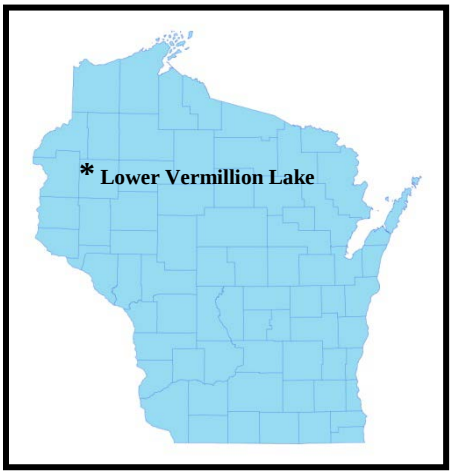
Curly-leaf pondweed (*Potamogeton crispus*) Bed Mapping Survey
Lower Vermillion Lake - WBIC: 2098200
Barron County, Wisconsin

Curly-leaf Pondweed Plant (Berg 2022)

Lower Vermillion Lake Aerial Photo with 2022 CLP Beds

Project Initiated by:

Vermillion Lakes Association, Wisconsin Department of Natural Resources and Lake Education and Planning Services, LLC (WDNR Grant ACEI25221)



Dense canopied Northern water-milfoil in the southeast outlet bay 6/28/22

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 28, 2022

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INTRODUCTION:

Lower Vermillion Lake (WBIC 2098200) is a 215-acres stratified drainage lake in northwestern Barron County, Wisconsin in the Town of Cumberland (T35N R13W S15/16, 22). It reaches a maximum depth of 55 feet in the central basin and has an average depth of approximately 25ft (Busch et al 1967) (Figure 1). The lake is mesotrophic in nature, and, from 2000-2022, water clarity has been fair to good with summer Secchi readings ranging from 6-12ft and averaging 8.6ft (WDNR 2022). This clarity produced a littoral zone that reached approximately 14.0ft in 2021. Bottom substrates along the north, south, and southeastern shorelines are primarily rock and sand, while most of the east bay and main basin are organic or sandy muck.

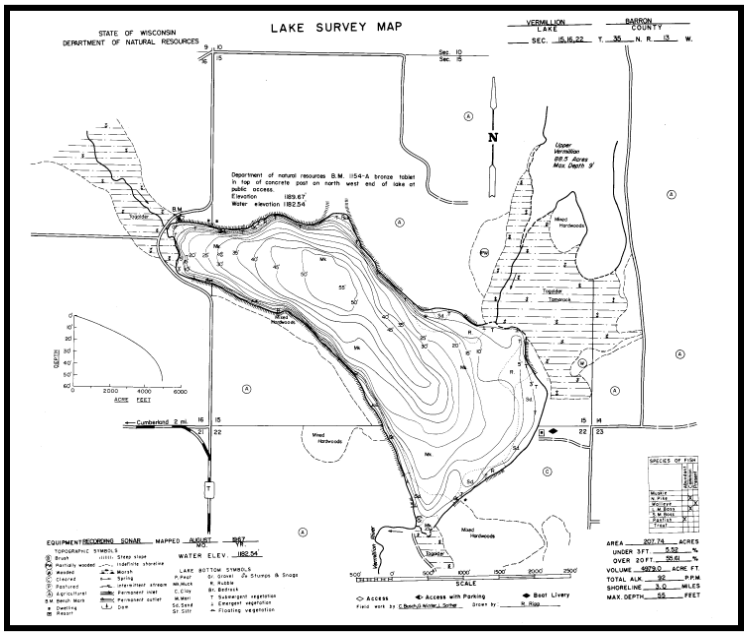

Figure 1: Lower Vermillion Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM), an exotic invasive plant species, was discovered in Lower Vermillion Lake in 2008. Since that time, the Vermillion Lakes Association (VLA) has engaged in active management using herbicides and manual removal as outlined in their Wisconsin Department of Natural Resources (WDNR) approved 2009 and 2017 Aquatic Plant Management Plans (APMP). In addition to EWM, the plans also addressed the lake's Curly-leaf pondweed (*Potamogeton crispus*) (CLP) infestation - another exotic invasive species that is especially common in areas of the lake with nutrient-rich sediments.

In anticipation of updating their plan in 2022, the VLA, under the direction of Dave Blumer (Lake Education and Planning Services, LLC), requested three lakewide surveys on Lower Vermillion in 2021. The May 29, 2021 Curly-leaf pondweed bed mapping survey found unexpectedly sharp increases in total CLP acreage. To better understand if this was a short-term response to annual growing conditions or the new "normal" for CLP coverage, we were asked to return to the lake in 2022 and complete another bed mapping survey. This report is the summary analysis of that survey conducted on June 28, 2022.

METHODS:

Curly-leaf Pondweed Bed Mapping Survey:

During the Curly-leaf pondweed bed mapping survey, we searched the lake's visible littoral zone. By definition, a "bed" was determined to be any area where we visually estimated that CLP made up >50% of the area's plants, was generally continuous with clearly defined borders, and was canopied, or close enough to being canopied that it would likely interfere with boat traffic. After we located a bed, we motored around the perimeter of the area taking GPS coordinates at regular intervals. We also estimated the rake density range and mean rake fullness of the bed (Figure 2), the maximum 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 (Table 1). We also recorded the GPS coordinates of all EWM plants found. These waypoints were shared with the DASH contractor that was hired by the VLA in 2022 to do manual removal following the denial of their chemical treatment permit.

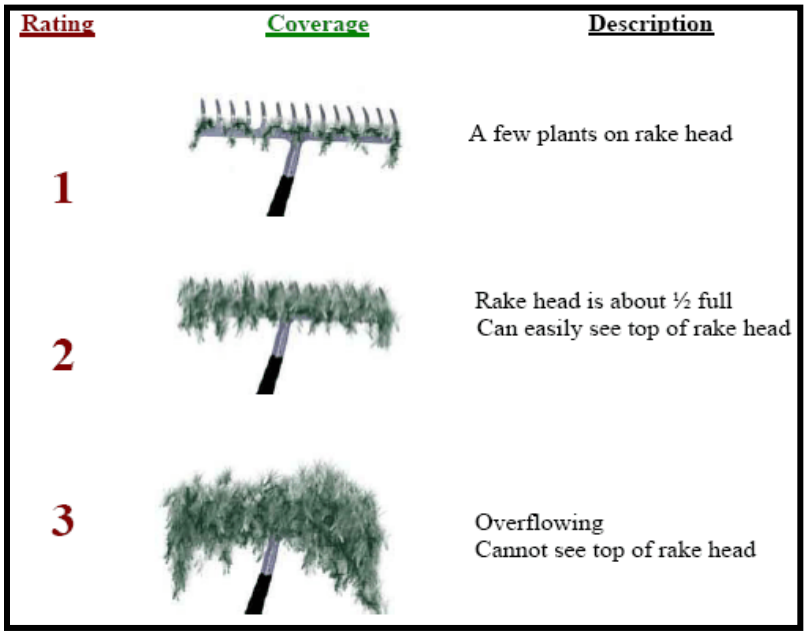

Figure 2: Rake Fullness Ratings (UWEX 2010)

RESULTS:

Curly-leaf Pondweed Bed Mapping Survey:

The late ice-off and rapid warm up in the spring of 2022 did not appear to favor Curly-leaf pondweed. Because of these conditions, we opted to delay the survey until June 28th. At that time, we mapped 12 Curly-leaf pondweed beds that totaled 2.02 acres (approximately 0.9% of the lake's surface area) (Figure 3). This was an 8.83-acre decline (-81.38%) from 2021 when we delineated eight beds that covered 10.85 acres (5.0% of the lake's surface area (Table 1). The 2022 results seemed to be more in line with previous CLP surveys conducted on the lake in 2016 (nine CLP beds on 3.66 acres - 1.7% coverage) and 2009 (a single CLP bed on 1.10 acres - 0.6% coverage) (Appendix III).

Although at face value the increase in 2021 CLP bed coverage might appear troubling, we found more overall CLP during the 2009 point-intercept survey than either the 2016 or 2021 surveys. We noted CLP was common and present throughout the lake in 2009, but it was seldom invasive or bed forming. In 2016, CLP was more restricted, but tended to occur at greater densities when it was present. The 2021 survey found CLP beds were common, but they were generally patchy and seemed unlikely to cause more than minor navigation impairment. In 2022, CLP was again patchy and seldom bed forming. During each of the four surveys, we noted these beds tended to hold schools of both adult and juvenile panfish potentially making them important early-season vertical habitat.

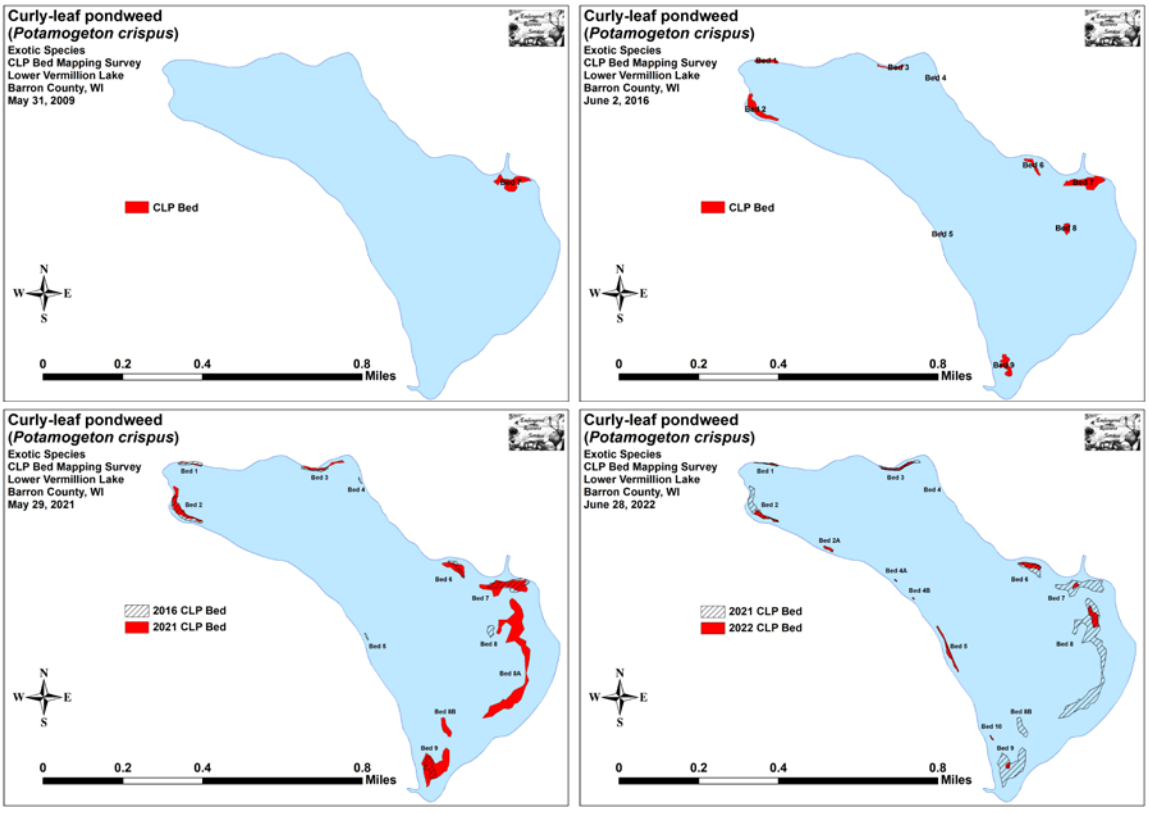

Figure 3: 2009, 2016, 2021, and 2022 Curly-leaf Pondweed Bed Maps

Descriptions of Past and Present Curly-leaf Pondweed Beds:

Beds 1 and 2 – Each of these beds in the lake's northwest bay were reduced in both coverage and density when compared to the 2021 survey. Unfortunately, they both also appeared to have increased Eurasian water-milfoil density and distribution.

Beds 3 and 4 – Bed 3 continued to be a narrow strip along the shoreline that was unlikely to be more than a minor impairment to navigation or lake access. In the areas formerly covered by Bed 4, we found only a few scattered individual CLP plants. Each of these areas had large numbers of native pondweeds present.

Beds 2A, 4A, and 4B – These small patches and microbeds of CLP were scattered along the southwestern shoreline. None of them were big enough to be an impairment, and, in the case of Beds 4A and 4B, they could have likely been hand pulled with little trouble if area residents were inclined to do so.

Bed 5 – Although it was the second biggest bed on the lake in 2022, Bed 5 was so narrow and patchy that it was unlikely to have caused any navigation impairment.

Beds 6 and 7 – Established just southwest and southeast of the inlet from Upper Vermillion Lake, these two beds were more a collection of CLP patches than a continuous bed, and neither appeared likely to cause more than a minor impairment. Most of the areas that had been dominated by CLP in 2021 supported only native species in 2022; especially Clasping-leaf pondweed (*Potamogeton richardsoni*) in Bed 6 and Coontail (*Ceratophyllum demersum*) in Bed 7.

Beds 8 and 8A – Unlike 2021 when we found much of the eastern bay had patchy CLP growing in the 5-8ft bathymetric ring, the 2022 survey found almost none. Even random raking in the core of formerly dense CLP areas usually failed to produce any plants.

Bed 8B – We saw almost no CLP in this former bed, but EWM was increasing in a narrow band on the outer edge.

Bed 9 – Similar to Beds 8 and 8A, CLP was nearly absent from this area where it had been so common in 2021. Most of the outlet bay was dominated by dense canopied Northern water-milfoil (*Myriophyllum sibiricum*) (see report cover) with widely scattered EWM plants mixed in. The area again bordered the lake's largest patch of Northern wild rice (*Zizania palustris*).

Bed 10 - This "bed" was little more than a low-density ribbon of nearly continuous CLP. As it was both narrow and away from the immediate shoreline, it was unlikely to cause any impairment.

Table 1: Curly-leaf Pondweed Bed Summary
Lower Vermillion Lake – Barron County, Wisconsin – June 28, 2022

Bed Number	2022 Area (Acres)	2021 Area	2016 Area	2009 Area	2021-2022 Change in Area	Est. Range and Mean Rake	Depth Range and Mean Depth	Canopied	Potential Nav. Impair.	Field Notes
1	0.05	0.08	0.27	0	-0.03	<<<1-2; <1	4-7; 6	Yes	Minor	Bed now dominated by EWM.
2	0.25	0.81	0.83	0	-0.56	<<<1-2; 1	2-8; 5	Yes	None	Bed now dominated by EWM.
2A	0.10	0	0	0	0.10	<<<1-3; 1	4-8; 6	Yes	None	Too narrow to be an impairment.
3	0.23	0.33	0.18	0	-0.10	<<<1-2; <1	4-8; 6	Near	Minor	Less dense than in 2021.
4	0	0	0.03	0	0.00	<<<1	-	-	None	A few scattered plants.
4A	0.01	0	0	0	0.01	1-3; 2	4-8; 6	Yes	None	Moderately dense microbed.
4B	0.01	0	0	0	0.01	<<<1-2; 1	5-8; 6	Near	None	Too narrow to be an impairment.
5	0.37	0	0.03	0	0.37	<<<1-2; 1	5-8, 6	Near	None	Too narrow to be an impairment.
6	0.35	0.61	0.25	0	-0.26	<<<1-2; 1	4-8; 5	Near	Minor	Mixed with Clasping - patchy.
7	0.08	1.62	1.24	1.12	-1.54	<<<1-2; <<1	2-5; 4	Yes	None	Bed now dominated by Coontail.
8 and 8A	0.48	4.83	0.24	0	-4.35	<<<1-2; <1	4-8; 6	Near	None	Bed now dominated by NWM.
8B	0	0.41	0	0	-0.41	<<<1	-	-	None	A few scattered plants.
9	0.08	2.17	0.60	0	-2.09	<<<1-3; 1	4-6; 5	Yes	Minor	Microbed in center of bay.
10	0.02	0	0	0	0.02	<<<1-2; 1	5-8; 6	Near	None	Too narrow to be an impairment.
Total Acres	**2.02**	**10.85**	**3.66**	**1.12**	**-8.83**					

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Potential Future Curly-leaf Pondweed Management:

Although Curly-leaf pondweed is an exotic species, in most years it appears to play a generally minor role in the lake's ecosystem. Because of this, active management may not be required - at least in all but the worst places. Much like algae and duckweeds, CLP tends to grow best in areas with excessive nutrients in the water; especially when there is also bottom disturbance. To help limit CLP's opportunities to thrive and expand, all lake residents are encouraged to evaluating how their shoreline practices may be impacting the lake. Simple things like establishing or maintaining their own buffer strip of native vegetation along the lakeshore to prevent erosion, building rain gardens, bagging grass clippings, switching to a phosphorus-free fertilizer or preferably eliminating fertilizer near the lake altogether, collecting pet waste, and disposing of the ash from fire pits away from the lakeshore can all significantly reduce the amount of nutrients entering the lake. Avoiding motor starts in water less than 4ft deep can also maintain native vegetation and prevent the stirring up of nutrient-rich sediment. By limiting nutrient inputs, residents not only create less than ideal growing conditions for CLP, but also promote better water clarity and quality by limiting algal growth. Hopefully, a greater understanding of how all property owners can have lake-wide impacts will result in more people taking appropriate conservation actions.

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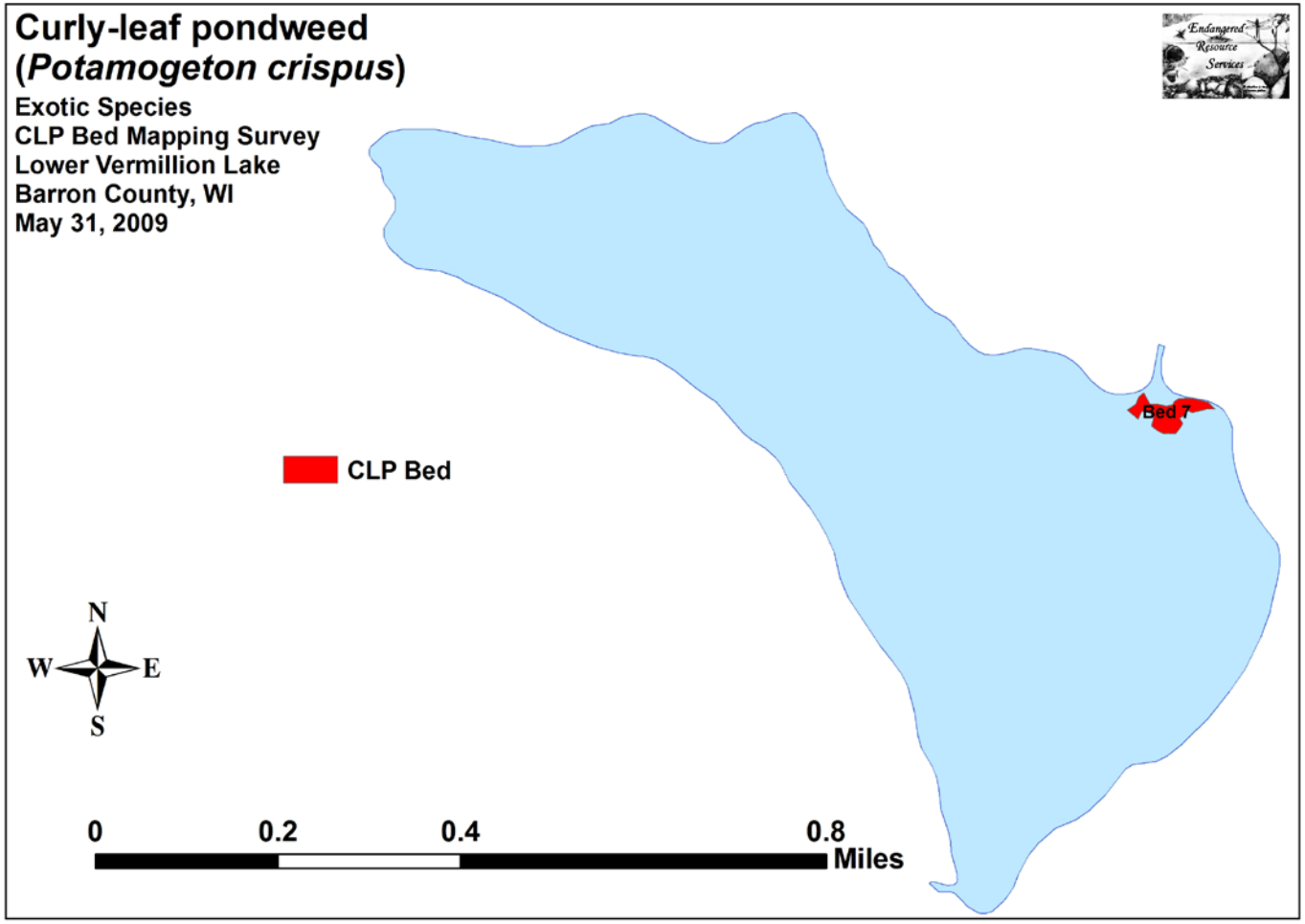
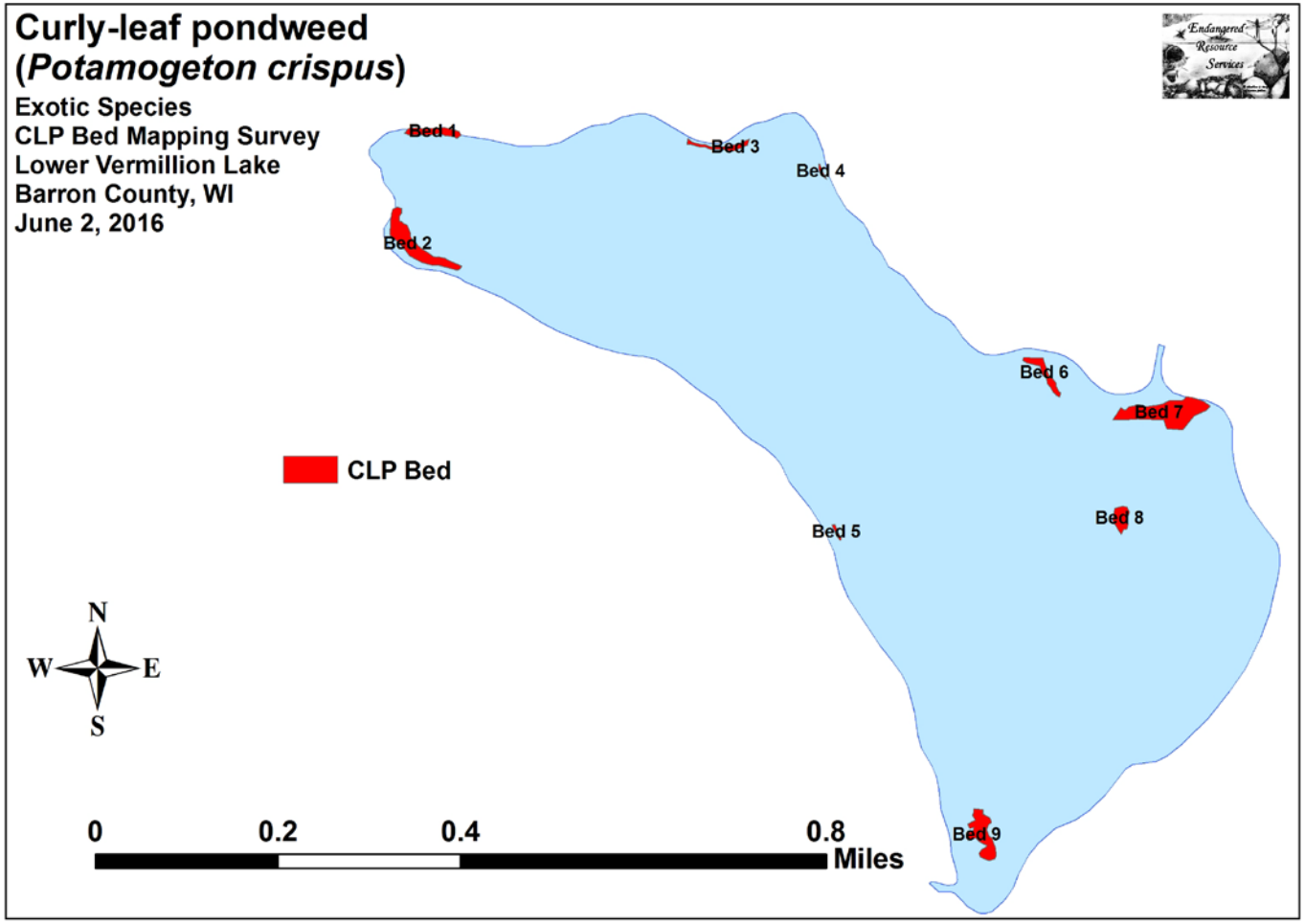
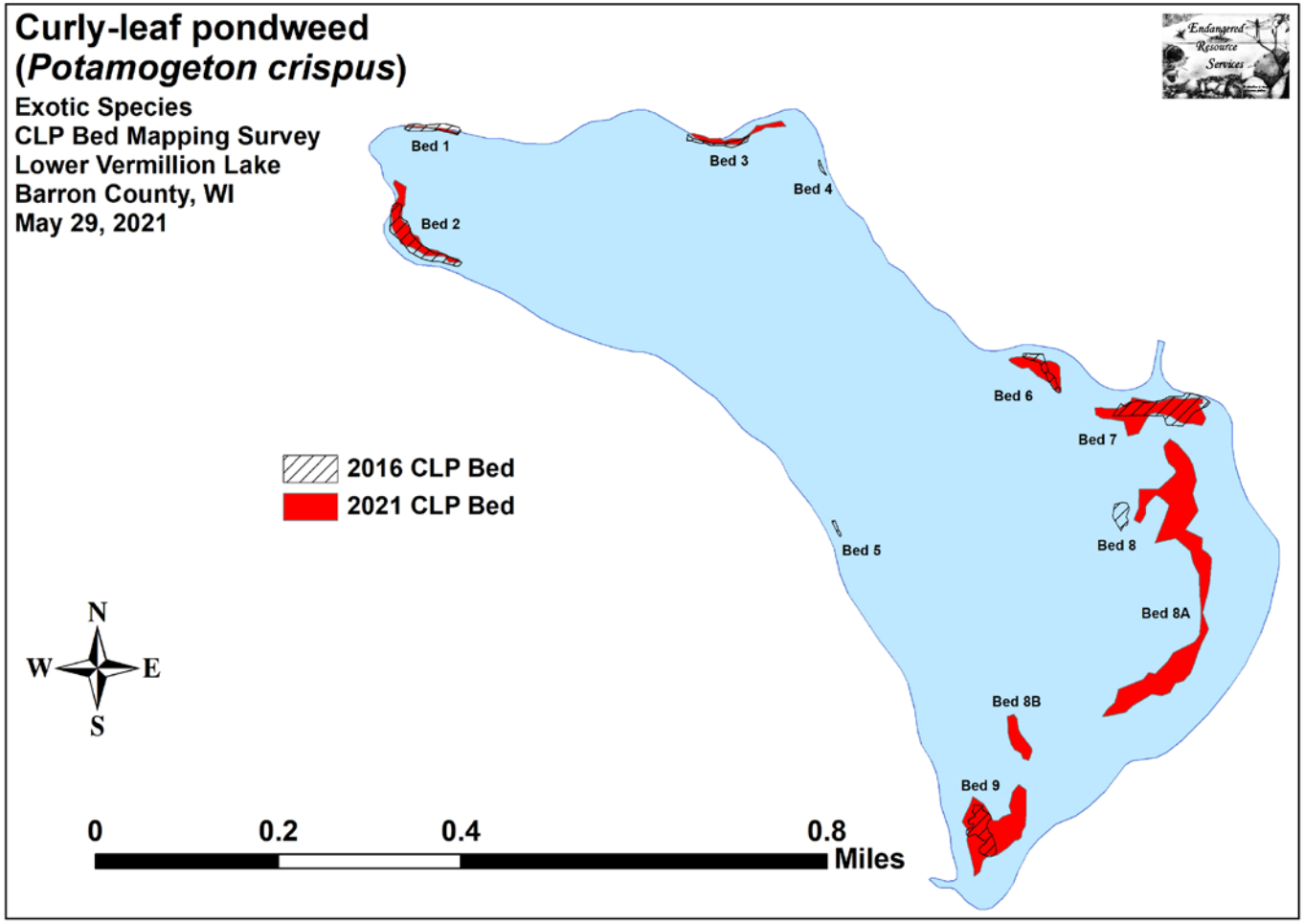
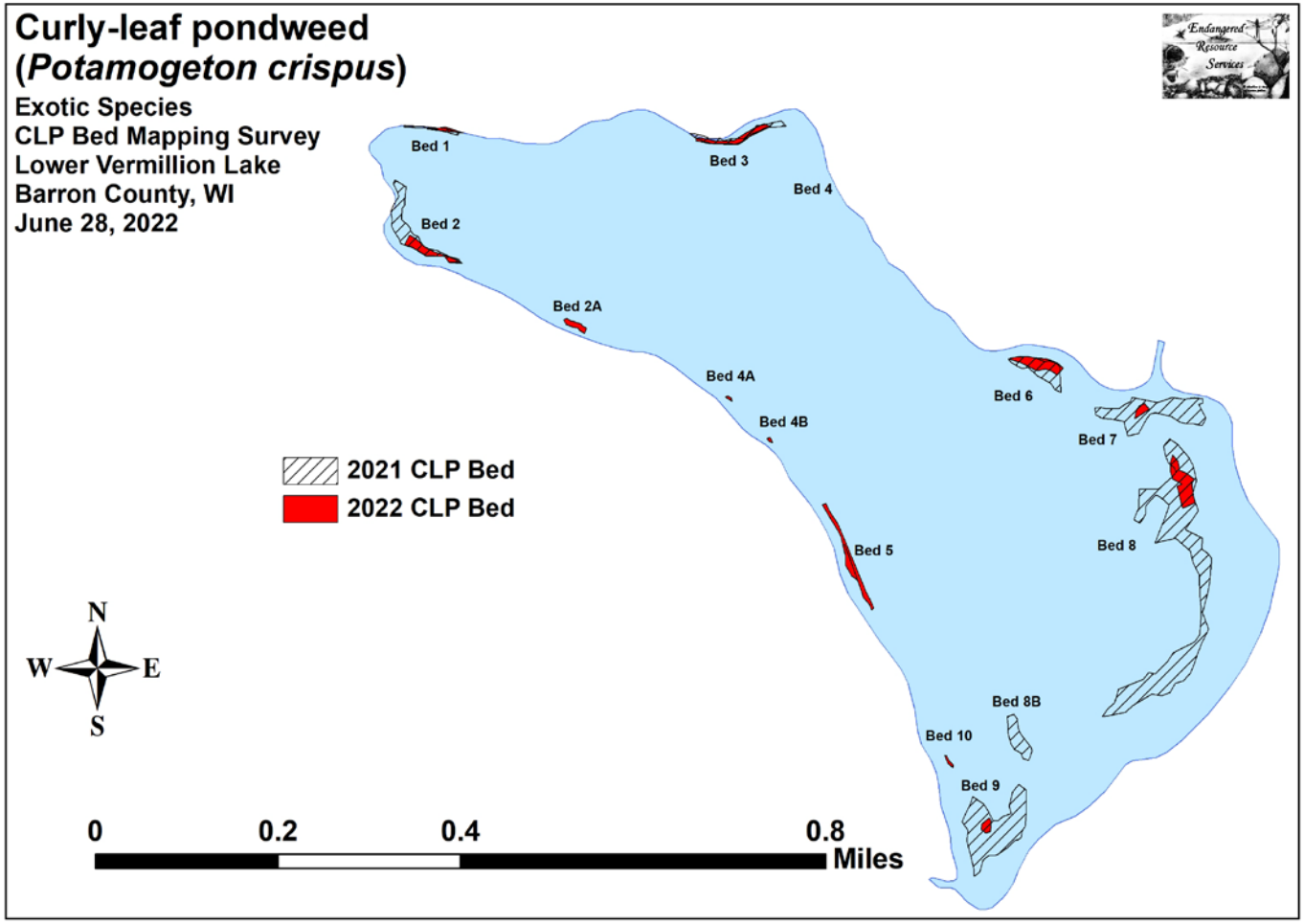
Appendix I: 2009, 2016, 2021, and 2022 Curly-leaf Pondweed Bed Maps


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
May 31, 2009
Endangered Resource Services
Bed 7
CLP Bed
N
W
E
S
0
0.2
0.4
0.8
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
June 2, 2016
Endangered Resource Services
Bed 1
Bed 3
Bed 4
Bed 2
Bed 6
Bed 7
CLP Bed
Bed 8
Bed 5
N
W
E
S
0
0.2
0.4
0.8
Miles
Bed 9


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
May 29, 2021
Endangered Resource Services
Bed 1
Bed 2
Bed 3
Bed 4
Bed 5
Bed 6
Bed 7
Bed 8
Bed 8A
Bed 8B
Bed 9
2016 CLP Bed
2021 CLP Bed
N
W
E
S
0
0.2
0.4
0.8
Miles


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
June 28, 2022
Endangered Resource Services
Bed 1
Bed 2
Bed 3
Bed 4
Bed 2A
Bed 4A
Bed 4B
Bed 5
Bed 6
Bed 7
Bed 8
Bed 8B
Bed 10
Bed 9
2021 CLP Bed
2022 CLP Bed
N
W
E
S
0
0.2
0.4
0.8
Miles