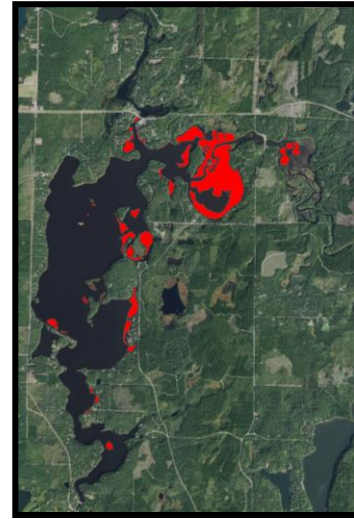


**Eurasian Water-milfoil (*Myriophyllum spicatum*)  
Late Summer Bed Mapping Survey  
Minong Flowage - (WBIC: 2692900)  
Washburn and Douglas Counties, Wisconsin**



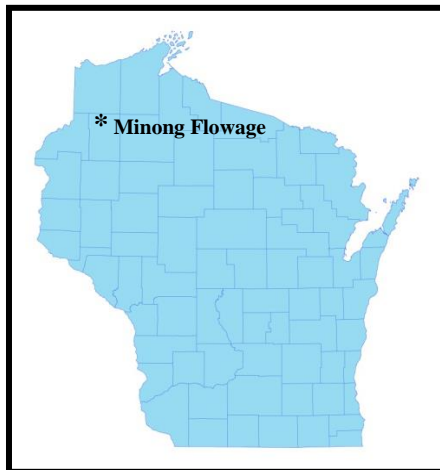
EWM among the rice in the Totagatic Inlet 9/19/21



September 2021 EWM Beds

**Project Initiated by:**

Minong Flowage Association, Lake Education and Planning Services, LLC  
and the Wisconsin Department of Natural Resources



Japanese knotweed – a new exotic species found on the flowage 9/19/21

**Survey Conducted by and Report Prepared by:**

Endangered Resource Services, LLC  
Matthew S. Berg, Research Biologist  
St. Croix Falls, Wisconsin  
September 19, 2021

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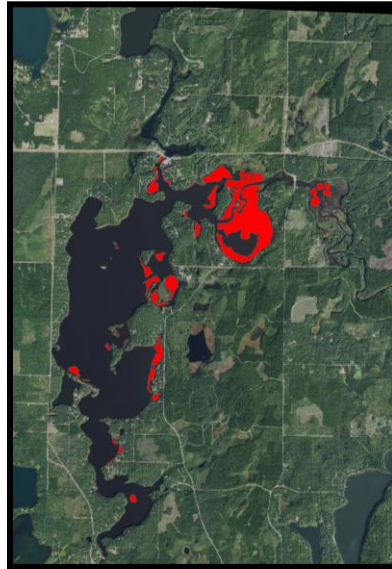
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## INTRODUCTION:

The Minong Flowage (WBIC 2692900) is a 1,564-acre eutrophic/mesotrophic drainage lake located in north-central Washburn County and south-central Douglas County, Wisconsin in the Towns of Minong and Wascott (T42N R13W) (Figure 1). It reaches a maximum depth of 21.5ft near the dam on the far south end and has an average depth of approximately 9ft. The bottom is predominately sand and sandy muck in the south basin and organic muck in the northern bays. Secchi disc readings from 1994-2021 have ranged from 2-6ft and averaged 3.9ft (WDNR 2021). This poor to very poor clarity produced a littoral zone that extended to a maximum of 10ft in 2021.



**Figure 1: 2021 September EWM Beds**

## BACKGROUND AND STUDY RATIONALE:

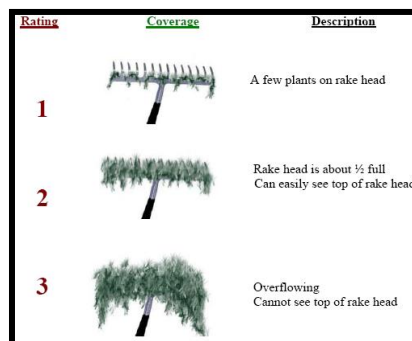
Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) was first identified in the Minong Flowage in 2002. From 2009-2011, the Minong Flowage Association (MFA), under the direction of Dave Blumer (Lake Education and Planning Services, LLC - LEAPS), actively managed the infestation using herbicide treatments and manual removal as outlined in the flowage's Wisconsin Department of Natural Resources (WDNR) approved Aquatic Plant Management Plan (APMP). Chemical treatments were suspended in 2012, but the 5ft drawdown to repair the dam in spring 2013 and extended period of freezing over the winter appeared to have killed all surviving terrestrial EWM beds. The subsequent refill in spring 2014 also eliminated most surviving aquatic individuals as the flowage's stained water prevented sufficient light penetration to allow these plants to survive.

Following the drawdown, EWM quickly began recolonizing shallow habitats that were now largely devoid of any native plants/competition. During our fall 2014 EWM bed mapping survey, we found just ten beds totaling 14.02 acres; but, by fall 2015, this had grown to 11 beds covering 90.36 acres. In 2016, the MFA used herbicides to treat a single EWM bed that covered 26.90 acres in the WDNR boat landing bay on the flowage's east side. Although this area remained clear throughout the rest of the growing

season, our 2016 fall mapping survey found 24 EWM beds covering 125.58 acres scattered throughout the rest of the flowage. This total jumped to 27 beds but shrank to 112.88 acres in 2017 before ballooning to 31 beds covering 141.88 acres in 2018 (9.07% of the flowage's surface area). Inexplicably, the August 2019 survey documented a sharp decline in both the number and coverage of beds (25 beds/85.27 acres/5.45% of the flowage's surface area). We also noted the EWM appeared to be in very poor health with many plants presenting blackened stems and only a whorl or two of green leaflets (see cover of 2019 report). As in 2018 and 2019, because most of these beds occurred in the northeast bays, it was ultimately decided **NOT** to do any active management on the flowage in 2020. However, in order to track EWM's coverage and to determine if levels would justify a future drawdown or other management, LEAPS, the MFA, and the WDNR requested a EWM bed mapping survey on August 30, 2020. This survey found 28 beds again covering 112.13 acres (7.17% of the total surface area). More worrying, plants were beginning to appear at depths greater than 5ft in areas where EWM hadn't been present in numbers since active management was initiated in 2009. Because of this, it was decided that another drawdown to freeze out EWM would occur over the winter of 2021-2022. To quantify the level of EWM prior to the drawdown, we were asked to complete a final bed mapping survey immediately prior. This report is the summary analysis of that survey conducted on September 19, 2021.

## METHODS:

During the bed mapping survey, we searched the flowage's visible littoral zone. By definition, a "bed" was determined to be any area where we visually estimated that Eurasian water-milfoil 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. Once located, 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 range and 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.



**Figure 2: Rake Fullness Ratings**



## RESULTS AND DISCUSSION:

### September Eurasian Water-milfoil Bed Mapping Survey:

During the September 2021 survey, we located and mapped 34 Eurasian water-milfoil beds that covered 205.85 acres or 13.16% of the flowage's surface area (Figure 3) (Appendix I). This was an increase of 93.72 acres (+83.58%) from the 28 beds on 112.13 acres (7.17% coverage) we mapped in 2020 (Table 1). It also represented the highest total found since active management began (Table 2).

Most of the increase in coverage seen in 2021 came from deepwater expansion in the north bays; especially around Serenity Bay where we saw plants in up to 10ft of water. Unlike in the previous two years when many plants in these bays seemed dormant or nearly so, we documented a general uptick in plant health with most beds showing active canopied growth. We also noted floating fragments were abundant throughout the entire flowage.

The majority of the flowage's EWM beds were likely causing at least minor and occasionally moderate impairment to watercraft (Table 1). Although most of the densest areas continued to occur among the stump fields in the northeast bays, beds along residential shorelines were showing noticeably increased growth.

In addition to EWM, we noted that the Japanese knotweed we first documented in 2020 had started to expand along the shoreline. This aggressive exotic species can be difficult to control once established, and we again encourage the board to work with the landowner to immediately remove the plants present (see cover of the report showing clusters of plants along the shoreline of a brown house just east of the "T" when leaving the south basin at GPS DD coordinates N46.16724 W91.92250).

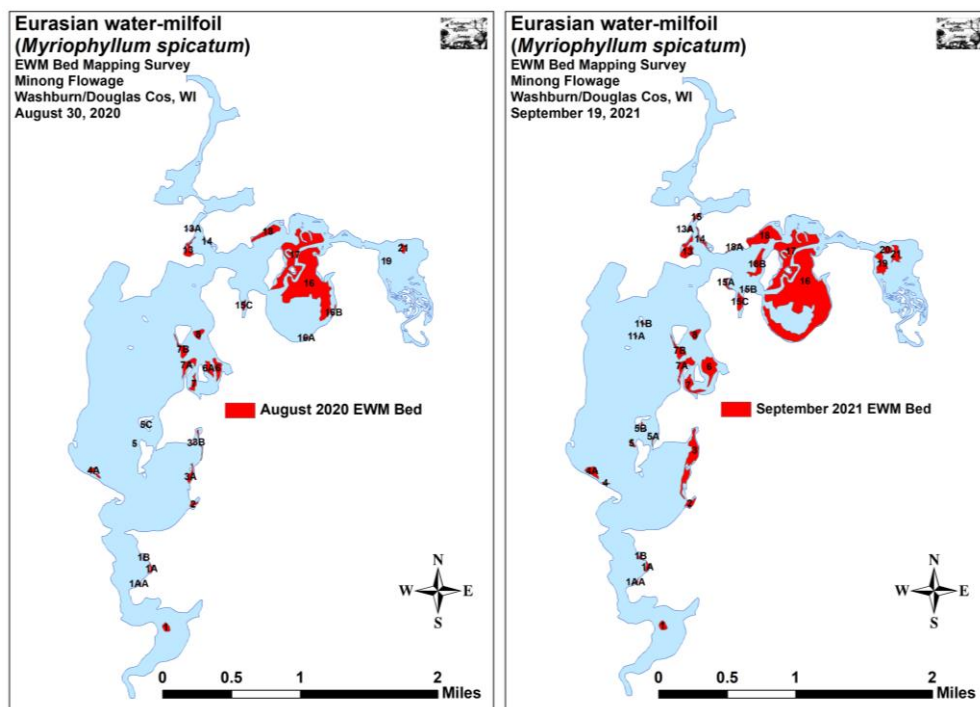


Figure 3: Late Summer EWM Beds 2020 and 2021

**Table 1: Late Summer Eurasian Water-milfoil Bed Mapping Summary  
Minong Flowage, Washburn and Douglas Counties  
August 30, 2020 and September 19, 2021**

Bed Number	2021 Area in acres	2020 Area in acres	2020-2021 Change in Acreage	Est. Rake Range/ Mean Rake Full.	Depth Range/ Mean Depth	Navigation Impairment	2021 Field Notes
1	1.91	1.69	0.22	2-3; 3	3-6; 4	Severe	Dense canopied mat.
1AAA	0	0	0	<<<1	2-4; 3	None	Only a few plants seen.
1AA	0.40	0.28	0.12	<<1-3; 2	2-6; 4	Moderate	Mixed with NWM.
1A	1.00	0.79	0.21	<<1-3; 2	2-6; 4	Moderate	Plants increasingly common in deep water.
1B	0.61	0.43	0.18	<<1-3; 2	2-6; 4	Moderate	Plants filling in shallow bay.
2	1.75	0.90	0.85	<<<1-3; 1	2-5; 3	Minor	Mixed with natives; patchy.
3 (A/AA/B)	11.59	2.91	8.68	<<<1-3; 2	2-6; 4	Moderate	Giant merged bed of varying density.
4	0.31	0	0.31	<1-3; 1	2-6; 4	Minor	Newly established.
4A	3.02	1.39	1.63	<1-3; 3	2-6; 4	Severe	Monotypic canopied mat.
5	0.78	0.30	0.48	2-3; 2	2-6; 5	Moderate	Increasing density on bar.
5A, B, C, D	0.83	0.14	0.69	<<1-2; 1	2-5; 3	Minor	Shoreline ribbon.
6 and 6A	8.58	5.79	2.79	<<1-3; 2	4-6; 5	Moderate	Many plants prop-clipped; frags everywhere.
7 and 7AA	4.43	1.95	2.48	<<<1-3; 1	3-6; 4	Minor	Many plants prop-clipped; frags everywhere.
7A	4.48	3.23	1.25	<1-3; 2	2-7; 5	Moderate	Prop-clipped on edges.
7B	3.37	2.98	0.39	<1-3; 2	2-7; 5	Moderate	Prop-clipped throughout.
8	2.42	2.31	0.11	2-3; 3	3-6; 4	Severe	Dense canopied bed at channel outlet.
9, 10, and 11	0	0	0	0	-	None	No EWM seen.
11A and 11B	0.36	0	0.36	<<1-2; 1	4-6; 5	Minor	New low-density beds between the islands.
12	0	0	0	0	-	None	No EWM seen.
13	5.25	2.62	2.63	<<1-3; 2	2-8; 6	Moderate	Expanding into deep water.
13A	0.61	0.45	0.16	<<<1-2; <<1	2-6; 4	None	Scattered, but regular plants.
14	1.22	0.29	0.93	<<1-3; 2	2-7; 4	Moderate	Sig. expansion - EWM/HWM/NWM mixed.
15	0.75	0	0.75	<<1-3; 1	2-8; 6	Minor	Newly established.
15A	0.93	0	0.93	<<<1-1; <1	3-6; 4	None	Newly establish/nearly continuous along shore.
15B and 15C	3.01	0.86	2.15	<<<1-3; 1	3-6; 4	Minor	Patchy clusters in thumb bay.
16 and 16A/B	90.74	51.30	39.44	<<<1-3; 2	3-10; 8	Moderate	Expanding into deep water.
17	27.87	25.08	2.79	<<<1-2; 1	2-5; 4	Minor	Stump field – most a HDA among rice.
18 and 18A/B	19.20	5.36	13.84	<<<1-3; 1	2-7; 4	Minor	Fragmented in deeper water; mixed with natives.
19	5.23	0.20	5.03	<<<1-3; 2	2-5; 3	Moderate	Dense mat, but low in rice.
20, 21, and 22	5.16	1.12	4.04	<<1-3; 1	2-5; 3	Minor	Regular EWM reestablishing among rice beds.
<b>Total</b>	<b>205.85</b>	<b>112.13</b>	<b>+93.72</b>				

**Table 2: Late Summer/Fall Eurasian Water-milfoil Bed Mapping Summary  
Minong Flowage, Washburn and Douglas Counties  
2015-2021**

<b>Bed Number</b>	<b>2021 Area in Acres</b>	<b>2020 Area in Acres</b>	<b>2019 Area in Acres</b>	<b>2018 Area in Acres</b>	<b>2017 Area in Acres</b>	<b>2016 Area in Acres</b>	<b>2015 Area in Acres</b>	<b>2021 Change in Acreage</b>
1	1.91	1.69	1.71	1.72	1.62	1.40	0.50	0.22
1AAA	0	0	0.07	0	0	0	0	0
1AA	0.40	0.28	0.31	0.32	0.23	0.33	0	0.12
1A	1.00	0.79	0.50	0.56	0.22	0.81	0.58	0.21
1B	0.61	0.43	0.47	0.68	0.47	0.48	0.31	0.18
2	1.75	0.90	0.63	1.77	1.66	1.80	1.40	0.85
3 (A/AA/B)	11.59	2.91	2.81	2.74	3.20	4.61	1.96	8.68
4	0.31	0	0	0	0	0	0	0.31
4A	3.02	1.39	0.62	1.14	0.09	1.05	0	1.63
5	0.78	0.05	0.30	0.42	0.15	0.30	0	0.48
5A, B, C, D	0.83	0.14	0.29	0.66	0.27	1.49	0	0.69
6 and 6A	8.58	5.79	6.84	11.50	1.06	0	16.39	2.79
7 and 7AA	4.43	1.95	1.34	2.19	0	0	1.23	2.48
7A	4.48	3.23	2.38	3.48	2.41	0.75	0	1.25
7B	3.37	2.98	2.48	2.73	1.50	1.46	0	0.39
8	2.42	2.31	2.13	2.10	1.55	0.76	0.18	0.11
9, 10, and 11	0	0	0	0	0	0	0	0
11A and 11B	0.36	0	0	0	0	0	0	0.36
12	0	0	0	0	0	0	0	0
13	5.25	2.62	1.53	2.56	3.11	0.85	0	2.63
13A	0.61	0.45	0	0.31	0.45	0	0	0.16
14	1.22	0.29	0	0.67	0.47	0.31	0	0.93
15	0.75	0	0	0	0	0	0	0.75
15A	0.93	0	0	0.22	0.18	0.10	0	0.93
15B and 15C	3.01	0.86	0.56	1.49	0.88	0.09	0	2.15
16 and 16A/B	90.74	51.30	32.80	58.54	54.45	75.32	43.08	39.44
17	27.87	25.08	21.99	29.05	26.05	24.27	19.43	2.79
18 and 18A	19.20	5.36	4.68	10.73	8.00	7.61	5.30	13.84
19	5.23	0.20	0.12	3.21	3.51	1.80	-----	5.03
20, 21 and 22	5.16	1.12	0.70	3.10	1.37	0	0	4.04
<b>Total</b>	<b>205.85</b>	<b>112.13</b>	<b>85.27</b>	<b>141.88</b>	<b>112.88</b>	<b>125.58</b>	<b>90.36</b>	<b>+93.72</b>



## **Descriptions of Current and Former Eurasian Water-milfoil Beds:**

Bed 1 – Eurasian water-milfoil covered the entire sandbar near the dam. Plants were much denser than in 2020, and we noted they were expanding into water over 5ft deep.

Beds 1A and 1AA – Despite being mixed with Northern water-milfoil (*Myriophyllum sibiricum*), EWM density in these southern side bays had thickened relative to 2020.

Bed 1B – Although this bed was also mixed with NWM, it was dominated by EWM in 2021. Scattered patches of Coontail (*Ceratophyllum demersum*) were mixed in making the entire area a moderate impairment.

Bed 2 – We found low-density EWM was scattered among moderately dense beds of Coontail. Plants were more widespread than in 2020, but the overall density remained low.

Beds 3, 3A and 3B – These three areas had merged into a nearly continuous moderate-density bed along much of the immediate shoreline area. In the northeast bay, EWM became patchy when it was mixed with Spatterdock (*Nuphar variegata*) and White water lily (*Nymphaea odorata*).

Beds 4 and 4A – The EWM bed just north of the county park and campground was also expanding into deeper water. At its core, Bed 4 was a severe impairment, and we noted it was full of prop-trails as people accessed their campsites on the southern shoreline.

Bed 5 – This monotypic bed showed significant expansion both in area and density. We also noted plants in water over 5ft.

Beds 5A-D – Beds 5A, 5B, and 5C were narrow ribbons along uninhabited shorelines. The area formerly covered by Bed 5D had only a handful of plants and looked like it had potentially frozen out again.

Beds 6, 6A, 7, and 7AA – EWM around the island in the WDNR landing bay was regular but still patchy. However, the mean density was greater than in 2020, and we noted that many plants in the main navigation channel leading away from the dock toward the Swift Nature Camp were prop-clipped. This area continues to have significant numbers of native pondweeds – especially Large-leaf pondweed (*Potamogeton amplifolius*), Ribbon-leaf pondweed (*Potamogeton epihydrus*), and Flat-stem pondweed (*Potamogeton zosteriformis*).

Beds 7A, 7B, and 8 – All three of these beds had numerous prop trails through them as boaters, who are potentially visiting the flowage and don't know the beds exist, tend to motor right through them on their way out from the WDNR landing.

Beds 9, 10, 11, and 12 – We found no EWM in these former beds.

Beds 11A and 11B – EWM was establishing on the edges of the exposed and sunken central sand islands.

Bed 13 – EWM was absent near shore in areas that had been solid in the past – presumably due to winterkill. However, the bay experienced a general thickening, and there were patches where the bed was becoming a canopied mat and at least a moderate impairment.

Beds 13A and 15 – EWM was again scattered in the bay southwest of Pogo’s making it more of a High Density Area than a true bed. The plant community was dominated by Coontail and native pondweeds; especially Fern pondweed (*Potamogeton robbinsii*).

Bed 14 – We again documented apparent Hybrid water-milfoil scattered among true EWM and true NWM in canopied beds stretching around the point. There were also significant amounts of Coontail and native pondweeds in the area.

Beds 15A, 15B, and 15C – In the “Thumb Bay” and the shorelines northwest and northeast of the bay, Coontail continued to be the dominant plant, but we found EWM was expanding; especially along the immediate shoreline.

Bed 16 – We were surprised to find that EWM had exploded in Serenity Bay. Plants were not only moderately dense throughout the majority of the bay, but they were also found in increasingly deep water – up to 10ft in many areas. Unfortunately, this likely means the drawdown will not be effective at eliminating EWM in many areas.

Bed 17 – Low density EWM continued to be mixed with the Northern wild rice (*Zizania palustris*) in the stump fields north of the channel.

Beds 18 and 18A – In Bed 18, patchy EWM was again mixed in with canopied beds of native species; especially Coontail. Around the point, Bed 18A was newly established, but already expanding into water over 5ft.

Bed 18B – The reemergence of EWM east of the island was also troubling. Plants were canopied in over 7ft of water, and this area also seems unlikely to be impacted by the drawdown.

Beds 19, 20, and 21 – Low to moderate density EWM had again reestablished through areas of low-density rice east of Smith’s Bridge. In general, rice and EWM densities were negative correlated with each species appearing to exclude the other when established in moderate to high densities.

Bed 22 – We saw no evidence of EWM in the area formerly covered by Bed 22.

## LITERATURE CITED

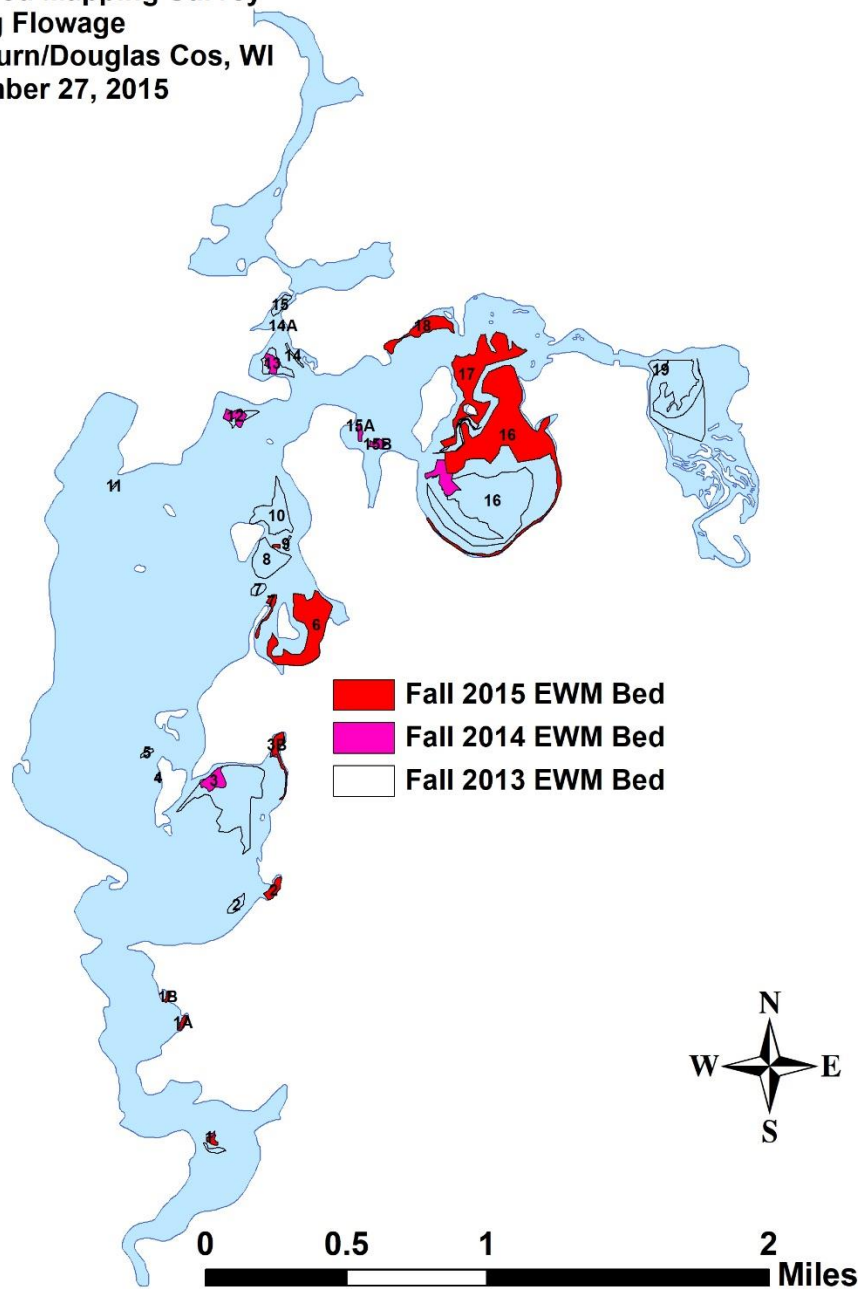
Pokorny, N., C. Busch, L. Sather, and C. Holt. [online]. 1966. Minong Flowage Map. Available from <http://dnr.wi.gov/lakes/maps/DNR/2692900a.pdf> (2021, September).

WDNR. [online]. 2021. Minong Flowage - Citizen Lake Water Quality Monitoring Database. Available from <http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2692900&page=waterquality> (2021, September).

## **Appendix I: 2015-2021 Late Summer/Fall Eurasian Water-milfoil Bed Maps**

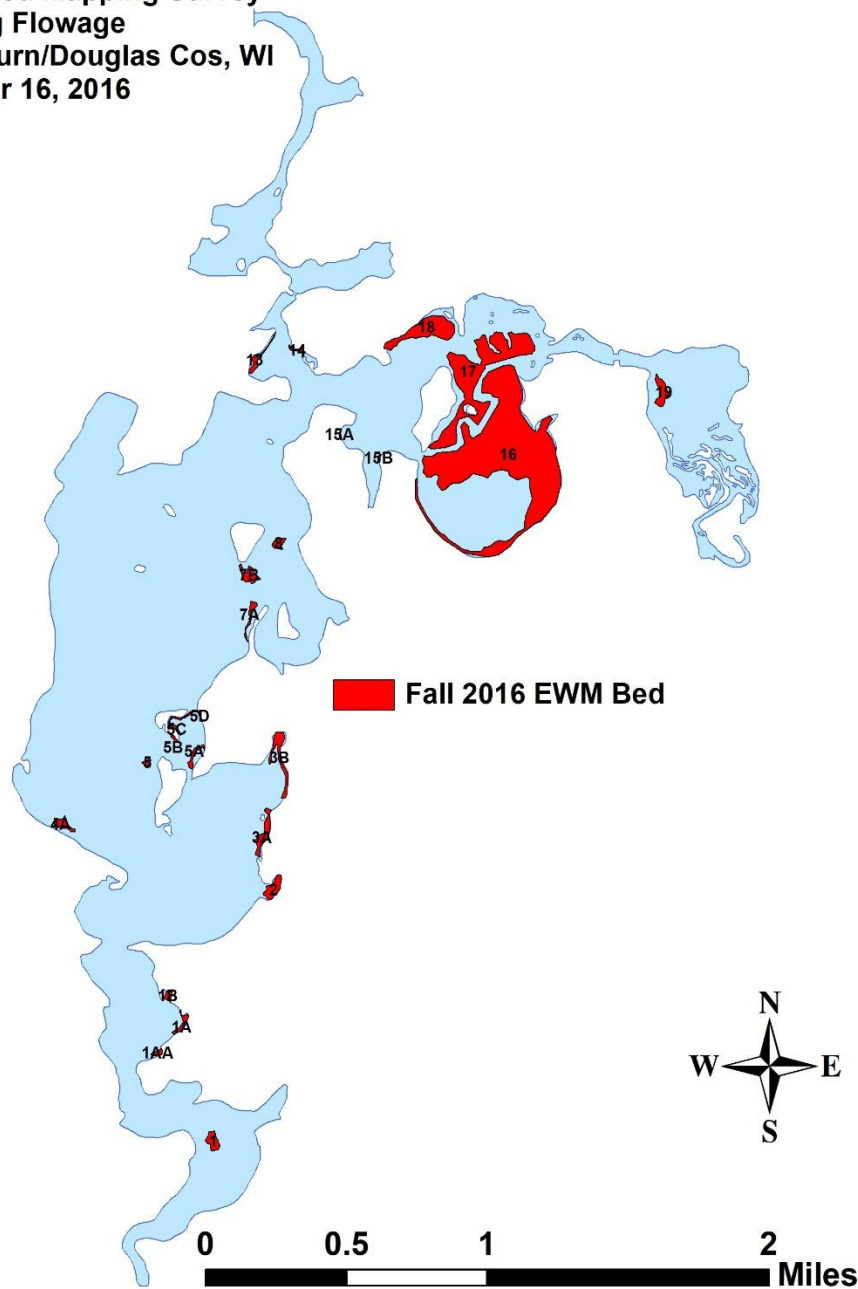
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EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
September 27, 2015



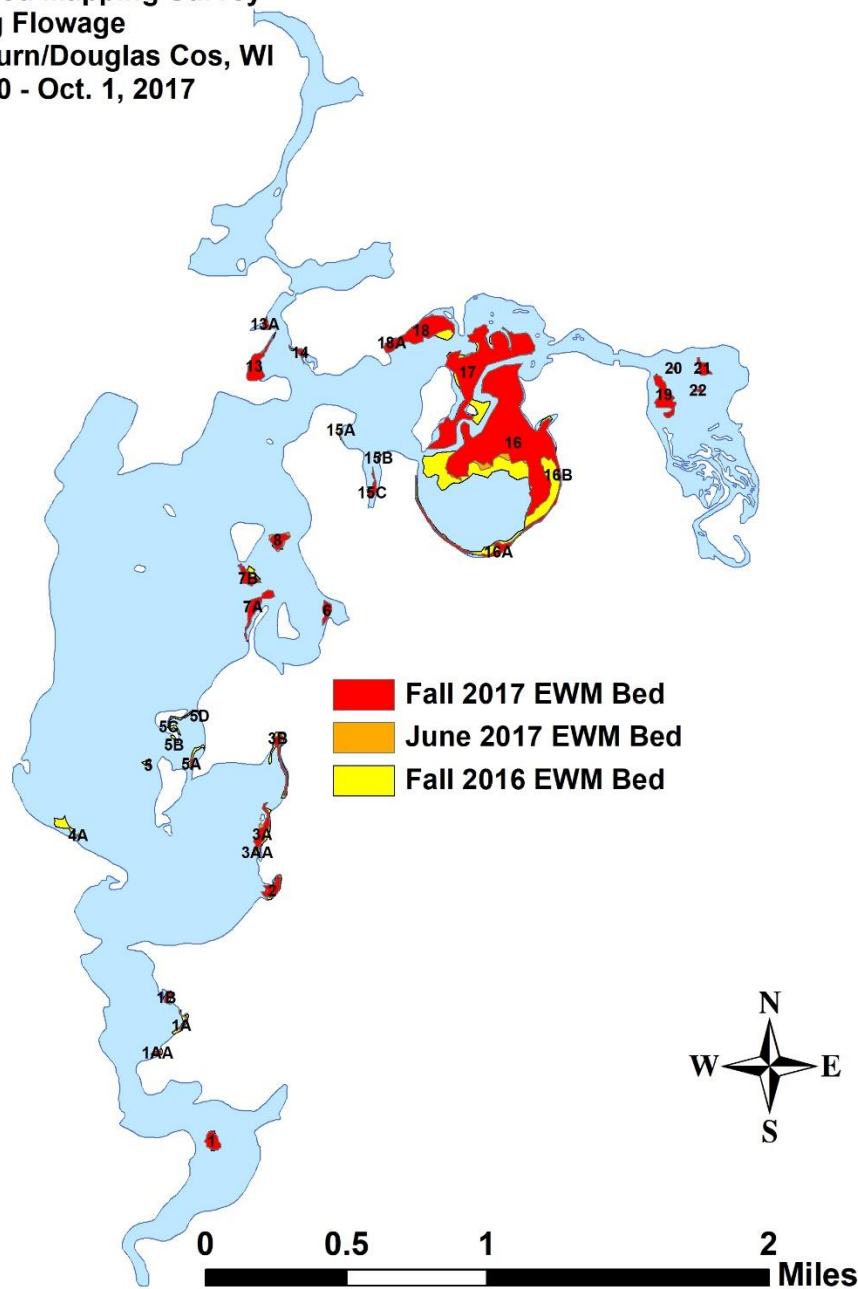
# Eurasian water-milfoil (*Myriophyllum spicatum*)

EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
October 16, 2016



# Eurasian water-milfoil (*Myriophyllum spicatum*)

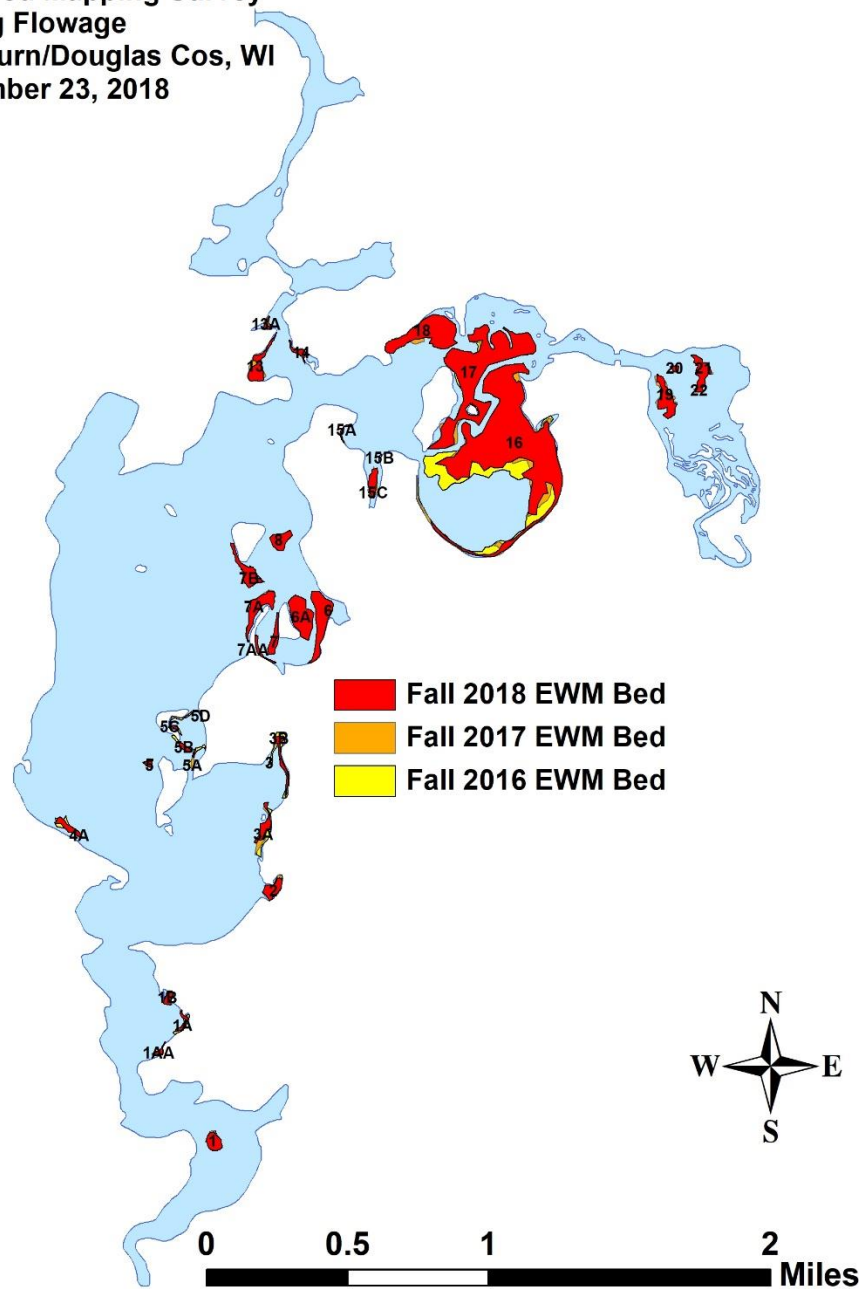
EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
Sept. 30 - Oct. 1, 2017





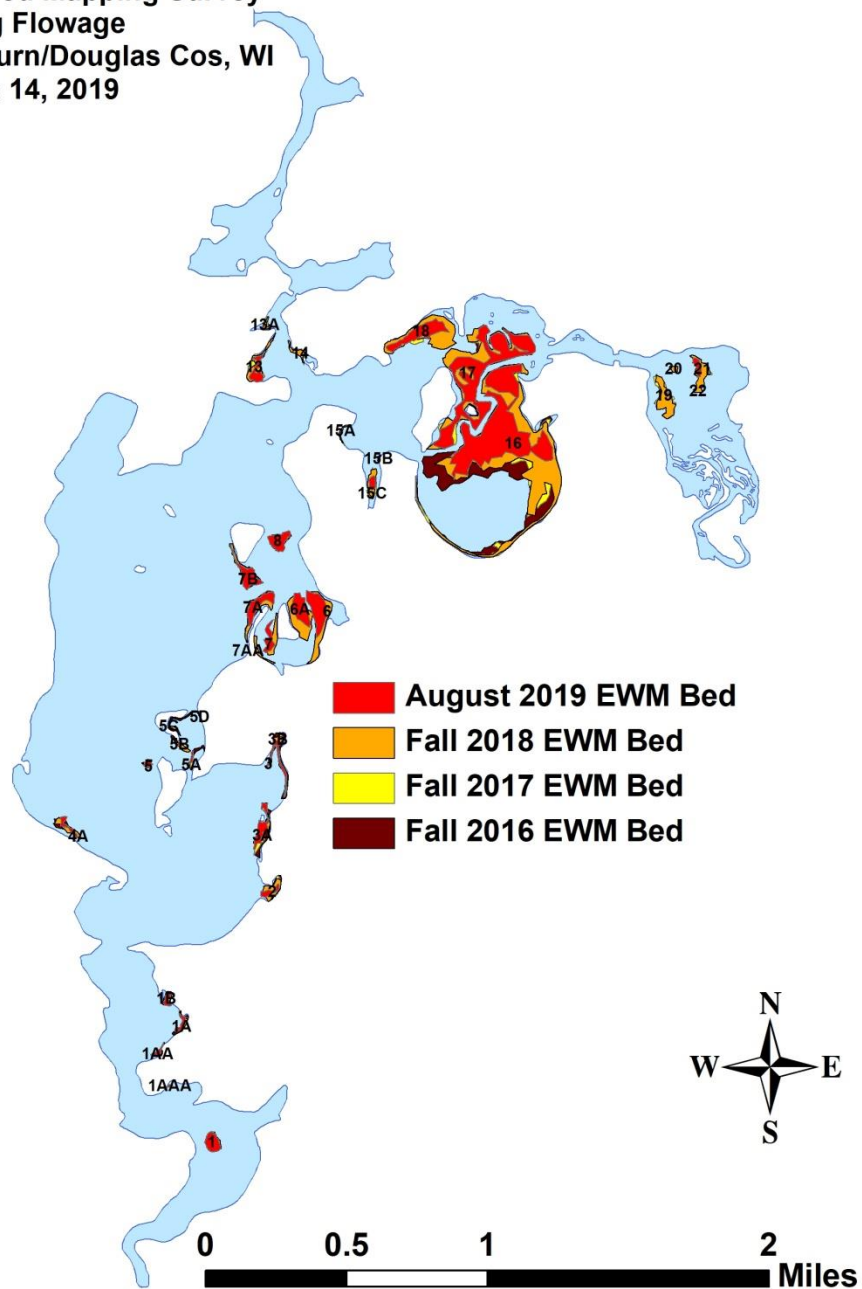
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EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
September 23, 2018



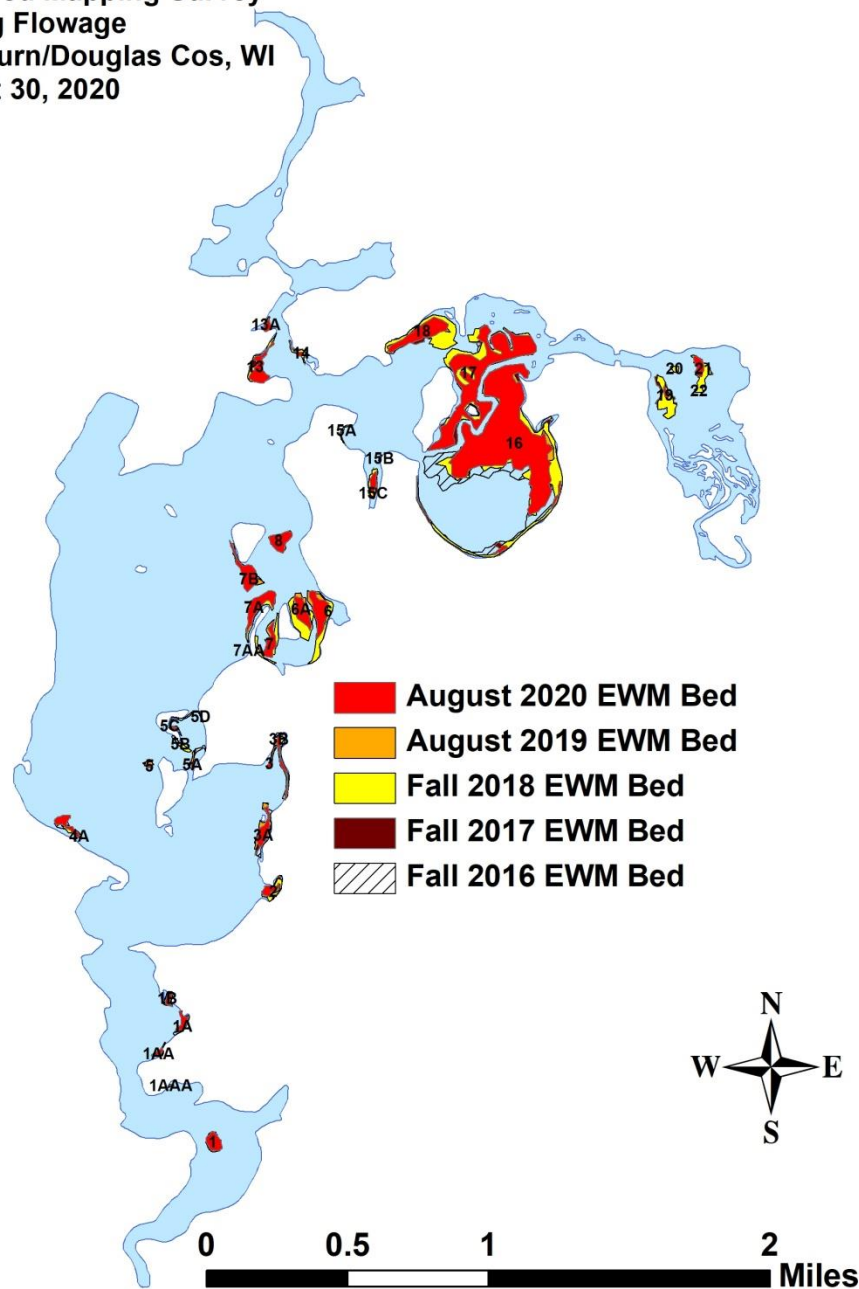
# Eurasian water-milfoil (*Myriophyllum spicatum*)

EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
August 14, 2019



# Eurasian water-milfoil (*Myriophyllum spicatum*)

EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
August 30, 2020



# Eurasian water-milfoil (*Myriophyllum spicatum*)

EWM Bed Mapping Survey  
Minong Flowage  
Washburn/Douglas Cos, WI  
September 19, 2021

