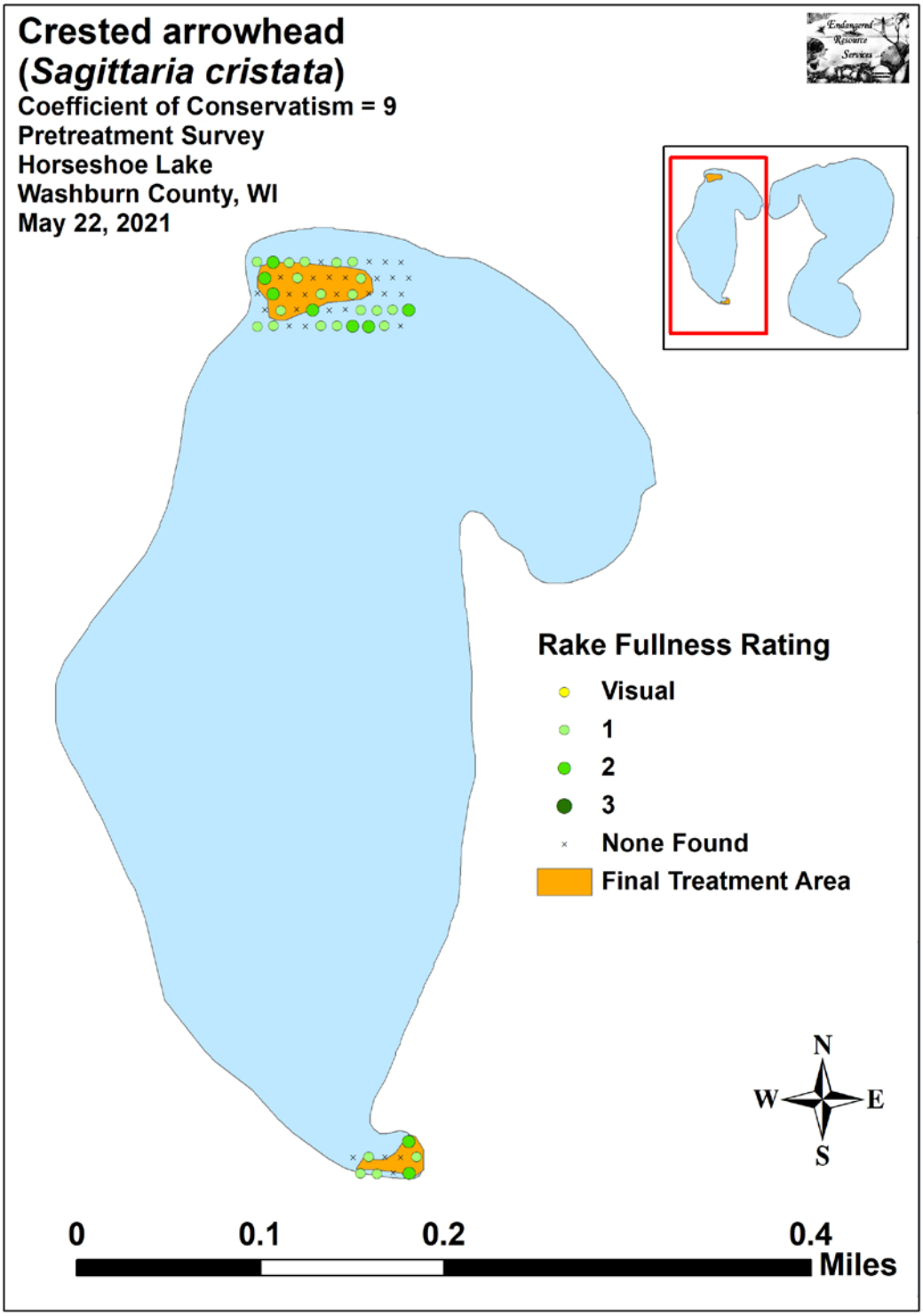

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

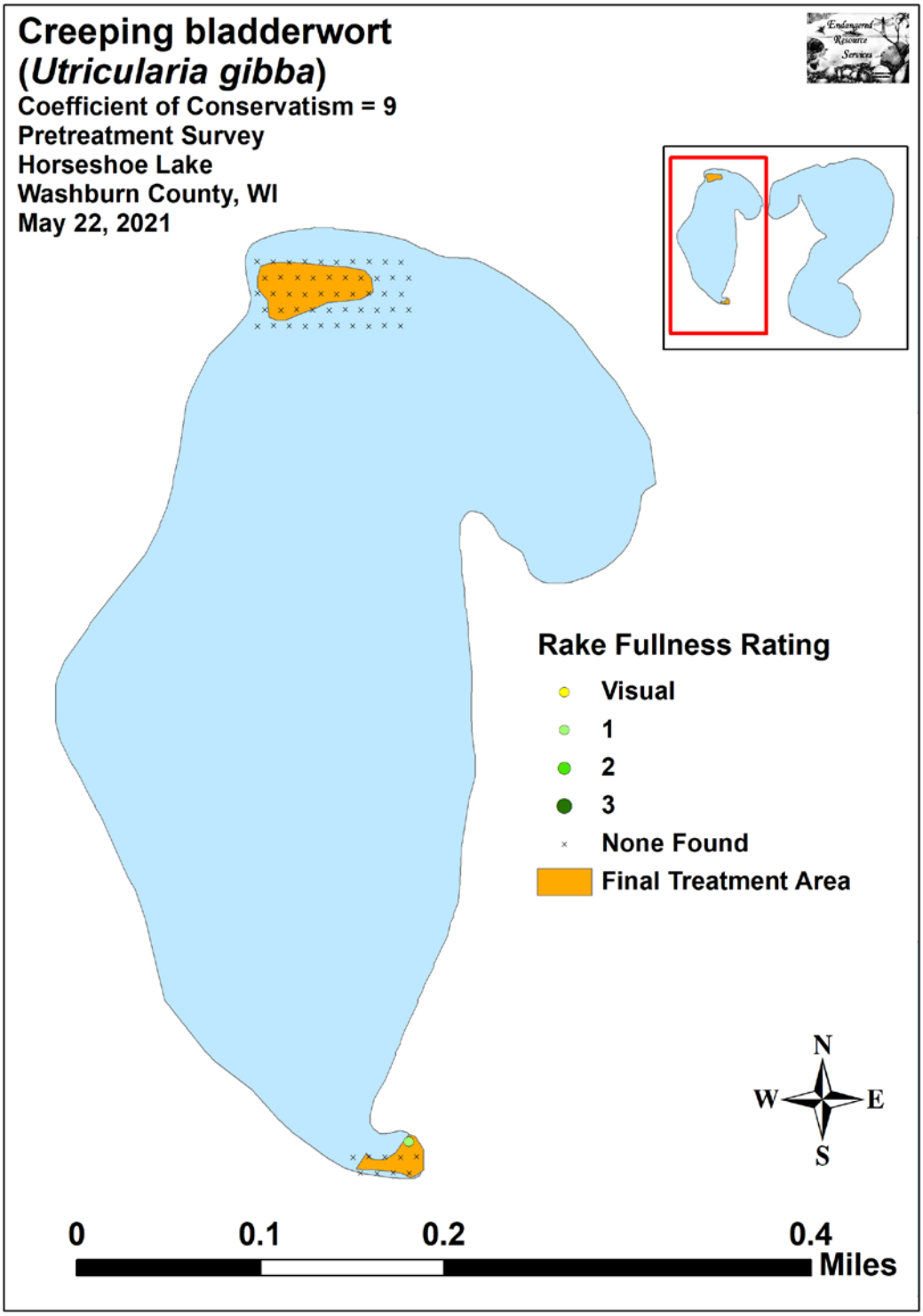

Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

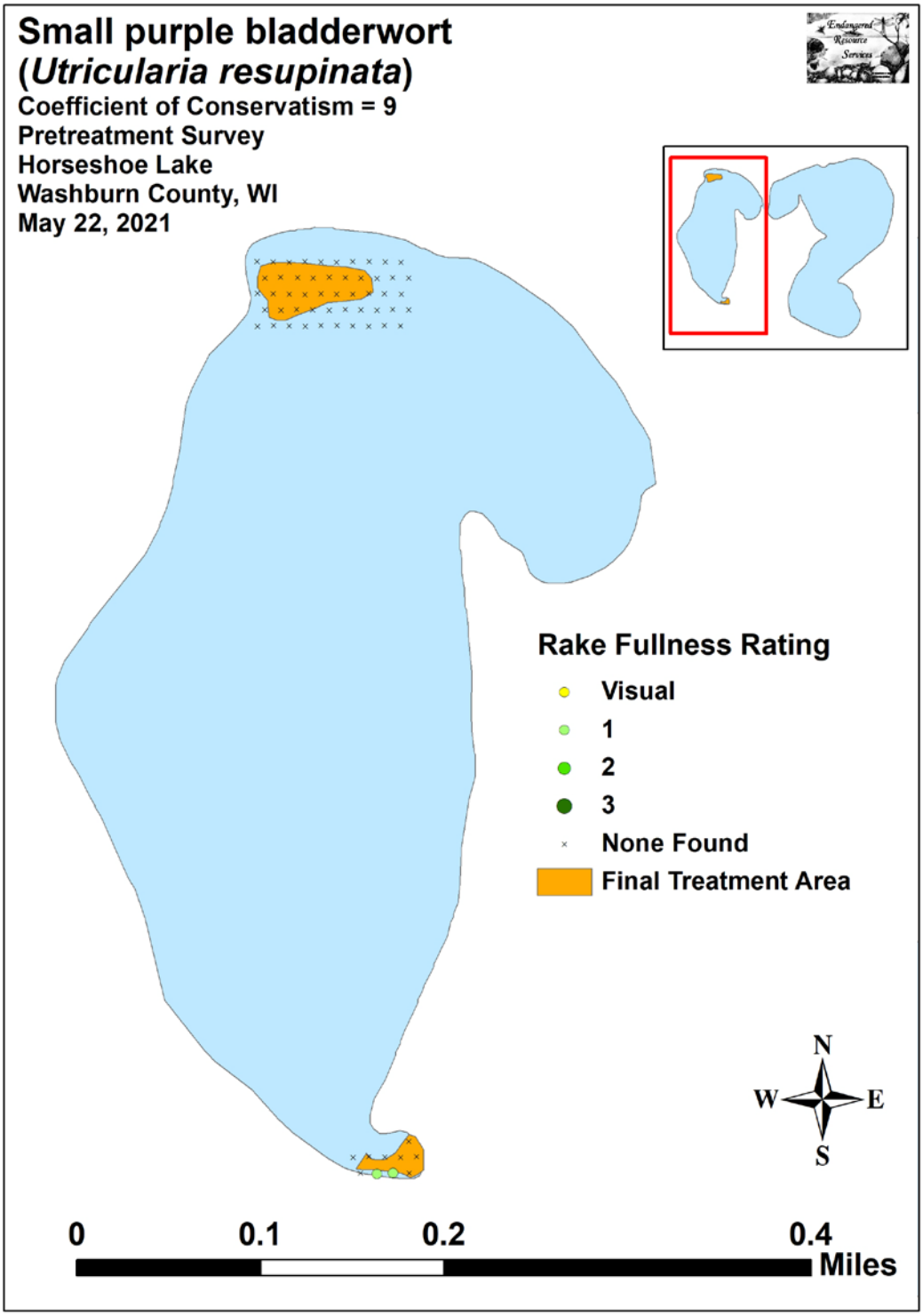

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

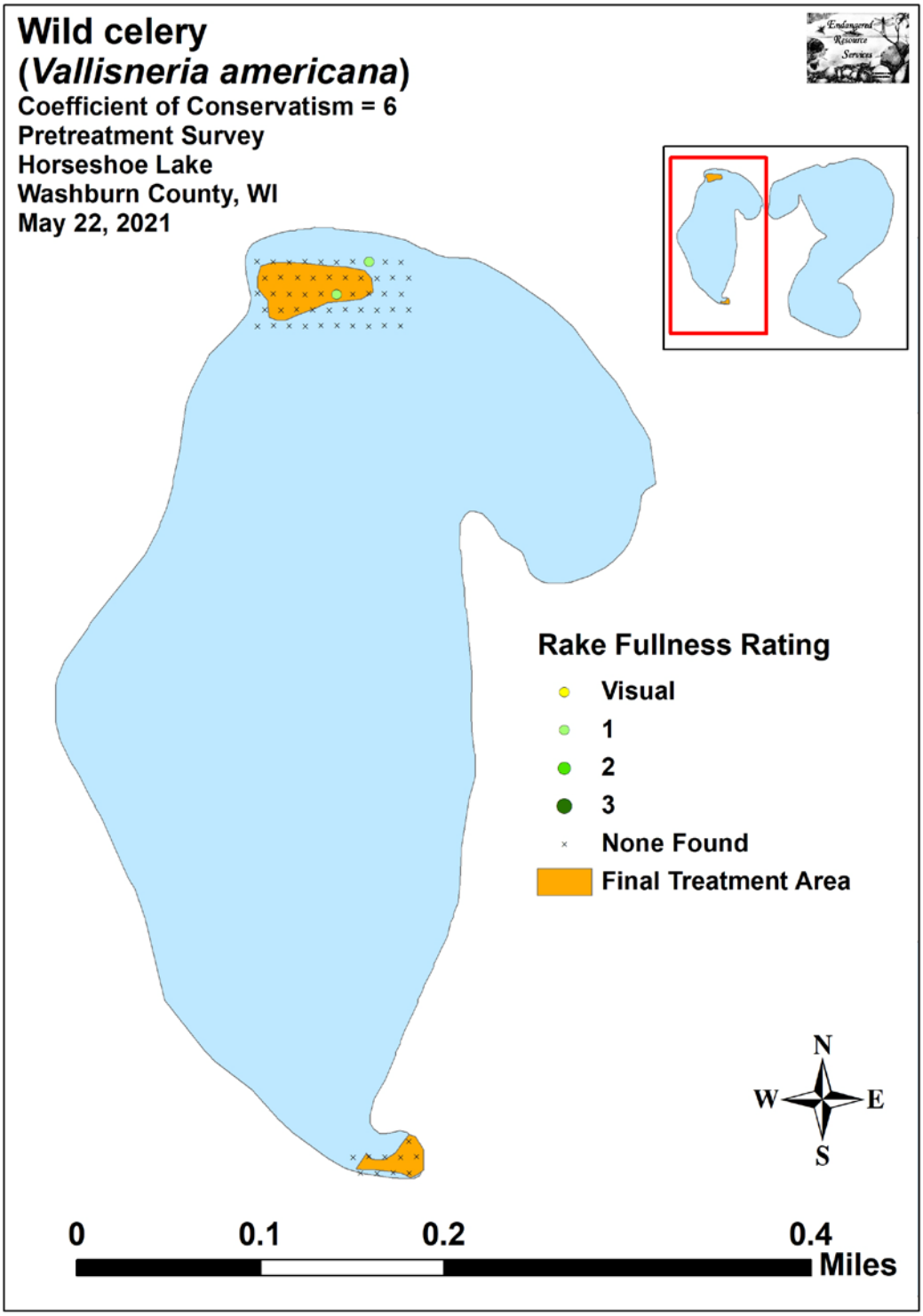

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

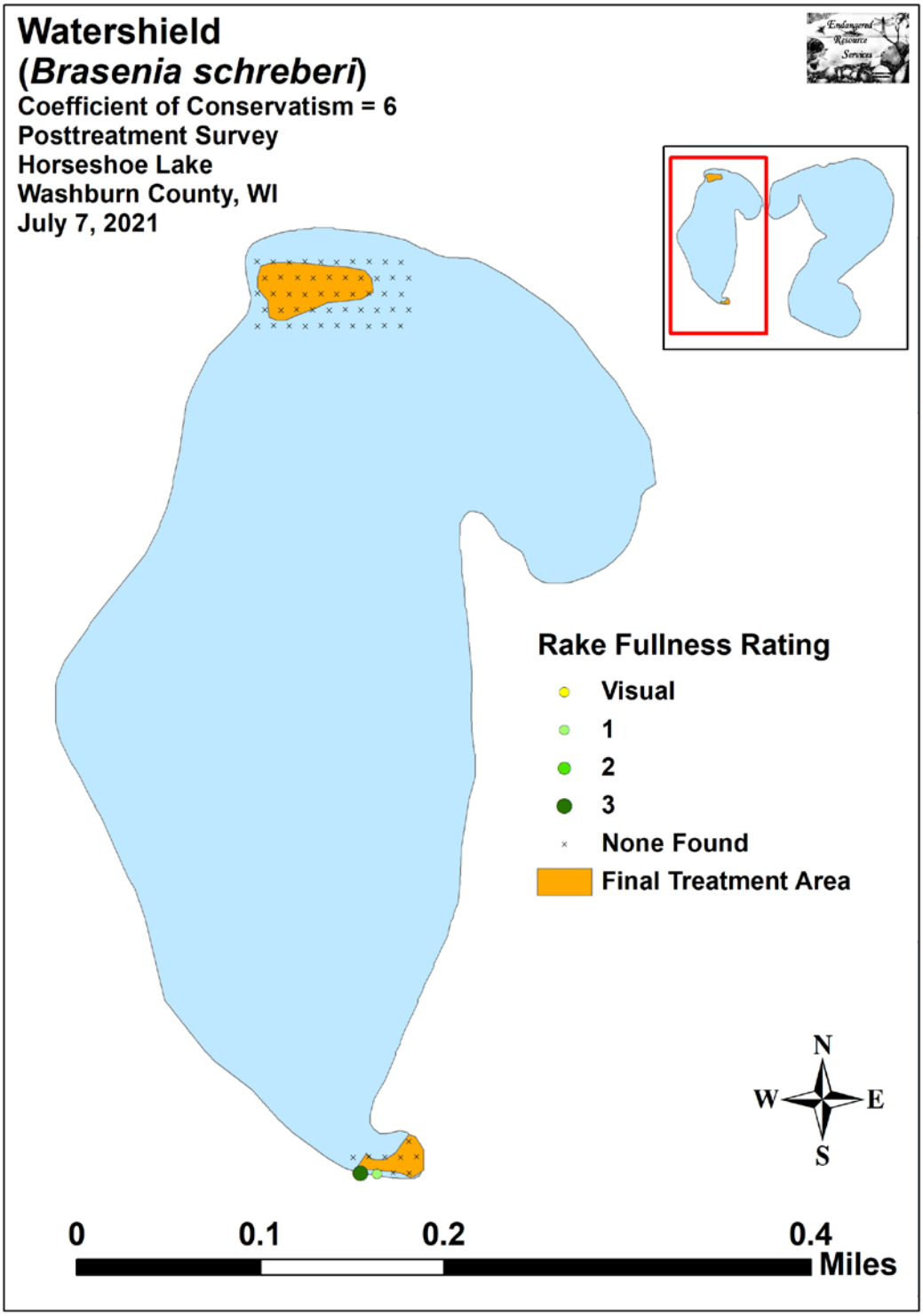

Crested arrowhead
(Sagittaria cristata)
Coefficient of Conservatism = 9
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

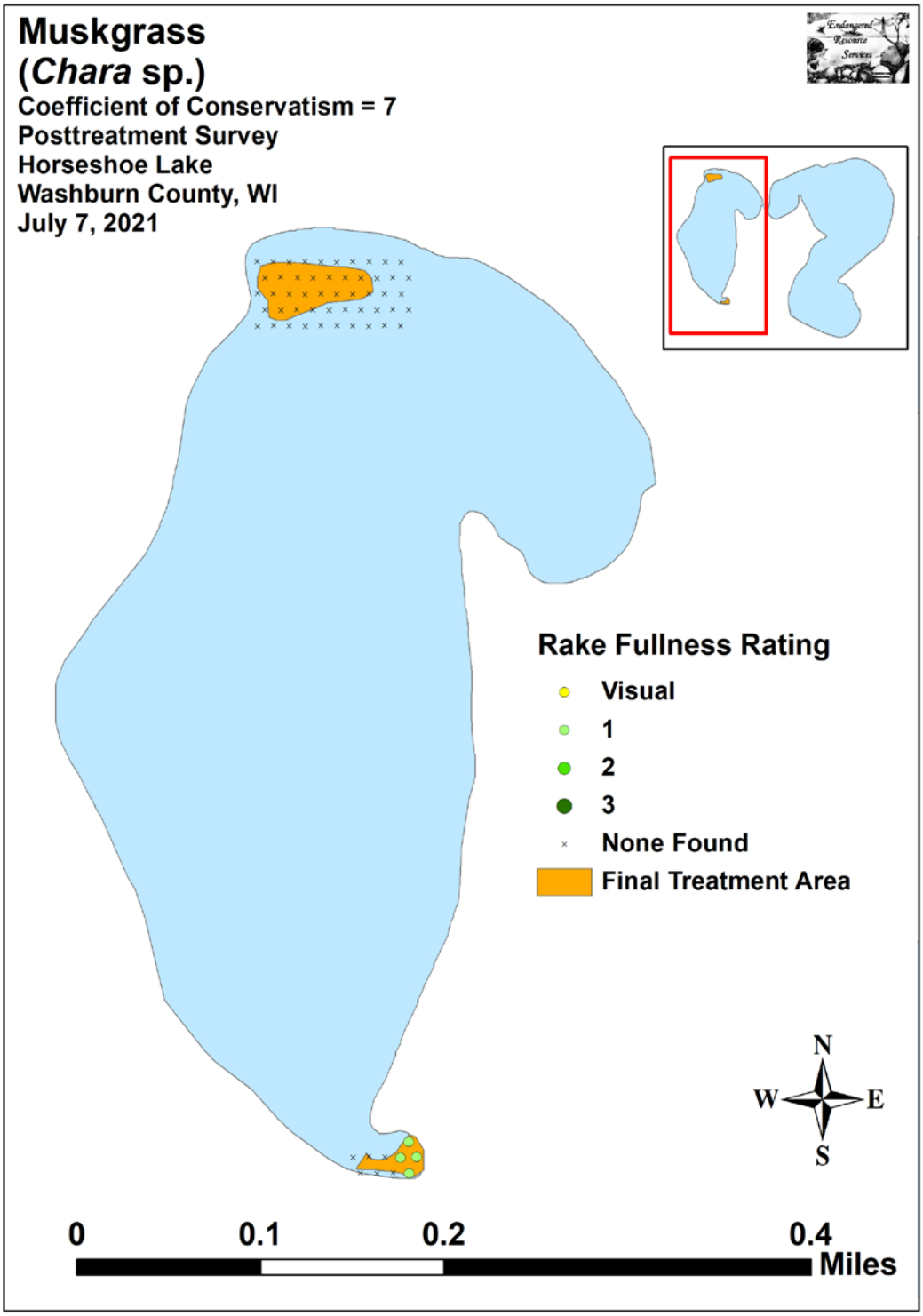

Creeping bladderwort
(Utricularia gibba)
Coefficient of Conservatism = 9
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

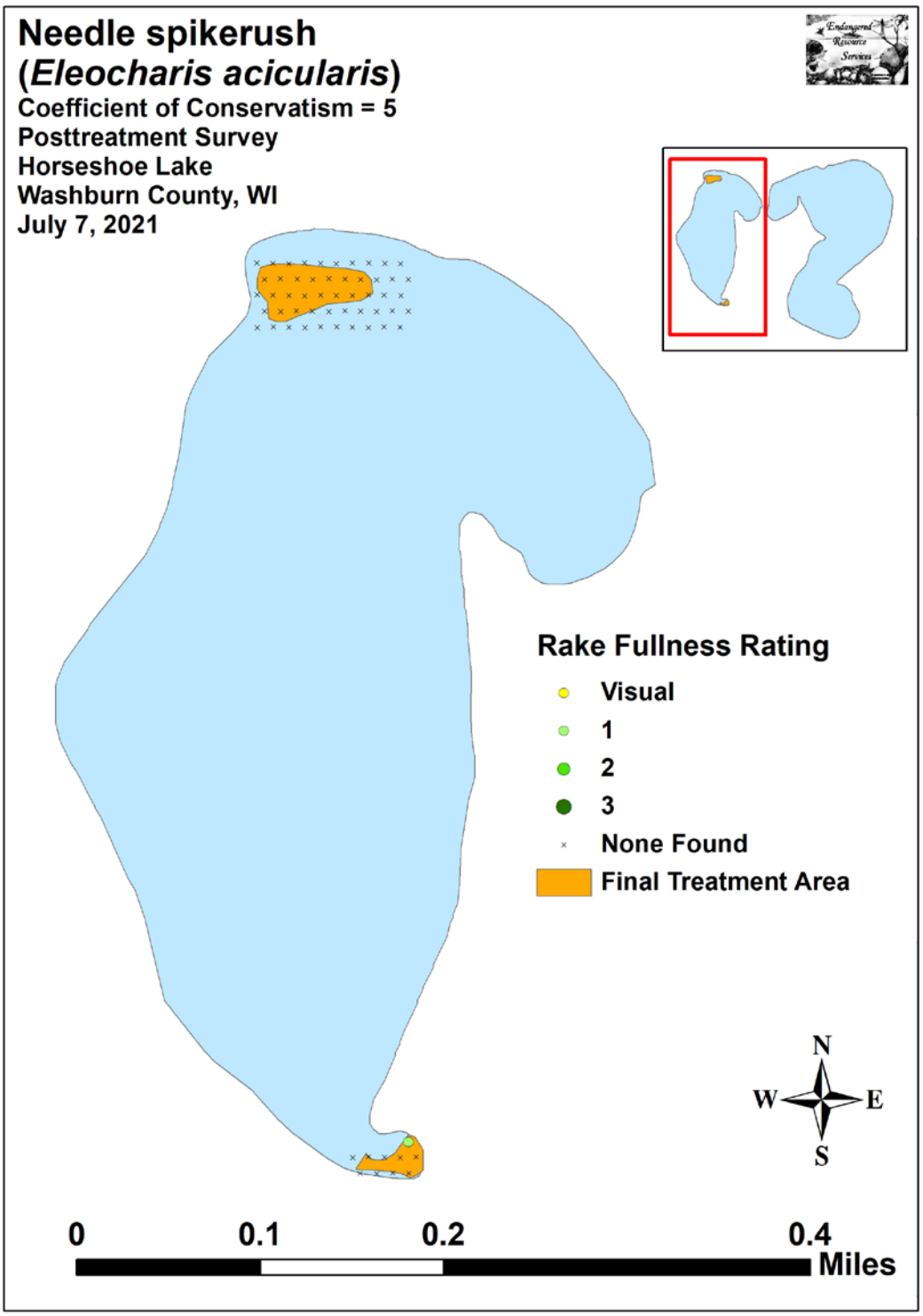

Small purple bladderwort
(Utricularia resupinata)
Coefficient of Conservatism = 9
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

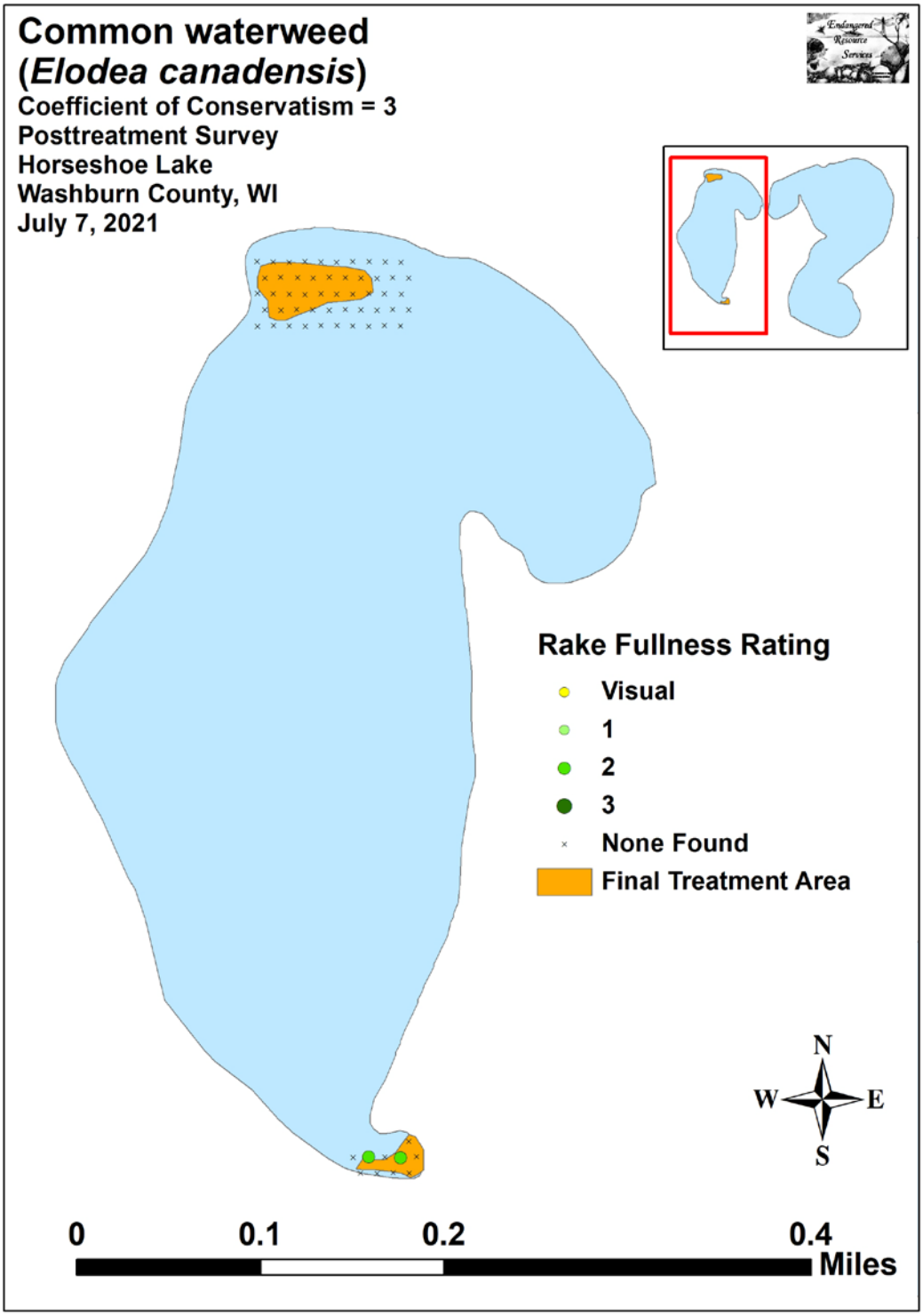

Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Pretreatment Survey
Horseshoe Lake
Washburn County, WI
May 22, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

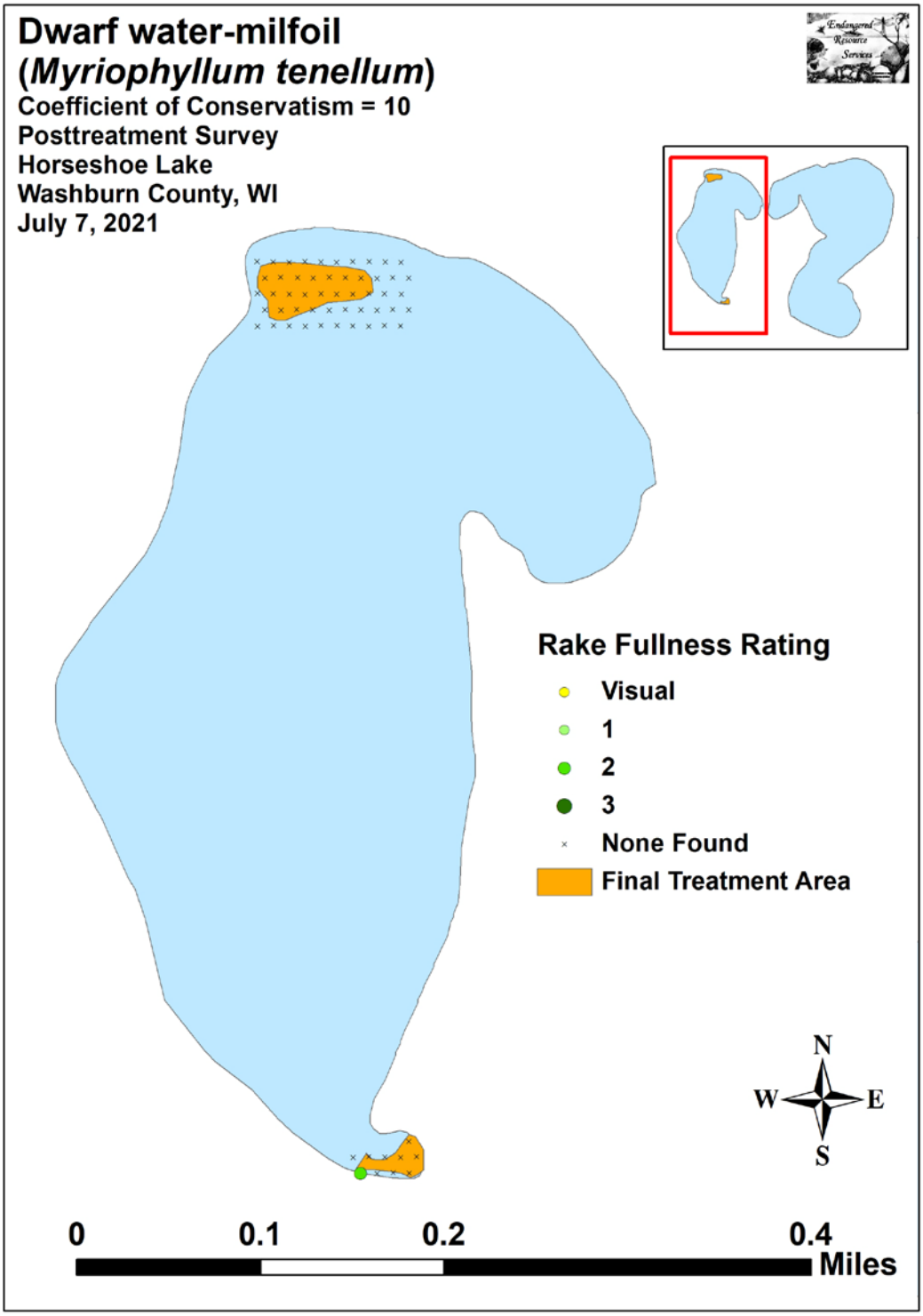
Appendix VII: Posttreatment Native Species Density and Distribution

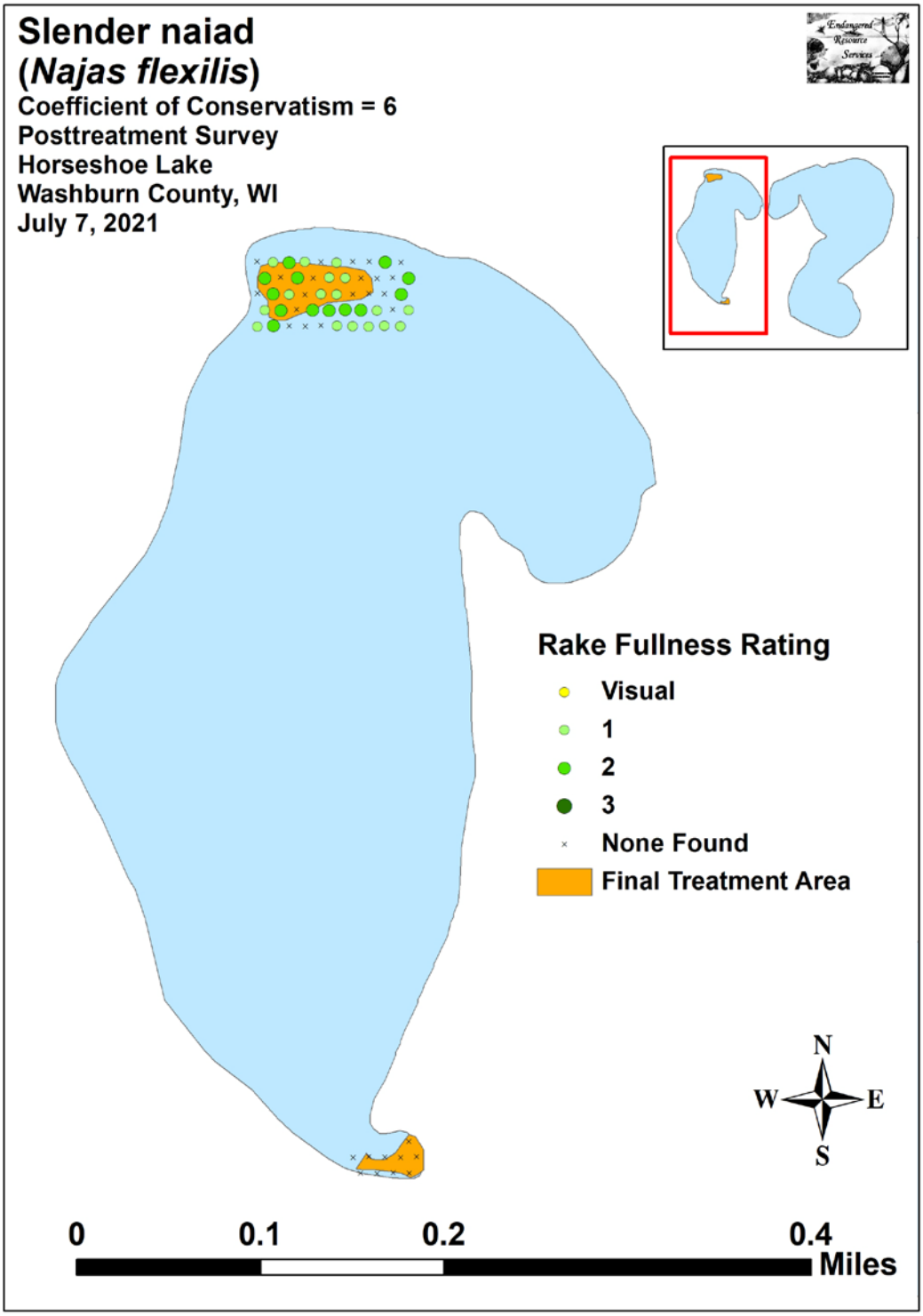

Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

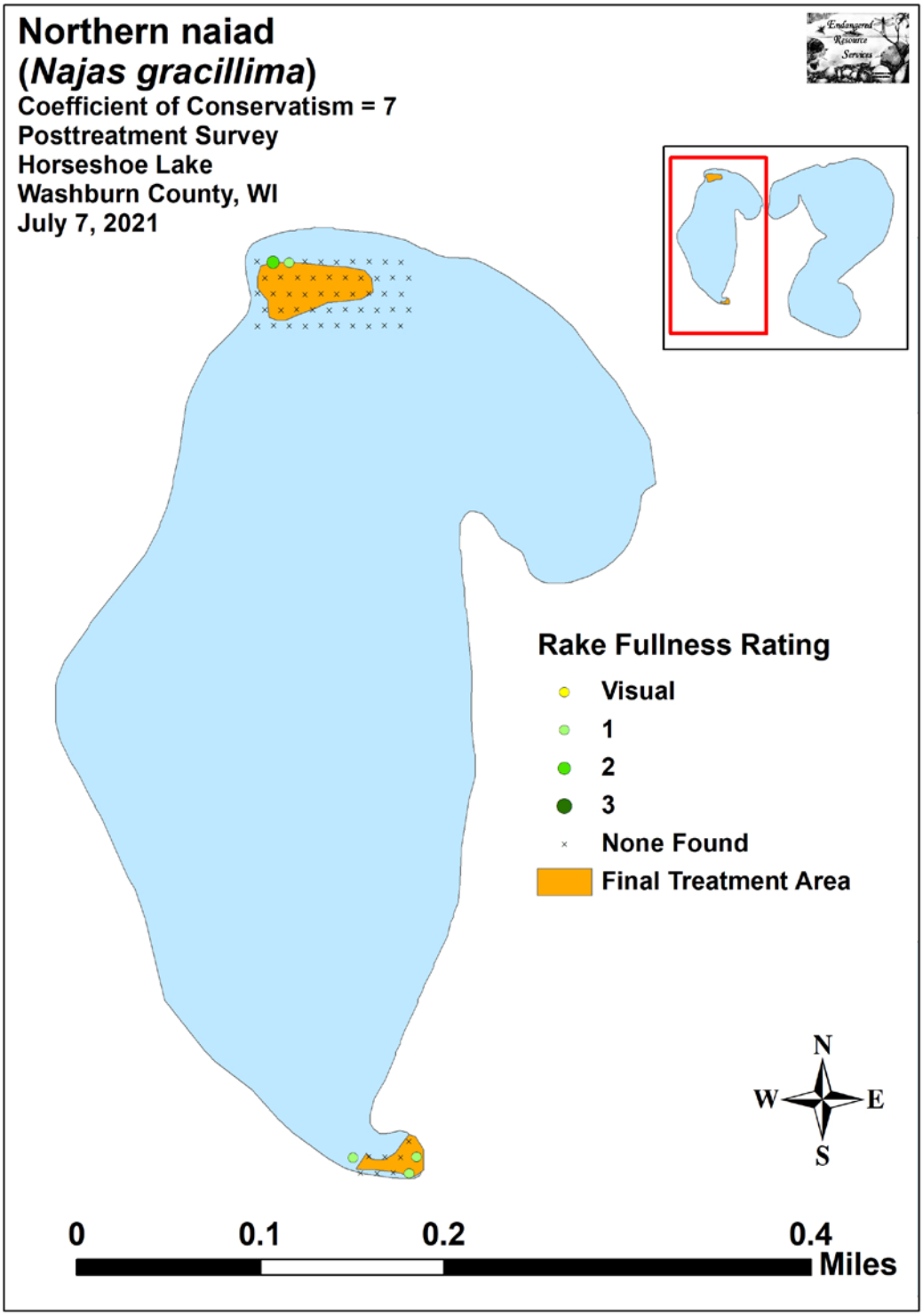

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

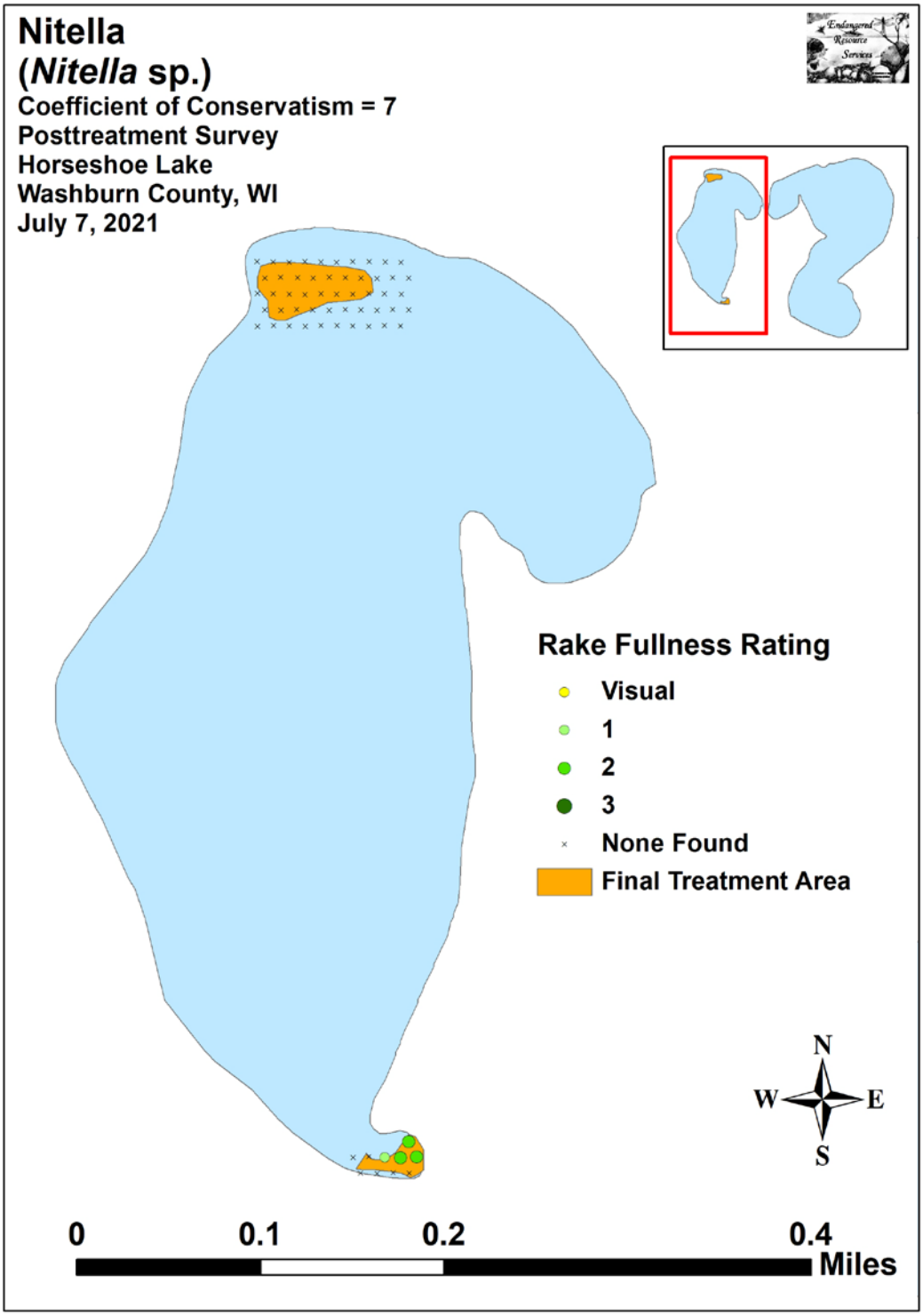

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

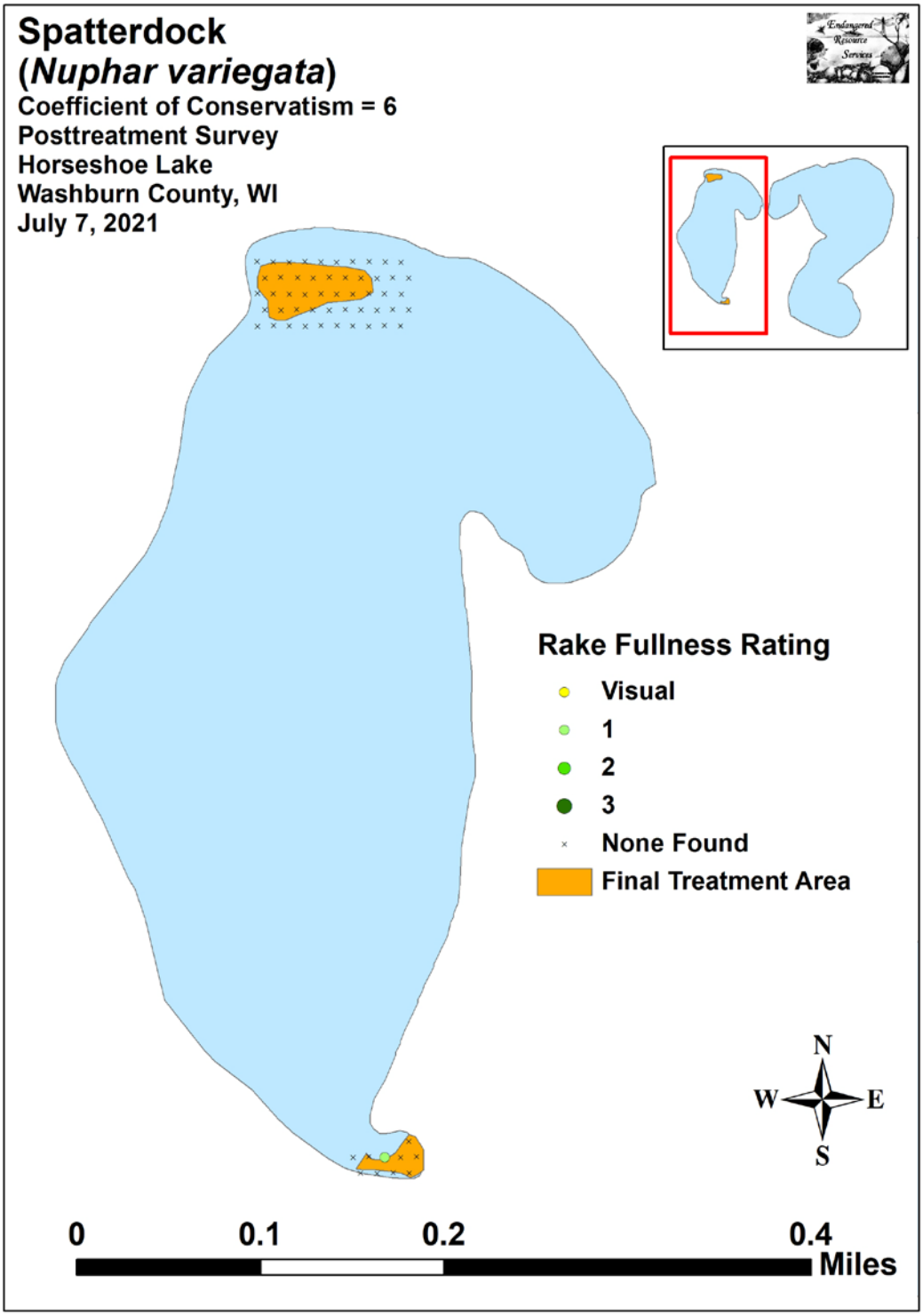

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

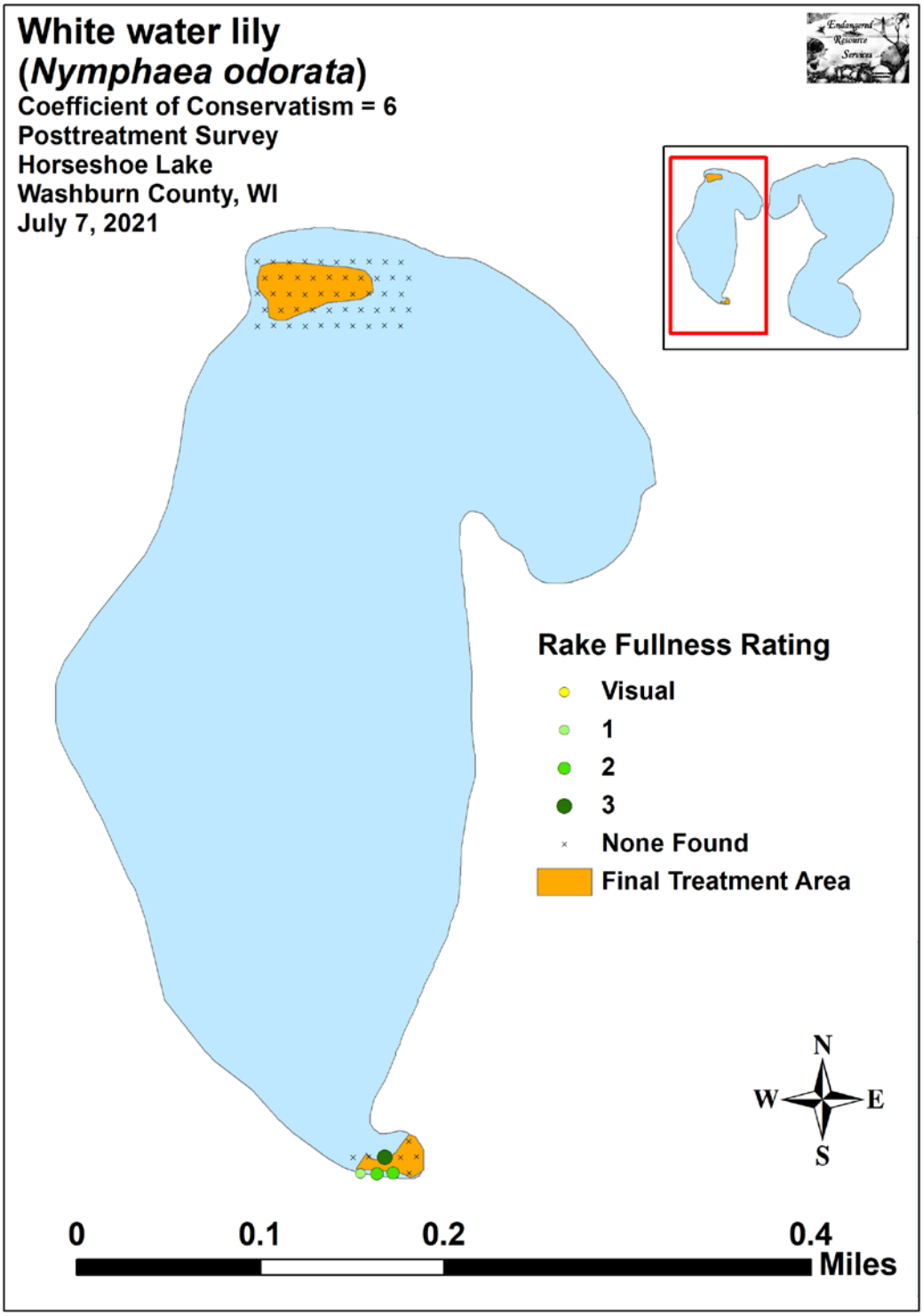

Dwarf water-milfoil
(Myriophyllum tenellum)
Coefficient of Conservatism = 10
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

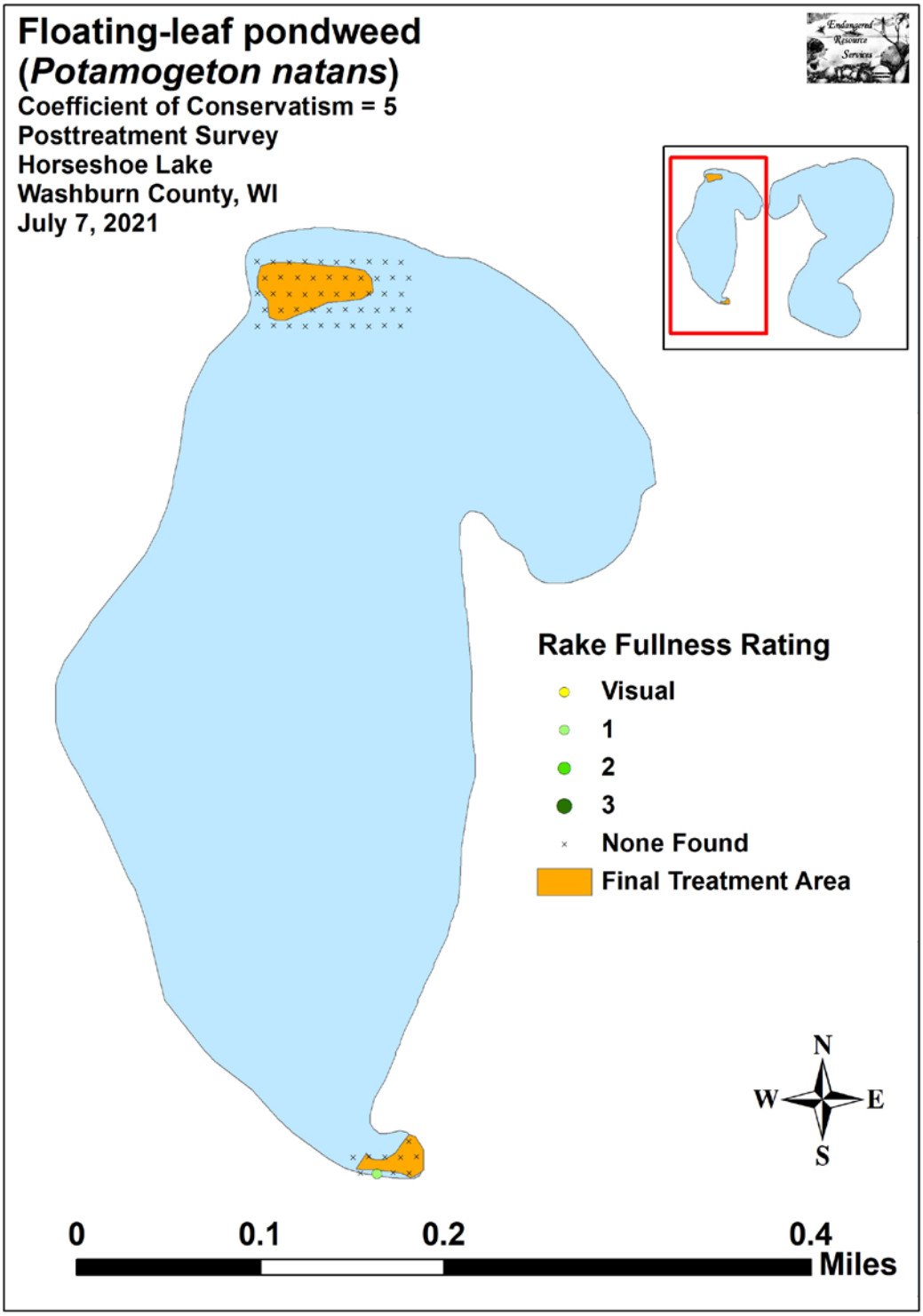

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

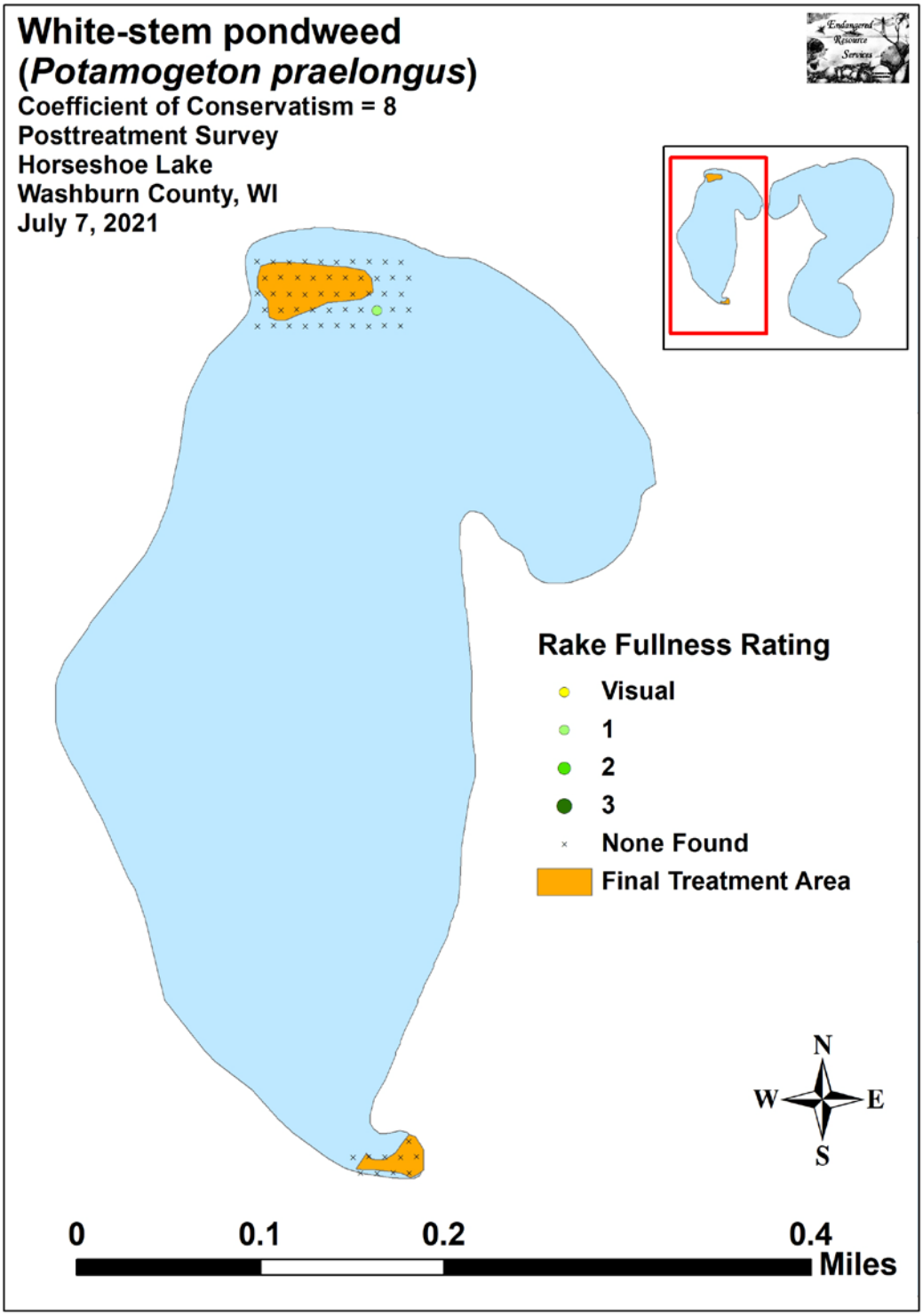

Northern naiad
(Najas gracillima)
Coefficient of Conservatism = 7
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

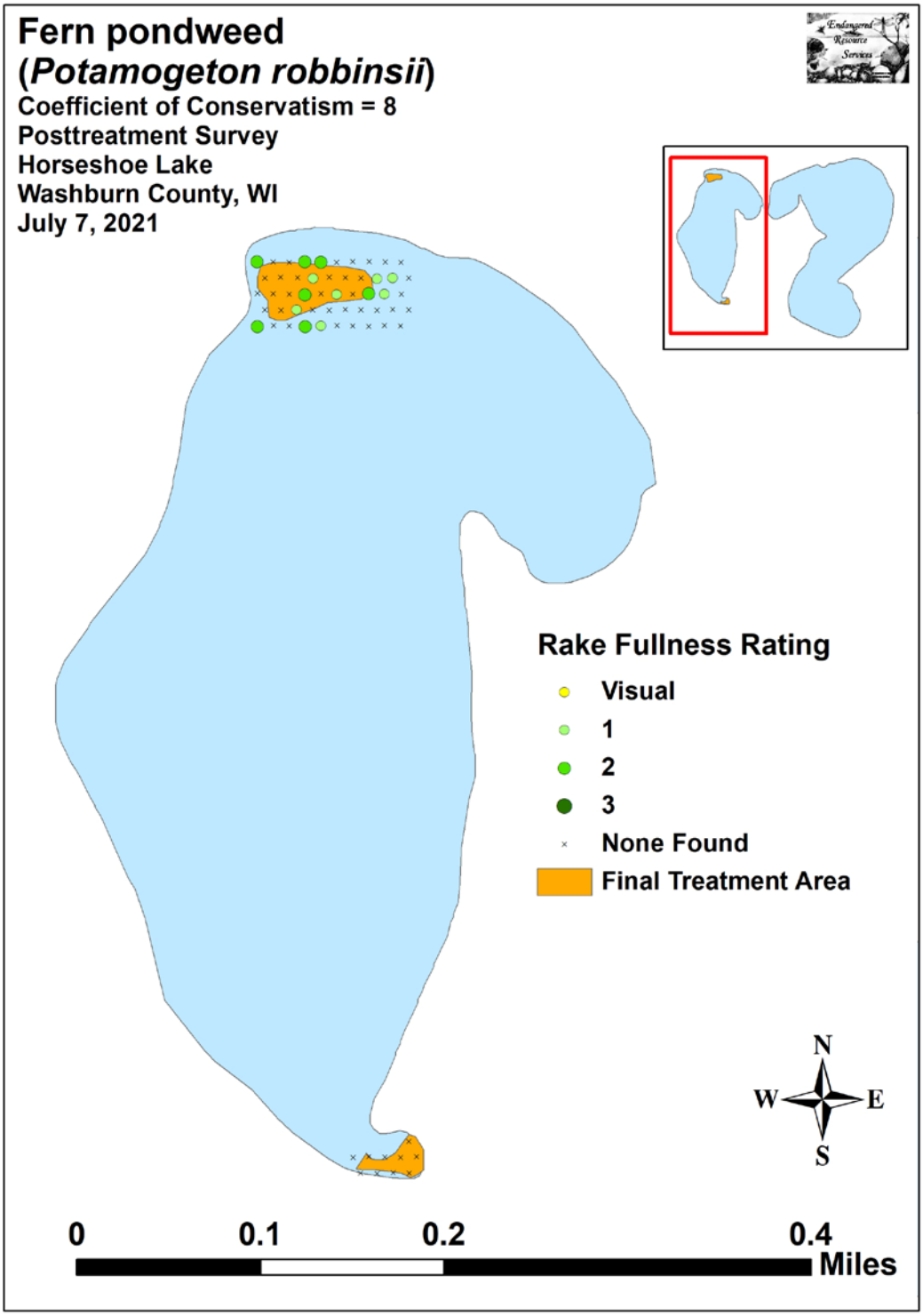

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

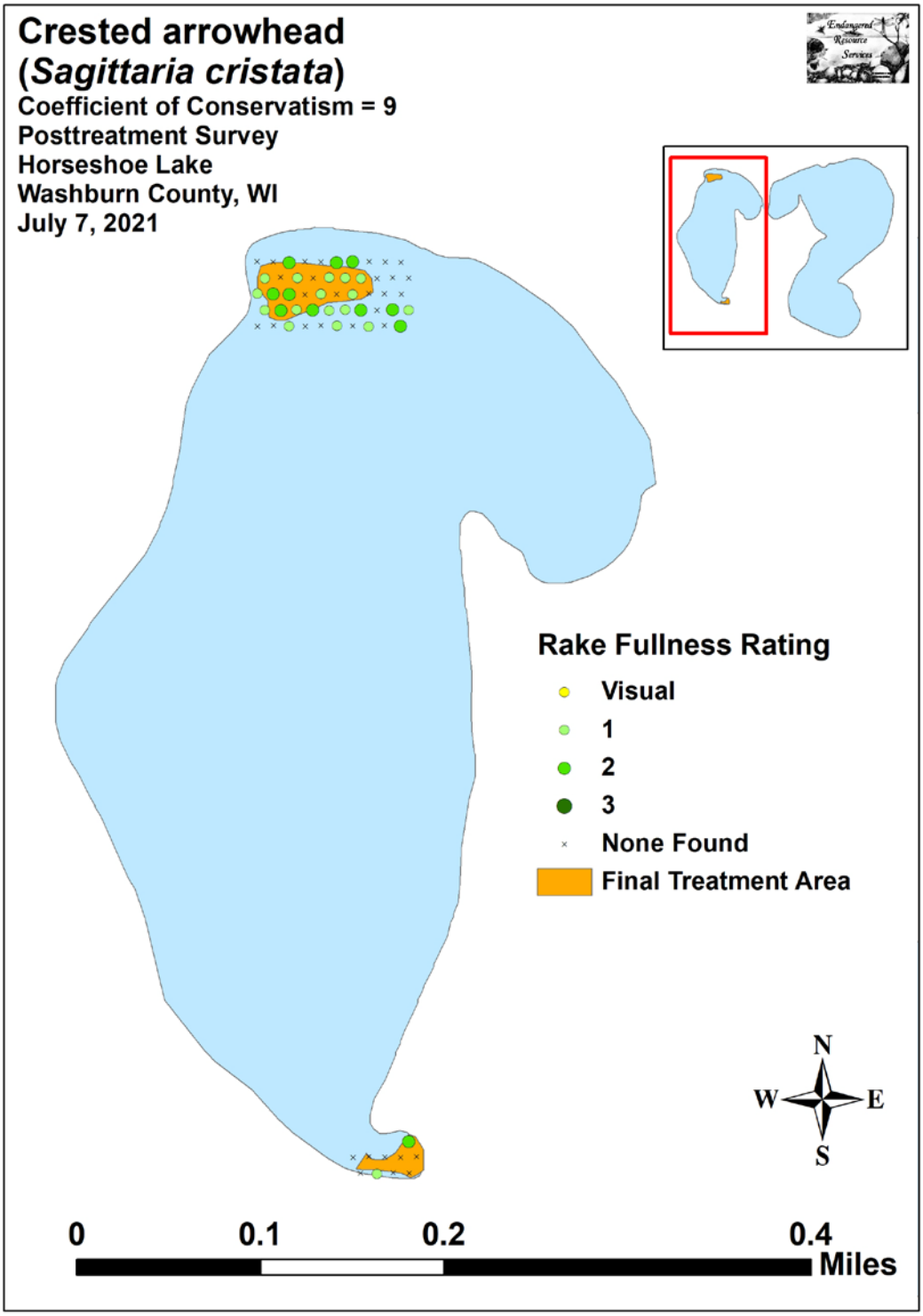

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

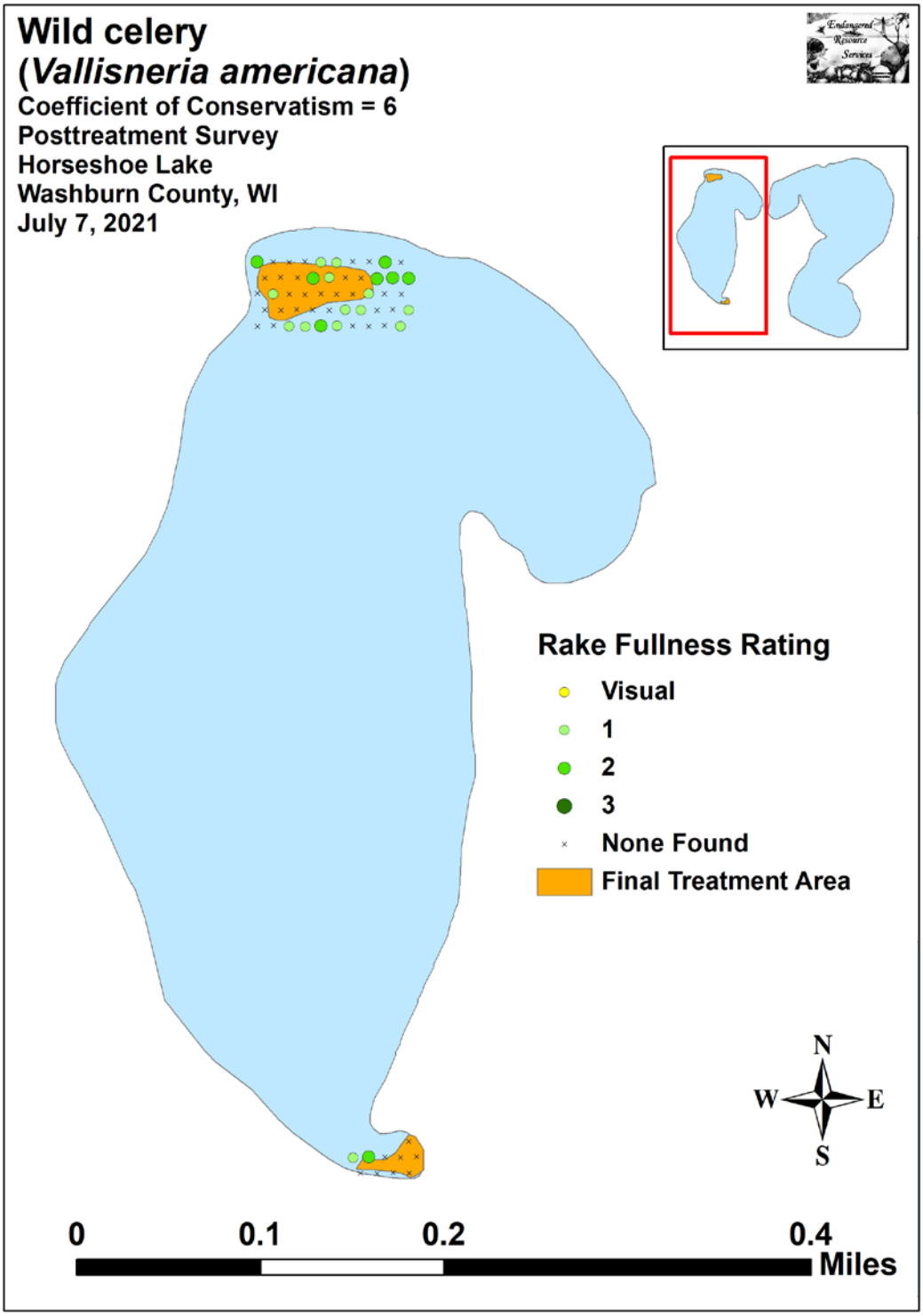

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Floating-leaf pondweed
(Potamogeton natans)
Coefficient of Conservatism = 5
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

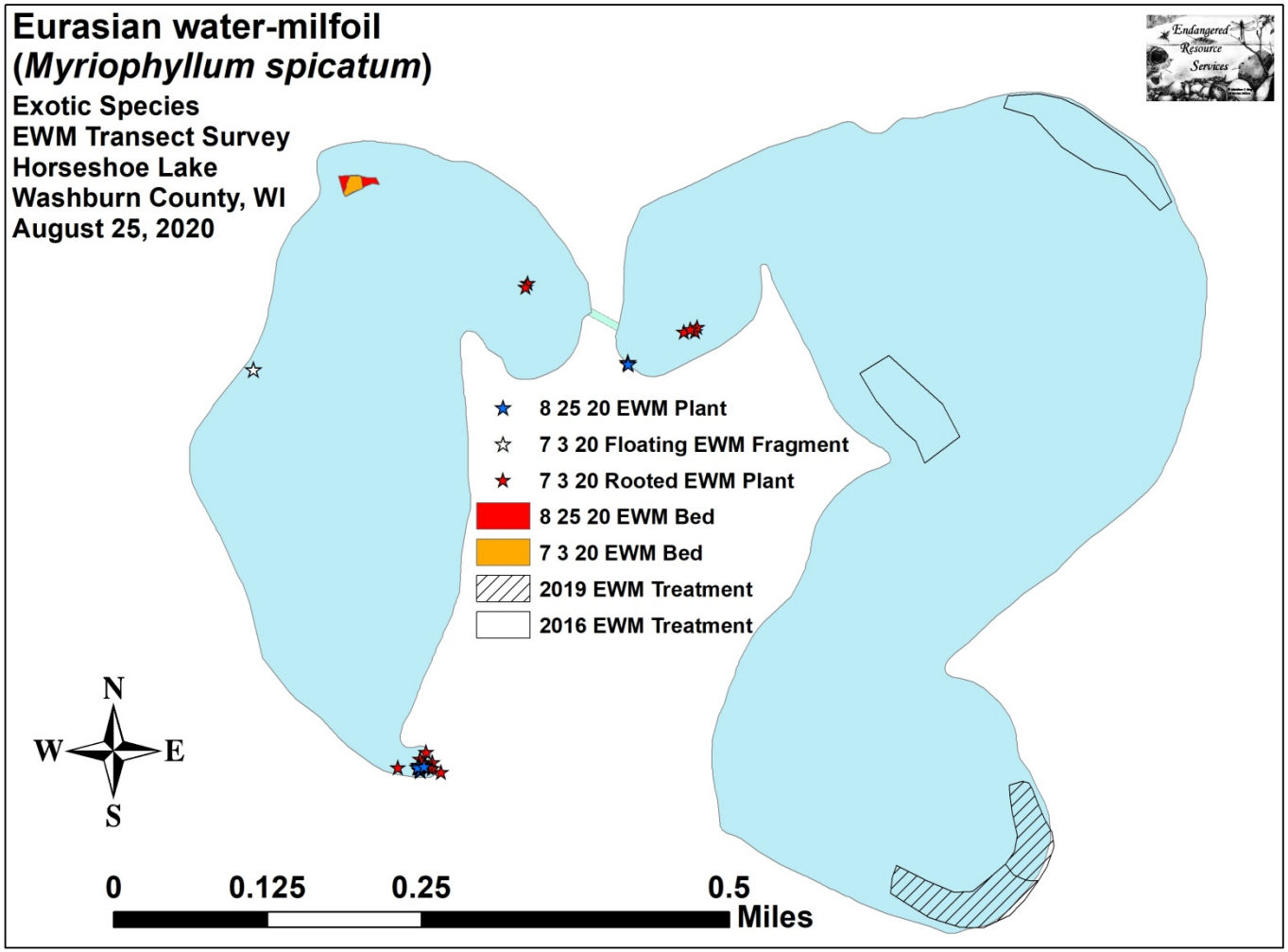

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

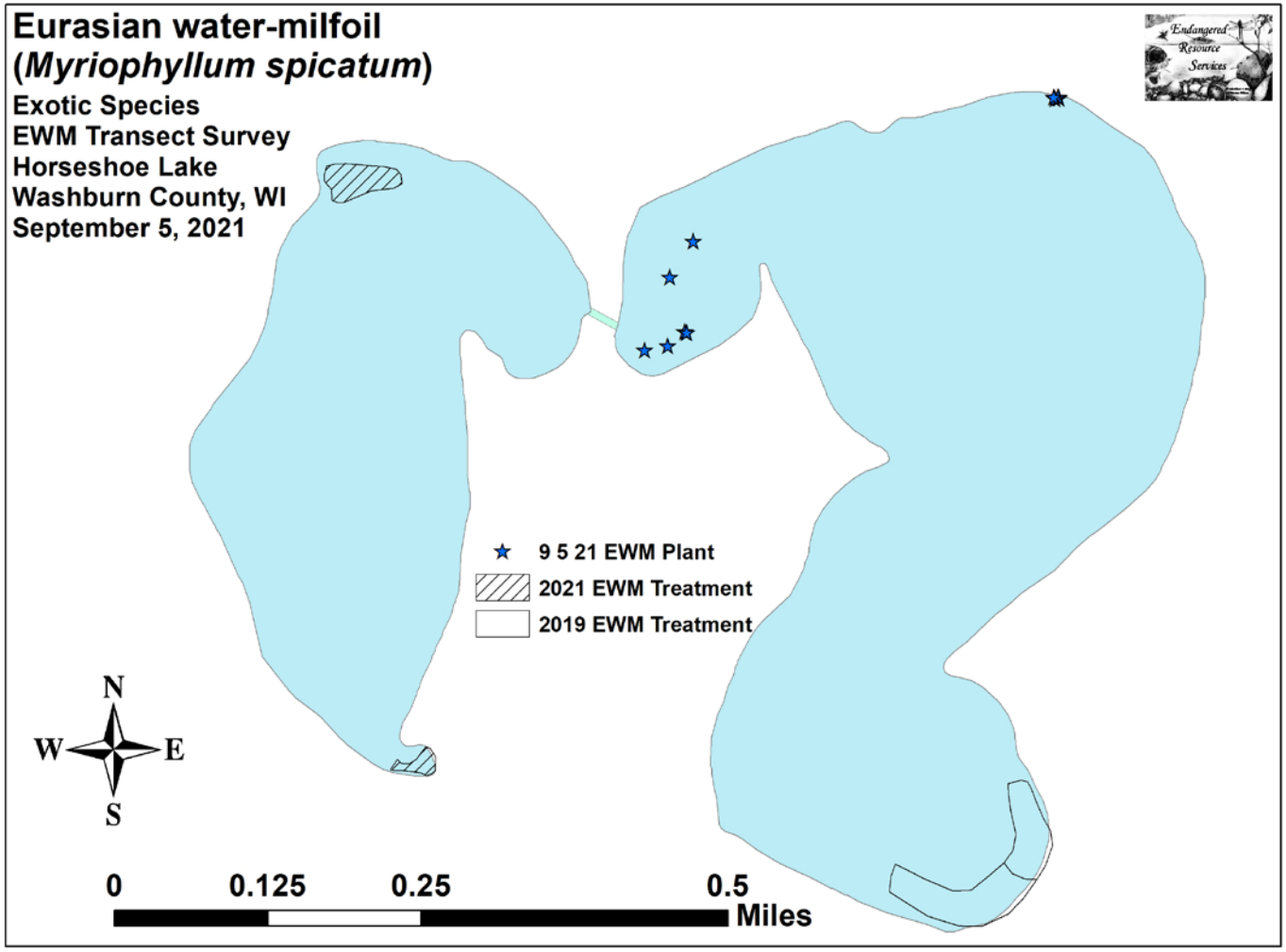

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Crested arrowhead
(Sagittaria cristata)
Coefficient of Conservatism = 9
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Posttreatment Survey
Horseshoe Lake
Washburn County, WI
July 7, 2021
Rake Fullness Rating
Visual
1
2
3
None Found
Final Treatment Area
N
W
E
S
0
0.1
0.2
0.4
Miles

Appendix VIII: 2020 and 2021 EWM Rake Removal and Bed Maps


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
EWM Transect Survey
Horseshoe Lake
Washburn County, WI
August 25, 2020
Endangered Resource Services
8 25 20 EWM Plant
7 3 20 Floating EWM Fragment
7 3 20 Rooted EWM Plant
8 25 20 EWM Bed
7 3 20 EWM Bed
2019 EWM Treatment
2016 EWM Treatment
N
W
E
S
0
0.125
0.25
0.5
Miles


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
EWM Transect Survey
Horseshoe Lake
Washburn County, WI
September 5, 2021
Endangered Resource Services
9 5 21 EWM Plant
2021 EWM Treatment
2019 EWM Treatment
N
W
E
S
0
0.125
0.25
0.5
Miles