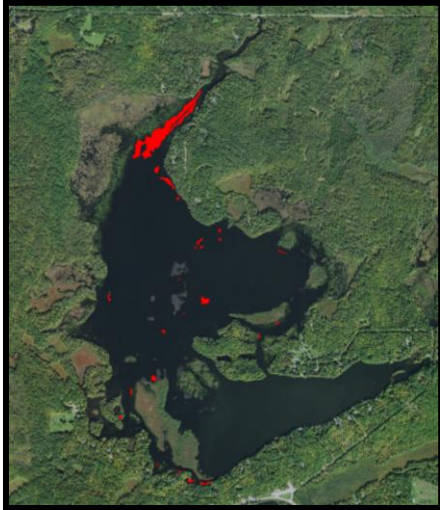


**Eurasian water-milfoil (*Myriophyllum spicatum*)  
Late Summer Bed Mapping Survey  
Mud Lake (WBIC: 2434800)  
Sawyer County, Wisconsin**



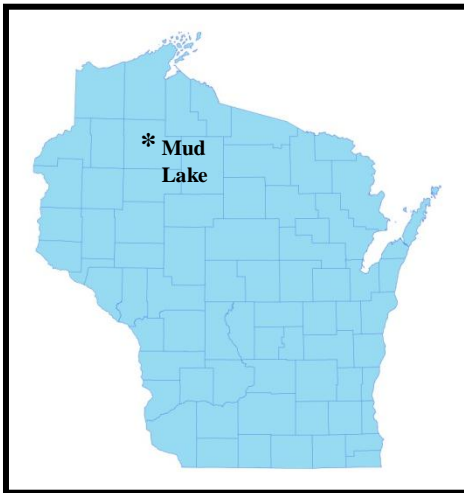
EWM beds on Mud Lake 9/5-6/20



Eurasian water-milfoil (Berg 2007)

**Project Initiated by:**

The Callahan and Mud Lakes Protective Association,  
Lake Education and Planning Services, LLC, and the  
Wisconsin Department of Natural Resources (Grant AEPP-610-20)



Canopied Eurasian Water-milfoil at the River Inlet - Mud Lake 9/5/20

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

Endangered Resource Services, LLC  
Matthew S. Berg, Research Biologist  
Saint Croix Falls, Wisconsin  
September 5-6, 2020

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## INTRODUCTION:

Mud Lake (WBIC 2434800) is a 464 acre drainage lake created by an 8ft dam on the north fork of the Chief River in north-central Sawyer County, Wisconsin in the Town of Round Lake (T41N R7W S27/28 and 33/34). It has a maximum depth of 15ft and an average depth of 6ft. The lake is mesotrophic in nature, and water clarity is good with summer Secchi readings averaging 11.1ft in 2020 (WDNR 2020). The lake's bottom substrate is primarily sand along the shoreline before transitioning to a sandy muck at most depths over 7ft (Bush et al. 1968) (Figure 1).

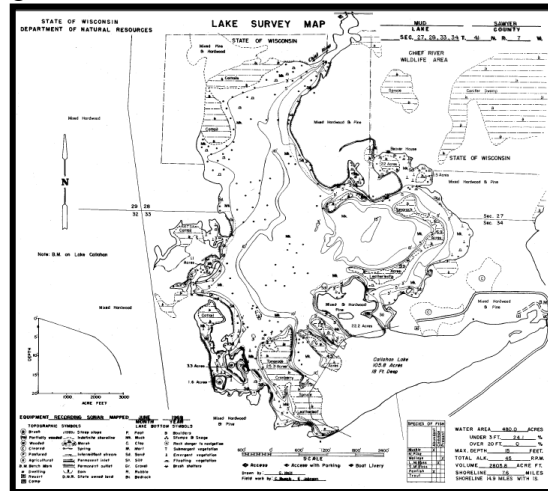


Figure 1: Mud Lake Bathymetric Map

## STUDY BACKGROUND AND RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) is an exotic invasive plant species that was first identified in Mud Lake in the fall of 2005. Following an initial whole lake point-intercept survey in 2008 (J. Williamson), the Callahan and Mud Lakes Protective Association (CMLPA) and the Sawyer County Land and Water Conservation Department (SCLWC - K. Maki) used a 2009 Wisconsin Department of Natural Resources (WDNR) rapid response grant (AIRR-060-09) to hire Ayres Associates to write the lakes' original Aquatic Plant Management Plan (APMP) that outlined herbicide applications to control the infestation (Kleczewski 2009). Since the APMP's approval by the WDNR, these small-scale treatments have occurred periodically based on low intensity delineation surveys by the applicator and/or the SCLWC.

Per WDNR expectations (Pamela Toshner/Alex Smith, WDNR – pers. comm.), whole lake plant surveys on actively managed lakes are normally repeated every five to seven years to remain current. In anticipation of updating their plan in 2021, the CMLPA – under the direction of Dave Blumer (Lake Education and Planning Services, LLC - LEAPS) – applied for and receive a WDNR planning grant (AEPP-61020) to help cover the cost of surveys and to update the APMP. In order to determine the current level of infestation, in addition to the point-intercept survey, the CMLPA, LEAPS, and the WDNR requested we complete a late-summer EWM bed mapping survey of the lake's visible littoral zone. These data will be used to determine the acreage and density of EWM to help guide any future management. This report is the summary analysis of that field survey conducted on September 5-6, 2020.

## METHODS:

### Late-Summer Eurasian Water-milfoil Bed Mapping Survey:

During the survey, we searched the visible littoral zone of the lake. By definition, a “bed” was determined to be any area where we visually estimated that EWM 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 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 mean depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (**none** – easily avoidable with a natural channel around or narrow enough to motor through/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – multiple prop clears and difficult to impossible to row through). These data were then mapped using ArcMap 9.3.1, and we used the WDNR’s Forestry Tools Extension to determine the acreage of each bed to the nearest hundredth of an acre. We also GPS marked additional individual EWM plants that occurred outside of the beds as they were generally few in number.




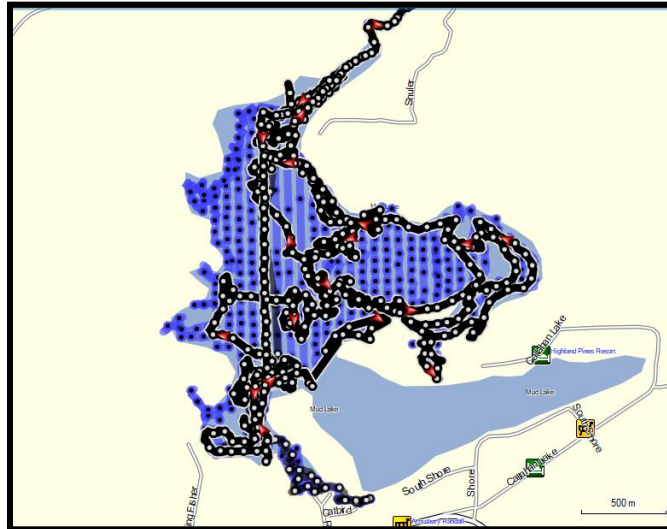
<u>Rating</u>	<u>Coverage</u>	<u>Description</u>
1		A few plants on rake head
2		Rake head is about ½ full Can easily see top of rake head
3		Overflowing Cannot see top of rake head

Figure 2: Rake Fullness Ratings (UWEX 2010)

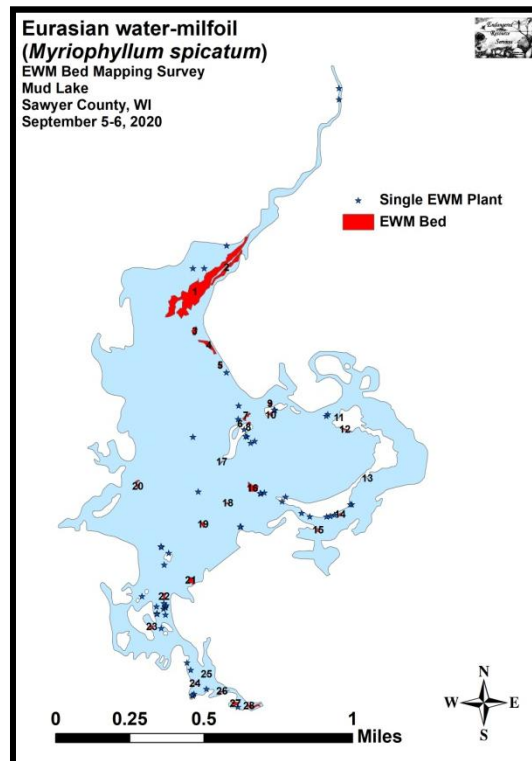
**RESULTS:**

**Late Summer Eurasian Water-milfoil Bed Mapping Survey:**

On September 5-6, 2020, we searched 36.8km (22.9 miles) of transects (black) throughout the lake’s visible littoral zone. This, coupled with the 42.8km (26.6 miles) of transects (blue) searched during the point-intercept survey resulted in a total search of 79.6km (49.5 miles) (Figure 3). Collectively, we mapped 28 beds that covered 11.06 acres (2.38% of the lake’s surface area) (Table 1). Outside of these areas, we marked 57 additional isolated plants (Figure 4) (Appendix I).



**Figure 3: September 5-6, 2020 EWM Littoral Zone Survey – GPS Tracks**



**Figure 4: September 5-6, 2020 Eurasian Water-milfoil Map**

**Table 1: Late Summer Eurasian Water-milfoil Bed Mapping Summary  
Mud Lake, Sawyer County  
September 5-6, 2020**

<b>Bed Number</b>	<b>2020 Acreage</b>	<b>Rake Range and Mean Rake Fullness</b>	<b>Depth Range and Mean Depth</b>	<b>Canopied</b>	<b>Navigation Impairment</b>	<b>2020 Field Notes</b>
1	7.18	<<1-3; 3	2-5; 4	Yes	Severe	Mat mixed with large amounts of WWM and native pondweeds.
2	0.92	<<1-2; 1	2-4; 3	Yes	Minor	Broken mat mixed with WWM and Large-leaf pondweed
3	0.23	<<<1-1; <1	4-5; 5	Near	None	More of a High Density Area – scattered but regular plants
4	0.48	<<<1-1; <1	4-6; 5	No	None	Not a true bed – more HDA – fragments floating throughout
5	0.07	<<1-2; 1	4-6; 5	Near	Minor	Low density bed near shore
6	0.03	<<1-1; 1	4-6; 5	Near	None	Microbed – mixed with Vallisneria
7	0.15	<1-3; 2	5-8; 6	Yes	Moderate	Continuous bed around floating bog island
8	0.07	<1-3; 2	4-8; 7	Near	Moderate	Small but dense bed on the back of a mud bog
9	0.08	<1-2; 1	4-6; 5	Near	Minor	Growing around a floating bog
10	0.07	<<1-2; 1	4-7; 5	Near	Minor	Established on a floating bog
11	<0.01	<1-2; 1	4-6; 5	Near	None	Microbed near a sunken island
12	0.09	<<<1-3; 1	4-7; 5	Yes	Minor	EWM on outside of dense mat of WWM
13	0.01	1-3; 2	4-6; 5	Yes	Minor	Too small to be a moderate impairment – microbed near island
14	0.05	<<1-1; 1	4-5; 5	Yes	Minor	Low density open bed
15	0.06	2-3; 2	2-4; 4	Yes	Moderate	Small but dense microbed
16	0.45	<<1-2; 1	3-6; 5	Near	Minor	Scattered around floating mud bog
17	0.03	<1-1; 1	4-6; 5	Near	Minor	Microbed
18	0.02	<<1-1; 1	5-6; 5	No	None	Low density open bed – appears newly established/plants small
19	0.09	<<1-2; 1	5-6; 5	Near	Minor	Low density bed on submerged bog island
20	0.12	<<1-2; 1	3-5; 4	Yes	Minor	Low density bed around floating island
21	0.21	<<1-2; 1	3-5; 4	Yes	None	Low density bed in isolated bay
22	0.10	<<1-1; 1	3-5; 4	Near	Minor	Narrow strip of regular plants
23	0.08	<<1-2; 1	4-5; 5	Near	Minor	Regular peppering of plants
24	0.04	<<1-1; 1	4-6; 5	Near	Minor	Prop-clipped plants in back navigation channels
25	0.01	<<1-1; 1	4-6; 5	Near	Minor	Prop-clipped plants in back navigation channels
26	0.06	<<1-1; 1	4-6; 5	Near	Minor	Prop-clipped plants in back navigation channels
27	0.15	<<1-1; 1	4-6; 5	Near	Minor	Prop-clipped plants near docks/scattered EWM in channel
28	0.20	<<1-1; 1	2-5; 5	Yes	Minor	Peppering of plants throughout channel
<b>Total Acres</b>	<b>11.06</b>					

## **Descriptions of Eurasian Water-milfoil Beds:**

Beds 1-2 – The two beds at the river inlet were by far the worst in the lake. At this location, Eurasian water-milfoil formed a nearly continuous canopied mat that was full of prop-trails and uprooted plants. Because every visitor to the lake must drive through them as they go to and from the upstream public landing, and because the beds are producing abundant fragments that are being pulled downstream, this area will likely be a high priority for future management. Interestingly, there were also abundant native water milfoils mixed in with EWM in this area. Most were Whorled water-milfoil (*Myriophyllum verticillatum*) and Northern water-milfoil (*Myriophyllum sibiricum*), but we also found Various-leaved water-milfoil (*Myriophyllum heterophyllum*) and Farwell's water-milfoil (*Myriophyllum farwellii*) in boggy shallow water areas.

Beds 3-5 – These “High Density Areas” had regular but not truly continuous plants, although they were clearly expanding out from their cores in all directions. They appeared to be in the “outwash” from Beds 1 and 2, and we observed many floating fragments in and along the shoreline adjacent to these beds. Because they are all low density and because a potential treatment upstream in Beds 1 and 2 could produce some residual control as herbicides move downstream, they are likely a low priority for treatment at this time.

Beds 6-8 – Located around floating mud bog islands, these three beds were unlikely to cause significant navigation impairment unless boaters motored right through them. Collectively, they were the second worst area on the lake as plants were well-established and canopied or near canopy in up to 7ft of water. Despite this, the isolated nature of these beds may reduce their management priority.

Beds 9-11 – The stained water in the system seems to largely restrict EWM from growing in water deeper than 7ft. However, these beds were able to establish on floating muck bogs that rose off the bottom in deeper water. Their small size, relatively low density, and isolated nature all likely mean they are low priorities for management.

Bed 12 – This bed was a canopied mat that, unusually, was dominated by Whorled water-milfoil. The mapped EWM portion was established on the outside of the greater bed, but was patchier and seemed to be unlikely to cause more than a minor impairment along this isolated bog island.

Beds 13 and 14 – These open beds occurred along the east shoreline of the crescent bog island. Because of their low density, nearness to shore, and low potential for impairment, they are likely low management priorities.

Bed 15 – Located along a bog island on the north end of the eastern channel to Callahan Lake, this small bed was moderately dense and would have caused impairment for boaters trying to go through it. Although there was some prop-clipping, most people seemed to be avoiding it, and this likely means it's not a high priority for management unless there is concern about fragments flowing through and seeding Callahan in this area.



Beds 16-21- These small beds were scattered along the edges of floating mud bogs and bog islands. None of them were near shore or particularly dense meaning, even if boaters drove right through them, they likely wouldn't have cause more than minor impairment.

Beds 22-28 – Scattered throughout the southwest channels, this collection of generally low density microbeds often showed some prop-clipping. However, they were so small or so newly established that they likely caused little more than minor impairment to navigation.

## **DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:**

Eurasian water-milfoil currently occupies a small percentage of Mud Lake's surface area, but it is well established making eradication an unrealistic expectation. Although the species grows well in the Mud/Callahan system, active management has dramatically reduced the levels of EWM from an estimated 109 acres covering 23.49% of the lake's surface area in 2008 (Kleczewski 2009) to 11.06 acres (2.38% coverage) in 2020 – a decline of **-89.85%**. This control has come at a high economic cost, and, as herbicides are non-selective, has also likely had significant impacts on the aquatic plant community. In the future, maintaining EWM at its current low levels using targeted management will likely continue to produce satisfactory control while simultaneously minimizing financial and ecological costs.

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**Appendix I: 2020 Eurasian Water-milfoil Bed Map**

# Eurasian water-milfoil (*Myriophyllum spicatum*)

EWM Bed Mapping Survey

Mud Lake

Sawyer County, WI

September 5-6, 2020

