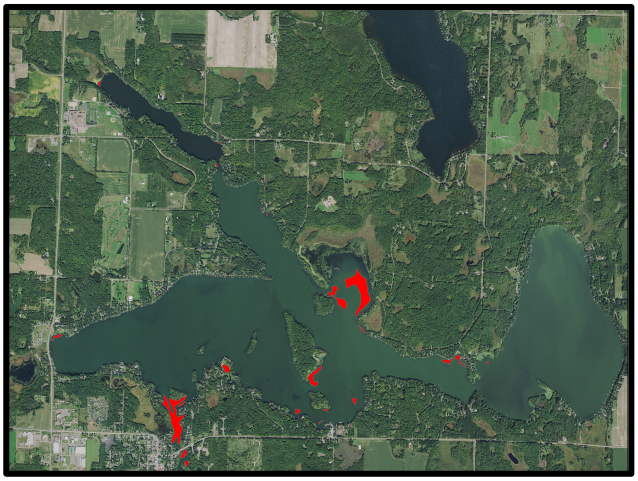
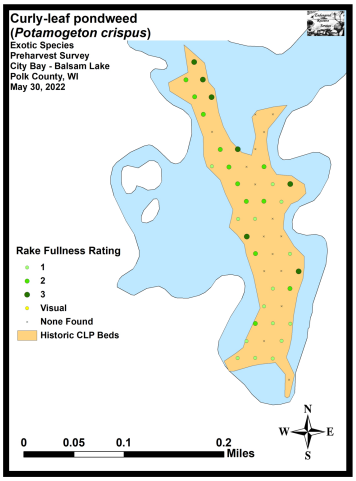
Curly-leaf Pondweed (*Potamogeton crispus*)
Preharvest Surveys
City Bay – Balsam Lake - WBIC: 2620600
Polk County, Wisconsin



Spring 2022 Curly-leaf Pondweed Beds



2022 CLP Preharvest in City Bay

Project Initiated by:
Balsam Lake Protection and Rehabilitation District and the
Wisconsin Department of Natural Resources – Grant ACEI21218

Rake of Curly-leaf pondweed (Berg 2022)

Surveys Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 31, 2021 and May 30, 2022

TABLE OF CONTENTS

	Page
LIST OF FIGURES AND TABLES……..	ii
INTRODUCTION……..	1
BACKGROUND AND STUDY RATIONALE……	1
METHODS…….	2
RESULTS AND DISCUSSION…….	3
Preharvest Surveys……..	3
LITERATURE CITED…….	14
APPENDIXES……...	15
I: Survey Sample Points and Historic CLP Bed Map……..	15
II: Vegetative Survey Datasheet……..……...	18
III: Preharvest Habitat Variables……..……...……...	20
IV: 2021 and 2022 Preharvest Littoral Zone, Native Species Richness and Total Rake Fullness……...	23
V: 2021 and 2022 Preharvest CLP Density and Distribution…….……	30
VI: 2021 Preharvest Native Species Density and Distribution…..…….……	33
VII: 2022 Preharvest Native Species Density and Distribution……...	51

LIST OF FIGURES AND TABLES

Page

Figure 1: Balsam Lake with 2022 CLP Beds……..……..… 1

Figure 2: Survey Sample Points in Historic CLP Beds……..…..…….…… 2

Figure 3: Rake Fullness Ratings…..…….…….……..... 2

Figure 4: CLP Area Depths and Bottom Substrate...….……..…….……. 3

Figure 5: 2021 and 2022 Preharvest Littoral Zone.……...….…….……. 4

Table 1: Preharvest Surveys Summary Statistics –
City Bay – Balsam Lake, Polk County May 31, 2021 and May 30, 2022….…… 4

Figure 6: 2021 and 2022 Preharvest Native Species Richness…….. 5

Figure 7: 2021 and 2022 Preharvest Total Rake Fullness……. 6

Figure 8: 2021 and 2022 Preharvest CLP Density and Distribution……. 7

Figure 9: 2021 and 2022 Preharvest Changes in CLP Rake Fullness…… 7

Figure 10: 2021 and 2022 Preharvest Coontail Density and Distribution..……... 8

Figure 11: 2021 and 2022 Preharvest Common Waterweed Density and Distr…… 9

Figure 12: 2021 and 2022 Preharvest Flat-stem Pondweed Density and Distr..…... 9

Figure 13: 2021 and 2022 Preharvest Fern Pondweed Density and Distribution…. 10

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Preharvest Survey – City Bay – Balsam Lake, Polk County May 31, 2021..…..…... 11

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Preharvest Survey – City Bay – Balsam Lake, Polk County May 30, 2022……... 12

Figure 14: 2021 and 2022 Preharvest Macrophyte Changes…….. 13

INTRODUCTION:

Balsam Lake (WBIC 2620600) is a 2,054-acre stratified drainage lake in central Polk County, Wisconsin in the Towns of Balsam Lake, Milltown, Georgetown, and Apple River (T34N R17W) (Figure 1). It reaches a maximum depth of 37ft north of Cedar Island in the western basin and has an average depth of 20ft (Hopke et al. 1964). The lake is mesotrophic bordering on eutrophic in nature, and water clarity is fair with historical summer Secchi readings averaging 5ft in East Balsam, 6ft in Little Balsam, and 8ft in the deep hole north of Cedar Island (WDNR 2022). Bottom substrate is variable with organic muck in most bays, and rock/sand in the Big and Little Narrows and around the lake's many islands.

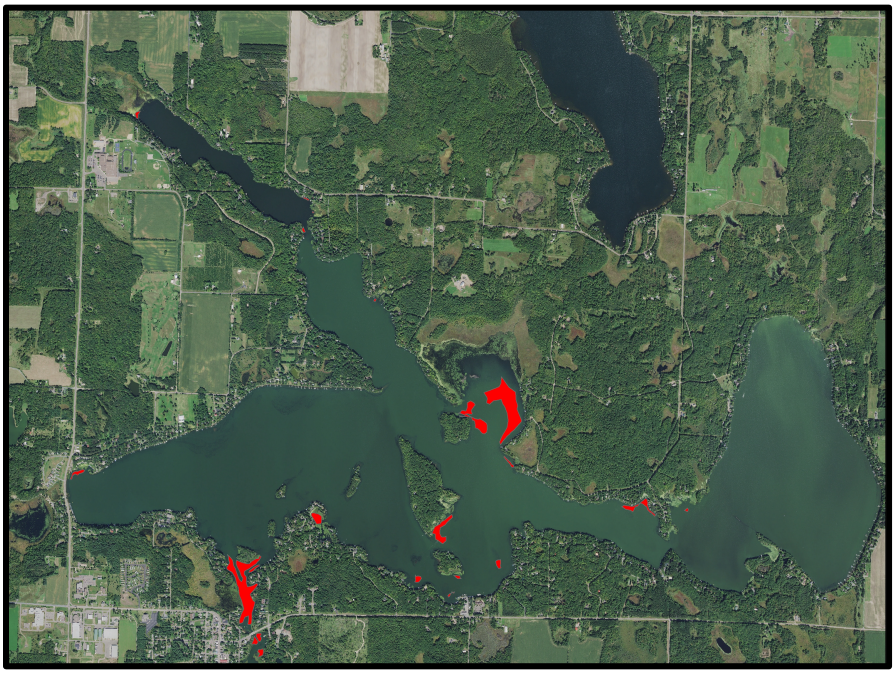


Figure 1: Balsam Lake with 2022 CLP Beds

BACKGROUND AND STUDY RATIONALE:

Curly-leaf pondweed (*Potamogeton crispus*) (CLP) is an invasive exotic plant that is common to abundant in parts of Balsam Lake. In their 2010 and 2015 Wisconsin Department of Natural Resources (WDNR) approved Aquatic Plant Management Plans (APMP), the Balsam Lake Protection and Rehabilitation District's (BLPRD) identified a) reducing overall lake coverage of CLP to <20 acres and b) relieving navigation impairment caused by canopied CLP beds as management goals (Clemens 2010, Clemens 2015). As part of their continuing efforts to meet these goals, the BLPRD and the WDNR is actively engaged in both herbicide treatments and mechanical harvesting. Although levels of CLP and native plants before and after herbicide use have been carefully studied, the long-term impacts of harvesting on the lake's vegetation have not been quantified. Because of this, the BLPRD and Harmoney Environmental (HE) requested we initiate annual preharvest sub point-intercept surveys of all plant species and fall CLP turion surveys in City Bay north of the CTH I bridge/south of First Island within areas historically dominated by CLP.

METHODS:

Preharvest Point-intercept Macrophyte Survey:

Starting with the spring 2020 survey that outlined a 9.81-acre Curly-leaf pondweed bed in City Bay, we used Hawth's Analysis Tools Extension to ArcGIS 9.3.1 to generate regular points at the rate of just over five points/acre within the historic bed. This produced a 50-point sampling grid which was used in both to 2021 and 2022 to allow for direct comparisons (Figure 2) (Appendix I).

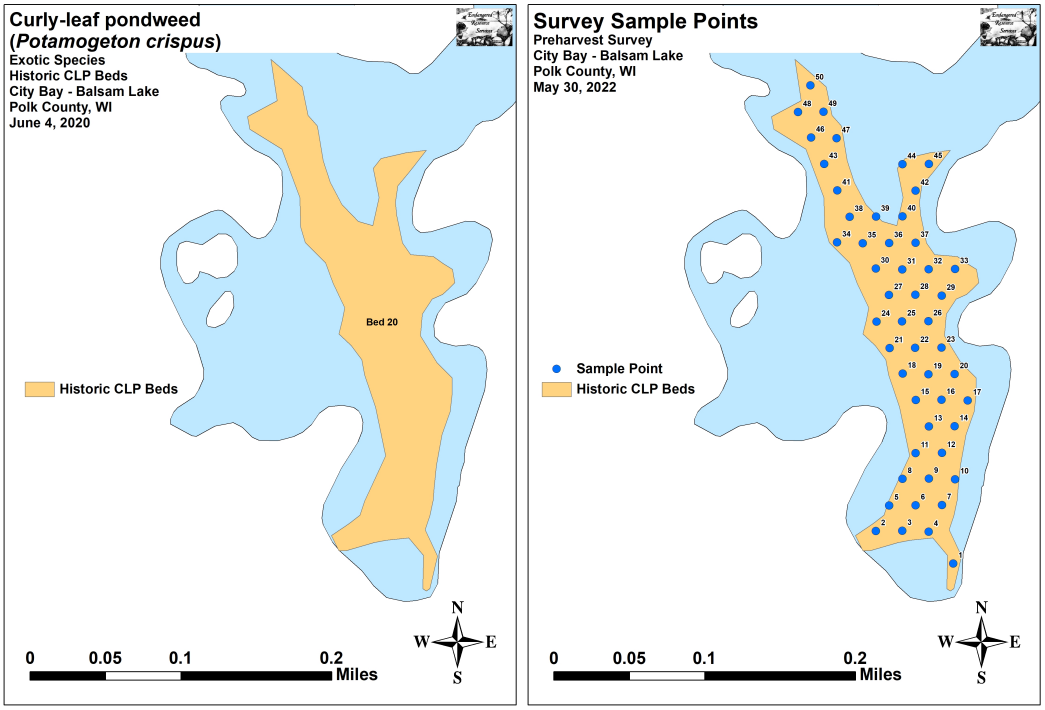


Figure 2: Survey Sample Points in Historic CLP Beds

These 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. CLP was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 3). We also recorded visual sightings of CLP within six feet of the sample point. Because visual sightings are not calculated into the statistical formulas, we only assigned a rake fullness value for non-CLP plants. A cumulative rake fullness value was also noted.

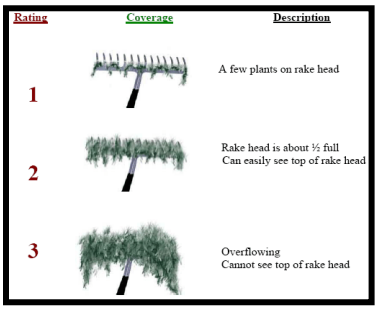


Figure 3: Rake Fullness Ratings

We entered all data collected into the standard APM spreadsheet (Appendix II), and data was analyzed using the linked statistical summary sheet. For pre/post differences of individual plant species and 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 $p<0.001$.

RESULTS AND DISCUSSION:

Preharvest Surveys:

All points occurred in areas between 2.0ft and 12.0ft of water. During the pretreatment survey, we found the mean and median depths of plant growth were 7.4ft and 7.5ft respectively for both the 2021 and 2022 surveys (Table 1). Most CLP was established over organic muck, but we also found scattered plants in the few areas that had sandy substrates (Figure 4) (Appendix III).

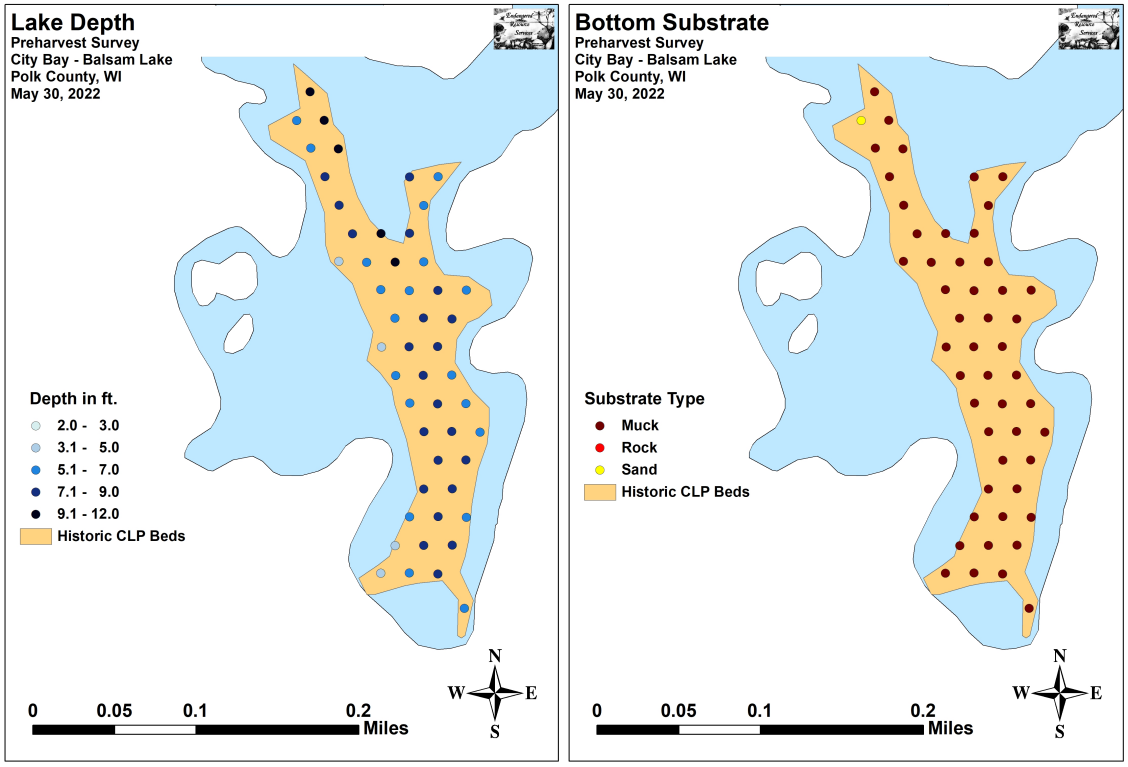


Figure 4: CLP Area Depths and Bottom Substrate

The littoral zone extended to 10.5ft and plants were found at all points during each survey (Figure 5) (Appendix IV). Species richness declined from 17 in 2021 to 13 in 2022. Similarly, the Simpson's Diversity Index declined from 0.87 in 2021 to 0.81 in 2022. The Floristic Quality Index, another measure of the native plant community health, also declined from 25.8 pretreatment to 21.7 posttreatment.

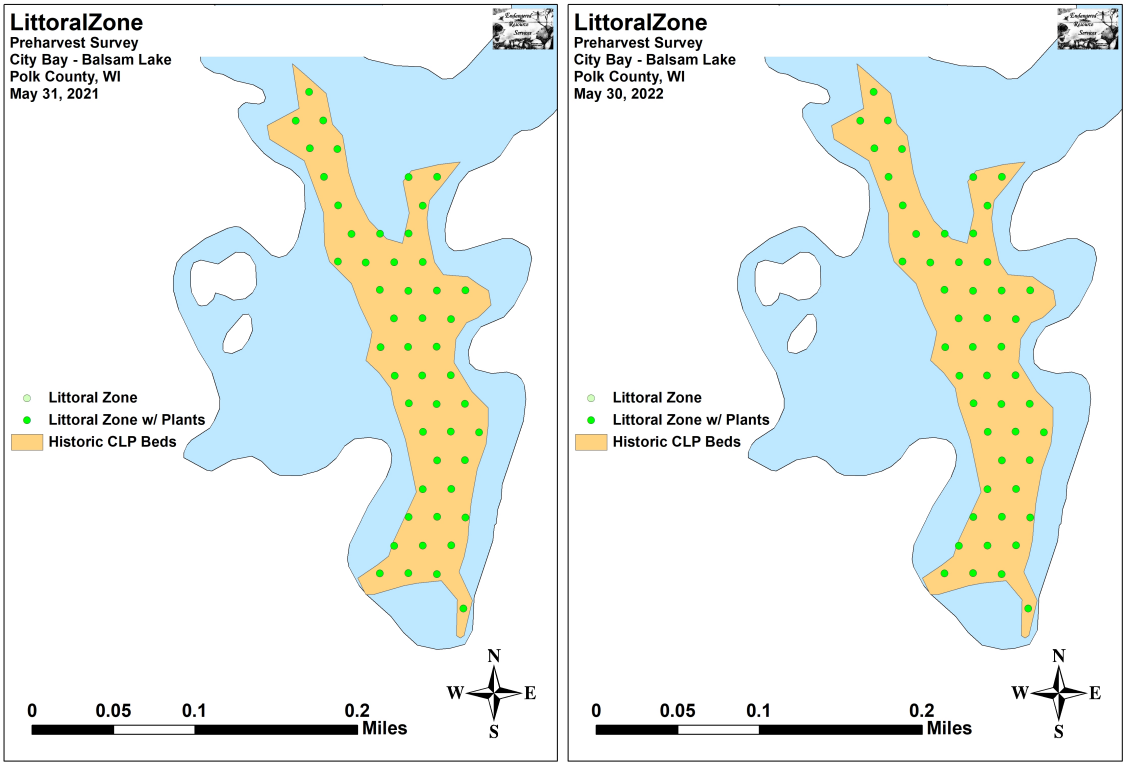


Figure 5: 2021 and 2022 Preharvest Littoral Zone

Table 1: Preharvest Surveys Summary Statistics
City Bay – Balsam Lake – Polk County, WI
May 31, 2021 and May 30, 2022

Summary Statistics:	5/31/21	5/30/22
Total number of points sampled	50	50
Total number of sites with vegetation	50	50
Total number of sites shallower than the maximum depth of plants	50	50
Frequency of occurrence at sites shallower than maximum depth of plants	100.00	100.00
Simpson Diversity Index	0.87	0.81
Mean Coefficient of Conservatism	6.4	6.3
Floristic Quality Index	25.8	21.7
Maximum depth of plants (ft)	10.5	10.5
Mean depth of plants (ft)	7.4	7.4
Median depth of plants (ft)	7.5	7.5
Average number of all species per site (shallower than max depth)	3.58	2.68
Average number of all species per site (veg. sites only)	3.58	2.68
Average number of native species per site (shallower than max depth)	2.98	2.00
Average number of native species per site (sites with native veg. only)	3.10	2.22
Species richness	17	13
Mean rake fullness (veg. sites only)	2.18	2.24

Mean native species richness at points with native vegetation experienced a highly significant decline **(*p*<0.001)** from 3.58 species/point in 2021 to 2.22 species/point in 2022 (Figure 6). Although this decline could be related to the harvesting program, it should be noted that growth in 2022 appeared to be much behind normal due to the exceptionally late ice-out, and this could be a contributing factor to the observed declines.

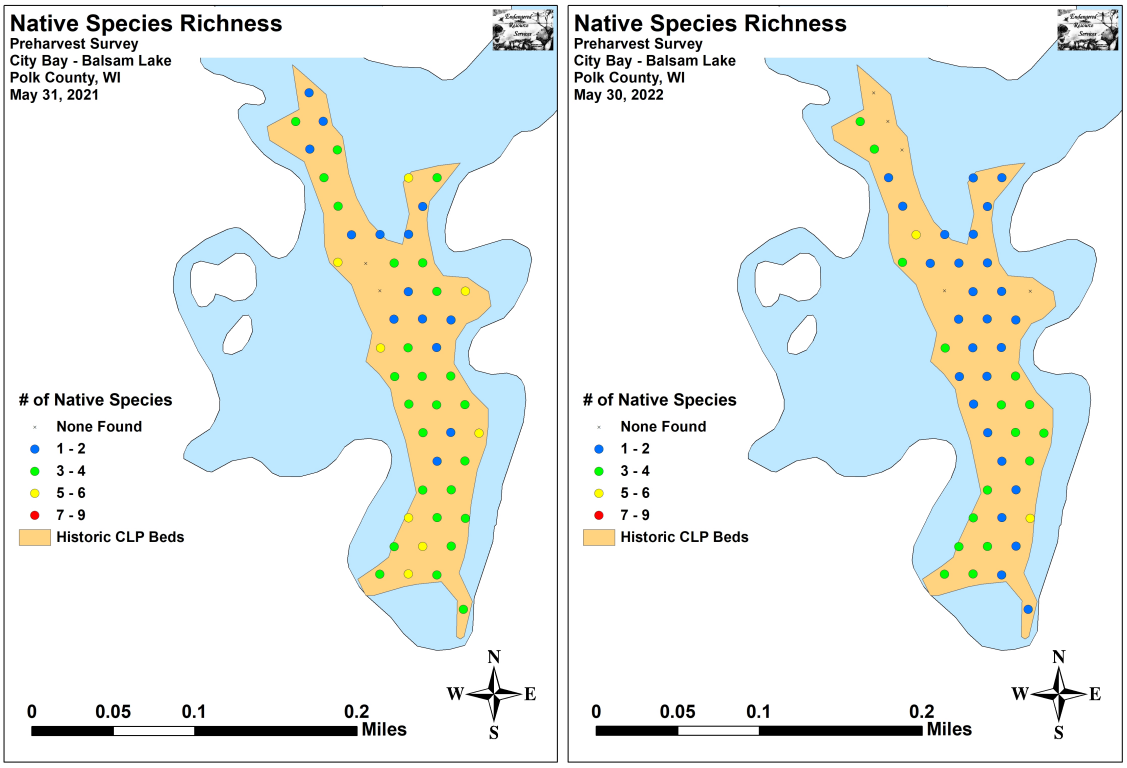


Figure 6: 2021 and 2022 Preharvest Native Species Richness

The total mean rake fullness during the 2021 survey was a moderate 2.18. The 2022 survey found these levels were almost unchanged at 2.24 – a non-significant increase (*p*=0.27) (Figure 7) (Appendix IV).

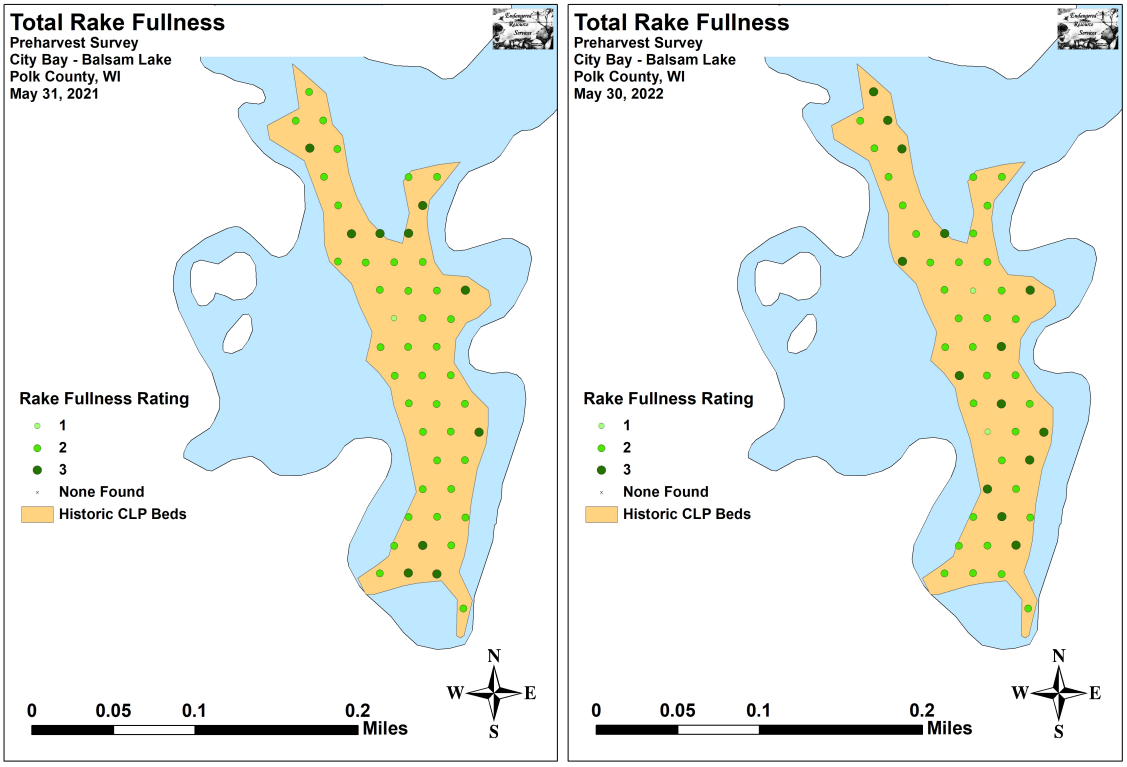


Figure 7: 2021 and 2022 Preharvest Total Rake Fullness

In 2021, we found Curly-leaf pondweed at 30 of 50 sites (60.0% coverage) during the preharvest survey (Figure 8). Of these, four points had a rake fullness rating of 3, 15 rated a 2, and 11 were a 1. This produced a mean rake fullness of 1.77 and suggested 38.0% of the beds had a significant infestation (rake fullness of 2 or 3). CLP was also recorded as a visual at eight points (Appendix V).

The 2022 survey documented CLP at 34 of 50 sites (68.0% coverage) – a non-significant increase (p=0.40) in distribution when compared to 2021 (Figure 8). We rated seven of these points a 3, 12 points a 2 (38.0% significant infestation), and the remaining 15 points a 1. This produced a mean rake fullness of 1.76 – a non-significant decrease (p=0.50) compared to 2021 levels. Similarly, none of the changes in rake fullness rating were significantly different; however, the decline in visual sightings was **moderately significant (p=0.002)** (Figure 9).

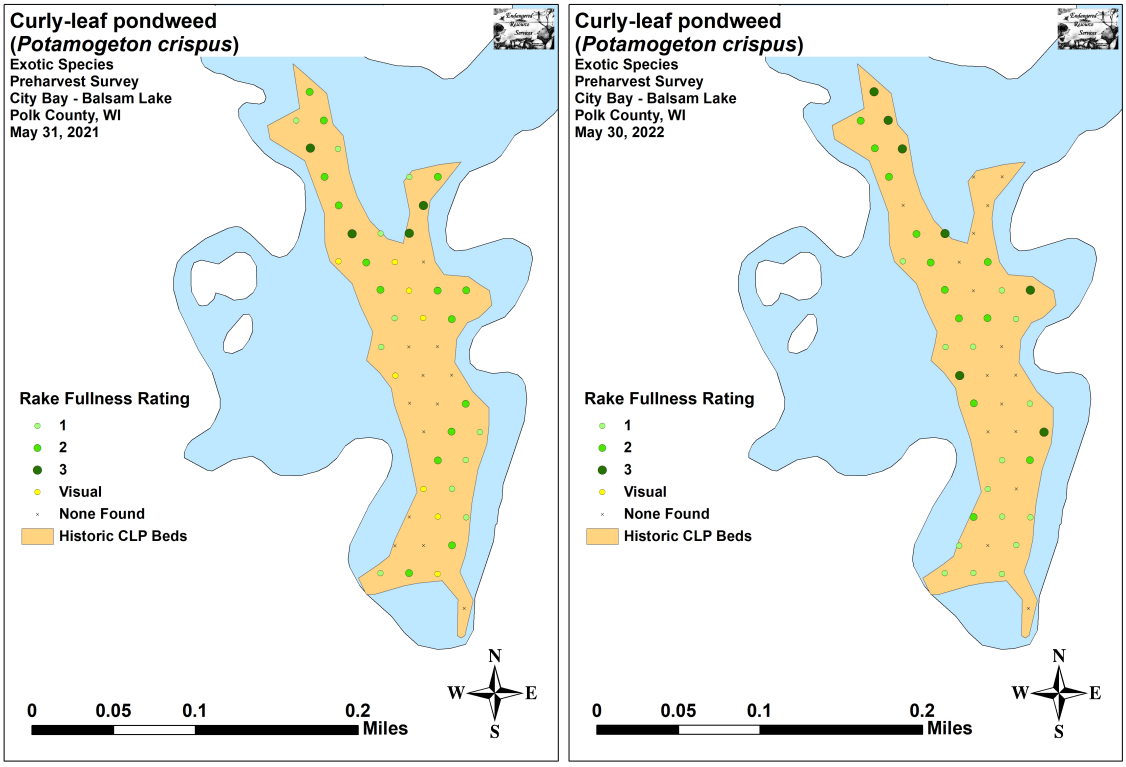
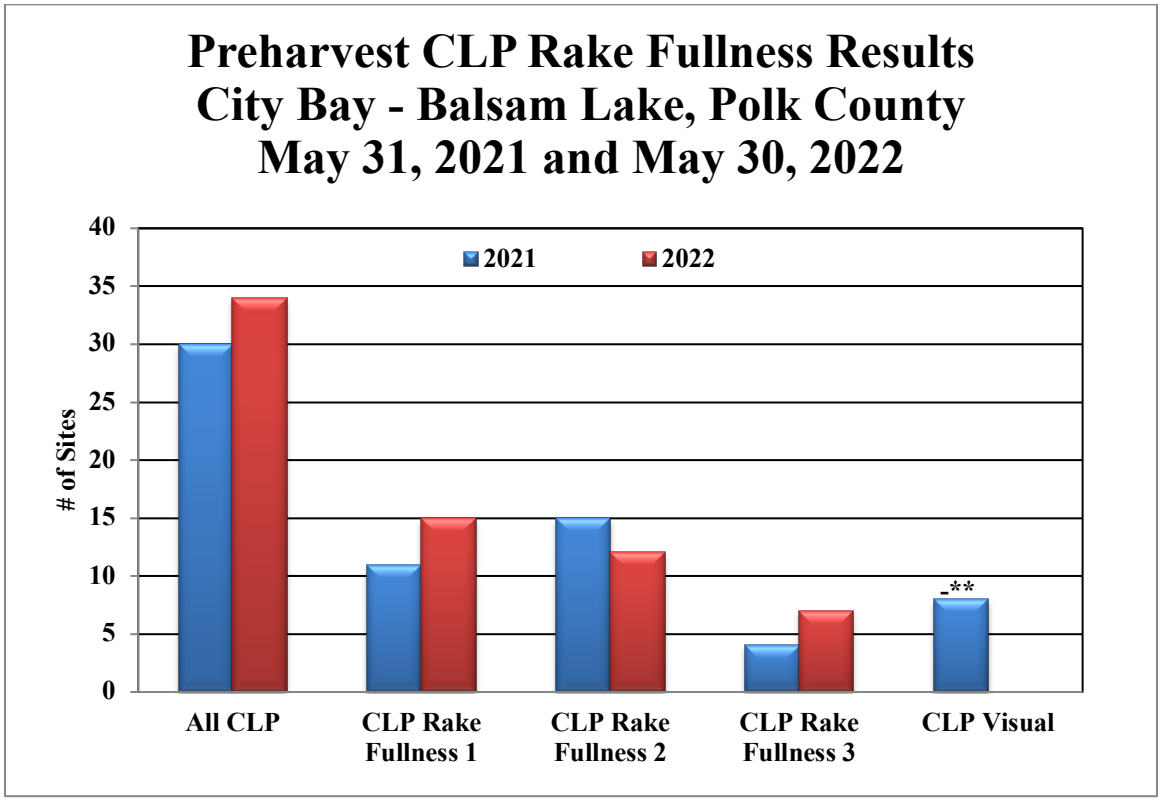


Figure 8: 2021 and 2022 Preharvest CLP Density and Distribution



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

Figure 9: 2021 and 2022 Preharvest Changes in CLP Rake Fullness

Coontail (*Ceratophyllum demersum*) was the most common native species during each of the surveys (Figure 10) (Tables 2 and 3). It experienced non-significant increases (p=0.48/p=0.17) in both distribution (37 sites in 2021/40 sites in 2022) and density (mean rake 1.68 in 2021/1.83 in 2022).

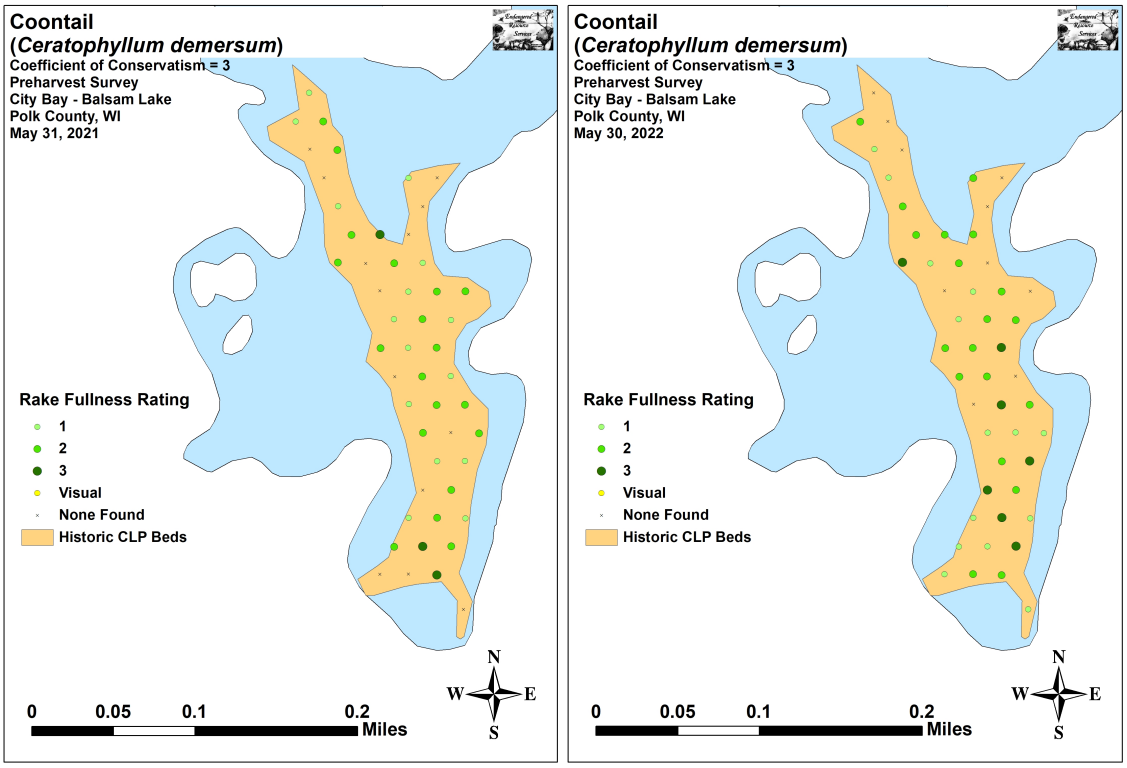


Figure 10: 2021 and 2022 Preharvest Coontail Density and Distribution

Common waterweed (*Elodea canadensis*), the second most common native species in 2021, underwent a highly significant decline **(p<0.001)** in distribution (32 sites in 2021/14 sites in 2022) and fell to the third most common species (Figure 11). It also underwent a significant decline **(p=0.04)** in density from a mean rake of 1.47 in 2021 to 1.21 in 2022.

Flat-stem pondweed (*Potamogeton zosteriformis*) was the third most common native species in 2021 and the fourth most common in 2022 (Figure 12). Present at 20 sites with a mean rake fullness of 1.20, it underwent a significant decline **(p=0.02)** in distribution (nine sites) and a non-significant decline (p=0.27) in density (mean rake 1.11).

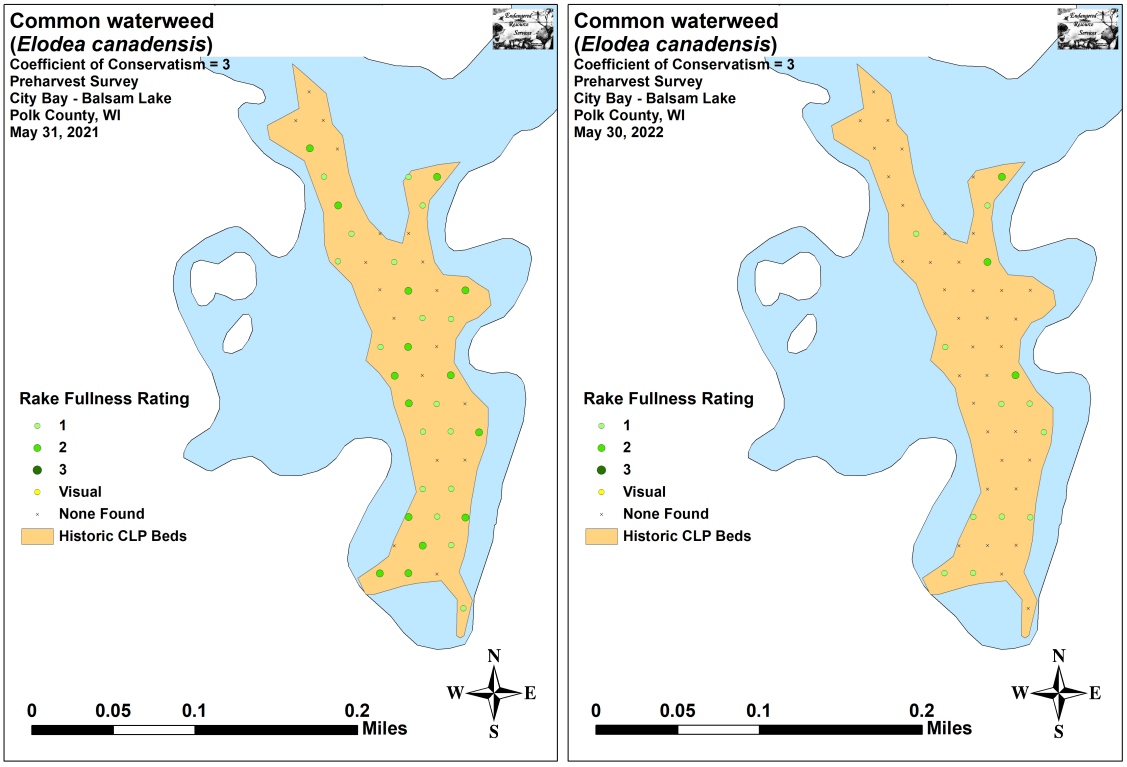


Figure 11: 2021 and 2022 Preharvest Common Waterweed Density and Distribution

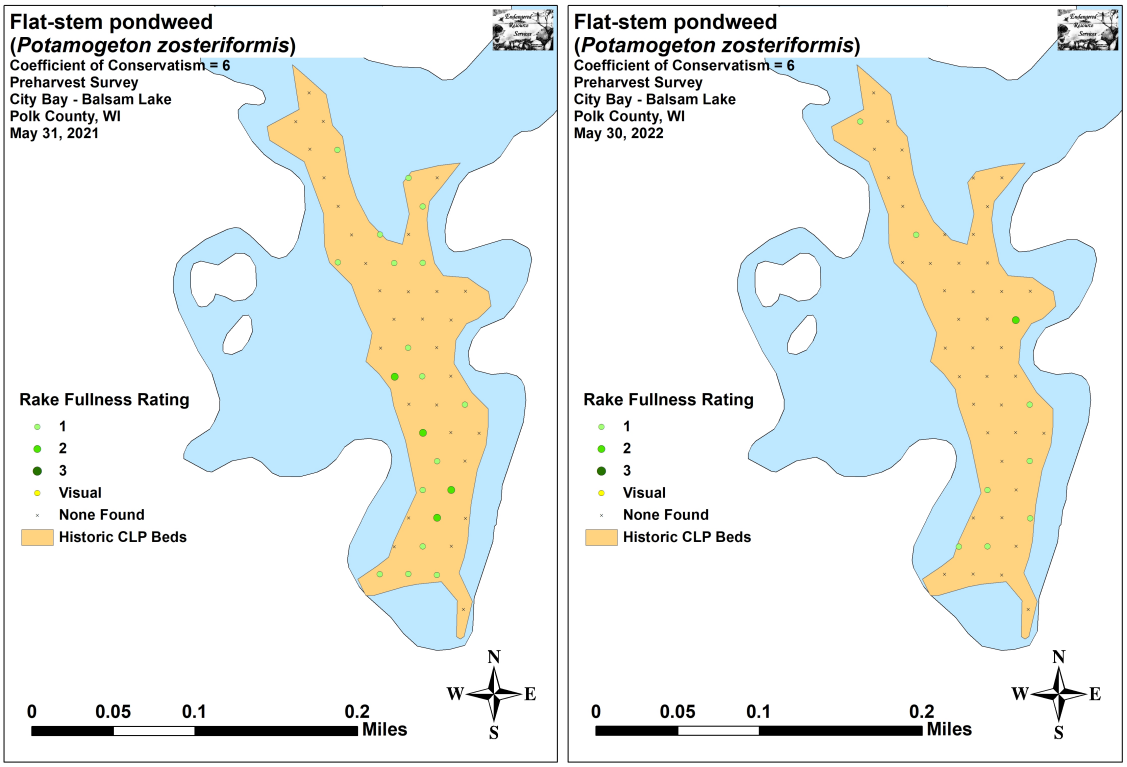


Figure 12: 2021 and 2022 Preharvest Flat-stem Pondweed Density and Distribution

Fern pondweed (*Potamogeton robbinsii*) increased its community rank from the fourth to the third most common native species (Figure 13). However, neither its increase in distribution (17 sites 2021/20 sites 2022), nor its increase in density (mean rake 1.41 2021/1.60 2022) were significant (p=0.53/p=0.13).

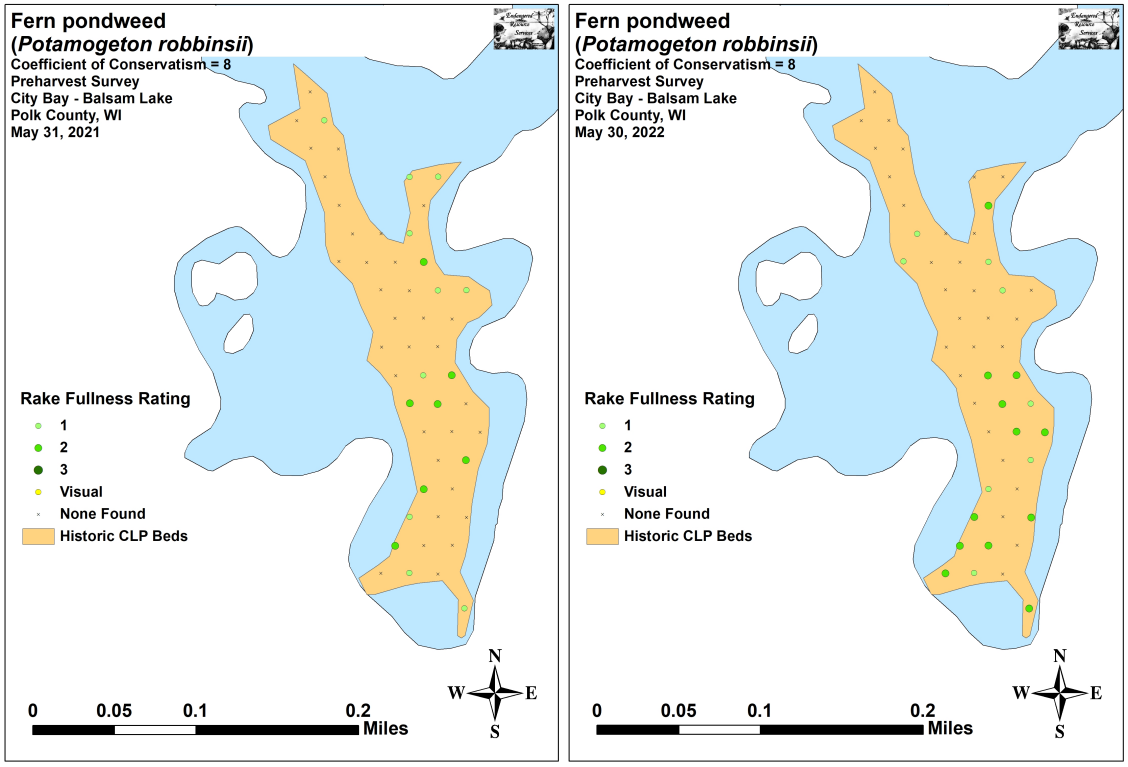


Figure 13: 2021 and 2022 Preharvest Fern pondweed Density and Distribution

Several other species experienced significant year-over-year changes (Figure 14). Filamentous algae underwent a significant increase **(p<0.05)** in distribution, but a non-significant increase in density (p=0.32) (10 sites/mean rake 1.30 in 2021 – 19 sites/mean rake 1.42 in 2022). In addition to Common waterweed and Flat-stem pondweed, Northern water-milfoil also suffered a significant decline in distribution **(p<0.05)** (Maps of all native species from the 2021 and 2022 surveys can be found in Appendixes VI and VII).

Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Preharvest Survey – City Bay – Balsam Lake, Polk County
May 31, 2021

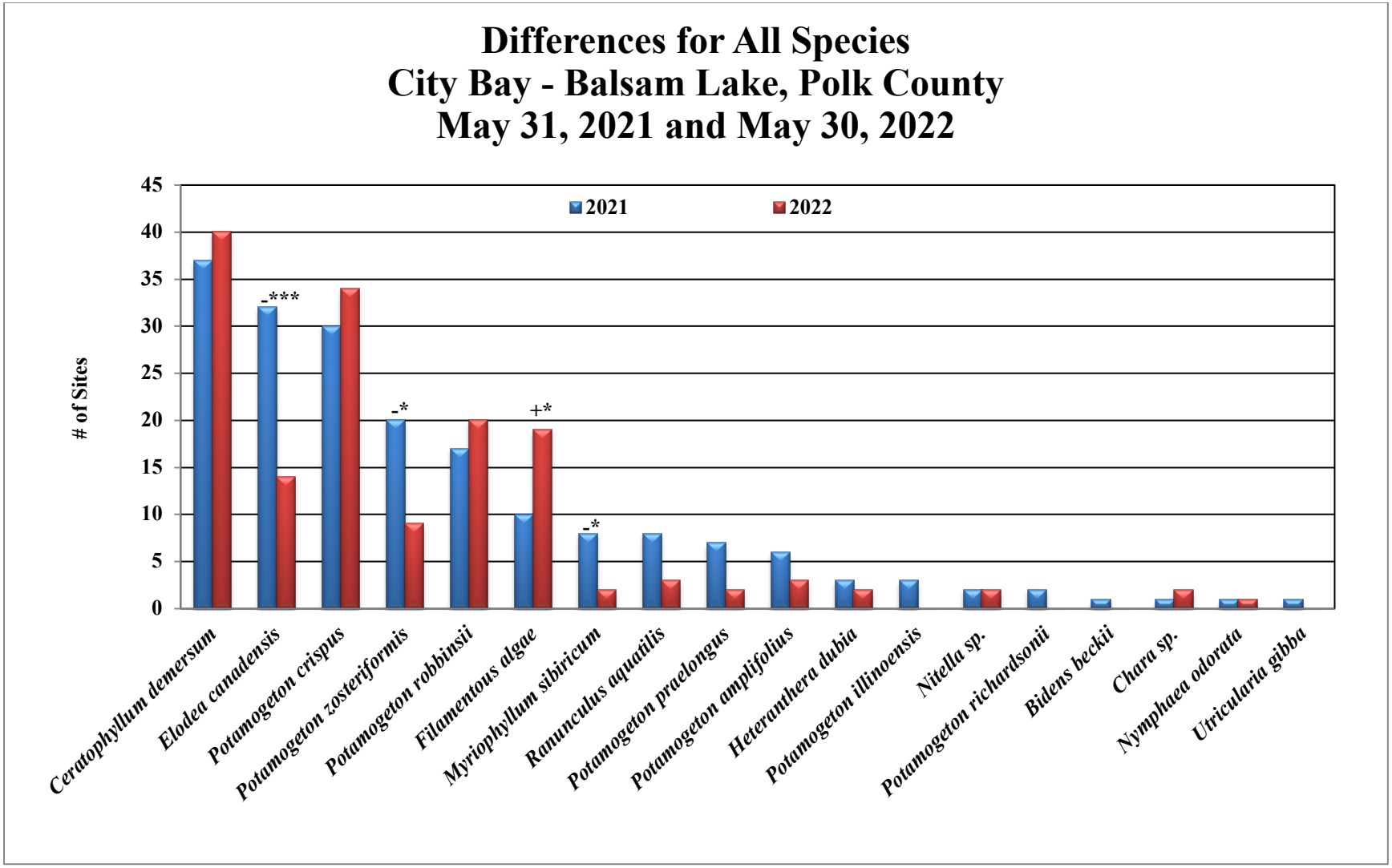
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Ceratophyllum demersum	Coontail	37	20.67	74.00	74.00	1.68	0
Elodea canadensis	Common waterweed	32	17.88	64.00	64.00	1.47	0
Potamogeton crispus	**Curly-leaf pondweed**	**30**	**16.76**	**60.00**	**60.00**	**1.77**	**8**
Potamogeton zosteriformis	Flat-stem pondweed	20	11.17	40.00	40.00	1.20	0
Potamogeton robbinsii	Fern pondweed	17	9.50	34.00	34.00	1.41	0
	Filamentous algae	10	*	20.00	20.00	1.30	0
Myriophyllum sibiricum	Northern water-milfoil	8	4.47	16.00	16.00	1.38	0
Ranunculus aquatilis	White water crowfoot	8	4.47	16.00	16.00	1.25	0
Potamogeton praelongus	White-stem pondweed	7	3.91	14.00	14.00	1.14	0
Potamogeton amplifolius	Large-leaf pondweed	6	3.35	12.00	12.00	1.67	0
Heteranthera dubia	Water star-grass	3	1.68	6.00	6.00	1.00	0
Potamogeton illinoensis	Illinois pondweed	3	1.68	6.00	6.00	1.00	0
Nitella sp.	Nitella	2	1.12	4.00	4.00	1.50	0
Potamogeton richardsonii	Clasping-leaf pondweed	2	1.12	4.00	4.00	1.00	0
Bidens beckii	Water marigold	1	0.56	2.00	2.00	2.00	0
Chara sp.	Muskgrass	1	0.56	2.00	2.00	1.00	0
Nymphaea odorata	White water lily	1	0.56	2.00	2.00	1.00	0
Utricularia gibba	Creeping bladderwort	1	0.56	2.00	2.00	1.00	0

* Excluded from relative frequency analysis **Exotic species in bold**

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Preharvest Survey – City Bay – Balsam Lake, Polk County
May 30, 2022

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sight.
Ceratophyllum demersum	Coontail	40	29.85	80.00	80.00	1.83	0
Potamogeton crispus	**Curly-leaf pondweed**	**34**	**25.37**	**68.00**	**68.00**	**1.76**	**0**
Potamogeton robbinsii	Fern pondweed	20	14.93	40.00	40.00	1.60	0
	Filamentous algae	19	*	38.00	38.00	1.42	0
Elodea canadensis	Common waterweed	14	10.45	28.00	28.00	1.21	0
Potamogeton zosteriformis	Flat-stem pondweed	9	6.72	18.00	18.00	1.11	0
Potamogeton amplifolius	Large-leaf pondweed	3	2.24	6.00	6.00	1.33	0
Ranunculus aquatilis	White water crowfoot	3	2.24	6.00	6.00	1.00	0
Chara sp.	Muskgrass	2	1.49	4.00	4.00	2.00	0
Heteranthera dubia	Water star-grass	2	1.49	4.00	4.00	1.00	0
Myriophyllum sibiricum	Northern water-milfoil	2	1.49	4.00	4.00	1.50	0
Nitella sp.	Nitella	2	1.49	4.00	4.00	1.00	0
Potamogeton praelongus	White-stem pondweed	2	1.49	4.00	4.00	1.50	0
Nymphaea odorata	White water lily	1	0.75	2.00	2.00	1.00	0

* Excluded from relative frequency analysis **Exotic species in bold**



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

Figure 14: 2021 and 2022 Preharvest Macrophyte Changes

LITERATURE CITED

Hopke, R., E. Nelson, and E. Eaton [online]. 1964. Balsam Lake Maps. Available from http://dnr.wi.gov/lakes/maps/DNR/2620600a.pdf (November, 2022).

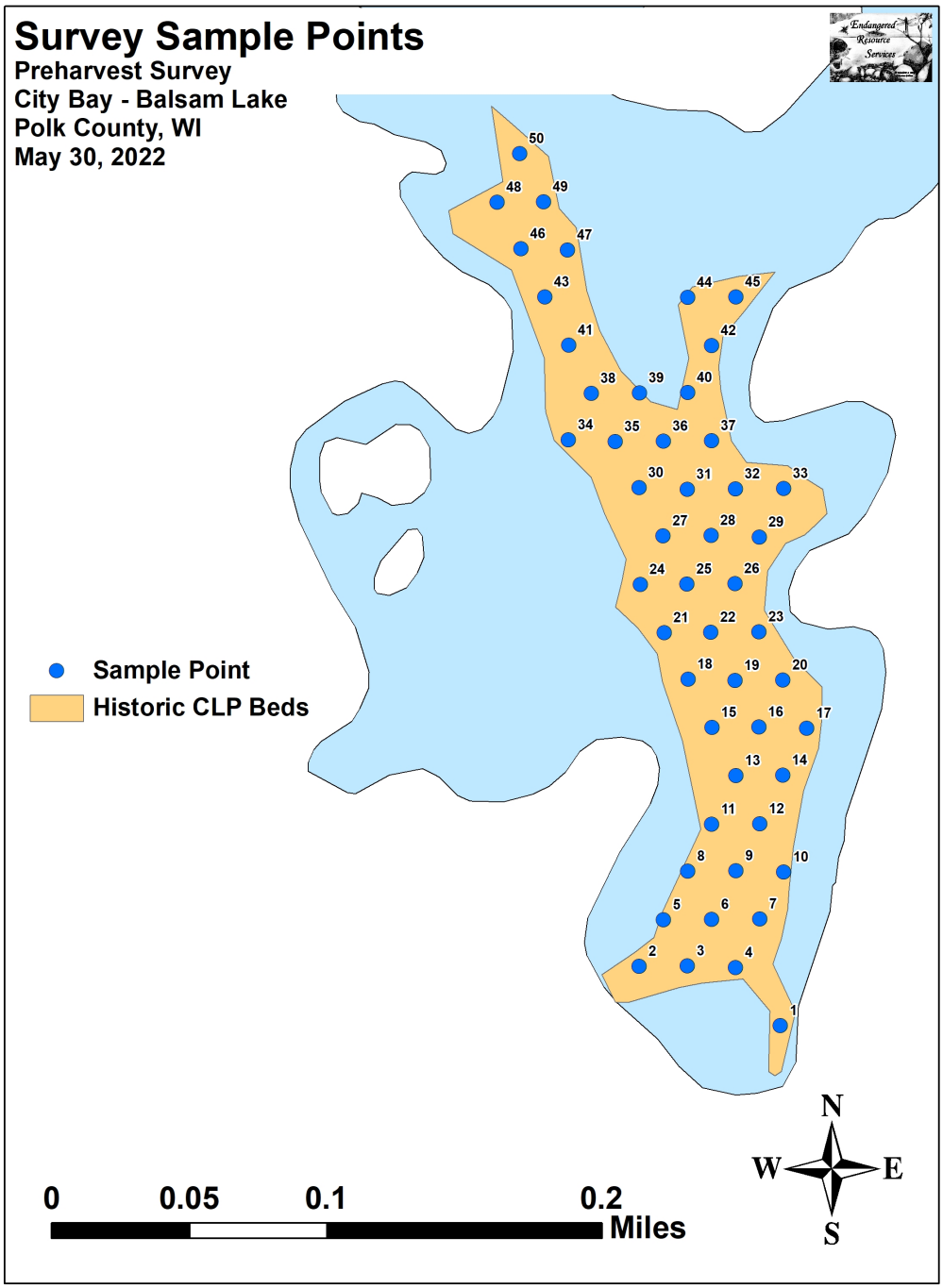
UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/ecology/aquaticplants/default.aspx (November, 2022).

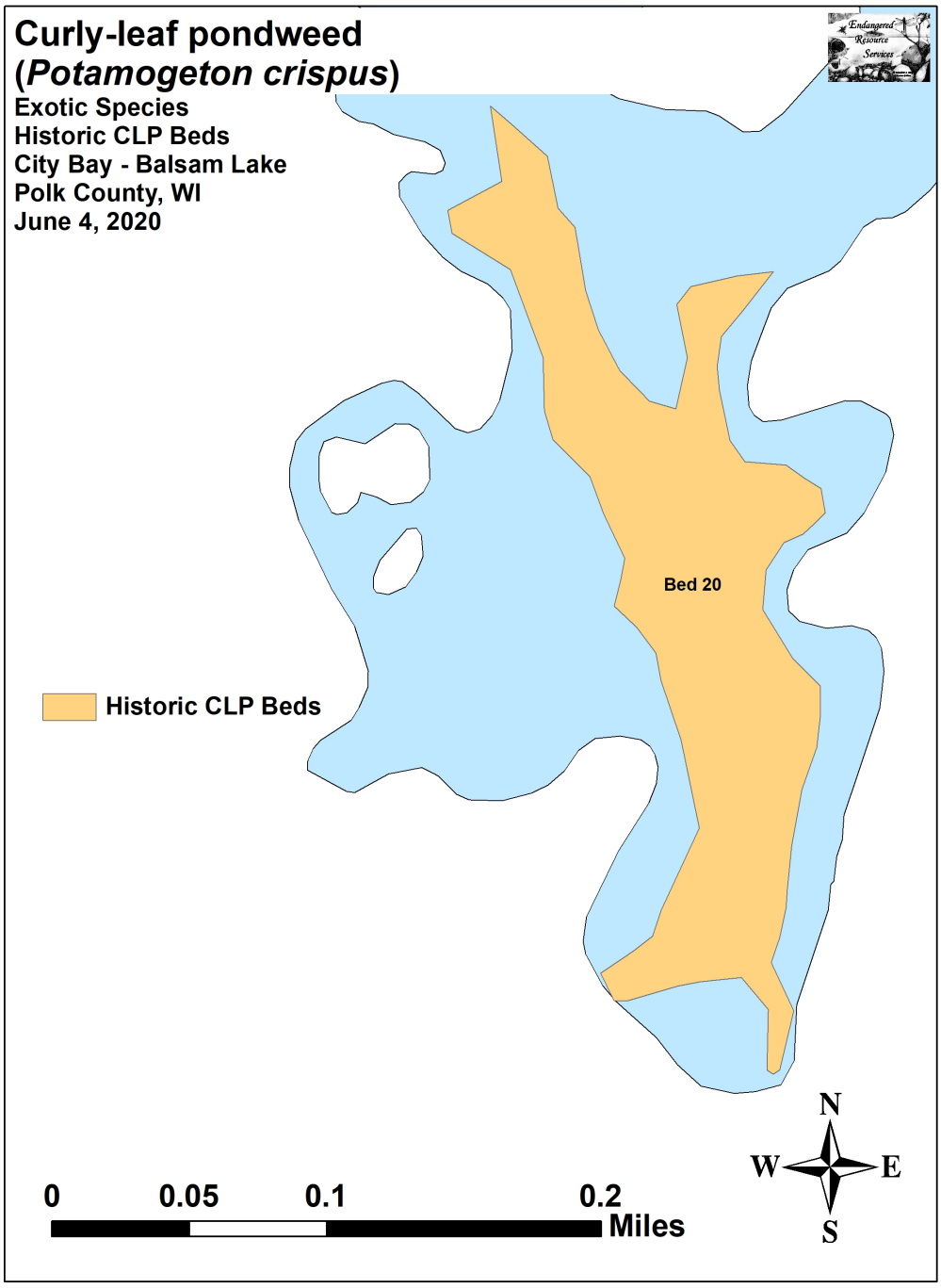
UWEX Lakes Program. [online]. 2010. Pre/Posttreatment Herbicide Comparison. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/Appendix-D.pdf (November, 2022).

WDNR. [online]. 2022. Balsam Lake Citizen Monitoring Water Quality Database. Available from http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2620600&page=waterquality (November, 2022).

WDNR. [online]. 2022. Wisconsin Lakes Information – Balsam Lake – Polk County. https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2620600 (November, 2022).

Appendix I: Survey Sample Points and Historic CLP Bed Map

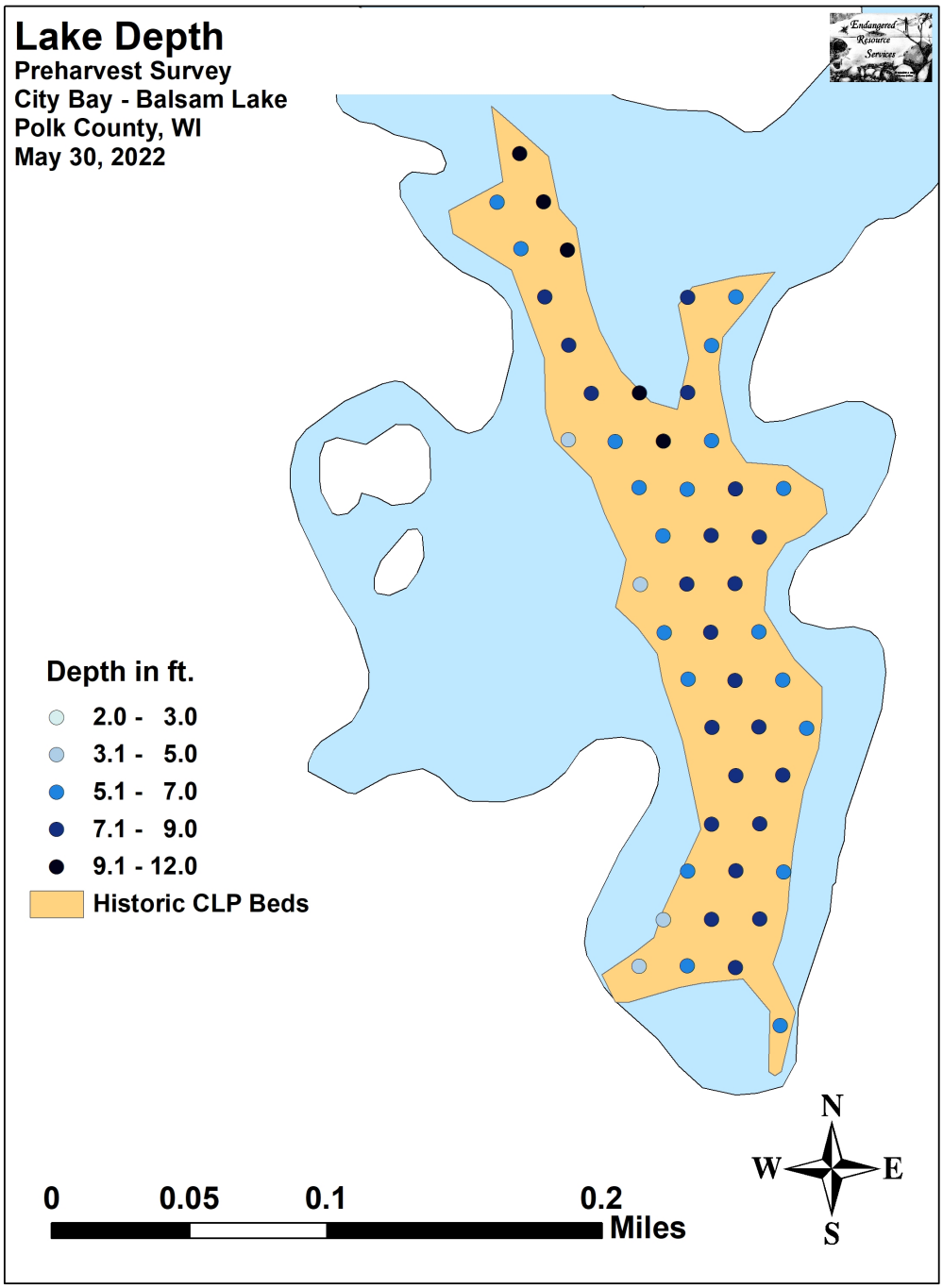

Survey Sample Points
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Sample Point
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S

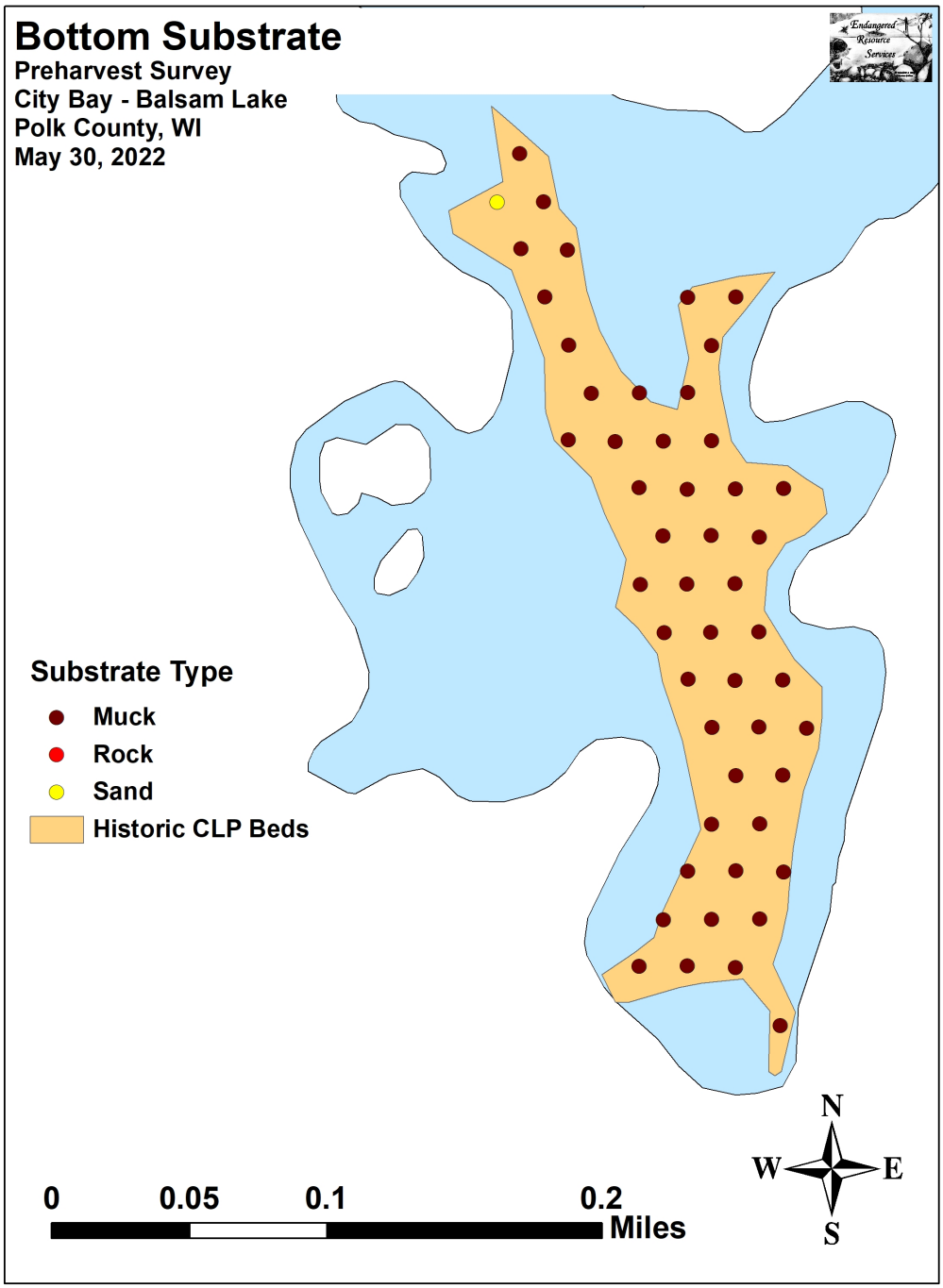

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Historic CLP Beds
City Bay - Balsam Lake
Polk County, WI
June 4, 2020
Endangered Resource Services
Bed 20
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

Appendix II: Vegetative Survey Datasheet

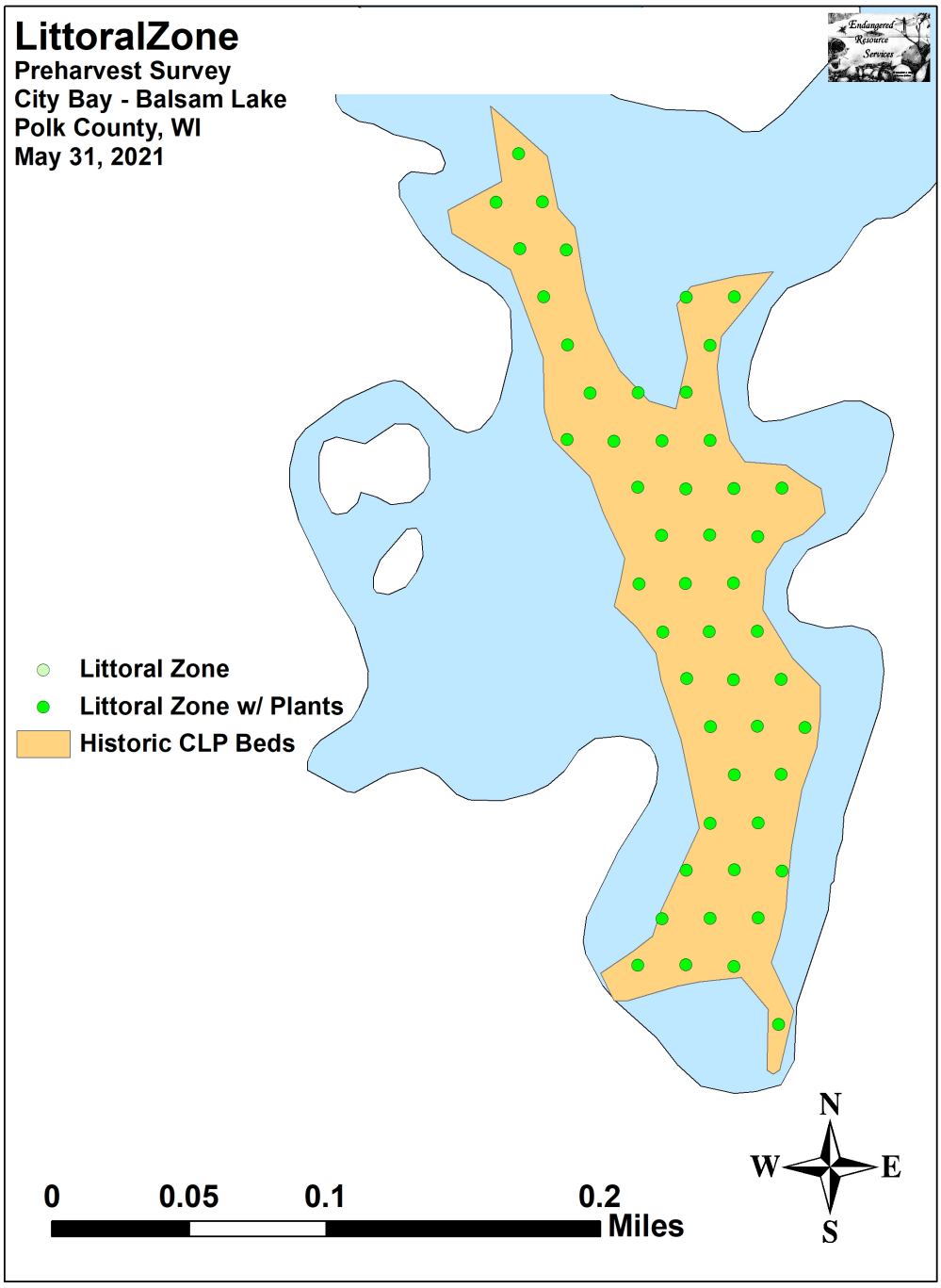
Observers for this lake: names and hours worked by each:																										
Lake:									WBIC									County						Date:		
Site #	Depth (ft)	Muck (M), Sand (S), Rock (R)	Rake pole (P) or rake rope (R)	Total Rake Fullness	CLP	CLP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1															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

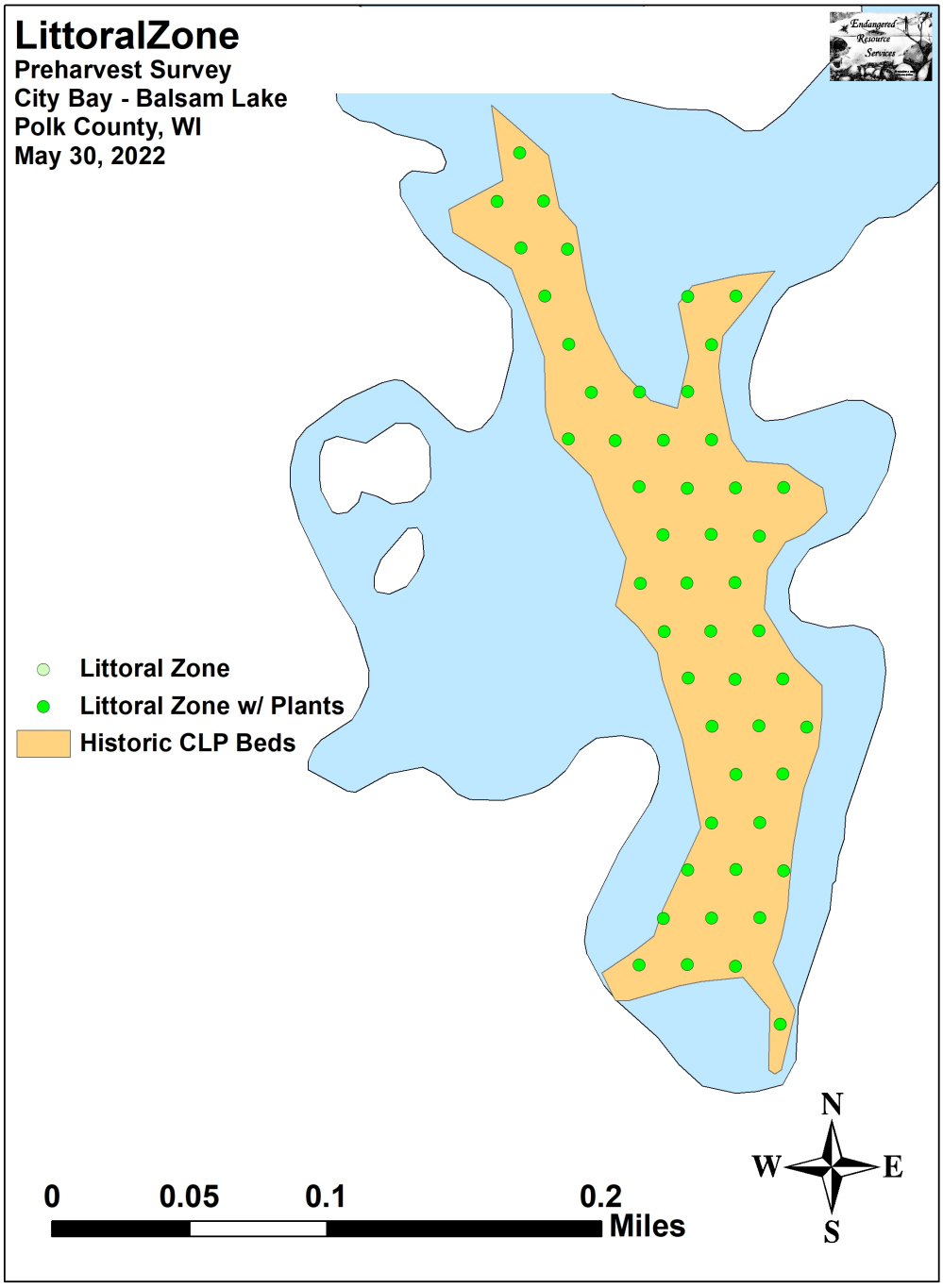
Appendix III: Preharvest Habitat Variables

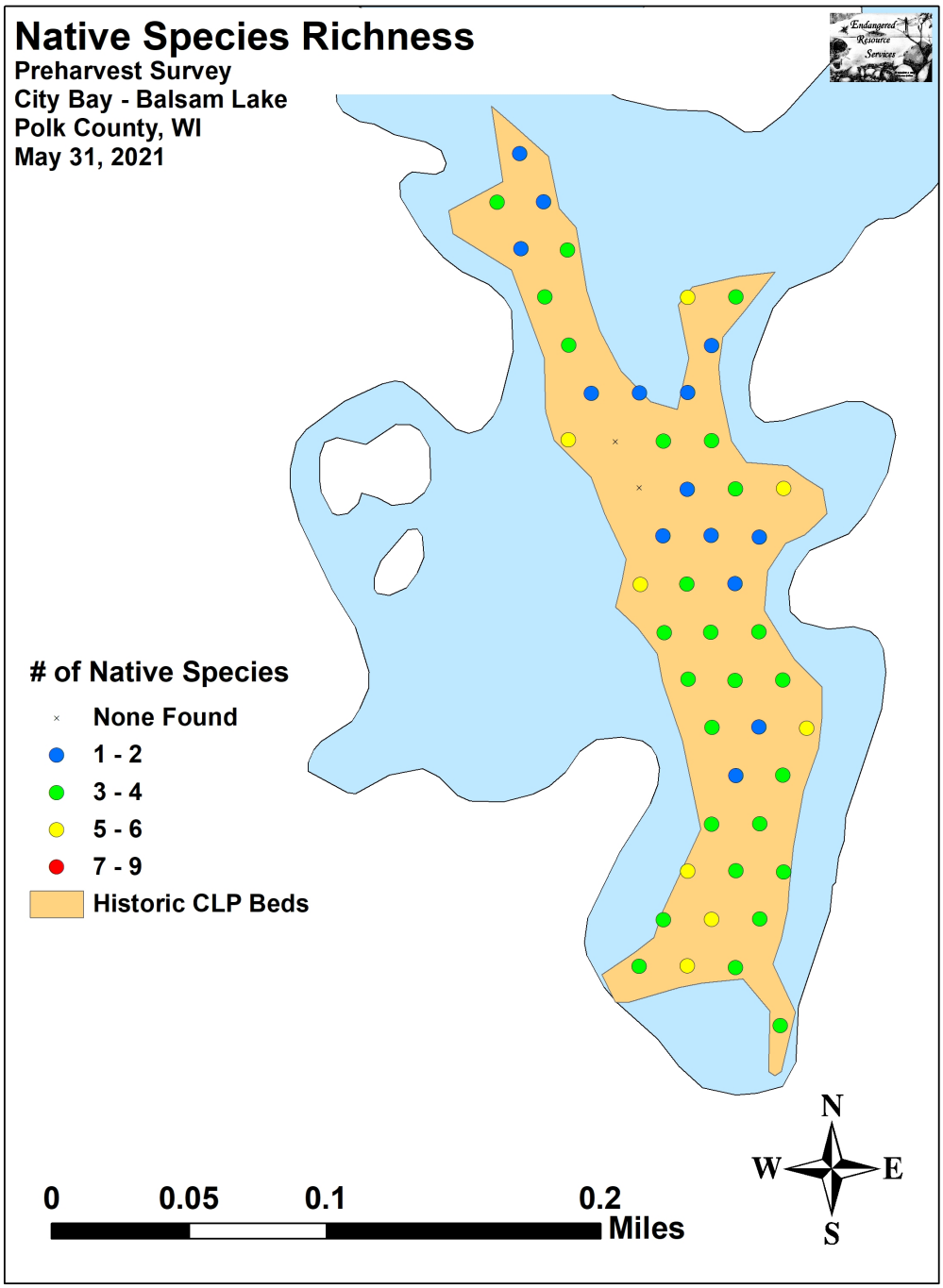

Lake Depth
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Depth in ft.
2.0 - 3.0
3.1 - 5.0
5.1 - 7.0
7.1 - 9.0
9.1 - 12.0
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S

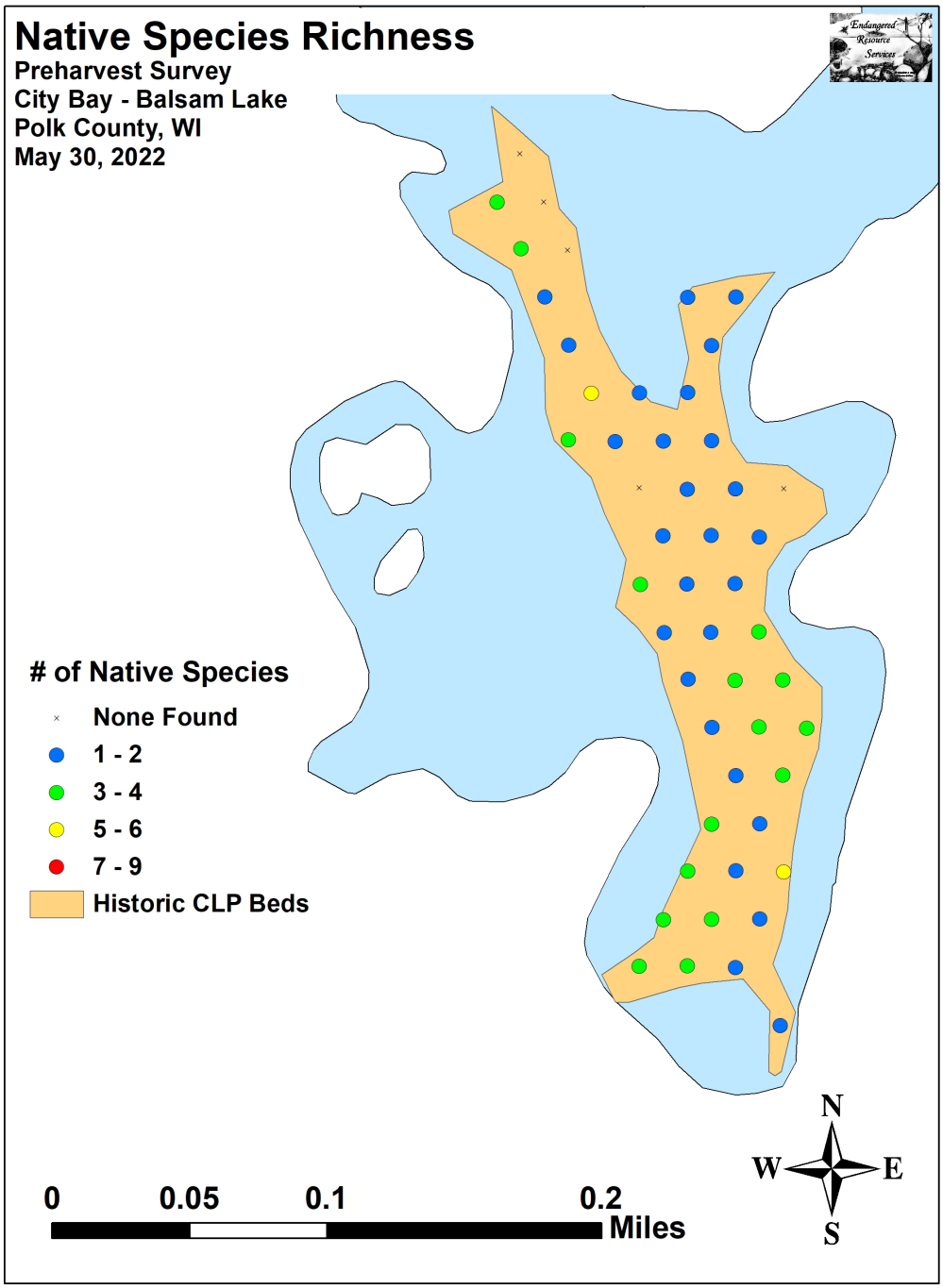

Bottom Substrate
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

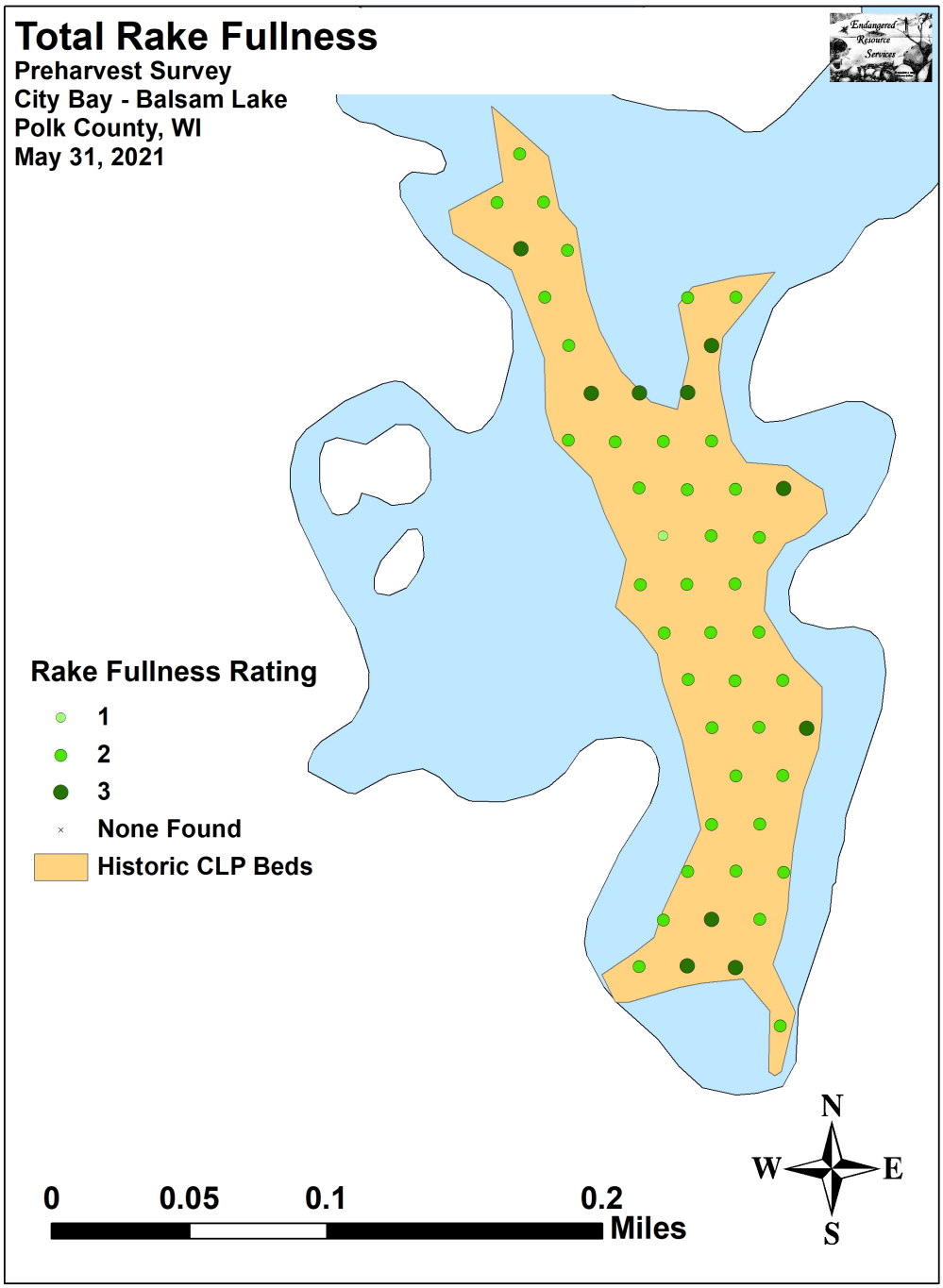
Appendix IV: 2021 and 2022 Preharvest Littoral Zone, Native Species Richness and Total Rake Fullness

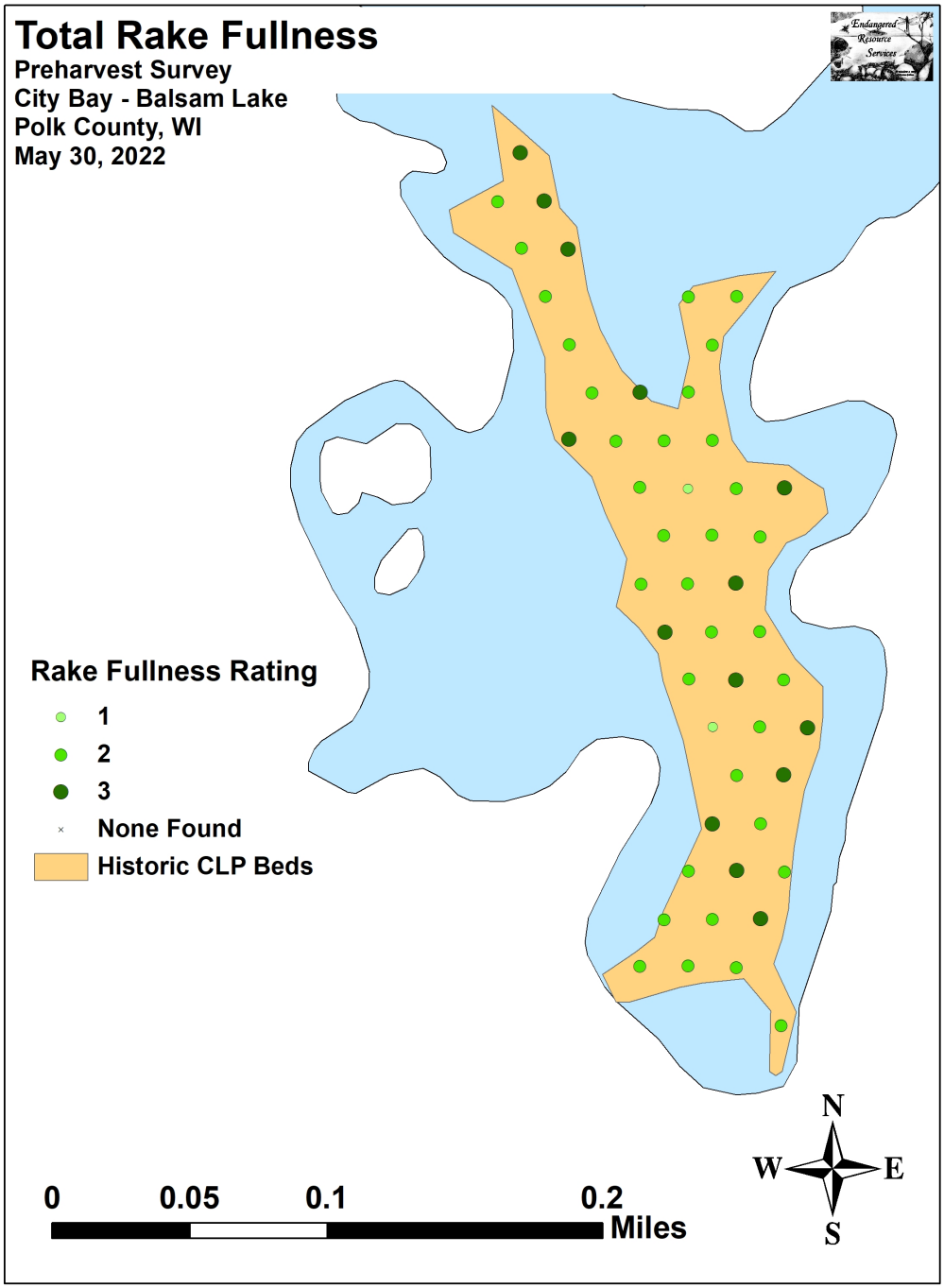

LittoralZone
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Littoral Zone
Littoral Zone w/ Plants
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


LittoralZone
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Littoral Zone
Littoral Zone w/ Plants
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

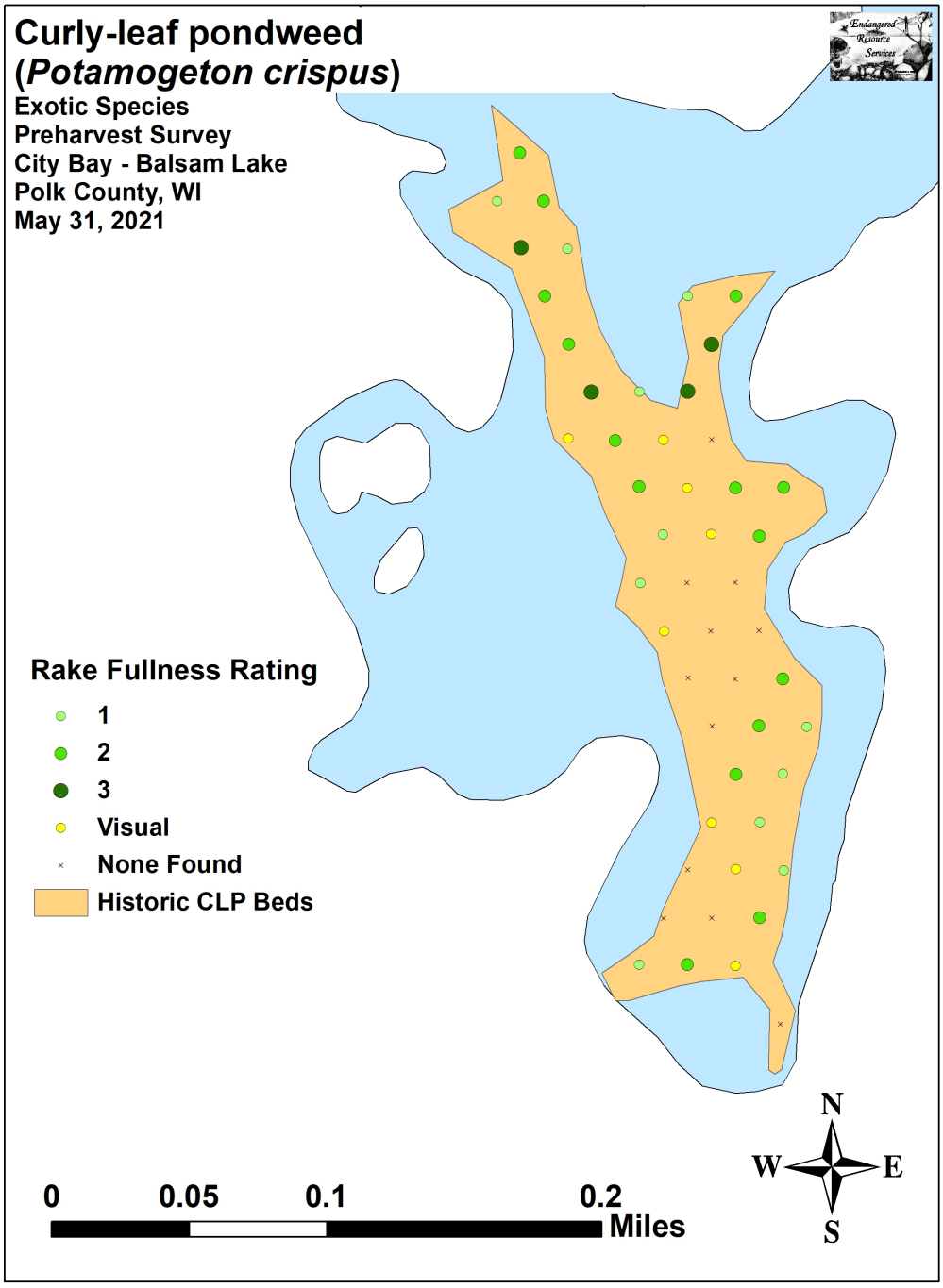

Native Species Richness
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 9
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S

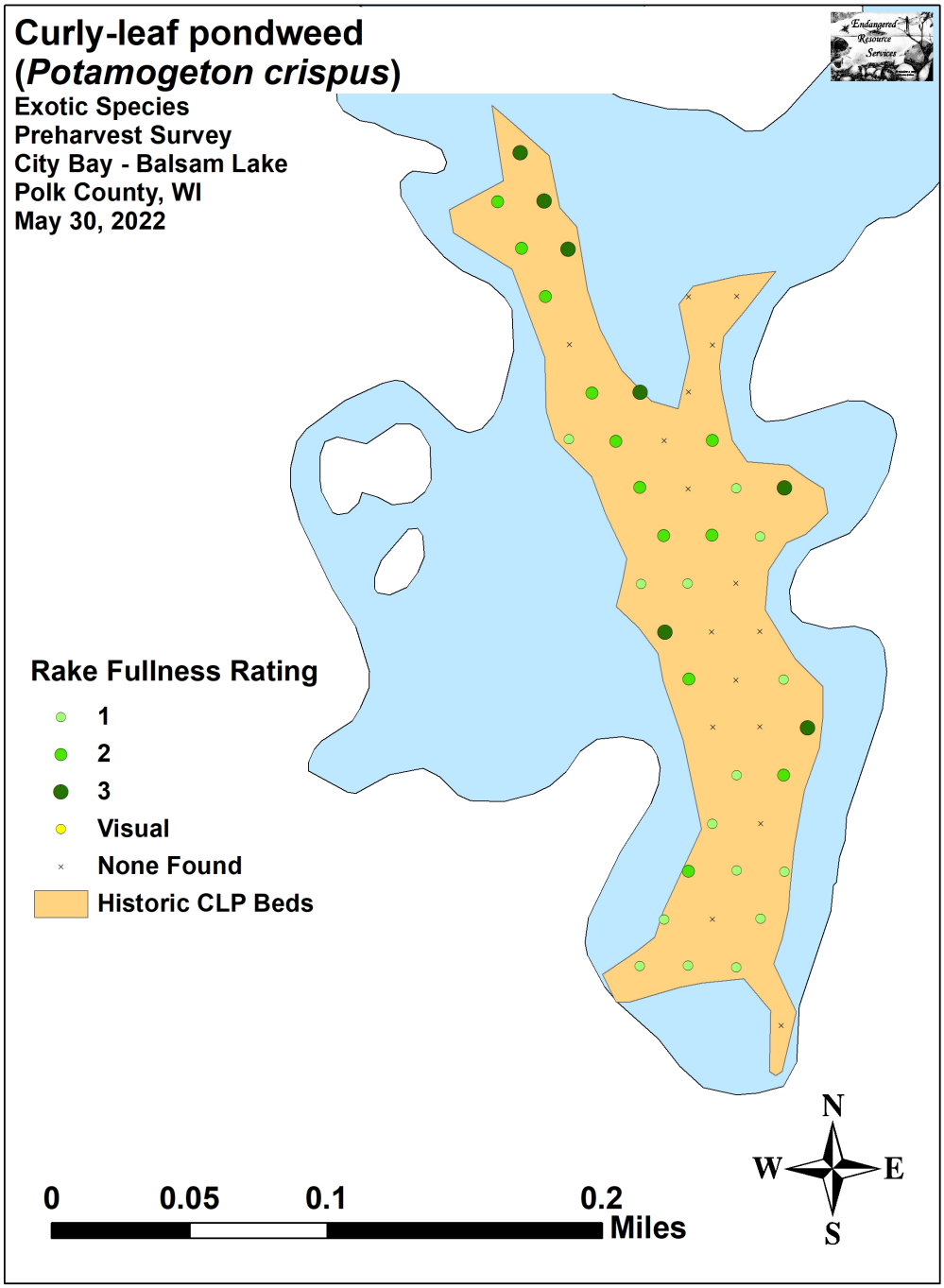

Native Species Richness
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 9
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S


Total Rake Fullness
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

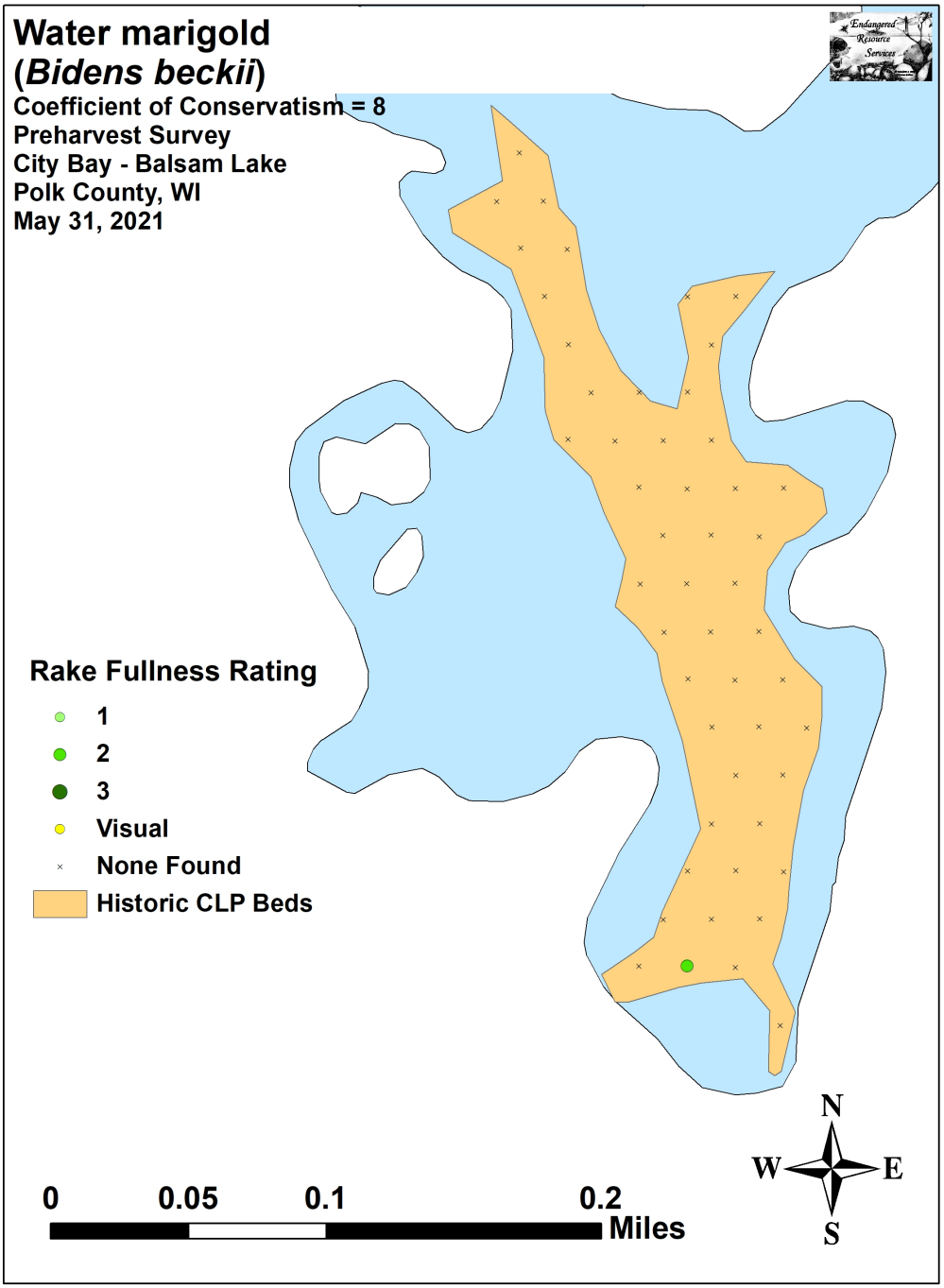

Total Rake Fullness
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

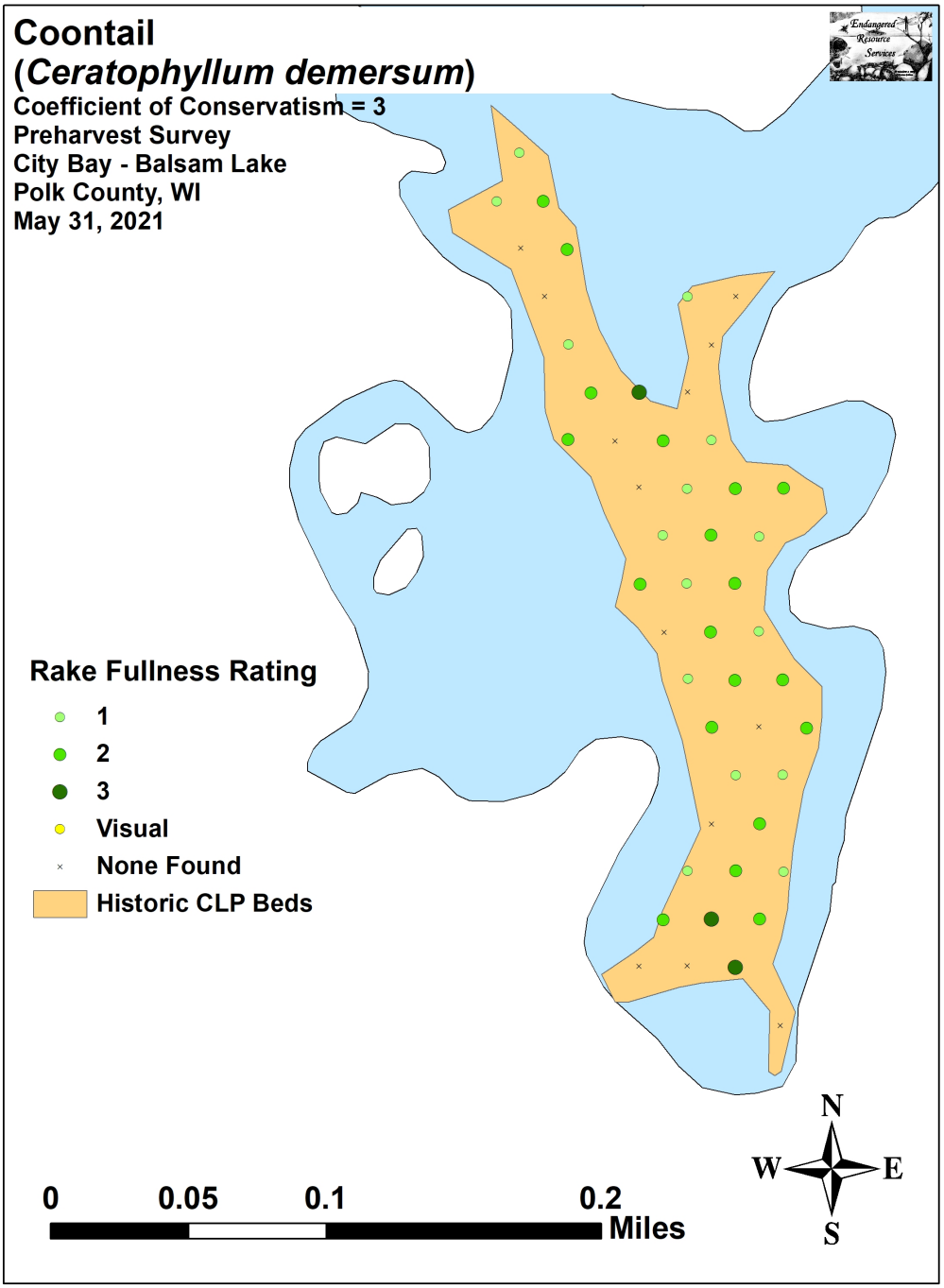
Appendix V: 2021 and 2022 Preharvest CLP Density and Distribution

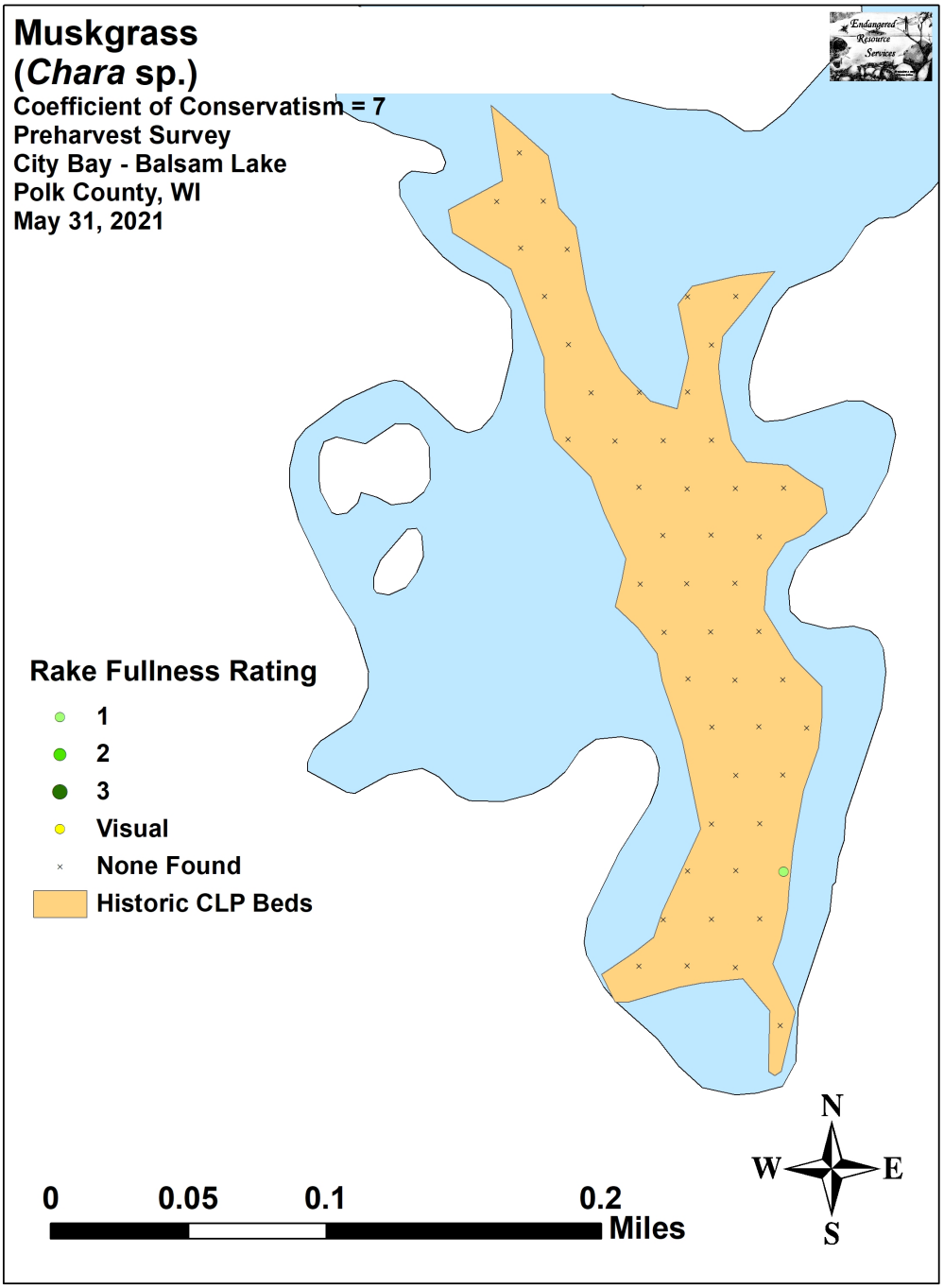

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S

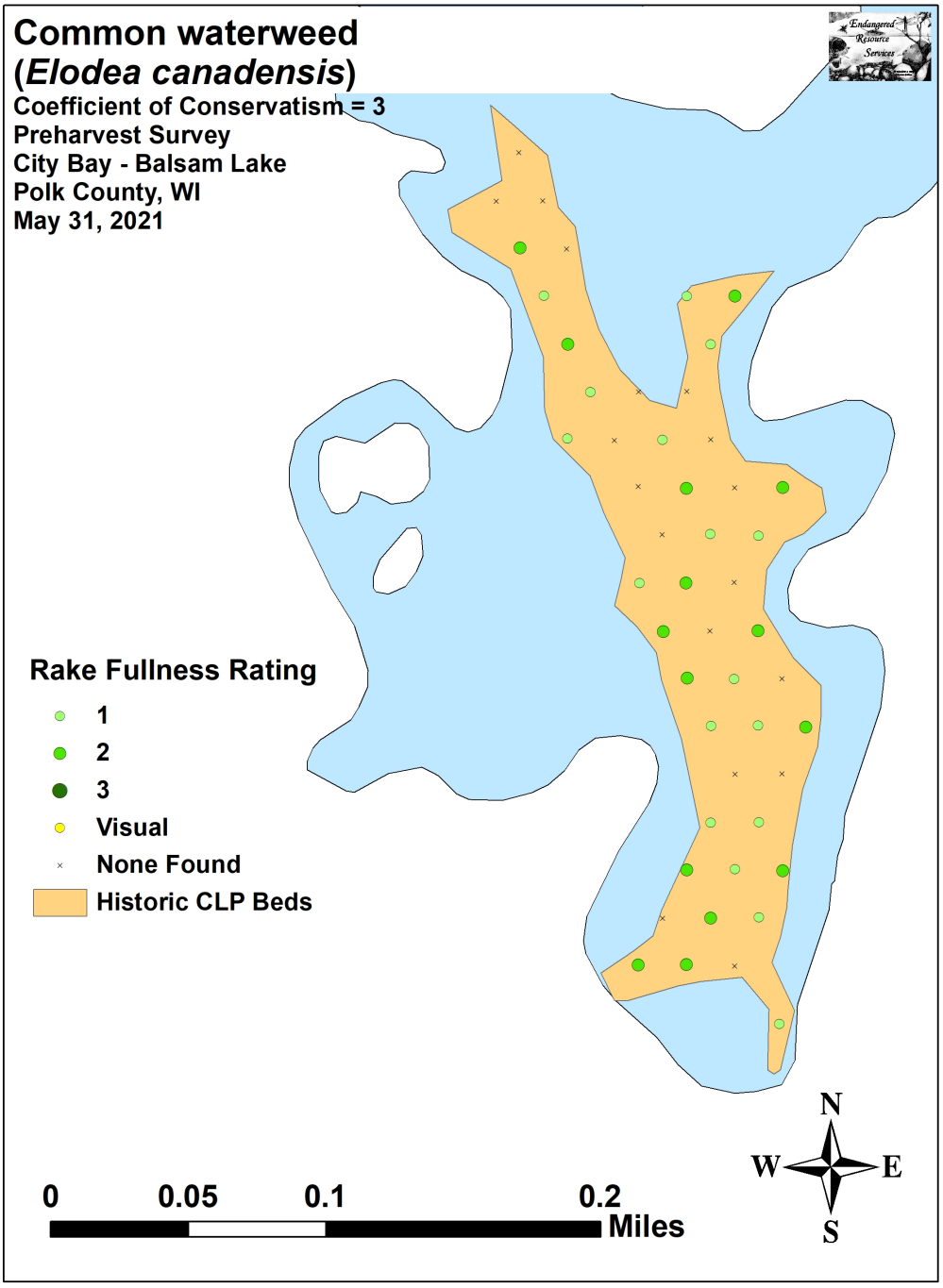

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
0
0.05
0.1
0.2
Miles
N
W
E
S

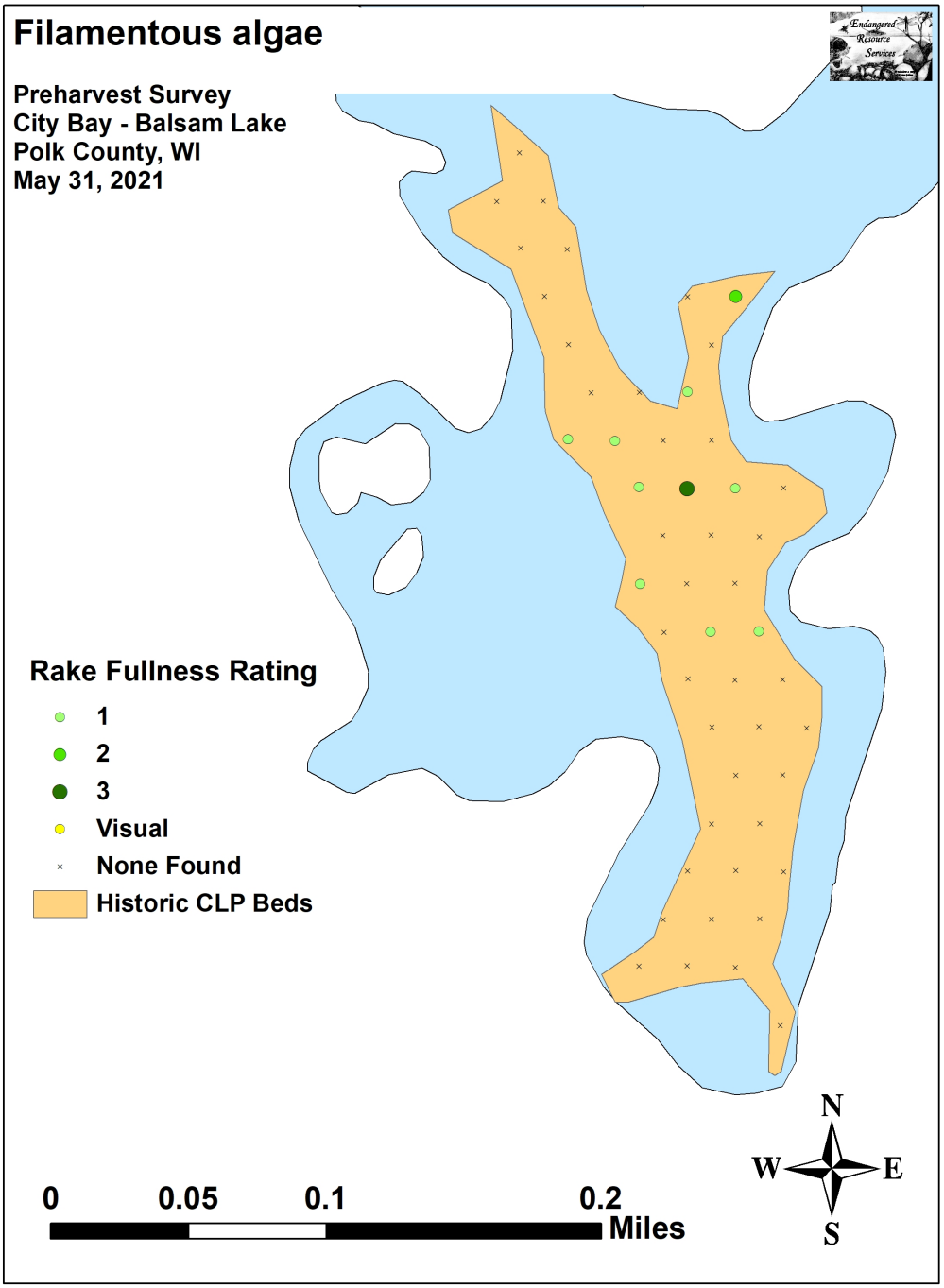
Appendix VI: 2021 Preharvest Native Species Density and Distribution

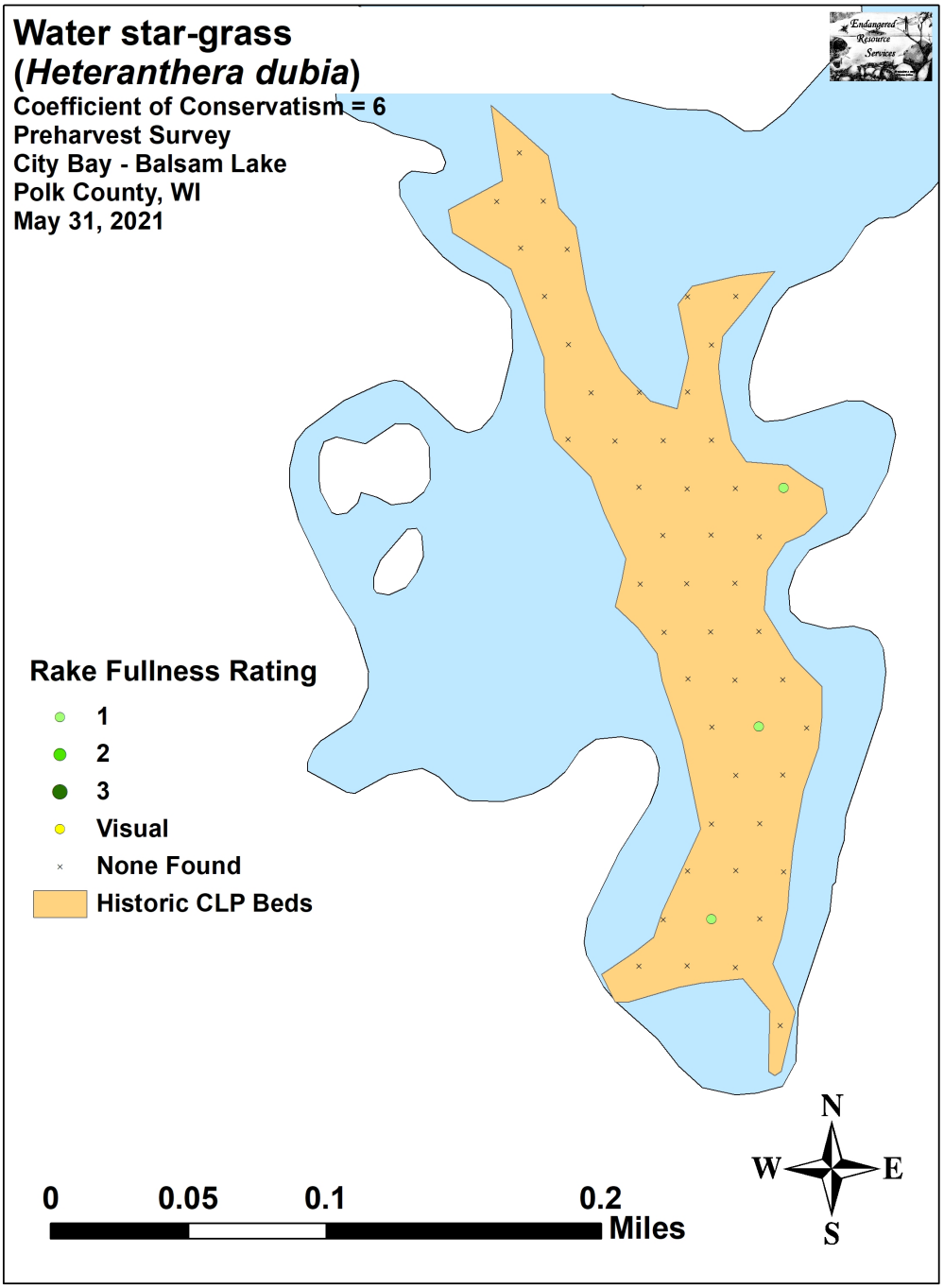

Water marigold
(Bidens beckii)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

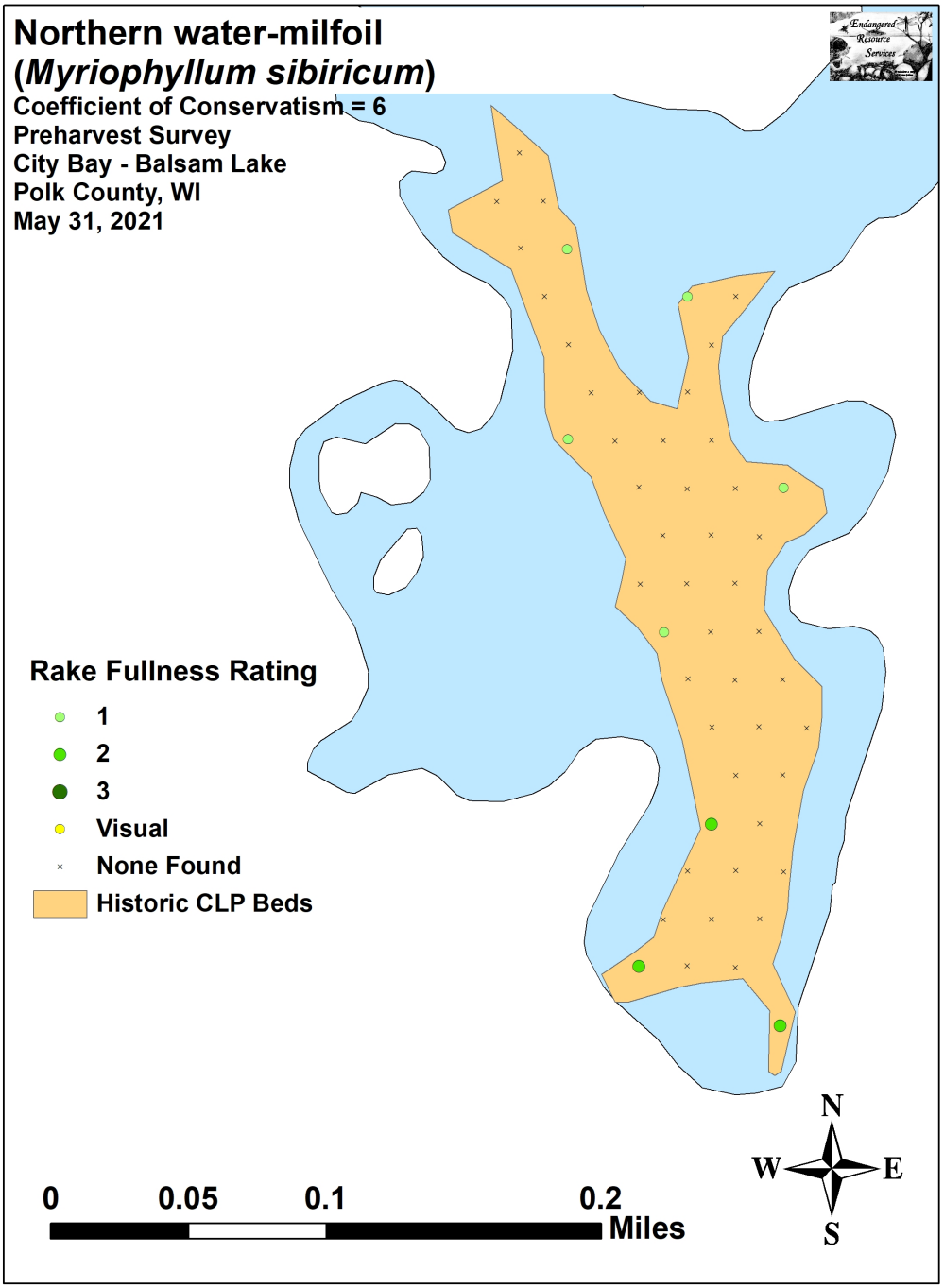

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

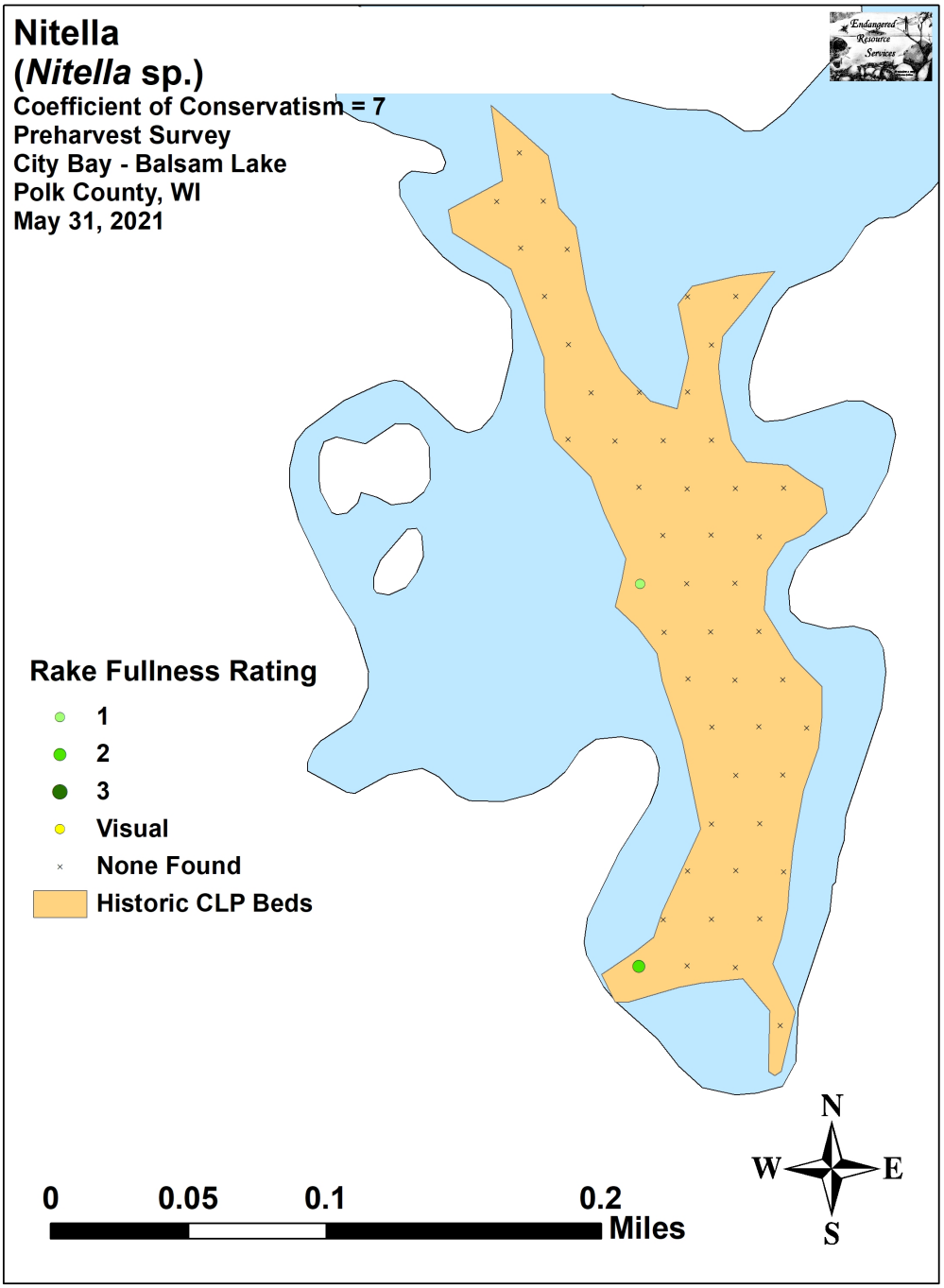

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

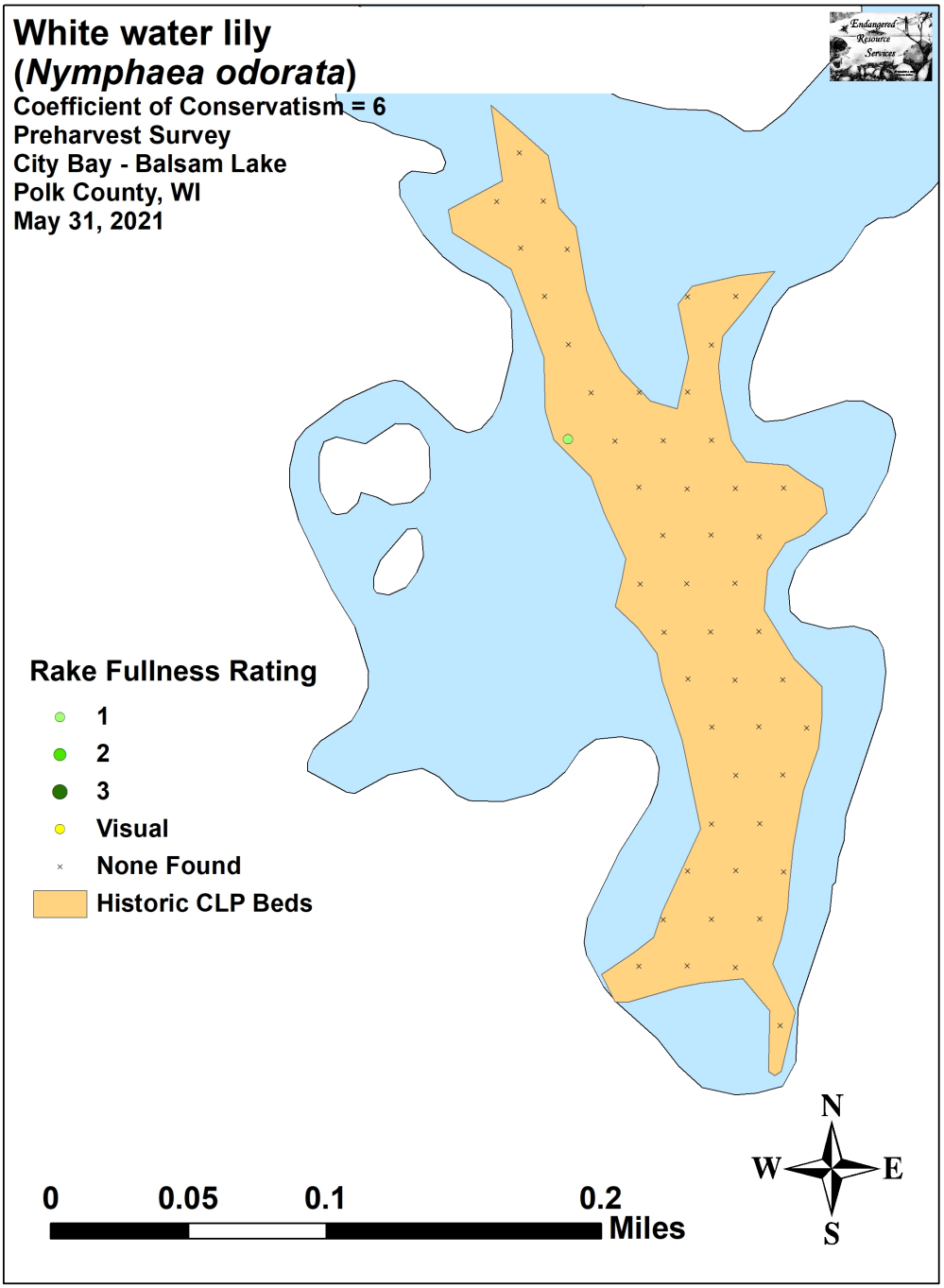

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

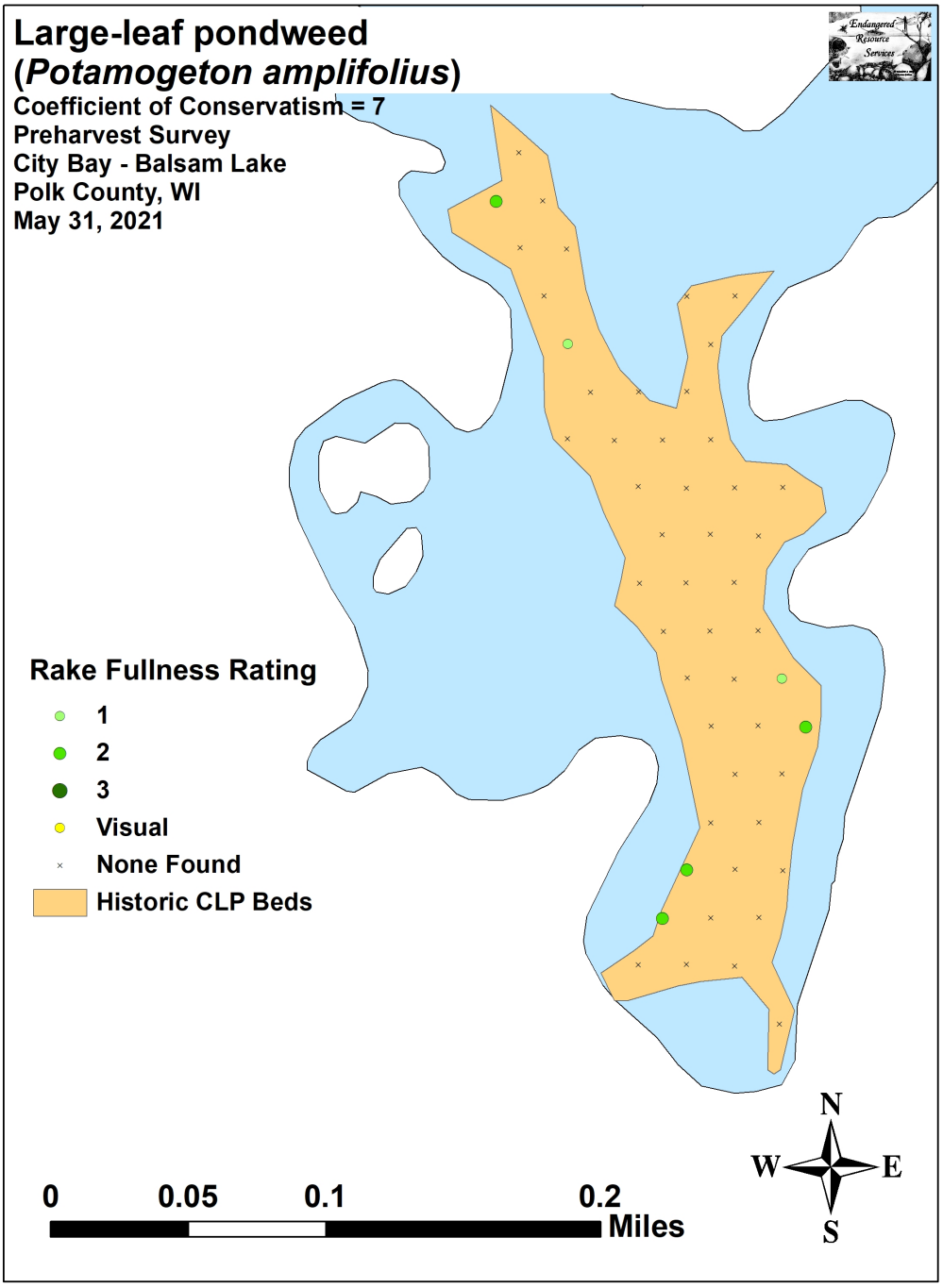

Filamentous algae
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

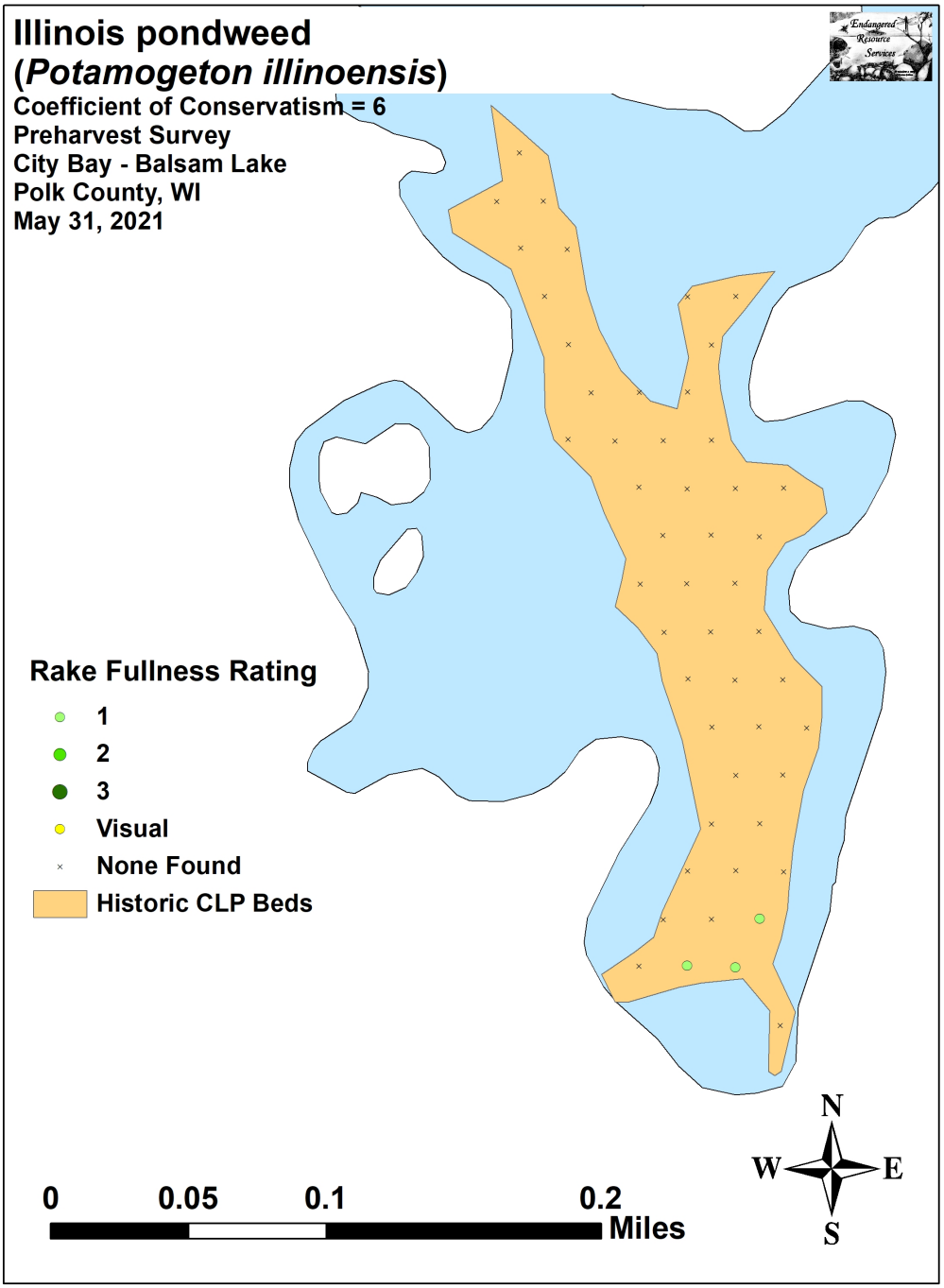

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

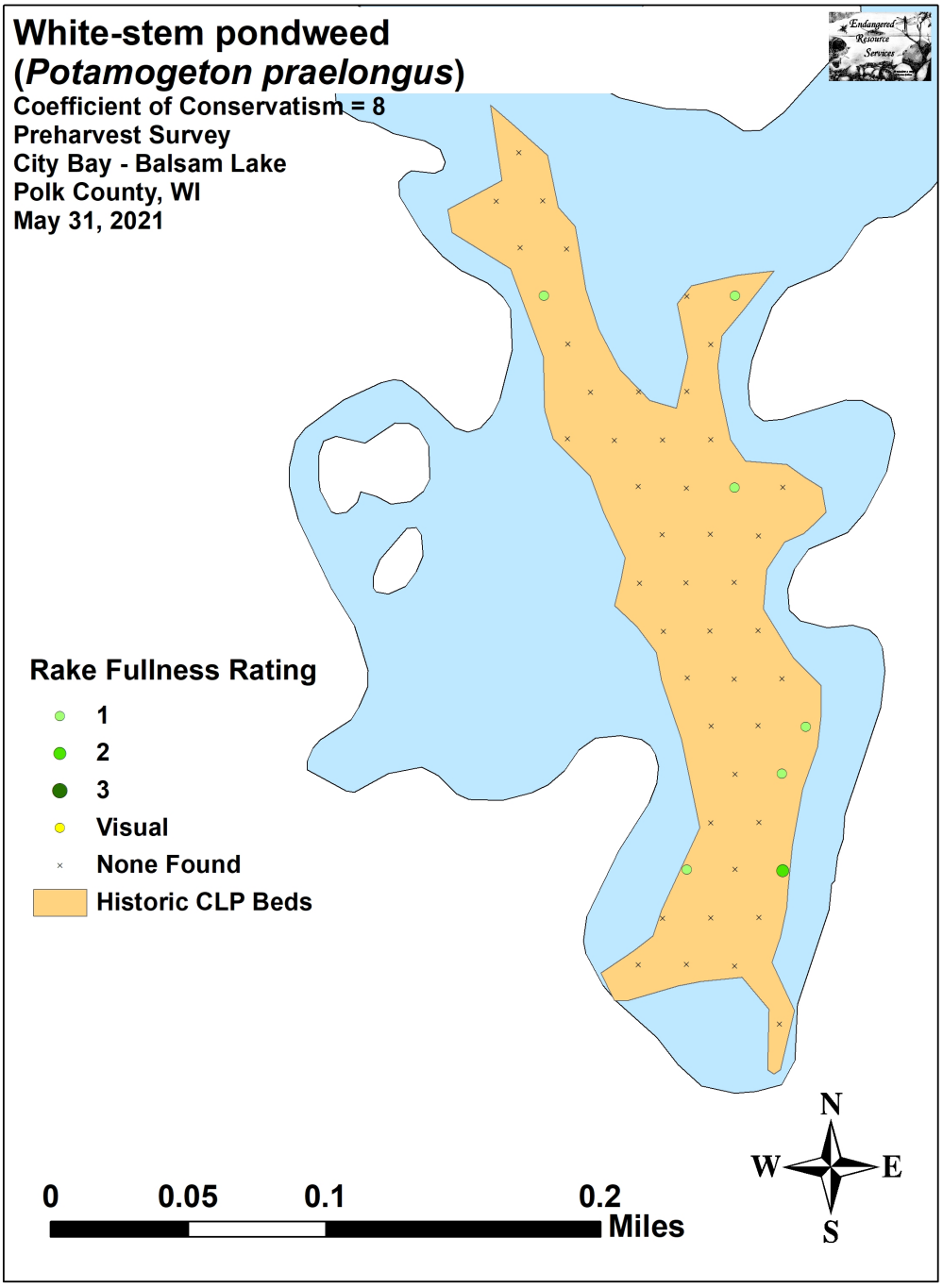

Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

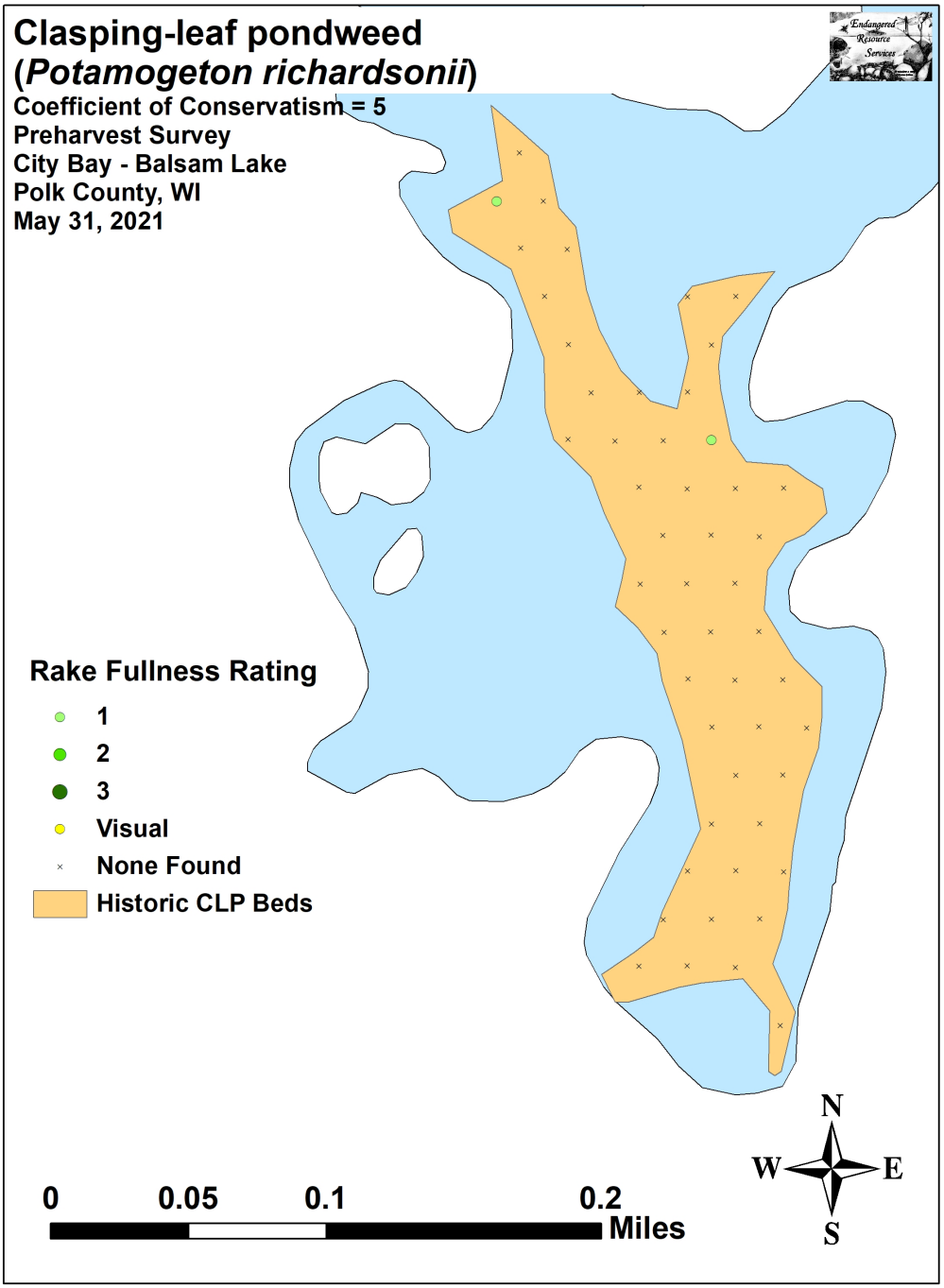

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

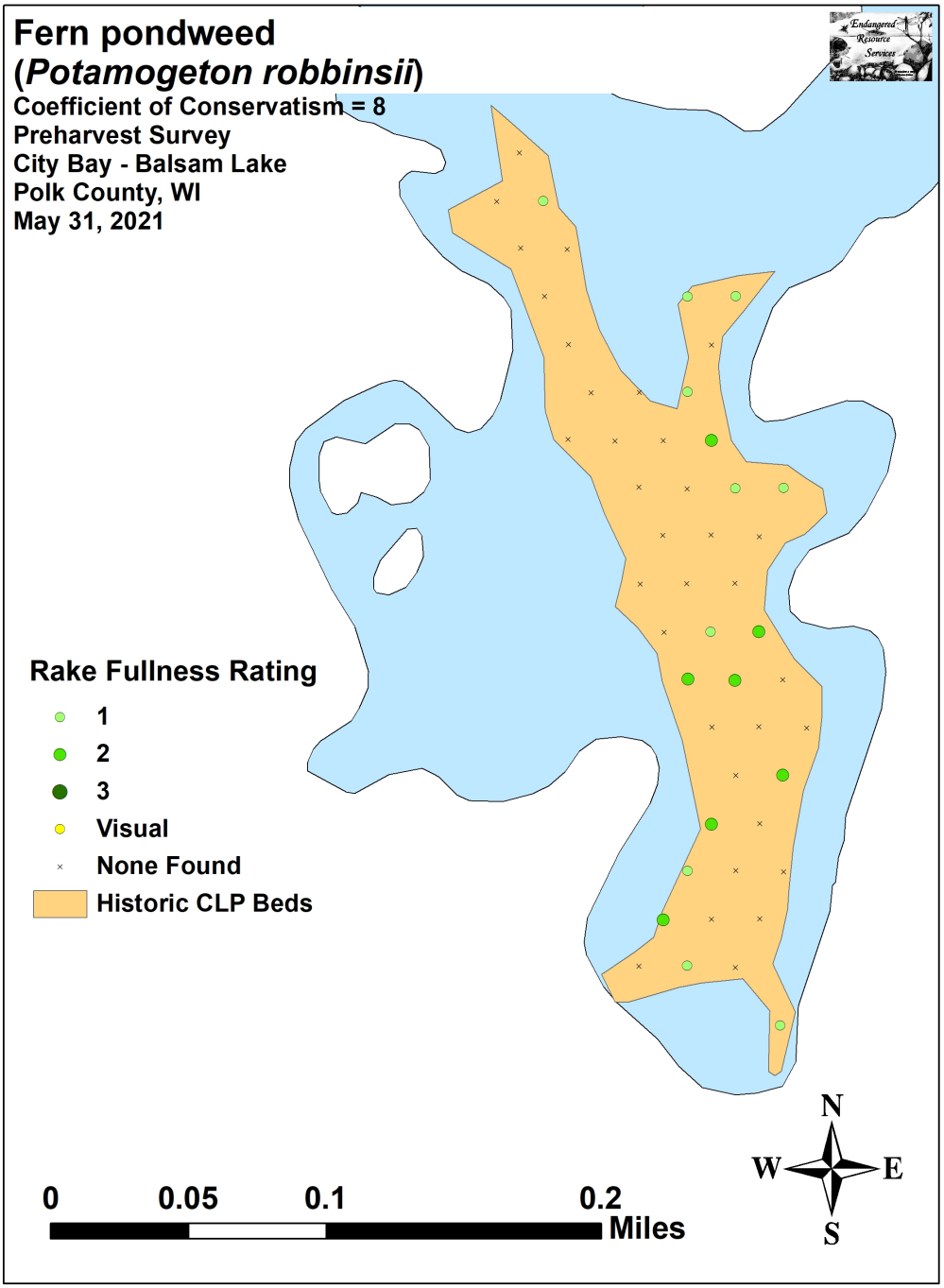

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

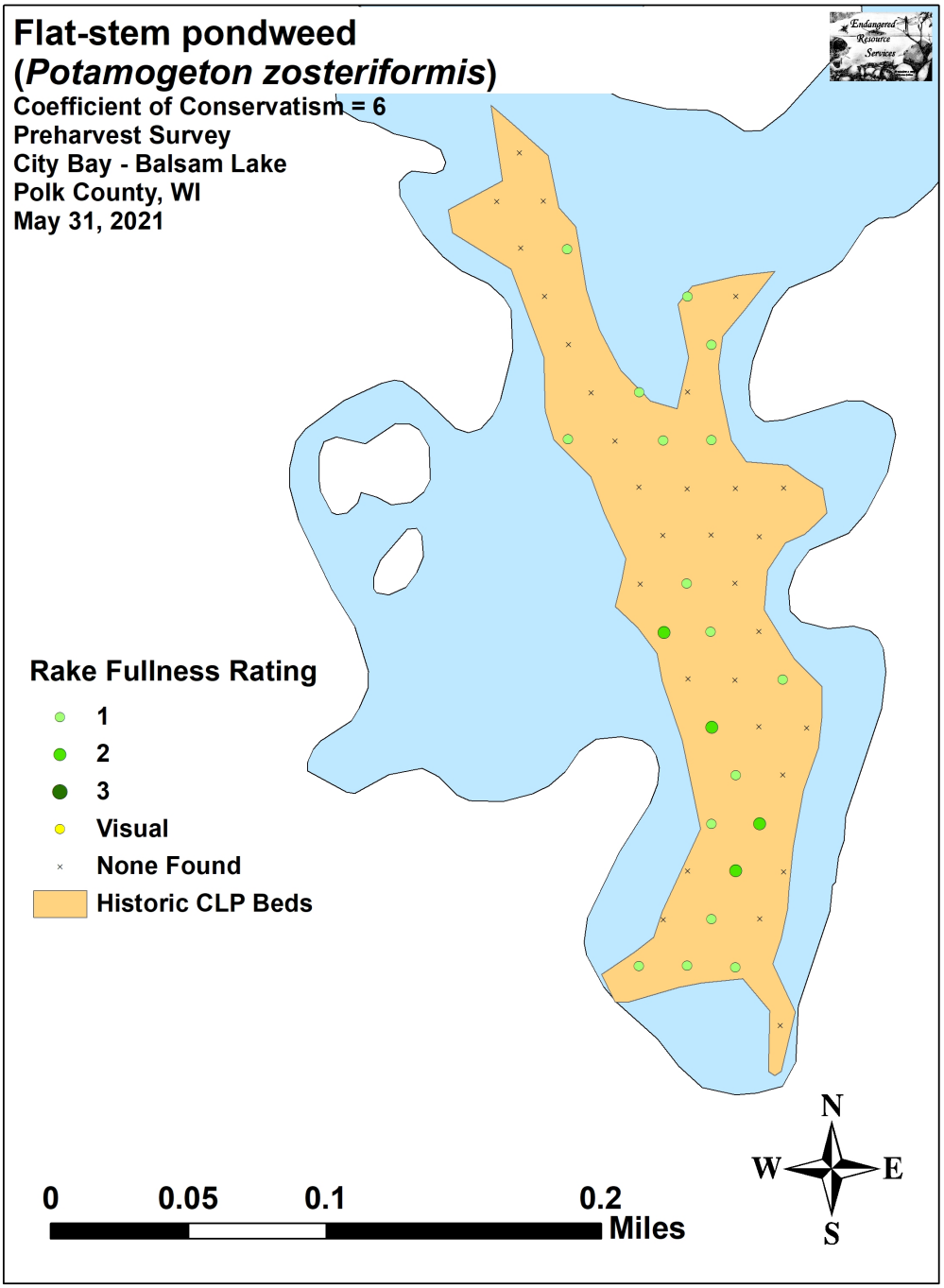

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

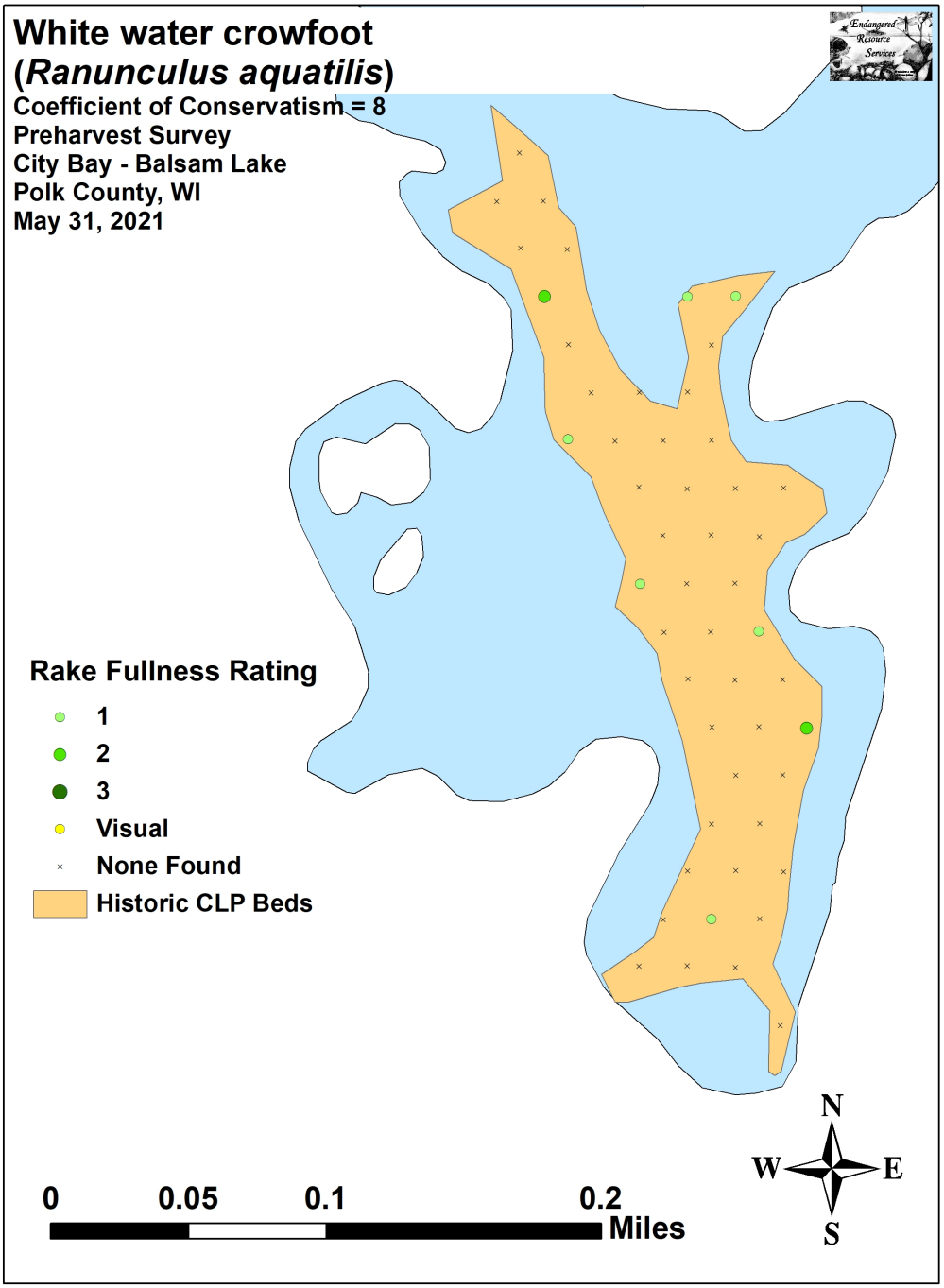

Illinois pondweed
(Potamogeton illinoensis)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

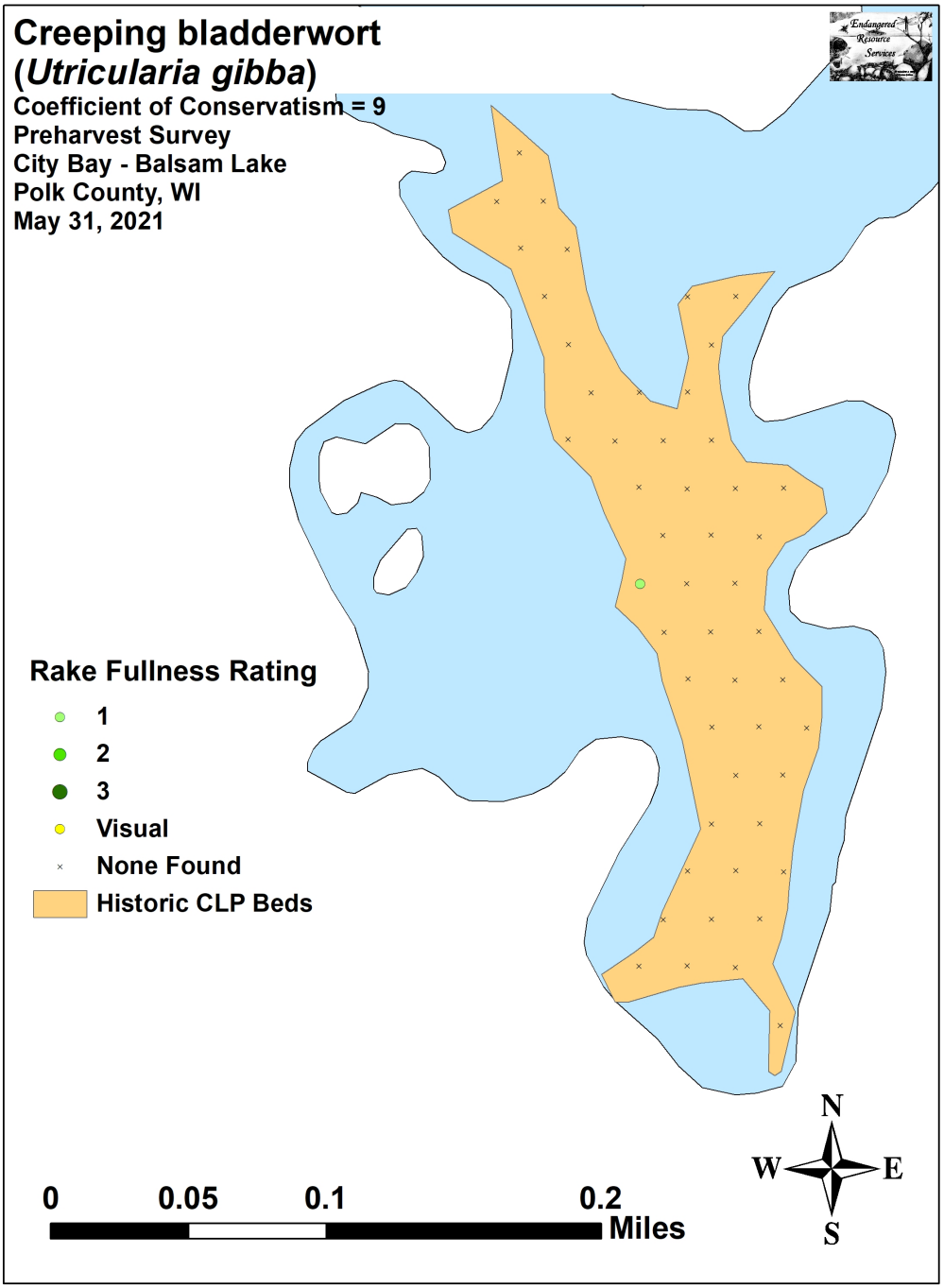

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

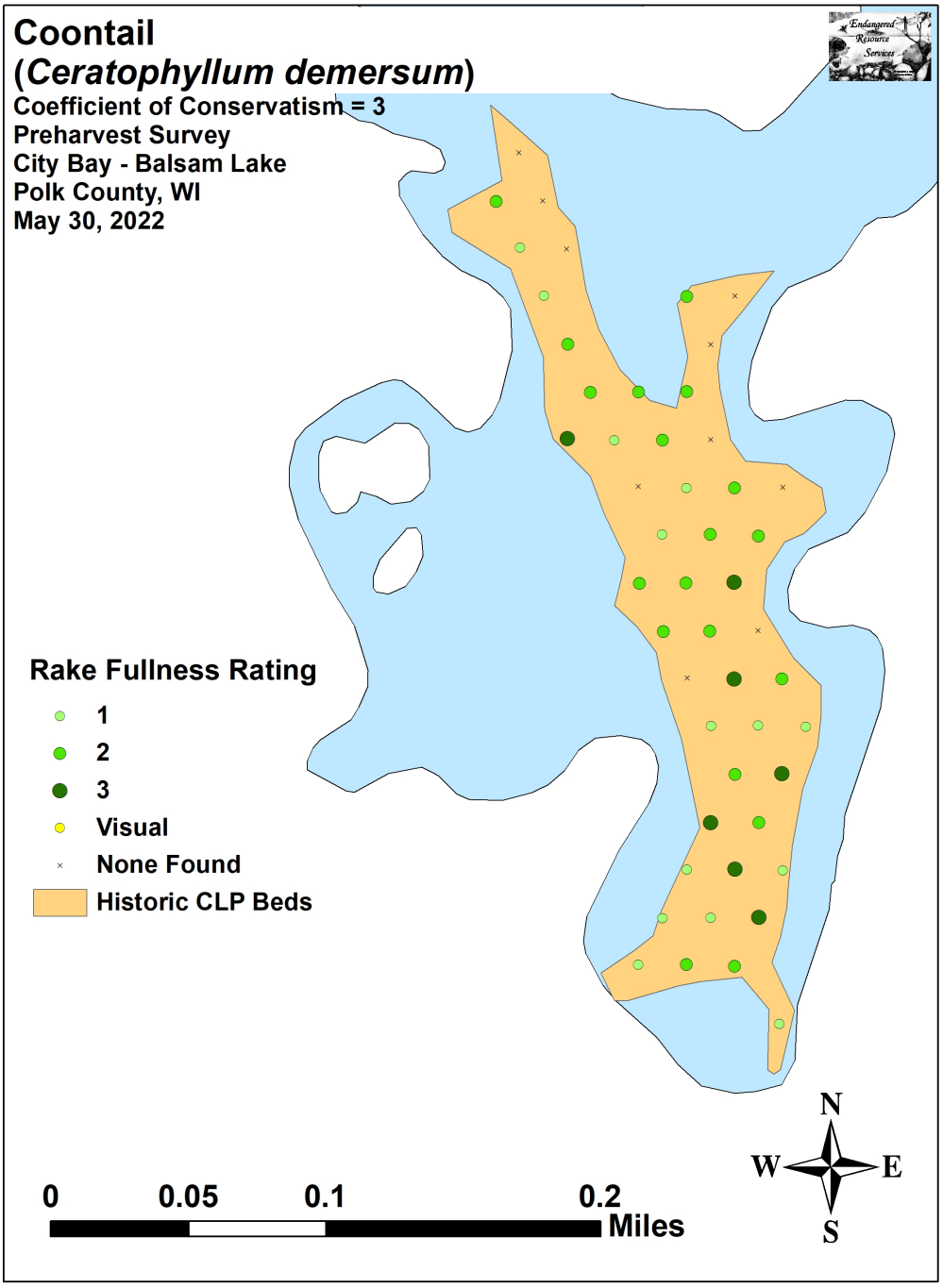

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

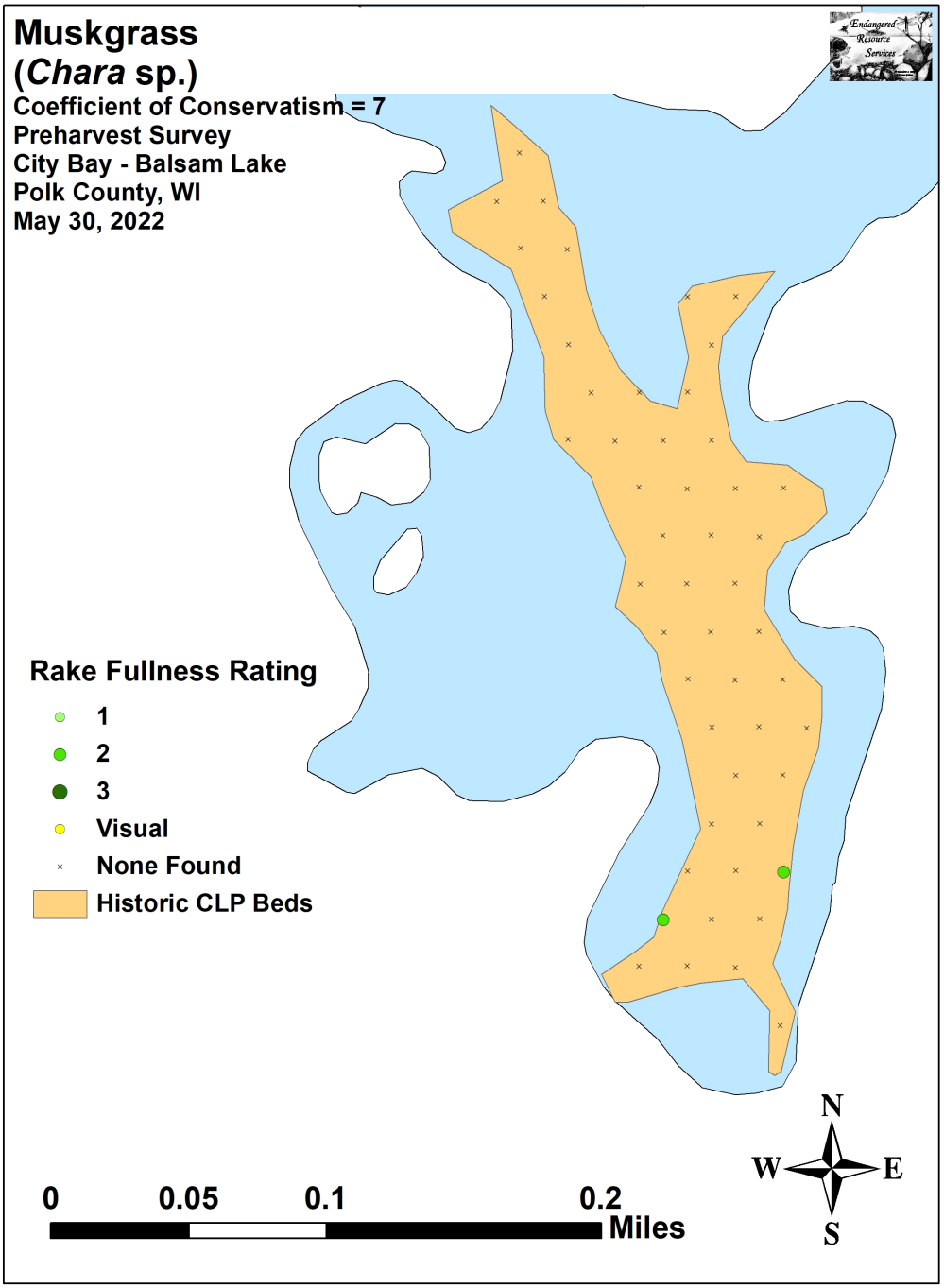

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

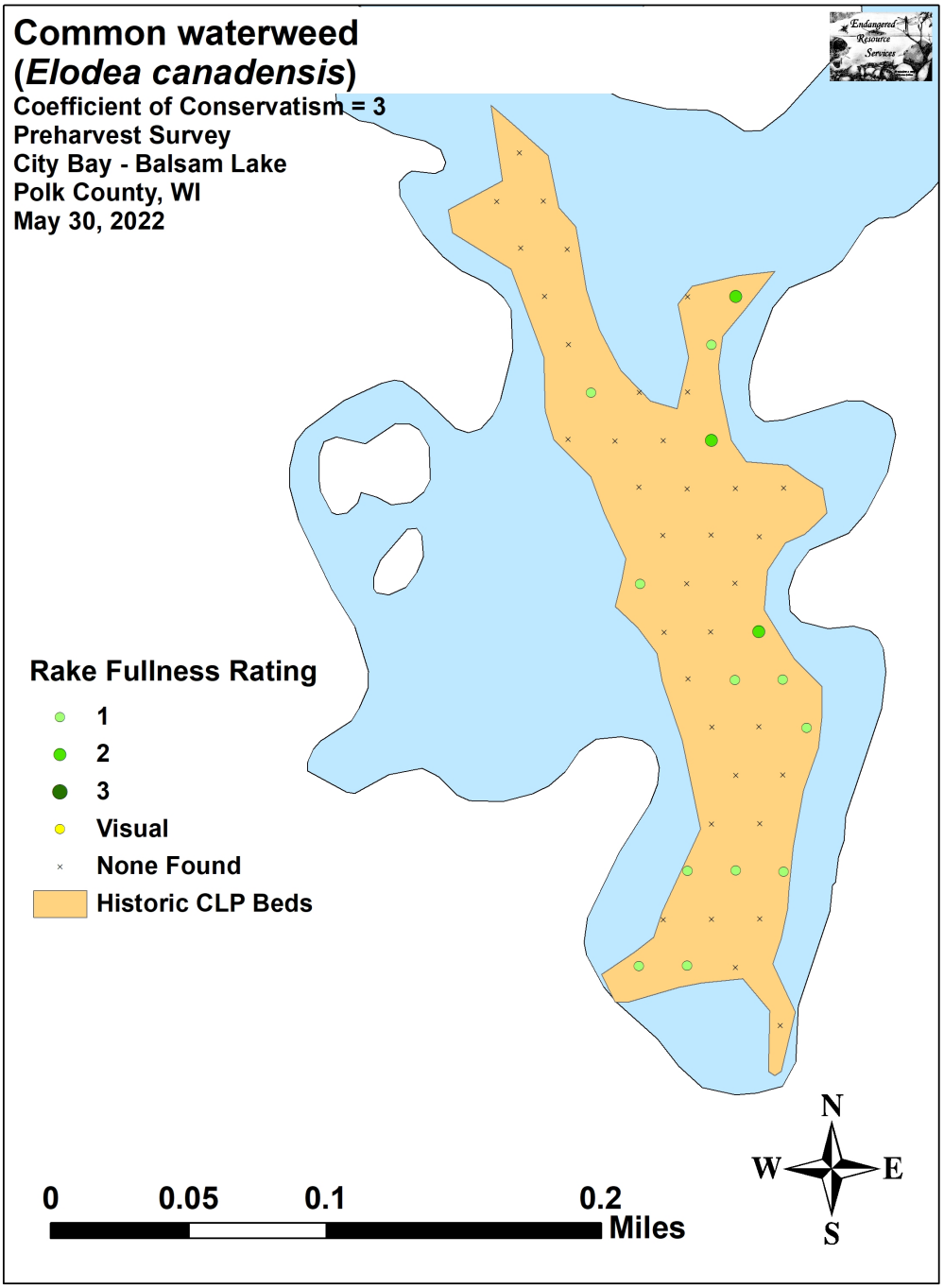

White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

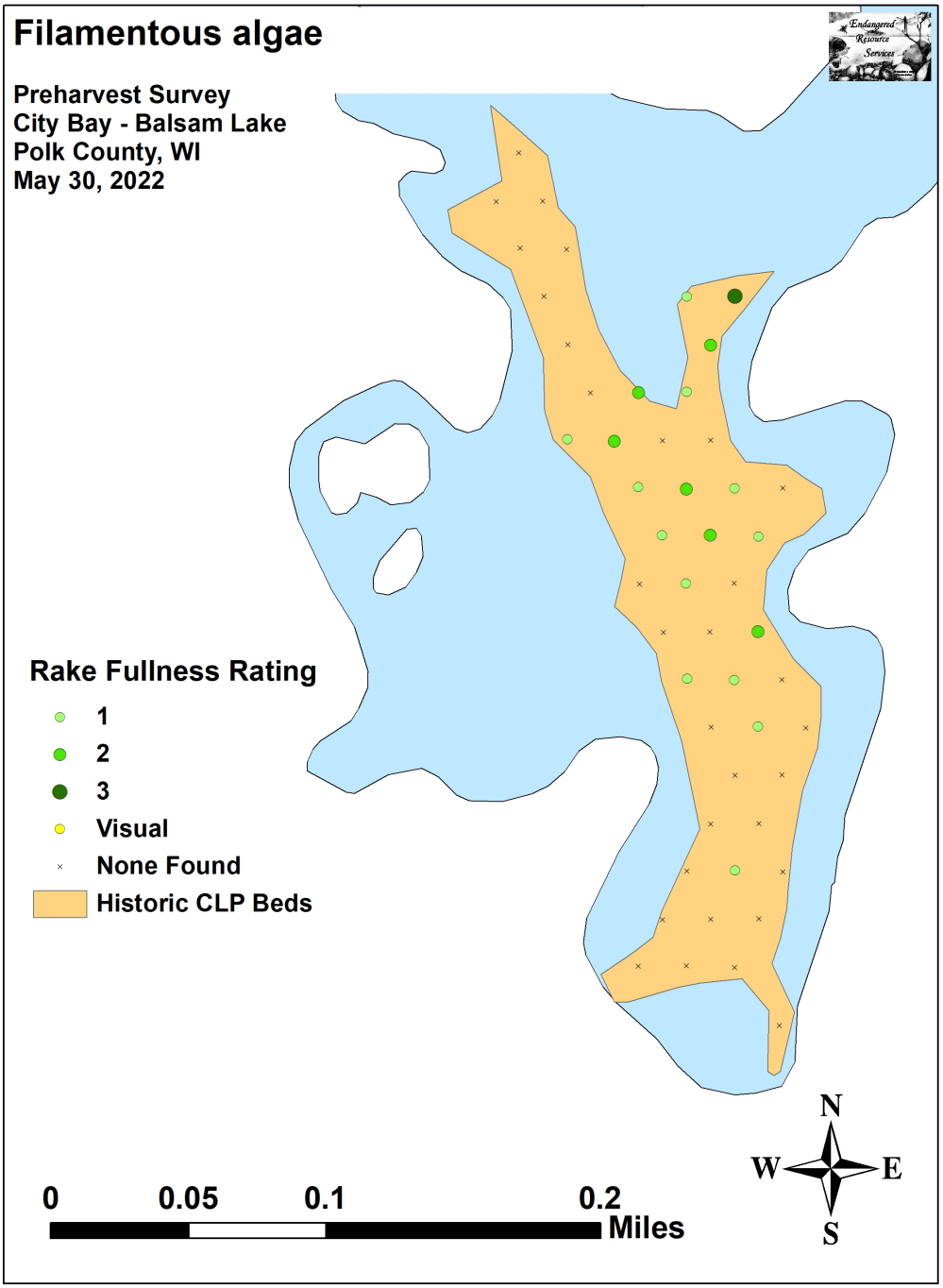

Creeping bladderwort
(Utricularia gibba)
Coefficient of Conservatism = 9
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 31, 2021
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

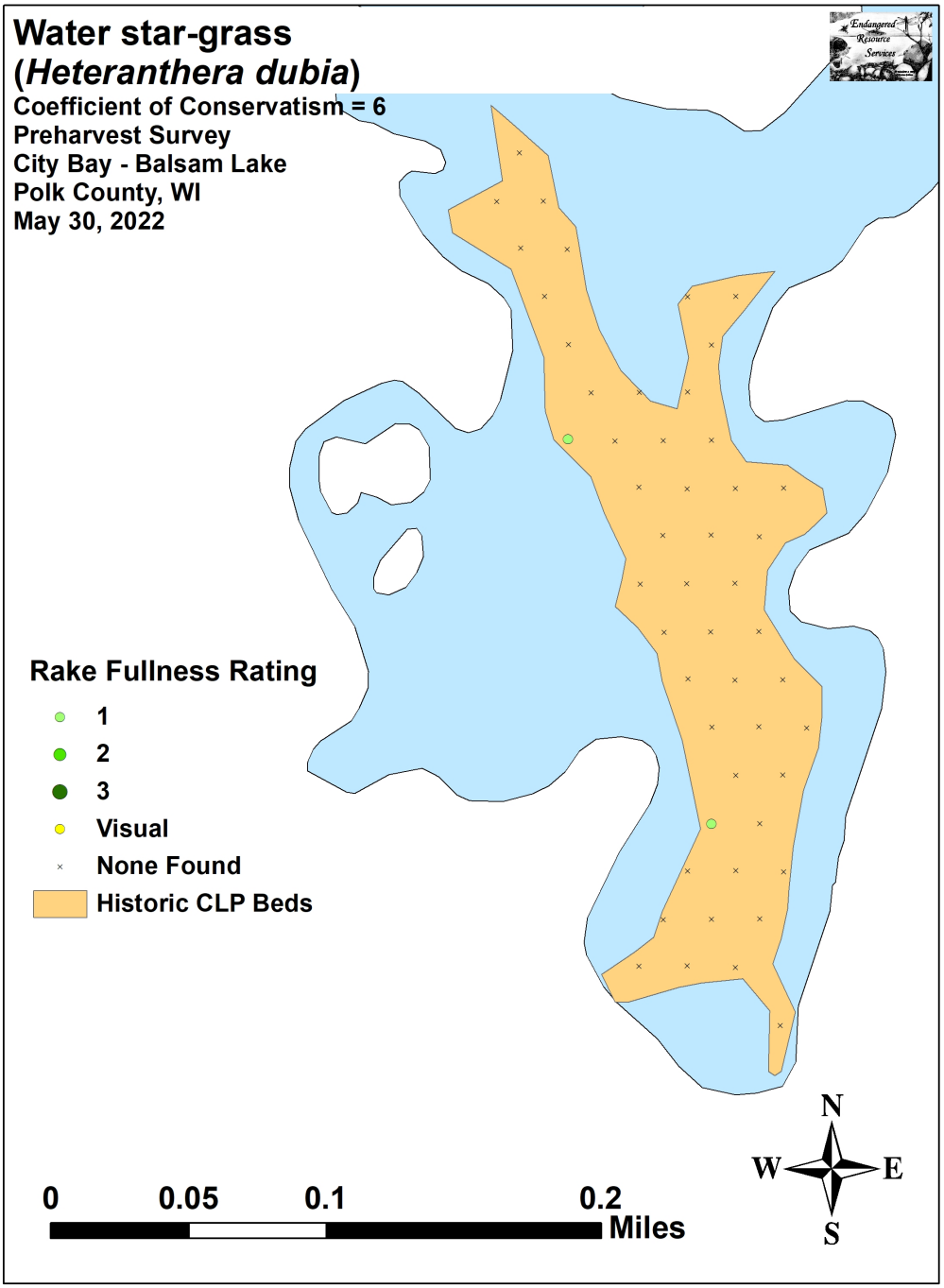
Appendix VII: 2022 Preharvest Native Species Density and Distribution

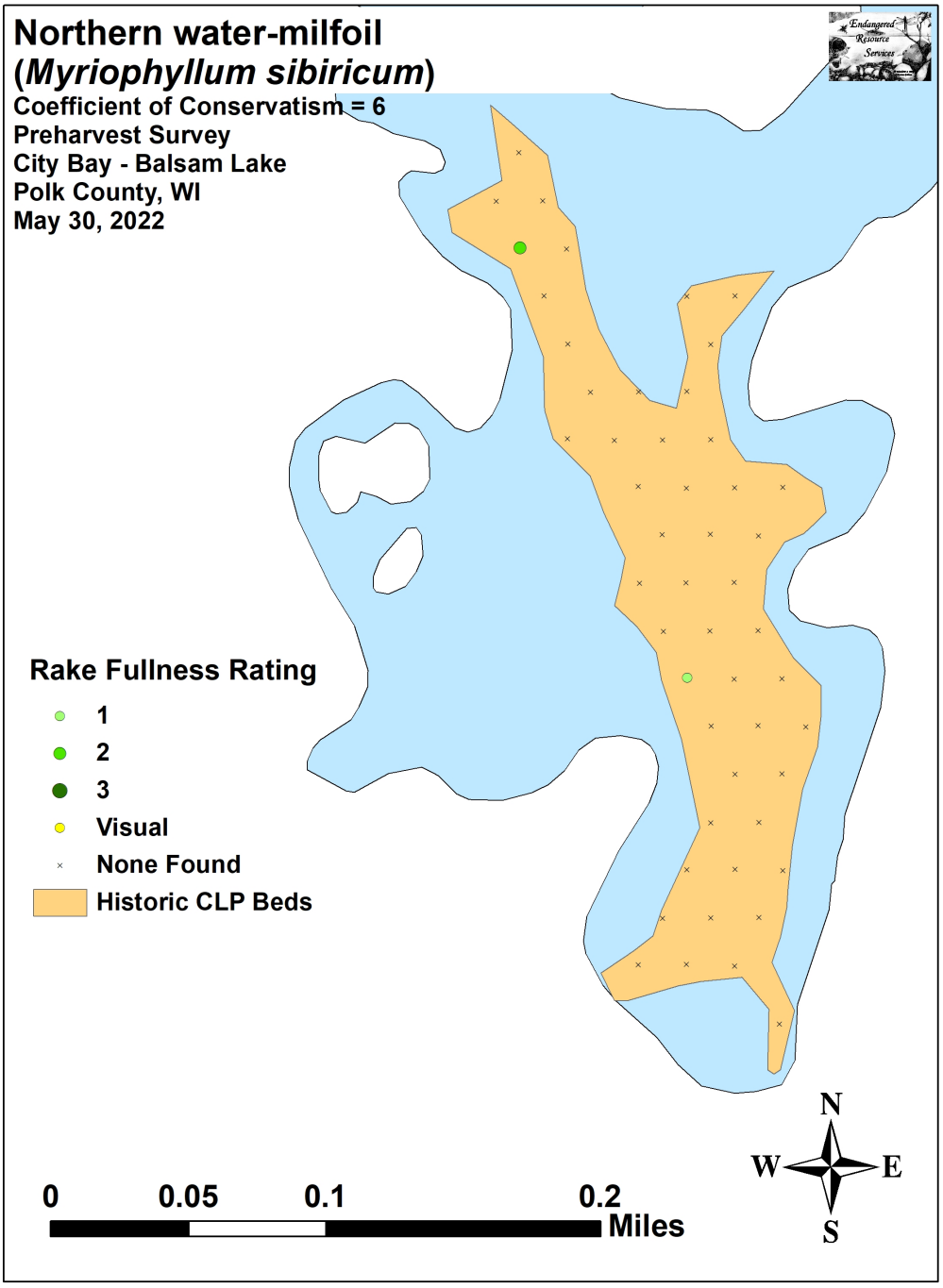

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

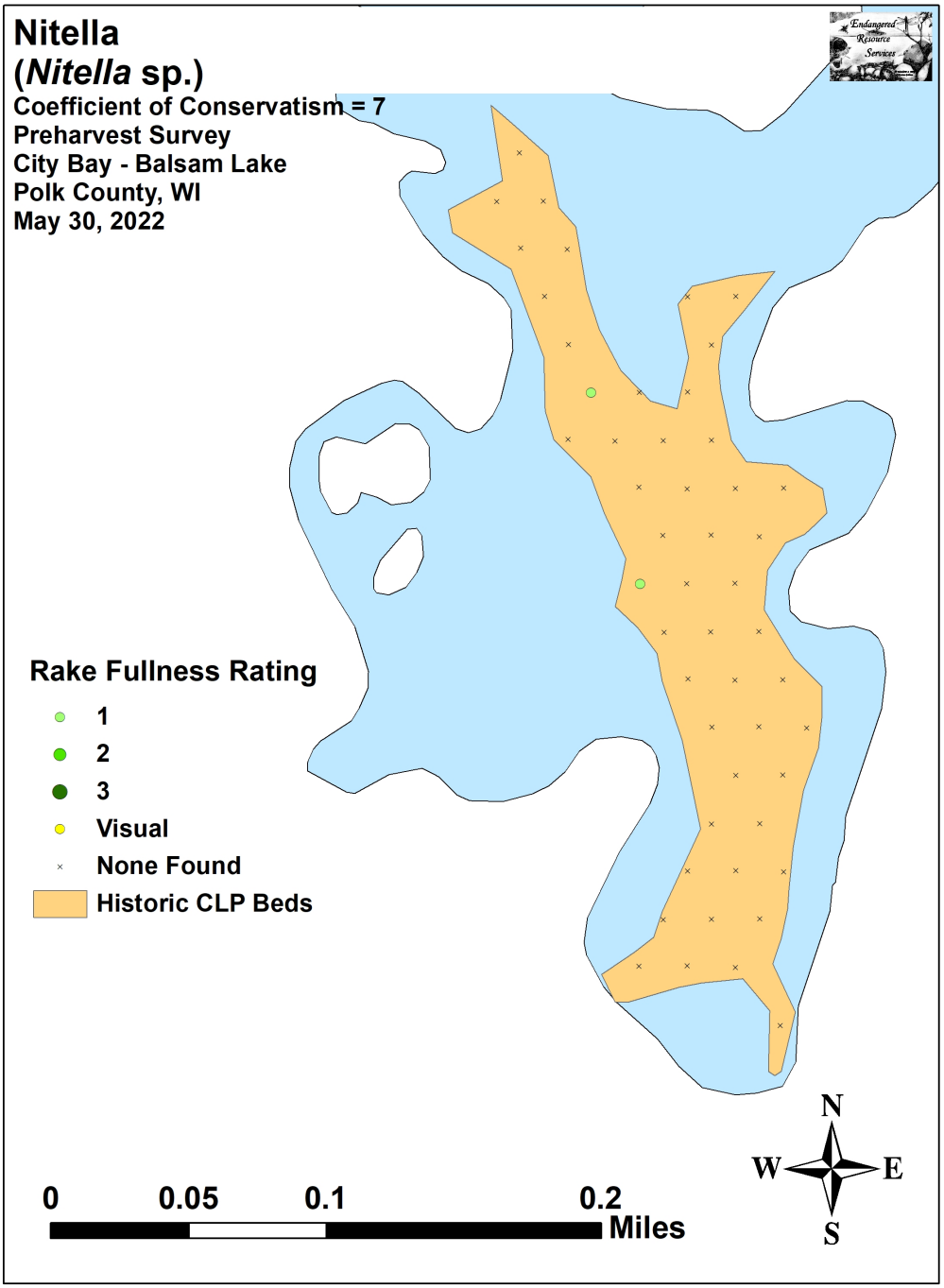

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

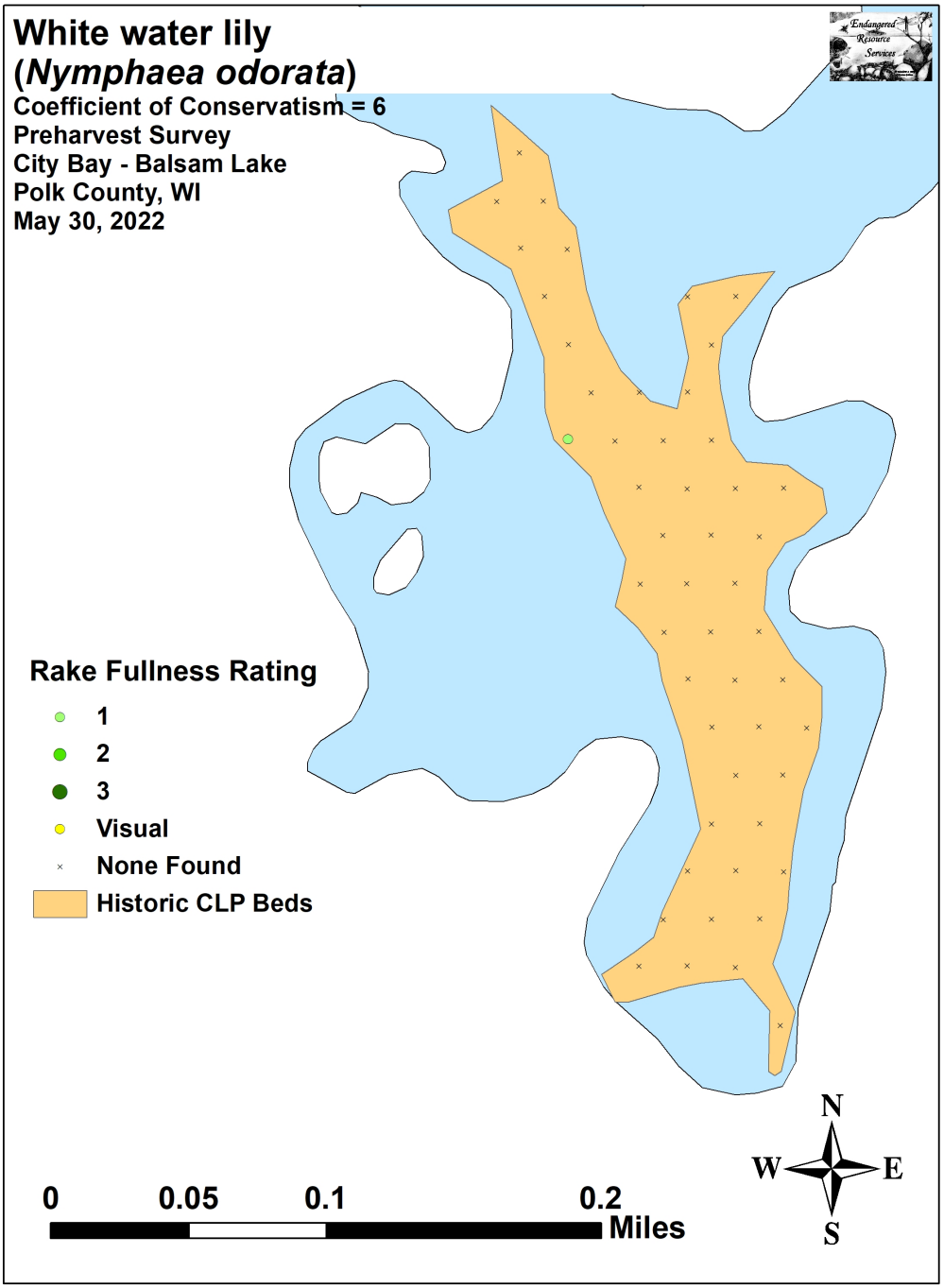

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

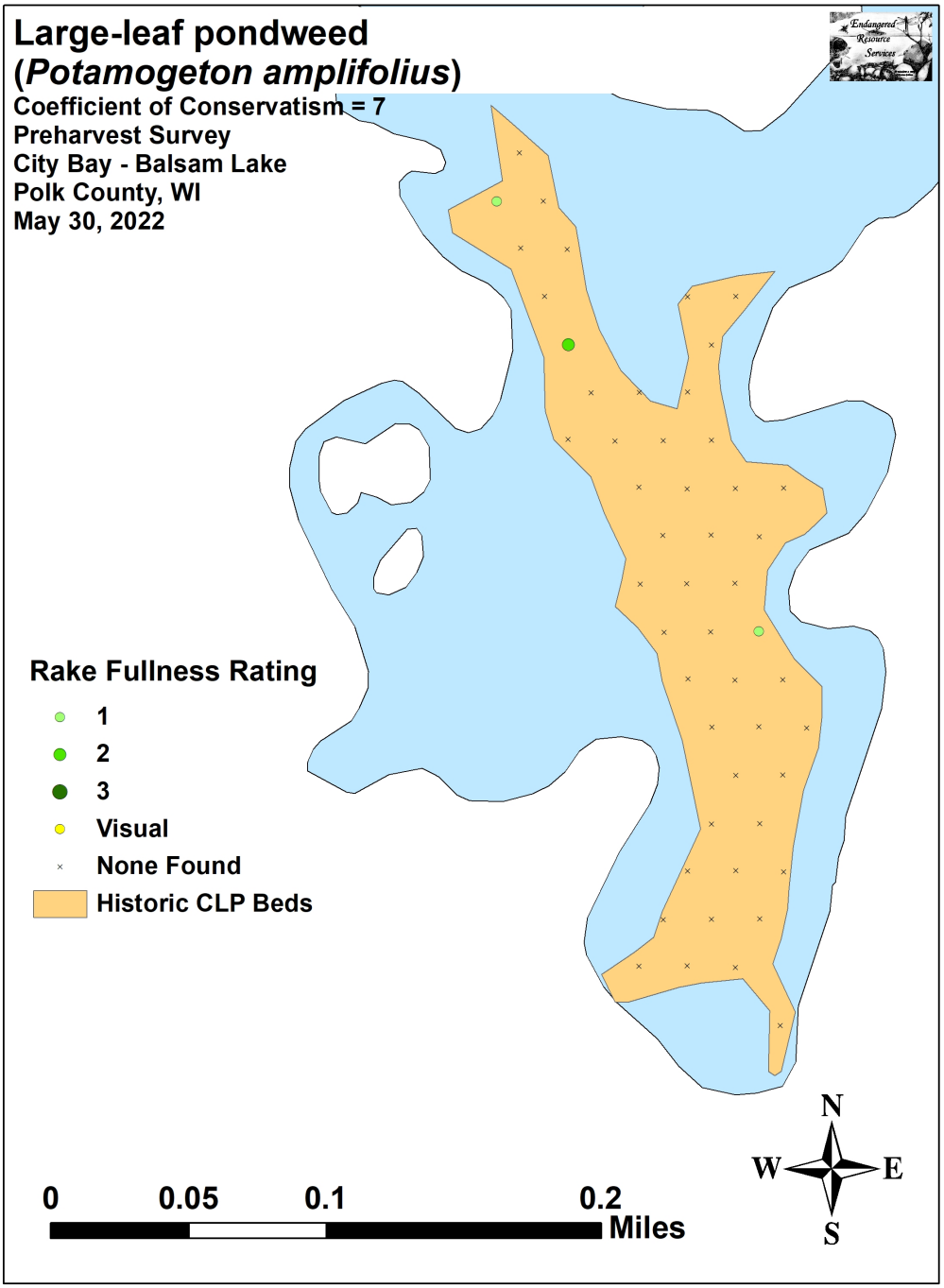

Filamentous algae
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

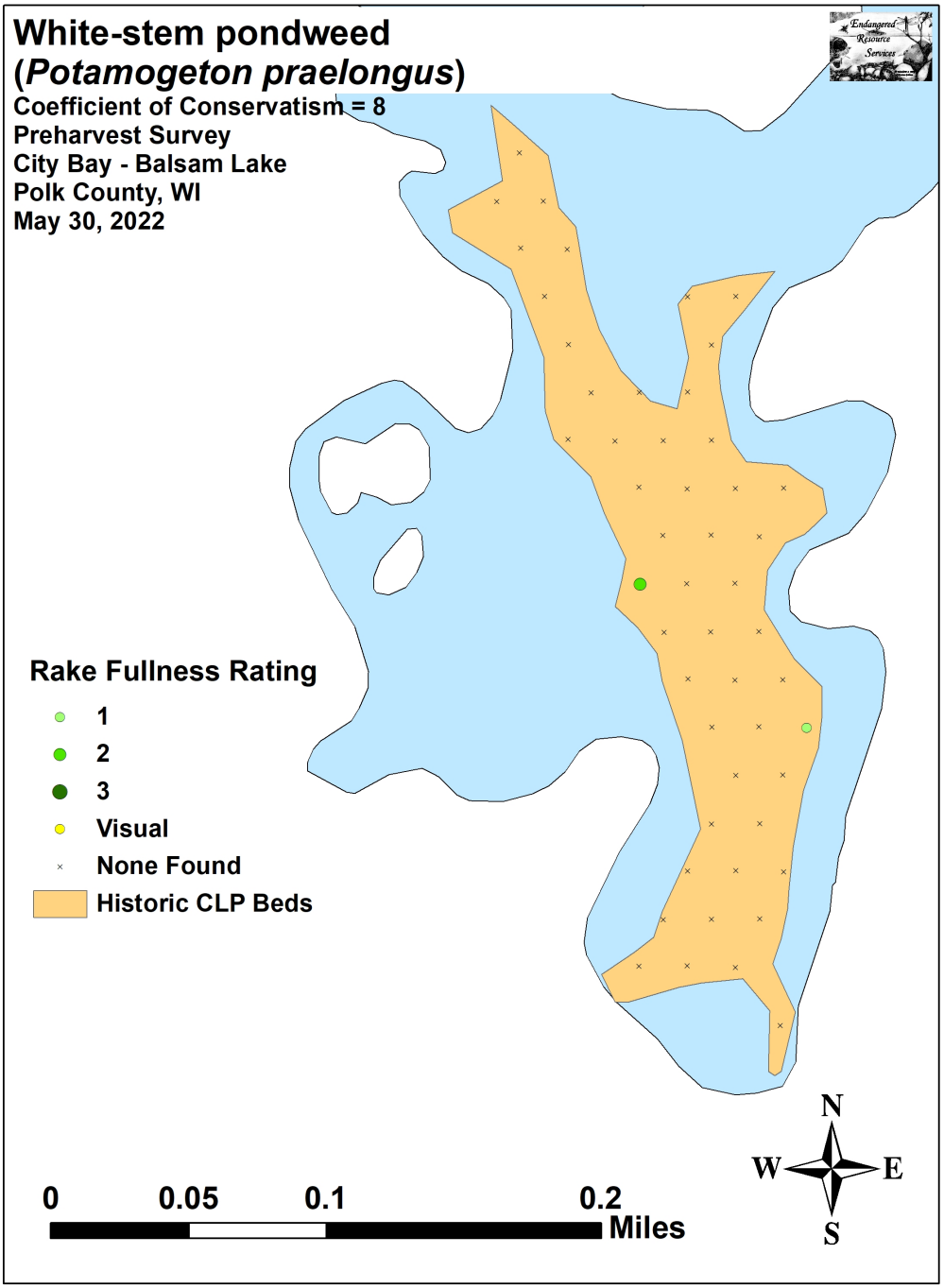

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

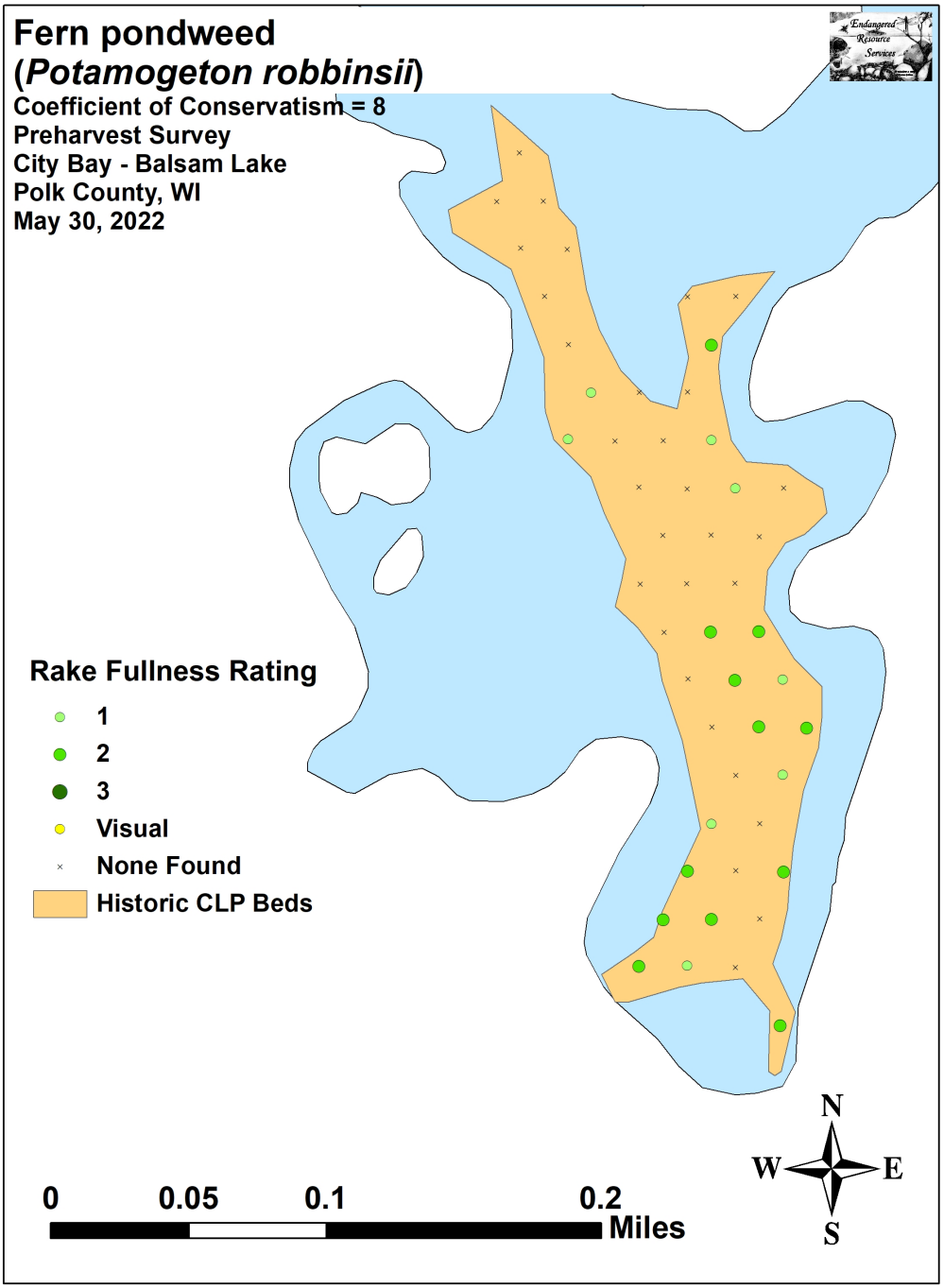

Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

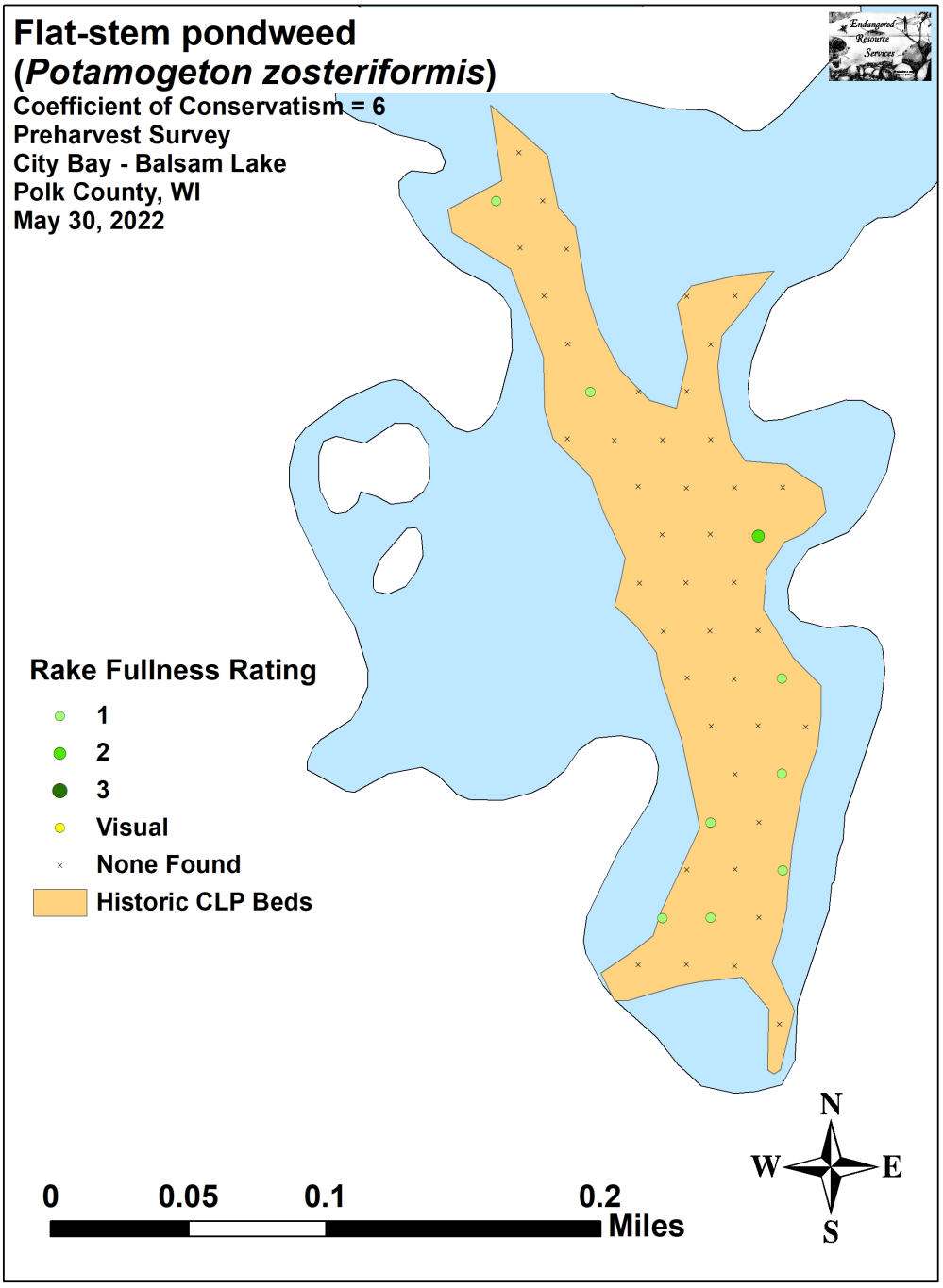

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles

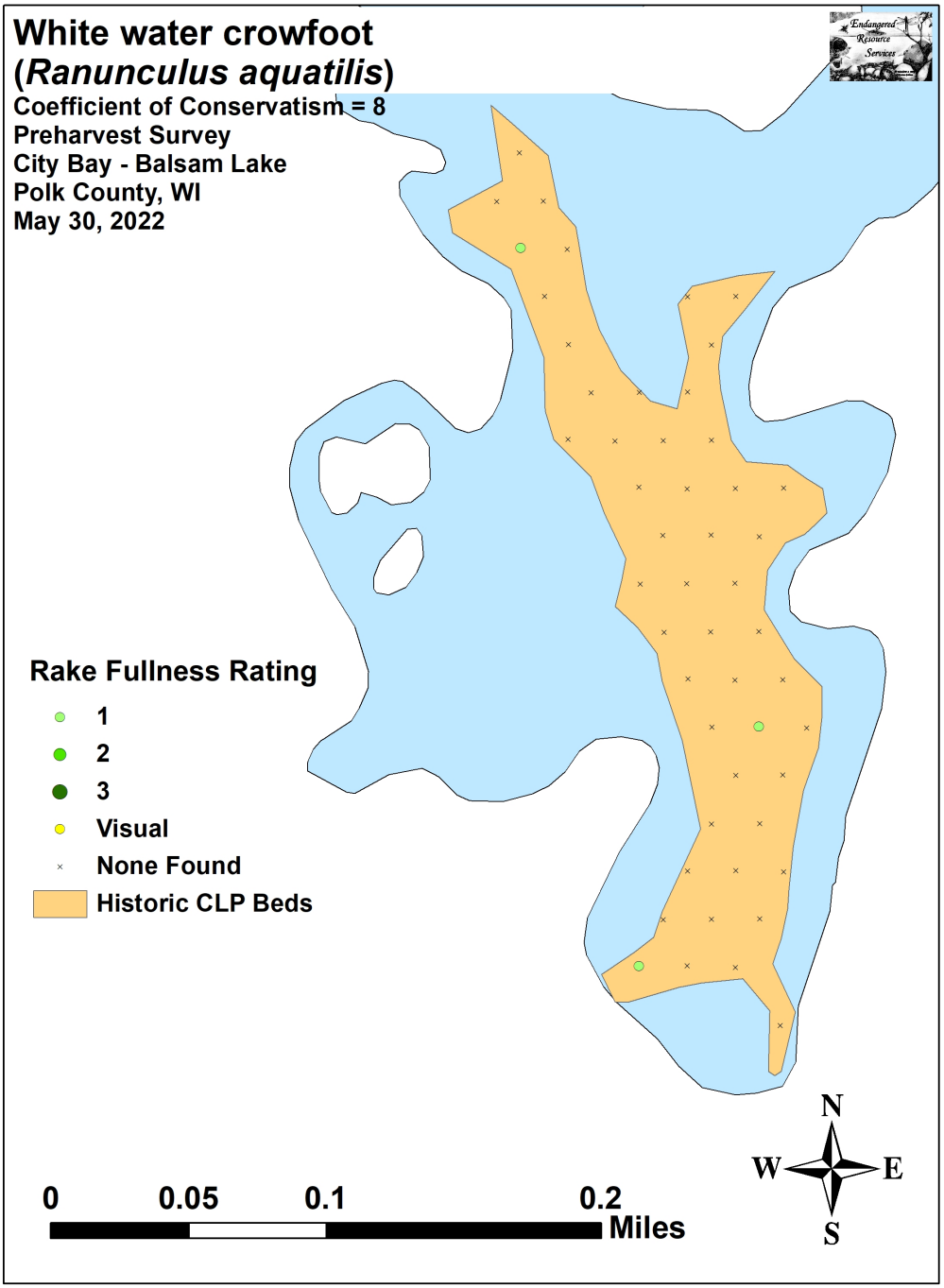

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles


White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Preharvest Survey
City Bay - Balsam Lake
Polk County, WI
May 30, 2022
Endangered Resource Services
Rake Fullness Rating
1
2
3
Visual
None Found
Historic CLP Beds
N
W
E
S
0
0.05
0.1
0.2
Miles