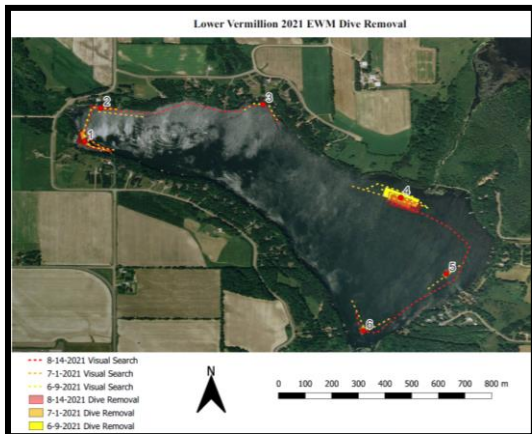


Eurasian water-milfoil (*Myriophyllum spicatum*) Spring and Fall Bed Mapping Surveys and Manual Removal Locations Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin



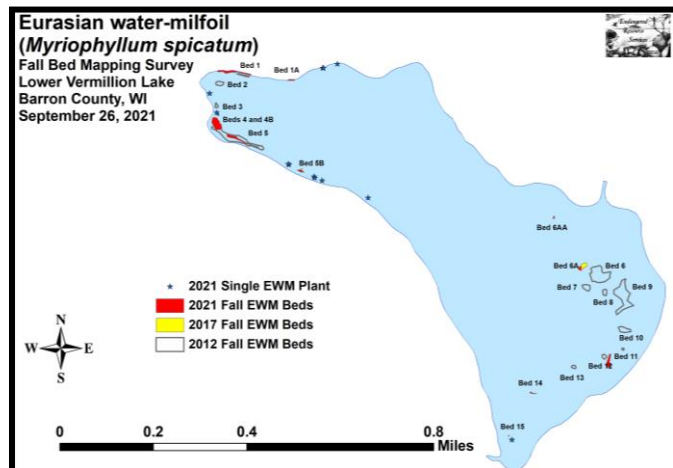
2021 EWM Dive Removal by Lutra Biological, LLC



Eurasian water-milfoil (Berg 2007)

Project Initiated by:

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



2021 Fall EWM Bed Mapping Survey

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 29 and September 26, 2021

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INTRODUCTION:

Lower Vermillion Lake (WBIC 2098200) is a 215-acre 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). The lake is mesotrophic in nature, and, from 2000-2021, water clarity has been fair to good with summer Secchi readings ranging from 6-12ft and averaging 8.7ft (WDNR 2021). 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 muck or sandy muck.



Figure 1: Aerial Photo of 2020 EWM/CLP Treatment Areas

BACKGROUND AND STUDY RATIONALE:

In 2008, the Wisconsin Department of Natural Resources (WDNR) confirmed the presence of Eurasian water-milfoil (EWM) (*Myriophyllum spicatum*) in Lower Vermillion Lake, and the Vermillion Lakes Association (VLA) has been actively working to control this exotic invasive species ever since. Following the 2019 fall EWM bed mapping survey that found scattered patches of EWM throughout the northwest bays near the boat landing and in the east bay, the VLA, under the direction of D. Blumer - Lake Education and Planning Services, LLC (LEAPS) and in accordance with their WDNR approved Aquatic Plant Management Plan, decided to chemically treat three areas totaling approximately 5.13 acres (2.39% of the lake's total surface area) in 2020 (Figure 1). Several of these areas were simultaneously treated for Curly-leaf pondweed (CLP) (*Potamogeton crispus*) – another exotic invasive plant species that is locally abundant early in the growing season.

In 2021, it was decided that herbicide treatments would be suspended in favor of manual removal of EWM with SCUBA divers. To assist in these efforts, we were asked to perform a spring EWM littoral zone survey to identify locations for the divers to focus on. Following dive removal in June, July, and August, we returned to the lake to complete a fall EWM bed mapping survey to help determine the effectiveness of these efforts and to determine where active management might be considered in 2022. This report is the summary analysis of these two field surveys conducted on May 29th and September 26th, 2021.

METHODS:

Eurasian Water-milfoil Bed Mapping:

During the surveys, we searched the visible littoral zone of the lake and mapped all known beds of Eurasian water-milfoil. A “bed” was determined to be any area where we visually estimated that EWM made up >50% of the area’s plants and was generally continuous with clearly defined borders. After we located a bed, we motored around the perimeter of the area 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 2). We also took waypoints of EWM plants outside these beds as they were generally few in number.




<u>Rating</u>	<u>Coverage</u>	<u>Description</u>
1		A few plants on rake head
2		Rake head is about 1/2 full Can easily see top of rake head
3		Overflowing Cannot see top of rake head

Figure 2: Rake Fullness Ratings

RESULTS AND DISCUSSION:

Spring Eurasian Water-milfoil Bed Mapping Survey:

On May 29th, while simultaneously conducting an early-season point-intercept survey for Curly-leaf pondweed and Eurasian water-milfoil, we searched for EWM throughout the lake's visible littoral zone. Collectively, we searched transects totaling 21.0km (13.0 miles) spending extra time in the 2020 treatment areas, looking at all areas that previously supported EWM beds, and searching in the northeast and northwest bays where fragments from elsewhere would likely be blown by the prevailing winds (Figure 3).

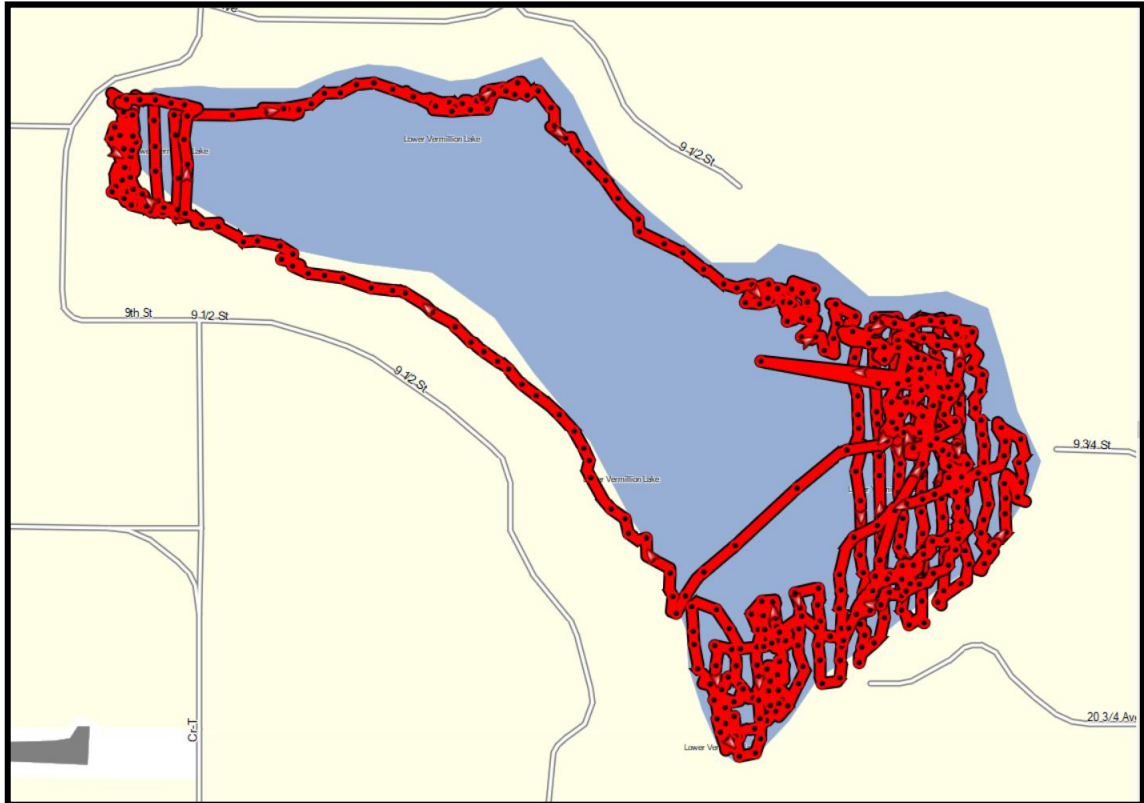


Figure 3: May 29, 2021 Littoral Zone Survey Transects

During the point-intercept survey, we found single EWM plants in the rake at two points and recorded it as a visual at one other site. Inter-point and along our extra search transects, we didn't find any true beds. In total, we marked nine additional plants all of which were located along the southwest shoreline of the lake's northwest bay (Figure 4) (Appendix I). These locations were shared with the dive removal company (Lutra Biological, LLC), and they used them as initial locations for the first of their three dive removal days (Figure 5).

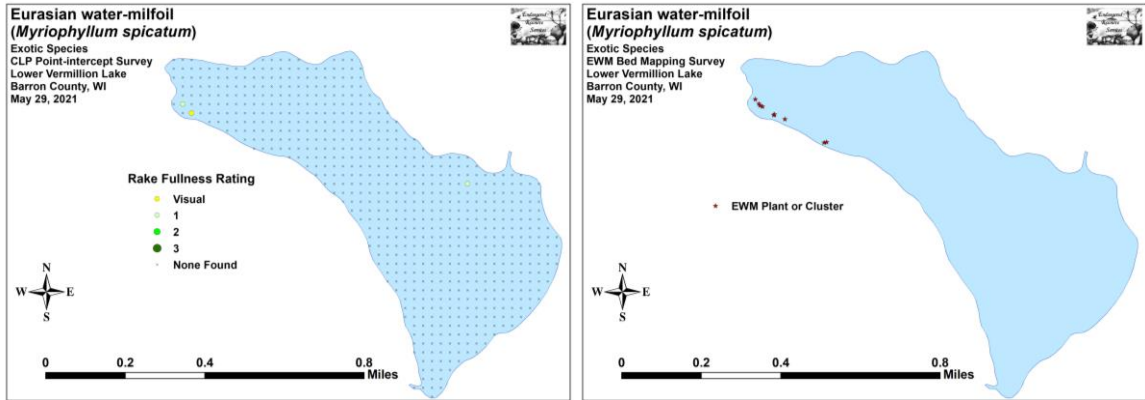


Figure 4: Early-season EWM Density and Distribution – 5/29/21

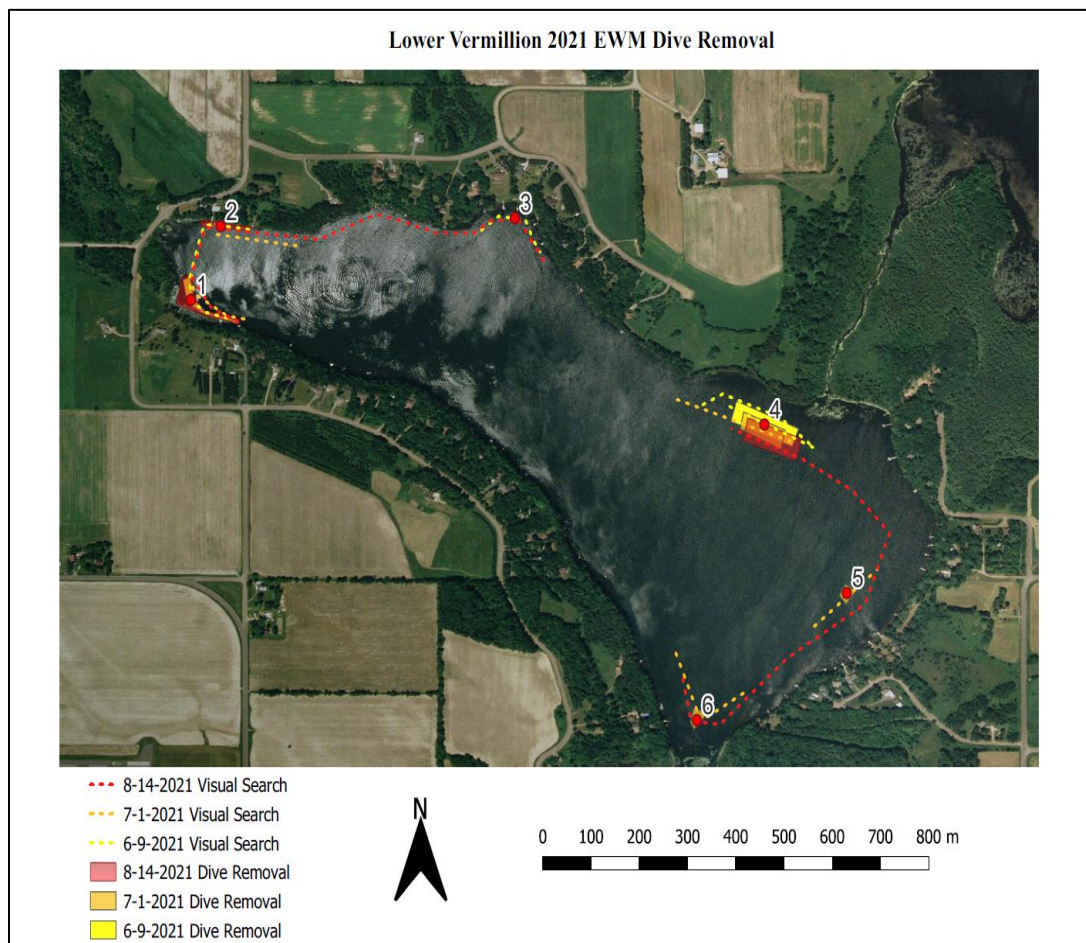


Figure 5: EWM Dive Removal Areas – June-August 2021

Dive Removal:

Over the course of the summer, Eurasian water-milfoil was manually removed from six different areas on the lake (Figure 5) (Table 1). Lutra Biological, LLC reported they were able to removal almost all plants found during the June and July dives; however, Beds 1, 2, and 4, which were initially located in shallower areas, spread outwards when clarity increased in August. This produced occasionally dense EWM in 6-12 ft of water where it was scattered among patches of Coontail (*Ceratophyllum demersum*). Lutra reported that, because of these increases in both density and distribution, it was impossible to remove all plants found during the August dive (Appendix II).

**Table 1: Dive Removal of Eurasian Water-milfoil Areas Summary
Lower Vermillion Lake – Barron County, Wisconsin
June-August 2021**

Bed Number	Depth Range	Mean Depth	Density Range	Mean Density
1	2-10ft	5ft	<1-3	2
2	2-10ft	6ft	<1-2	2
3	3-6ft	5ft	<<1-1	1
4	5-12ft	8ft	<1-3	2
5	4-7ft	5ft	<<1-2	1
6	4-6ft	5ft	<<1-1	1

Fall Eurasian Water-milfoil Bed Mapping Survey:

On September 26th, we returned to the lake and searched 19.3 kilometers (12.0 miles) of transects within the lake’s littoral zone (Figure 6). Clarity was very poor due to a significant algal bloom that limited visibility to 3-4ft. Collectively, we mapped ten small beds that totaled 0.72 acre (Figure 7) (Table 2). This was a significant increase from our 2019 fall survey when we found no beds and removed 21 isolated plants. It was also more than double our 2017 survey when we mapped six microbeds that totaled 0.31 acre (Table 2) (Appendix III). Despite these increases, EWM continues to occupy a low percentage of the lake as the 2021 fall total suggested that just 0.33% of the lake had EWM present.

Closer analysis of the 2021 fall EWM bed maps showed that manual removal appeared to have eliminated most EWM in the north-central bay. However, efforts on the lake’s northwest end appeared to have been less successful as we estimated many hundreds of plants were established in five beds that ringed the boat landing bay (Figure 8). Results appeared to have been similar in the east bay where, although there wasn’t a major expansion, none of the areas the diver worked on remained free of EWM (Figure 9).

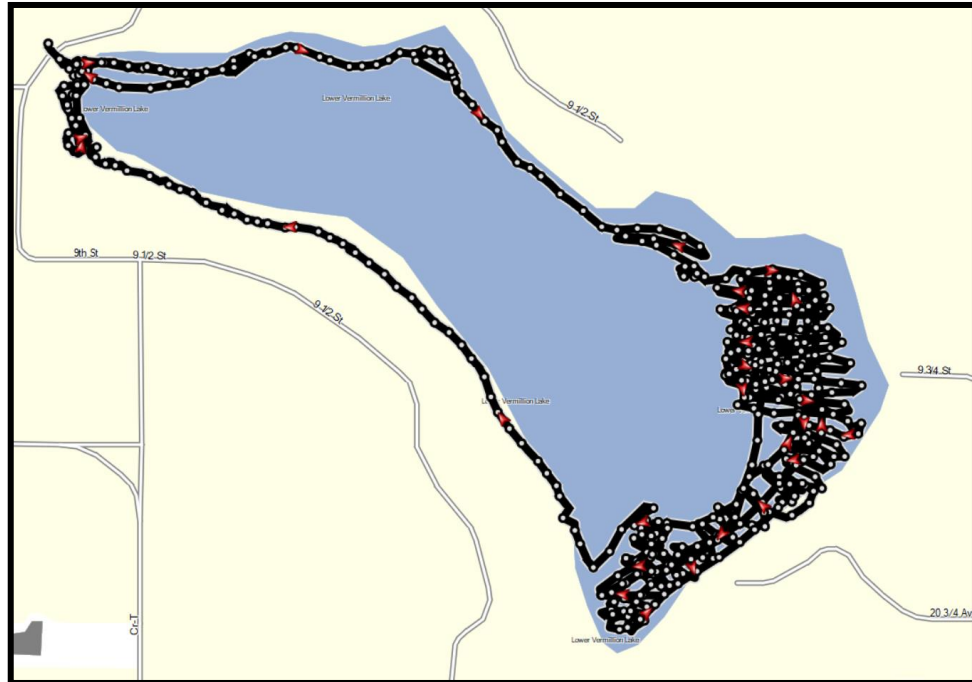


Figure 6: September 26, 2021 Littoral Zone Survey Transects

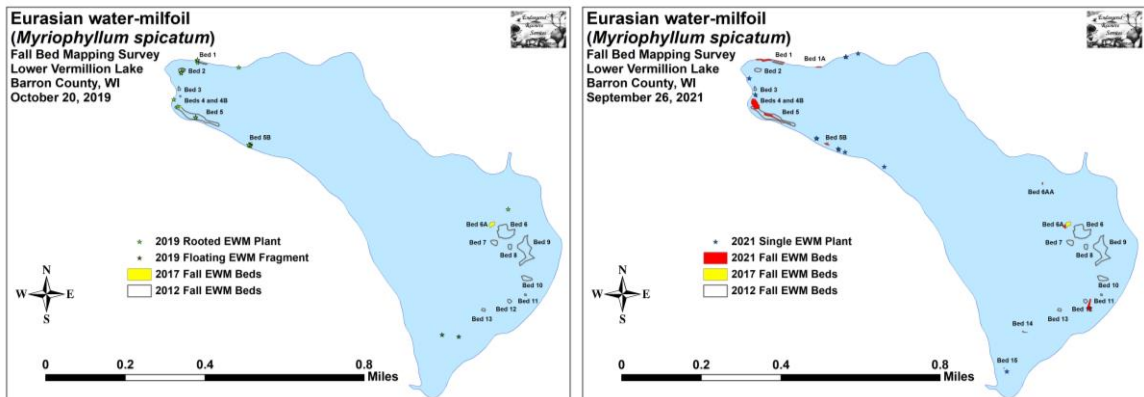


Figure 7: Fall 2019 and 2021 Eurasian Water-milfoil Bed Maps

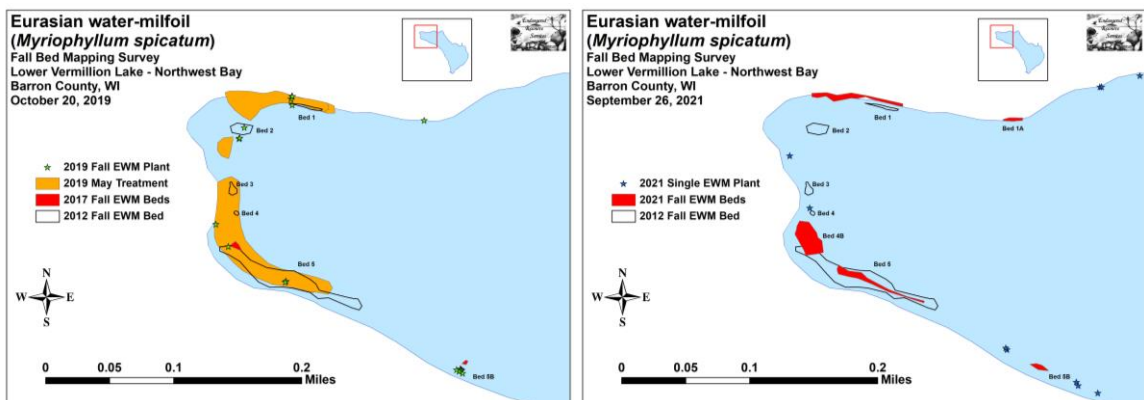


Figure 8: Fall 2019 and 2021 Close-up of EWM in the Northwest Bay

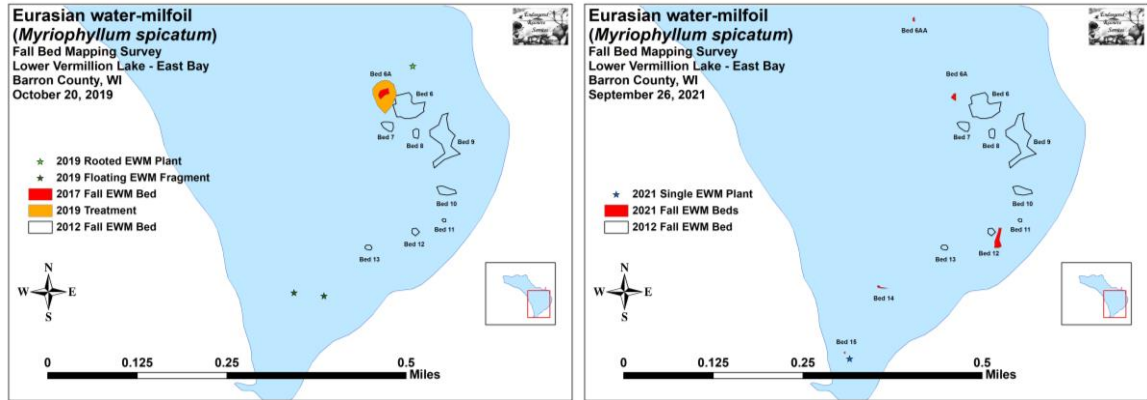


Figure 9: Fall 2019 and 2021 Close-up of EWM in the East Bay

Descriptions of Past and Present Eurasian Water-milfoil Beds/HDA:

Beds 1/1A and the Northwest Shoreline – Plants were peppered among docks along the north shoreline of the northwest bay. Although not a truly continuous bed, small satellite plants were common among the few mature canopied plants. Further along the shore, the summer diver removal seemed to have cleaned up almost all plants.

Beds 2 and 3 – We cleanly raked out the only plant we saw immediately out from the public boat landing.

Beds 4 and 4B – EWM plants were nearly continuous throughout the bed on the edge of the shingle debris in along the southwest shoreline of the northwest bay.

Beds 5 and 5B – Despite rake and dive removal efforts along the southern shoreline of the northwest bay, we again found regular plants scattered throughout the narrow littoral zone.

Beds 6 and 6A – On the deepwater edge of Bed 6A, we found a small but dense canopied mat of EWM had reformed.

Bed 6AA – This newly located bed was a focus of manual removal throughout the summer. Despite this, regular low-density plants were found during the fall survey.

Beds 6-11 and 13 – We saw no evidence of EWM anywhere in these former beds.

Bed 12 – Patchy clusters of dense EWM were scattered throughout the area. In between these canopied towers, smaller satellite plants were beginning to appear.

Beds 14 and 15 – These newly discovered beds were still quite low in density, and we spent time removing plants from both including the majority of what we found in Bed 15 near the outlet.

**Table 2: Fall Eurasian Water-milfoil Bed Mapping Summary
Lower Vermillion Lake – Barron County, Wisconsin
September 26, 2021**

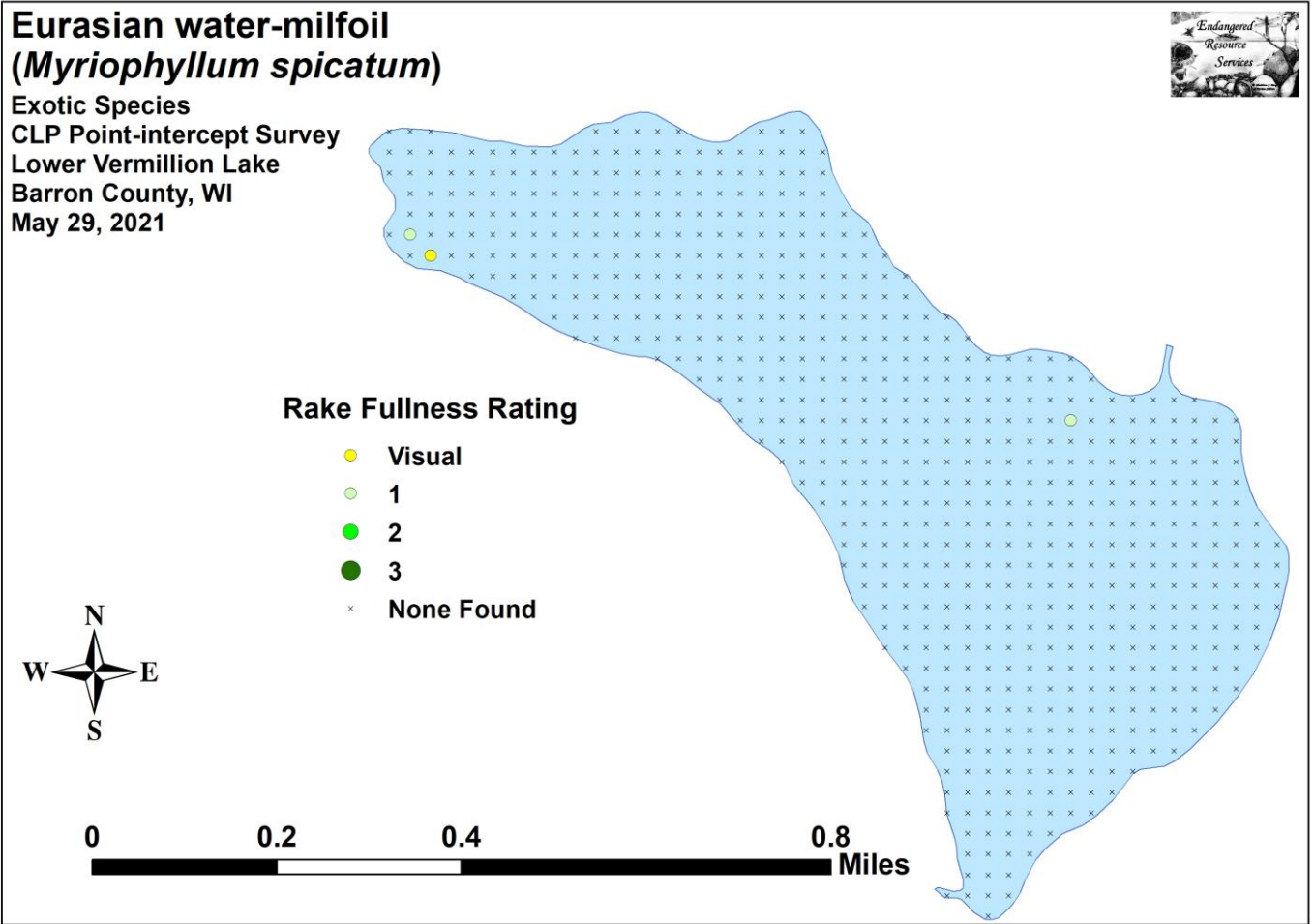
Bed Number	2021 Fall Bed Acreage	2019 Fall Bed Acreage	2017 Fall Bed Acreage	2016 Fall HDA Acreage	2015 Fall Bed Acreage	2014 Fall Bed Acreage	2013 Fall Bed Acreage	2012 Fall Bed Acreage	2019-21 Change in Acreage	Range and Est. 2021 Mean Rake	2021 Bed Characteristics And Field Notes
1	0.14	0	0	<0.01	0	0.01	0.02	0.02	0.14	<<<<1-2; <1	Regular towers
1AA	0.02	0	0	0	0	0	0	0	0.02	<<<<1-2; <1	Regular towers
2	0	0	0.17	0.21	0.47	0.39	0.43	0.07	0	<<<<1	1 EWM plant – RR*
3	0	0	0.02	0	0	0.01	<0.01	0.03	0	0	No EWM found
4 and 4B	0.25	0	0.01	0	0.05	0.04	0	0.01	0.25	<<<<1-3; 1	Regular towers
5	0.13	0	0.02	0.01	0.89	0.54	0.22	0.70	0.13	<<<<1-1; <1	Scattered towers
5B	0.02	0	0.01	0.03	0.26	0.13	0	0	0.02	<<<1-2; 1	Regular towers
6	0	0	0	0	0	0.06	0.04	0.68	0	0	No EWM found
6A	0.03	0	0.09	0	0	0	0	0	0.03	<<<1-3; 2	Small, canopied mat
6AA	0.01	0	0	0	0	0	0	0	0.01	<1-3; 1	Regular towers
7	0	0	0	0	0.11	0.01	0	0.10	0	0	No EWM found
8	0	0	0	0	0	0	0	0.06	0	0	No EWM found
9	0	0	0	0	0	<0.01	0	0.80	0	0	No EWM found
10	0	0	0	0	0	0	0	0.14	0	0	No EWM found
11	0	0	0	0	0	0	0	0.01	0	0	No EWM found
12	0.10	0	0	0	0	0	0	0.05	0.10	<<<<1-3; 1	Scattered dense towers
13	0	0	0	0	0	0	0	0.03	0	0	No EWM found
14	0.01	0	0	0	0	0	0	0	0.01	<<<<1-3; 1	Regular towers
15	<0.01	0	0	0	0	0	0	0	<0.01	<<<<1-2; <1	Regular towers – RR*
Total	0.72	0.00	0.31	0.25	1.77	1.18	0.71	2.70	+0.72		

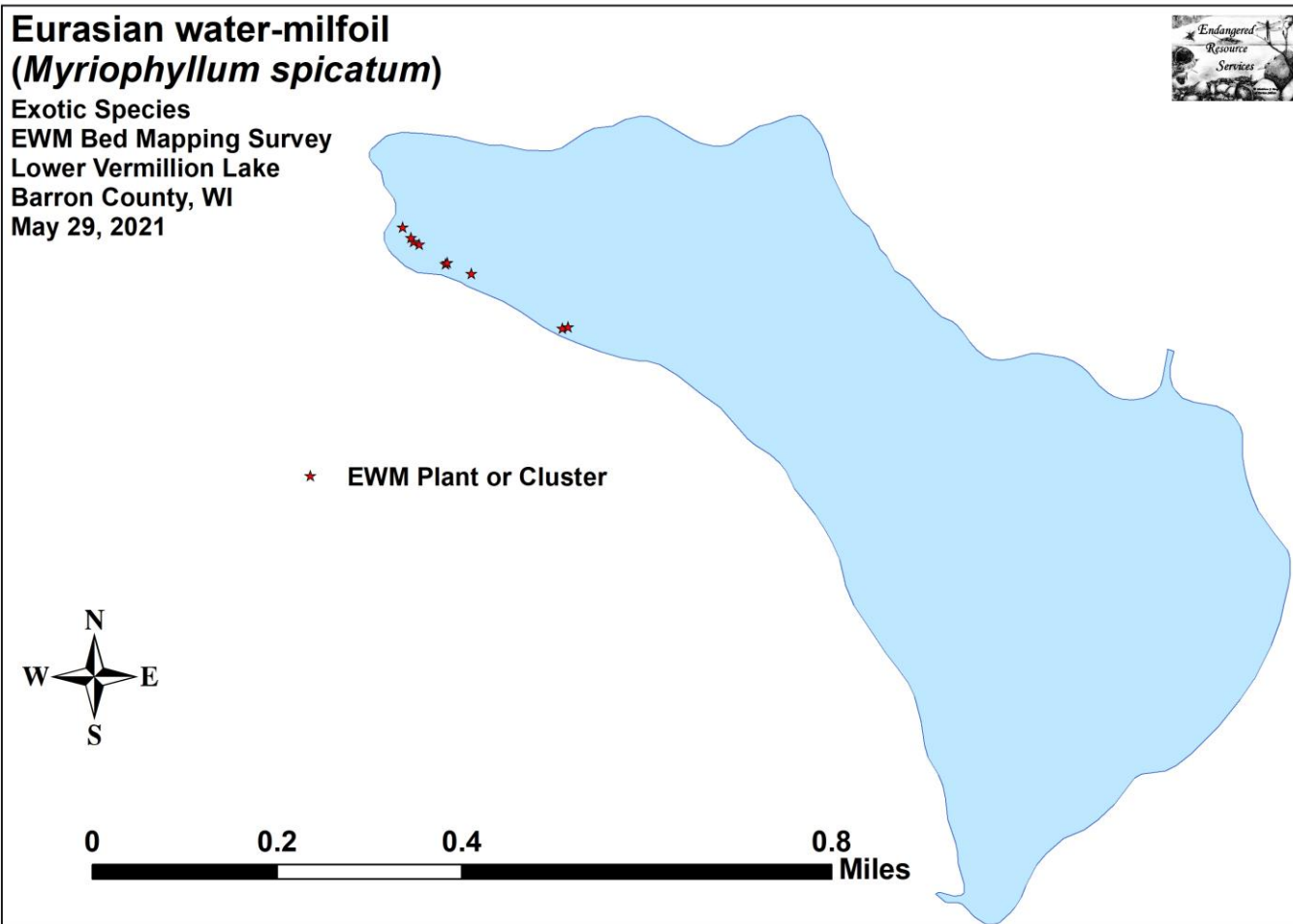
***RR = Rake Removed**

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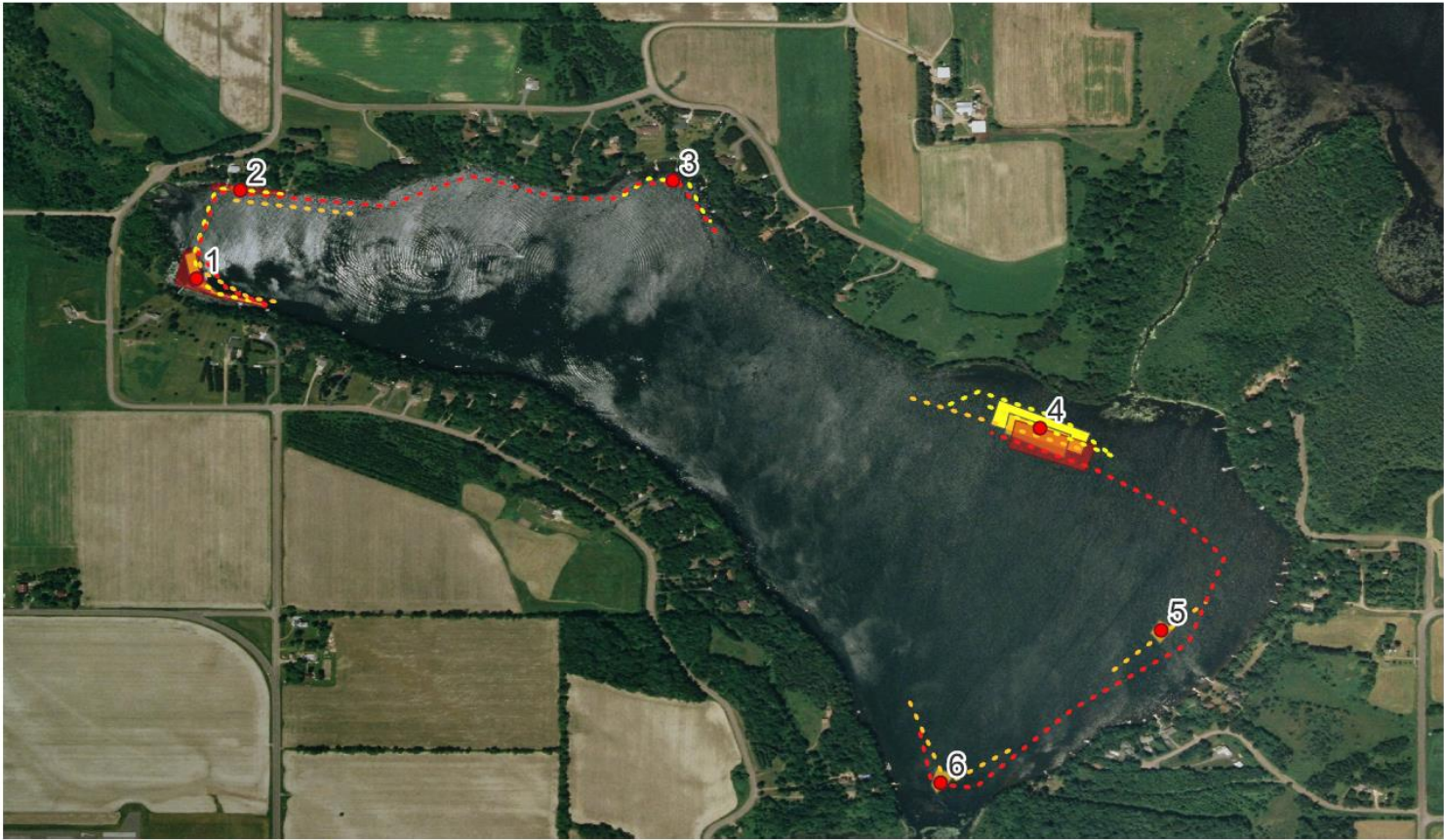
Appendix I: Early-season EWM Density and Distribution



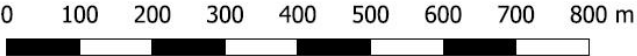


Appendix II: June-August 2021 Dive Removal Locations

Lower Vermillion 2021 EWM Dive Removal



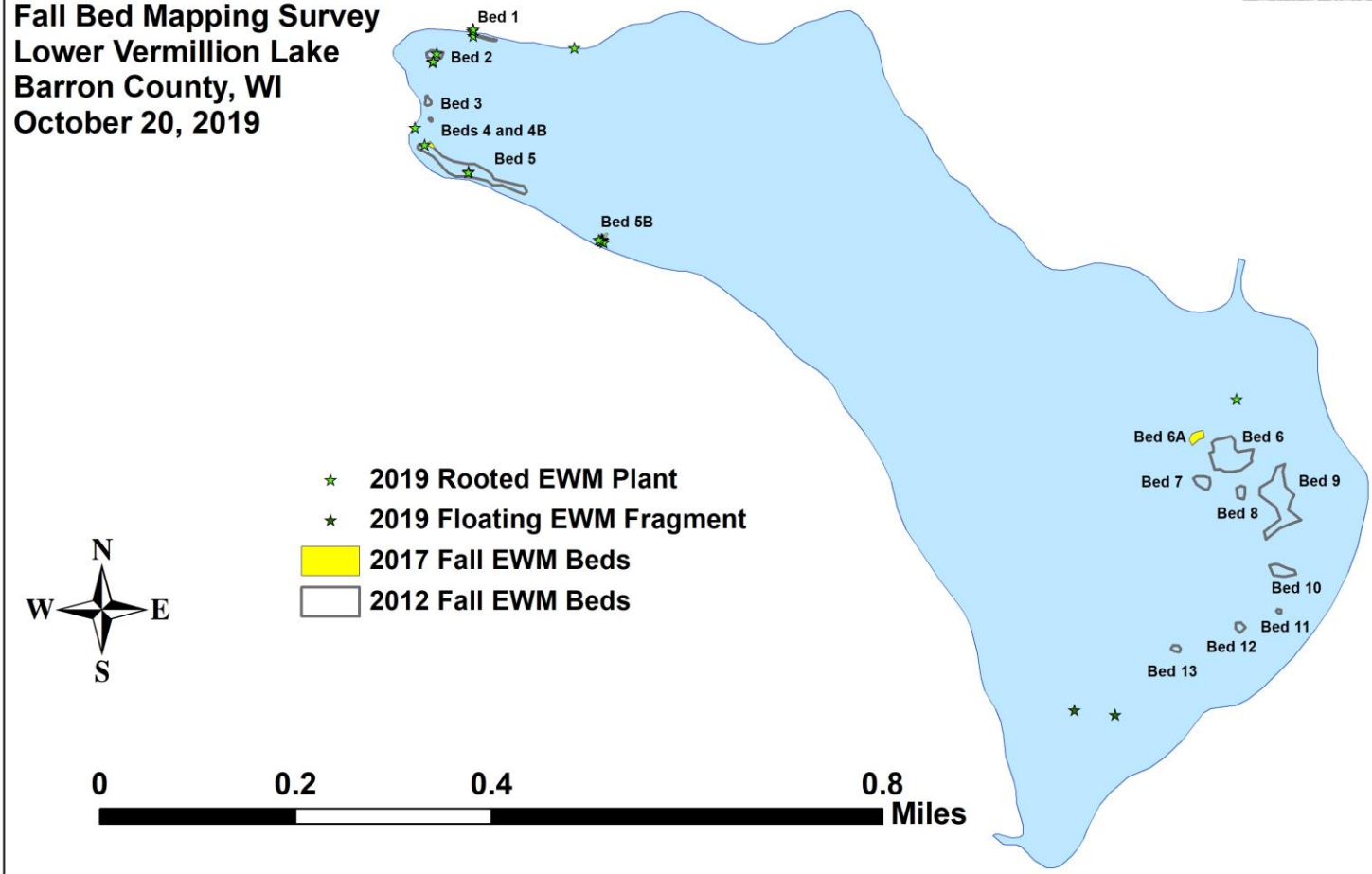
- 8-14-2021 Visual Search
- 7-1-2021 Visual Search
- 6-9-2021 Visual Search
- 8-14-2021 Dive Removal
- 7-1-2021 Dive Removal
- 6-9-2021 Dive Removal



Appendix III: Fall 2019 and 2021 EWM Bed Maps

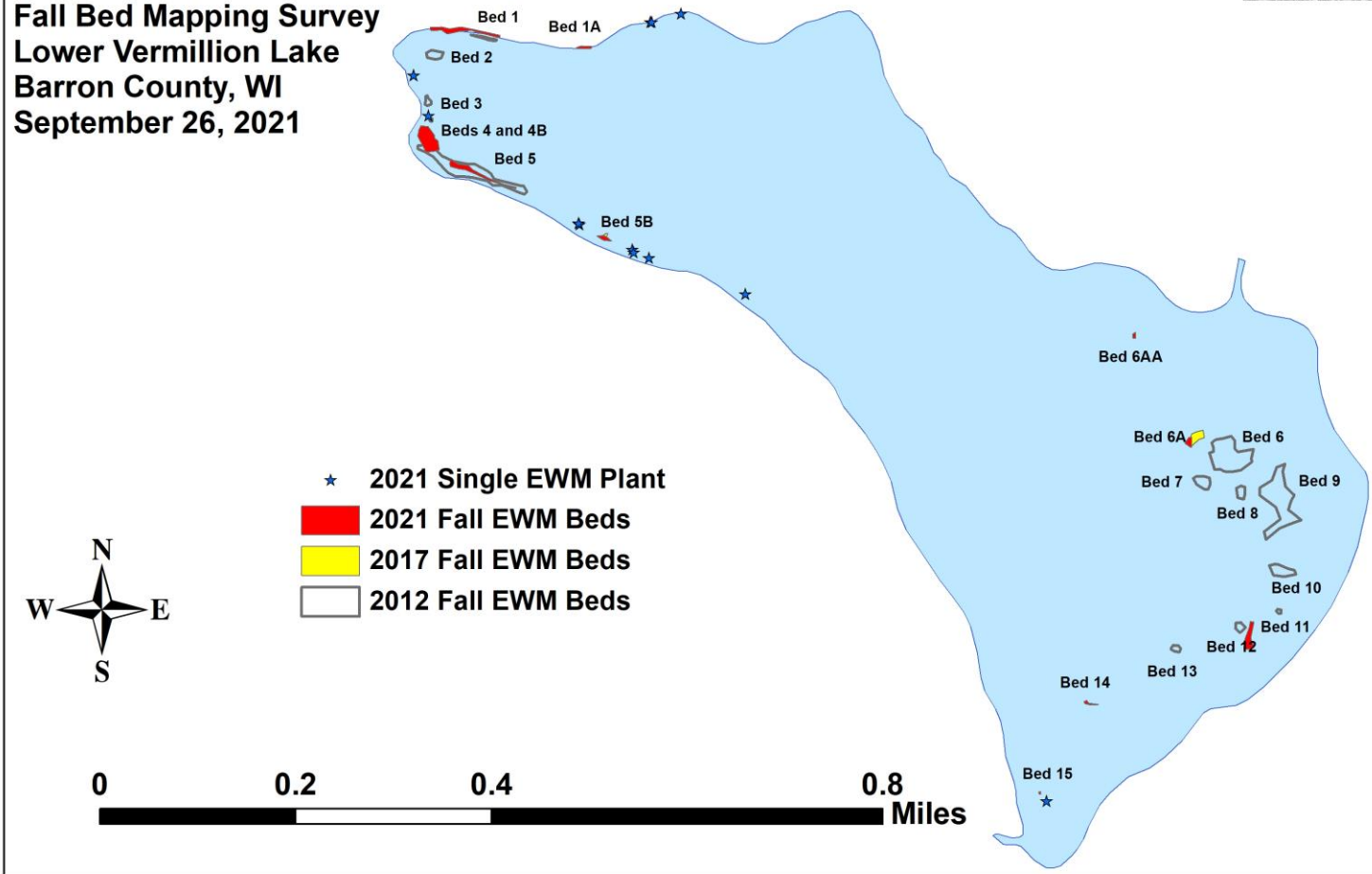
Eurasian water-milfoil (*Myriophyllum spicatum*)

Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
October 20, 2019



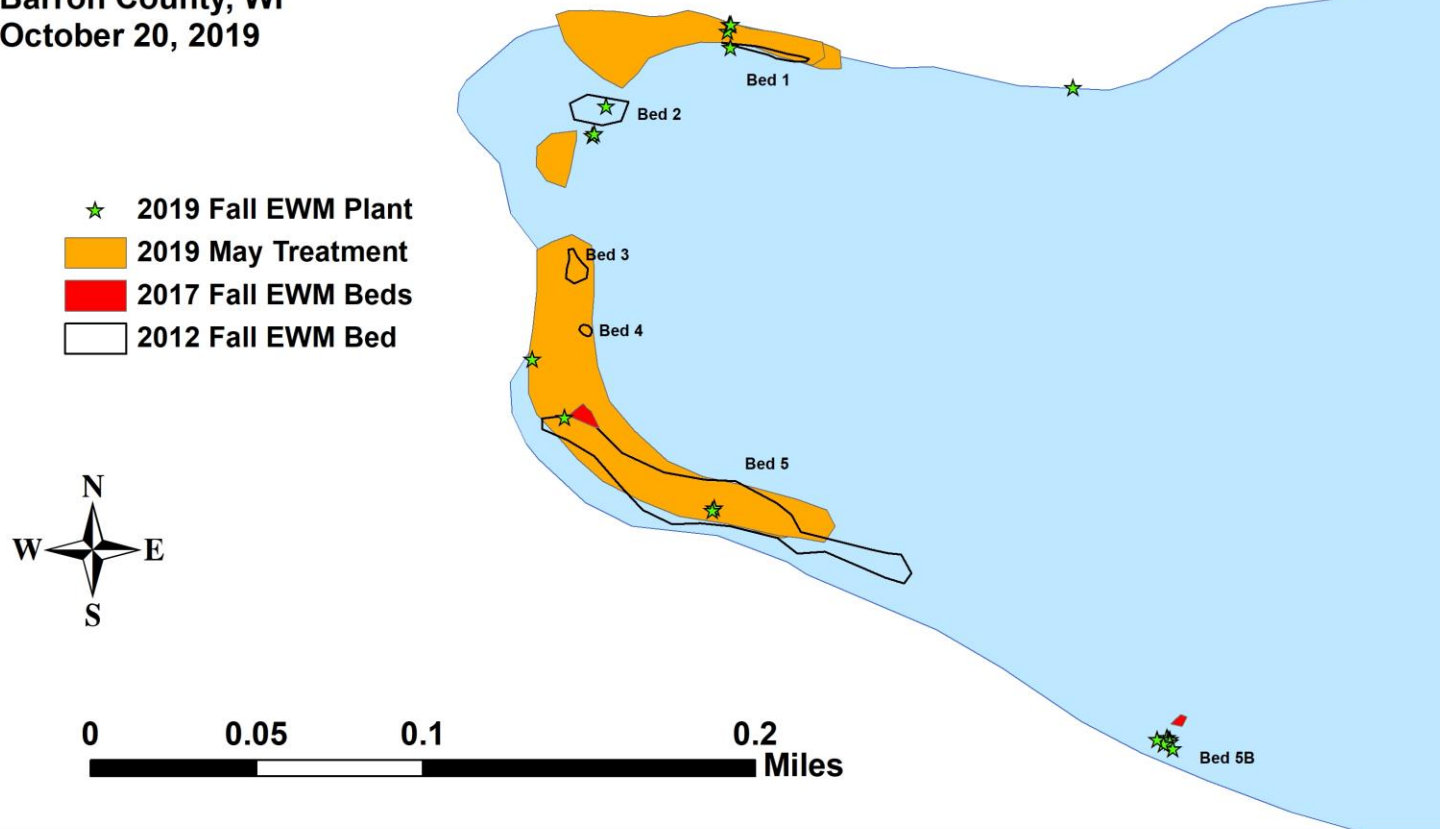
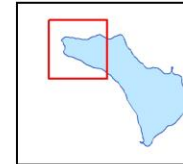
Eurasian water-milfoil (*Myriophyllum spicatum*)

Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
September 26, 2021



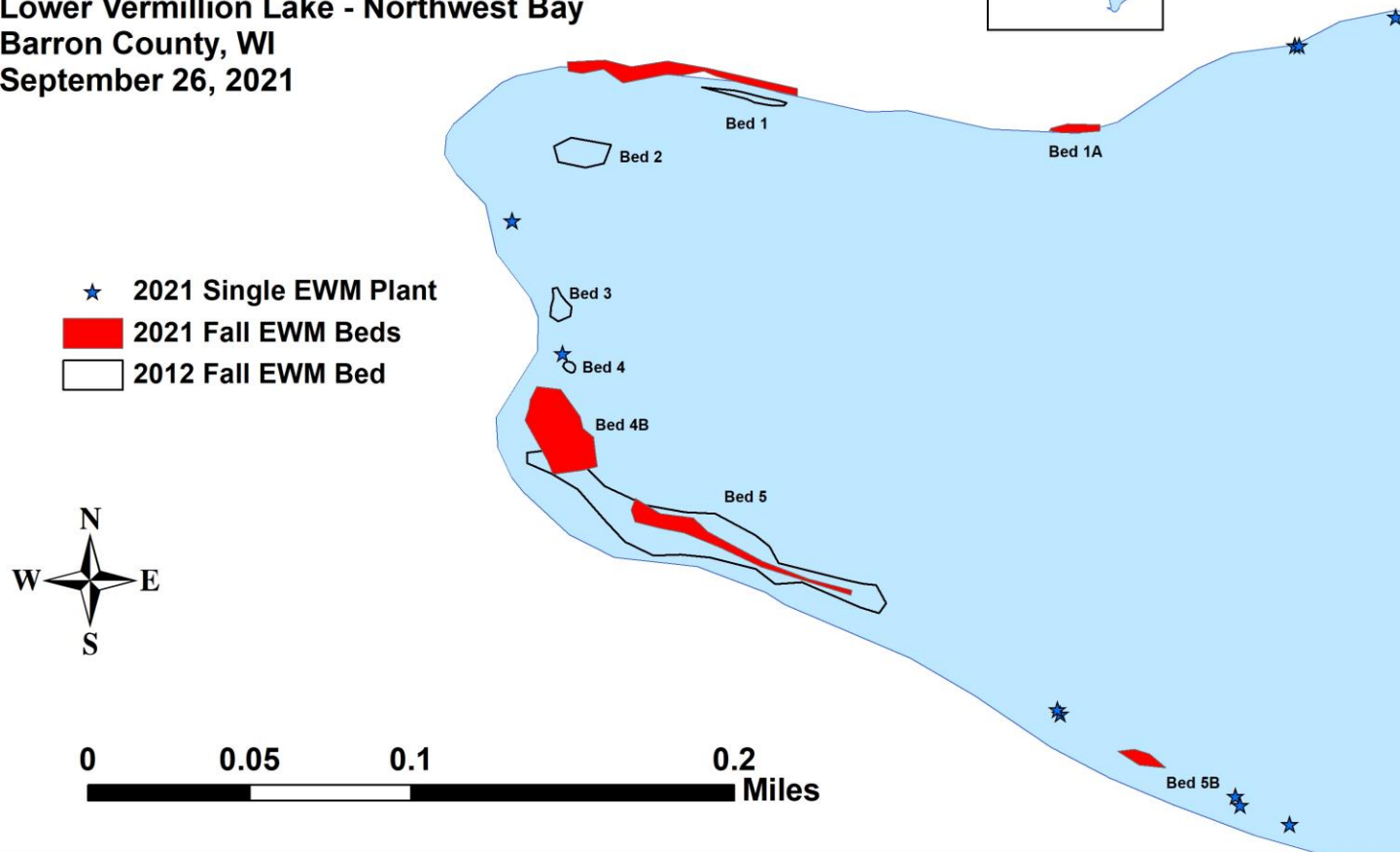
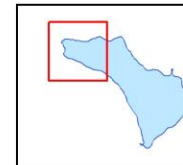
Eurasian water-milfoil (*Myriophyllum spicatum*)

Fall Bed Mapping Survey
Lower Vermillion Lake - Northwest Bay
Barron County, WI
October 20, 2019



Eurasian water-milfoil (*Myriophyllum spicatum*)

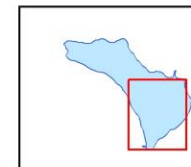
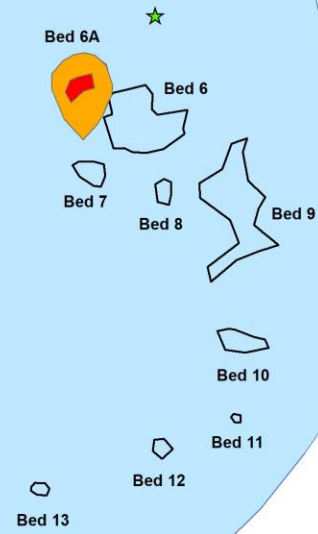
Fall Bed Mapping Survey
Lower Vermillion Lake - Northwest Bay
Barron County, WI
September 26, 2021



Eurasian water-milfoil
(*Myriophyllum spicatum*)
Fall Bed Mapping Survey
Lower Vermillion Lake - East Bay
Barron County, WI
October 20, 2019



- ★ 2019 Rooted EWM Plant
- ★ 2019 Floating EWM Fragment
- 2017 Fall EWM Bed
- 2019 Treatment
- 2012 Fall EWM Bed



Eurasian water-milfoil
(*Myriophyllum spicatum*)
Fall Bed Mapping Survey
Lower Vermillion Lake - East Bay
Barron County, WI
September 26, 2021



- ★ 2021 Single EWM Plant
- 2021 Fall EWM Beds
- 2012 Fall EWM Bed

