LAKE EDUCATION AND PLANNING SERVICES, LLC

SAND LAKE
BARRON COUNTY

2021 AQUATIC PLANT MANAGEMENT SUMMARY REPORT
WDNR WBIC: 2661100

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SAND LAKE MANAGEMENT DISTRICT
CUMBERLAND, WI 54829

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2021 AQUATIC PLANT MANAGEMENT SUMMARY REPORT

PREPARED FOR THE SAND LAKE MANAGEMENT DISTRICT

INTRODUCTION

This report discusses aquatic plant management activities completed by the Sand Lake Management District (SLMD) and Lake Education and Planning Services (LEAPS) throughout 2021. The following list of education and management actions were completed in 2021.

- Eurasian watermilfoil (EWM) treatment proposal
- Pre EWM treatment survey
- EWM treatment application
- ProcellaCOR concentration testing
- Post EWM treatment survey
- Fall EWM survey
- Purple loosestrife beetle rearing and release
- Purple loosestrife removal
- Clean Boats Clean Waters
- AIS monitoring
- EWM buoy placement
- Citizen Lake Monitoring Network water quality testing
- Fishsticks installation
- Picnic and annual meeting

Each of these actions will be summarized in the following sections of this report.

Below is a timeline of 2021 and the participating contractor for each event.

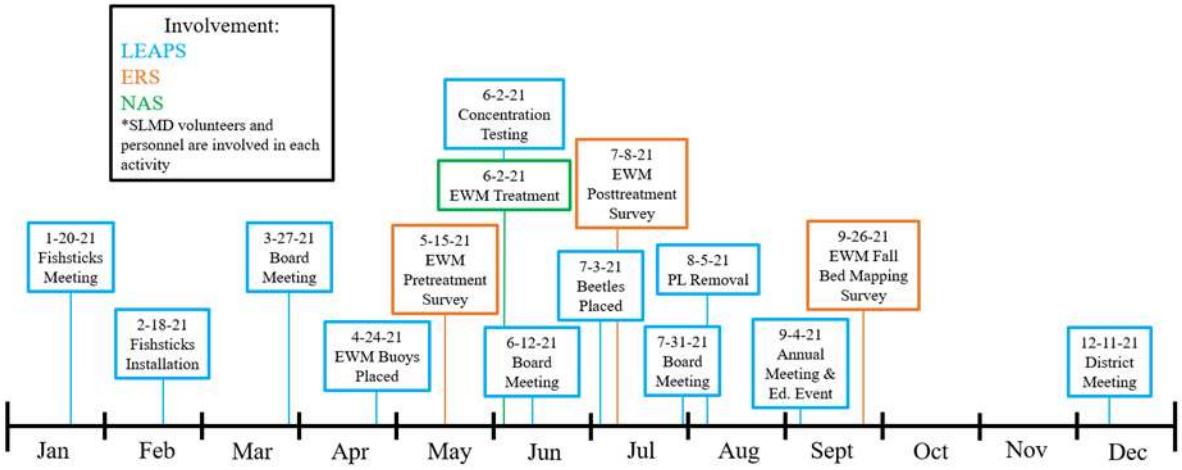

Figure 1: 2021 Timeline of Sand Lake activities

2021 PRELIMINARY EWM TREATMENT PROPOSAL

The 2021 spring EWM treatment plan was proposed by LEAPS based on 2020 fall bed mapping survey data collected by Endangered Resource Services LLC (ERS; Berg, 2020). The initial proposal recommended treating 19 areas totaling 6.39 acres with ProcellaCOR and 1 area totaling 3.12 acres with liquid 2,4-D (Table 1). A control area of 2.28 was included to allow comparisons of the pre and post treatments to an area that received no treatment. These areas were strategically selected to maximize EWM treatment based on SLMD funds while minimizing the impact to native plant communities. Treatment areas were selected by LEAPS to include high density beds identified by ERS in the 2020 fall bed mapping survey that occur in high boat traffic areas and smaller areas that had the potential to expand into larger beds.

Table 1: 2021 Final EWM treatment proposal (Berg, 2021)

Bed Number	Final Treatment Area (acres)	Chemical, Rate, and Total Volume
1	0.23	ProcellaCor – 8pdu/acre ft. – 16.56pdu
2	0.34	ProcellaCor – 8pdu/acre ft. – 21.76pdu
3	0	None – Control Area
4	0.29	ProcellaCor – 8pdu/acre ft. – 20.88pdu
4A	0.35	ProcellaCor – 8pdu/acre ft. – 25.20pdu
5	0.23	ProcellaCor – 8pdu/acre ft. – 16.56pdu
6	0.26	ProcellaCor – 8pdu/acre ft. – 18.72pdu
7	0.85	ProcellaCor – 5pdu/acre ft. – 38.25pdu
8	0.30	ProcellaCor – 8pdu/acre ft. – 21.60pdu
9	0.30	ProcellaCor – 8pdu/acre ft. – 21.60pdu
9A	0.17	ProcellaCor – 8pdu/acre ft. – 12.24pdu
9B	0.15	ProcellaCor – 8pdu/acre ft. – 10.80pdu
10	3.12	2,4-D (Amine 4) – 4ppm – 79.75 gallons
11	0.63	ProcellaCor – 6pdu/acre ft. – 34.02pdu
12	0.25	ProcellaCor – 8pdu/acre ft. – 16.00pdu
13	0.15	ProcellaCor – 8pdu/acre ft. – 10.80pdu
14	0.32	ProcellaCor – 8pdu/acre ft. – 23.04pdu
15	0.15	ProcellaCor – 8pdu/acre ft. – 10.80pdu
15A	0.27	ProcellaCor – 8pdu/acre ft. – 19.44pdu
15B	0.45	ProcellaCor – 6pdu/acre ft. – 24.30pdu
16	0.38	ProcellaCor – 7pdu/acre ft. – 23.94pdu
17	0.33	ProcellaCor – 8pdu/acre ft. – 23.76pdu
Total	**9.51**	**ProcellaCor – 5-8pdu/acre ft. – 490.02 total pdu/ 2,4-D (Amine 4) – 4ppm – 79.75 gallons**

2021 PRETREATMENT SURVEY

Matthew Berg with Endangered Resource Services LLC (ERS) performed a pretreatment survey on May 15th, 2021. The survey found EWM at and between points in each area, so the treatment went ahead as proposed by LEAPS with no modifications (Table 1; Figure 1). EWM occurred in scattered clusters and small beds throughout the treatment and control areas. During the pretreatment survey, it was present in the rake at 32 points (20.0% coverage within the study areas) with 25 additional visual sightings (Berg, 2021). Of these, 15 were rated a 3, seven a 2, and ten a 1 for a mean rake fullness of 2.16. This suggested 13.8% of the study areas had a significant infestation (rake fullness 2 and 3; Berg, 2021).

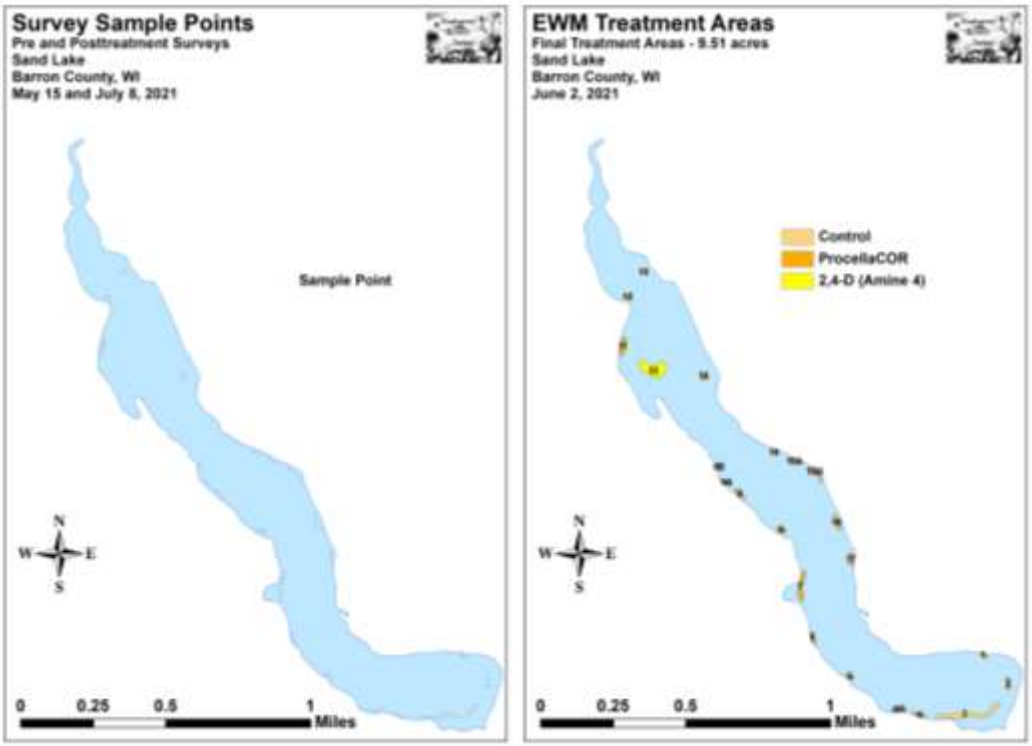

Figure 2: Sand Lake EWM pre/post treatment points and areas

2021 EWM HERBICIDE TREATMENT

Northern Aquatic Services (NAS) was contracted by LEAPS and the SLMD to apply the chemical herbicides. NAS completed the 2021 early season EWM treatment on Sand Lake on June 2nd and treated all the designated beds. NAS applied 2,4-D (Amine 4) at a rate of 4ppm and ProcellaCOR at a rate of 6-8 pdu/acre ft. (490.02 total pdu – at 3.17 fl. oz./pdu; Table 1). At the time of application, the reported water temperature was 69°F, and the air temperature was 73°F. Wind speeds were clocked at 3-5mph out of the southwest. During the treatment, coontail, large-leaf pondweed, clasping-leaf pondweed, northern watermilfoil, white waterlily, and white-stem pondweed were present in the treatment areas.

2021 PROCELLACOR CONCENTRATION MONITORING

LEAPS performed concentration at four ProcellaCOR treatment beds to determine the rate at which it gets taken up by the EWM and becomes non-detect. The deep hole Citizen Lake Monitoring Network site was sampled prior to treatment to establish a baseline zero for the lake. Then, Bed3-21, Bed7-21, Bed11-21, and Bed15B-21 were sampled after the ProcellaCOR treatment by NAS at 1 hour, 4 hours, 9 hours, and 24 hours, after treatment. The outlet was also sampled 24 hours after treatment to establish whether the chemical was able to leave the lake before being taken up by the plants. Bed3-21 was the designated control bed that received no chemical treatment.

The samples were sent to the EPL Bio Analytical Services Lab in Niantic, Illinois where they were tested for the concentration of ProcellaCOR. From the results, it can be inferred that the ProcellaCOR herbicide was quickly taken up by the plants in the treatment beds. Within 1 hour, the concentration decreased significantly in all beds to virtually zero ($p<0.001$; Figure Concentration).

Table 2: 2021 Sand Lake ProcellaCOR Concentration EPL Bio-Analytical Services (EPL-BAS) Results

Sample Site	Pre-treatment	Initial (ng/L)	1 hour (ng/L)	4 hour (ng/L)	9 hour (ng/L)	24 hour (ng/L)
Bed3-21 (Control)	-	-	0.000	0.192	0.522	0.128
Bed7-21	-	3619.00	2.690	1.400	0.314	0.191
Bed11-21	-	3219.00	0.022	1.800	0.301	0.126
Bed15B-21	-	2299.00	0.038	0.526	0.534	0.319
Outlet	-	-	-	-	-	0.016
Deep Hole	0.000	-	-	-	-	-

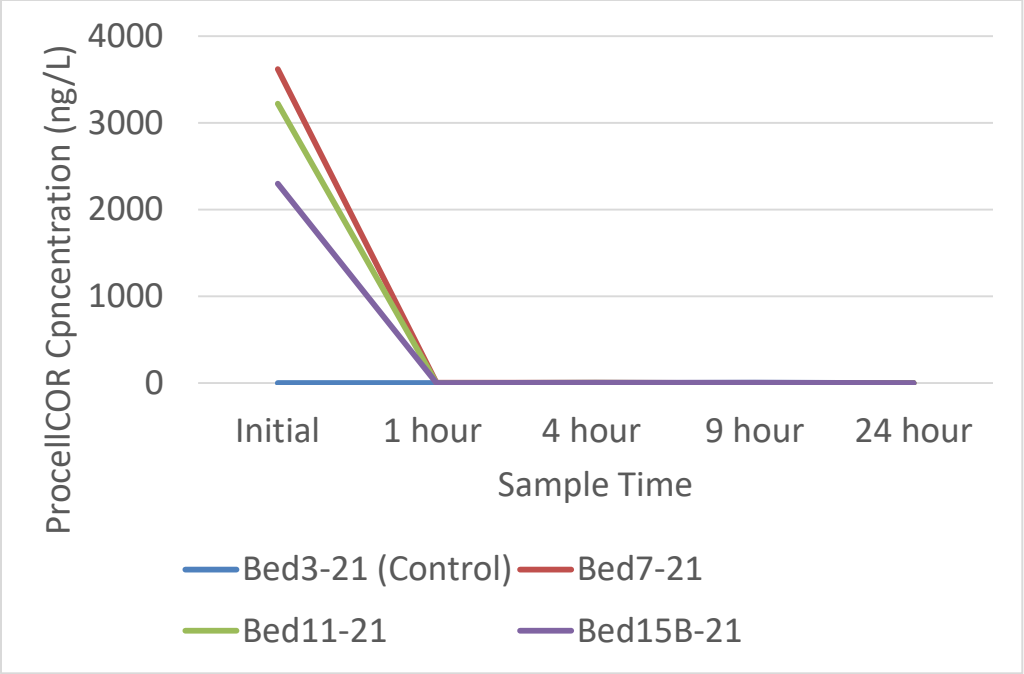

Figure 3: Sand Lake ProcellaCOR concentration – Application to 24 hours after treatment (HAT)

When comparing the results from 1 HAT to 24 HAT, the results get more interesting. From initial application concentrations, the herbicide applied nearly disappears – from 2300 to 3600 ng/L to <2.0 ng/L after one hour, except in the untreated, control bed (Bed 3) where no herbicide is recorded. By 4 HAT, the herbicide concentration goes up in 3 of the 4 beds, including the control bed. By 9 HAT, the herbicide is dropping once more except in the control bed where it continues to go up. Then at 24 HAT, even the infinitesimal amount of herbicide is still going down, almost disappearing altogether, with all four sites acting similarly. The results suggest rapid uptake of the herbicide by the plants within the treatment areas, with enough herbicide escaping to drift to nearby areas left untreated. While the it takes longer for these untreated areas to be impacted by the herbicide, once the herbicide arrives, the impact is rapid.

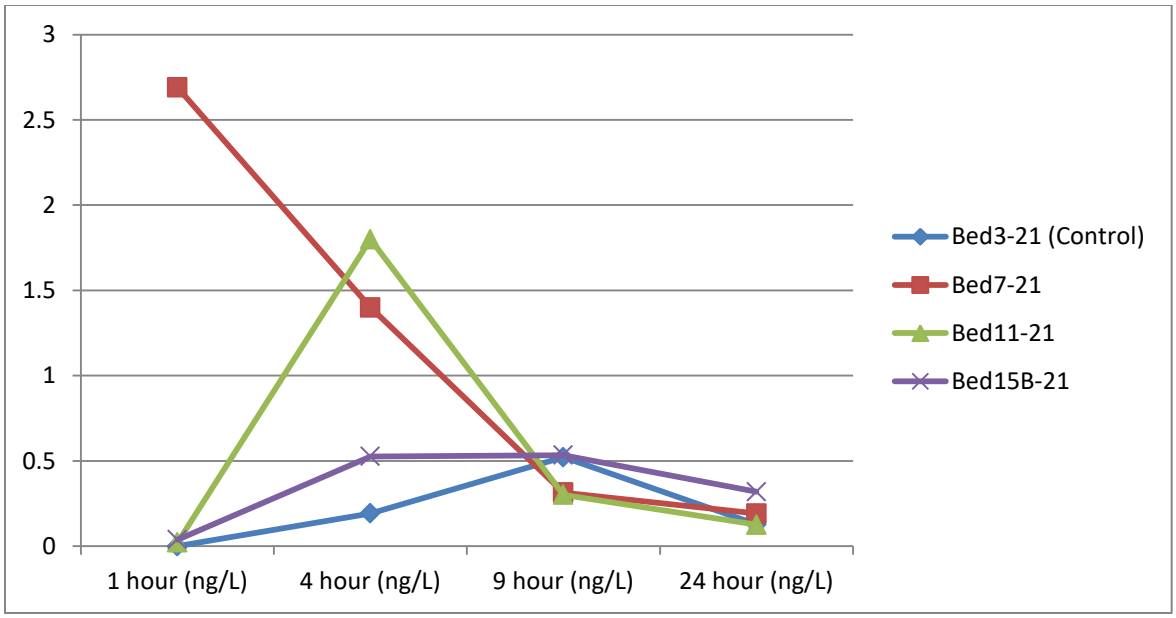

Figure 4: Sand Lake ProcellaCOR concentration – 1 to 24 HAT

2021 POST-TREATMENT POINT-INTERCEPT SURVEY

ERS was hired to perform a posttreatment survey (completed on July 8, 2021) to analyze changes to the plant community after the treatment. ERS found that the total species richness rose from 18 species pretreatment to 21 species posttreatment; the Simpson's Diversity Index also slightly increased from 0.87 to 0.88 (both of which are high values); and the Floristic Quality Index (another measure of plant community health) increased from 26.4 pretreatment to 28.2 posttreatment (Table Summary Stats; Berg, 2021). The mean native species richness significantly increased from 2.50 species per point pretreatment to 2.82 species per point posttreatment, and total mean rake fullness declined significantly from 2.11 pretreatment to 1.84 posttreatment (Figure Species Richness; Berg, 2021). These results indicate that the native plant community was positively affected by the treatment.

ERS found significant changes in the distribution and density of EWM after the treatment. EWM was found in clusters and small beds throughout the treatment and control areas in the pretreatment survey. ERS estimated that 13.9% of the study areas had a significant infestation of EWM with rake fullness ratings of 2 or 3. Posttreatment, no EWM was found in the study areas. These results indicate a highly significant decline in EWM total density and distribution ($p<0.001$; Figure Rake Fullness; Berg, 2021)

Table 3: Pre/Posttreatment surveys summary statistics (Berg, 2021)

Summary Statistics:	Pre	Post
Total number of points sampled	160	160
Total number of sites with vegetation	133	141
Total number of sites shallower than the maximum depth of plants	150	152
Freq. of occur. at sites shallower than max. depth of plants (in percent)	88.7	92.8
Simpson Diversity Index	0.87	0.88
Mean Coefficient of Conservatism	6.4	6.1
Floristic Quality Index	26.4	28.2
Maximum depth of plants (ft)	14.5	16.0
Mean depth of plants (ft)	8.2	8.1
Median depth of plants (ft)	8.0	8.0
Average number of all species per site (shallower than max depth)	2.37	2.62
Average number of all species per site (veg. sites only)	2.67	2.82
Average number of native species per site (shallower than max depth)	2.15	2.62
Average number of native species per site (sites with native veg. only)	2.50	2.82
Species Richness	18	21
Mean Rake Fullness (veg. sites only)	2.11	1.84

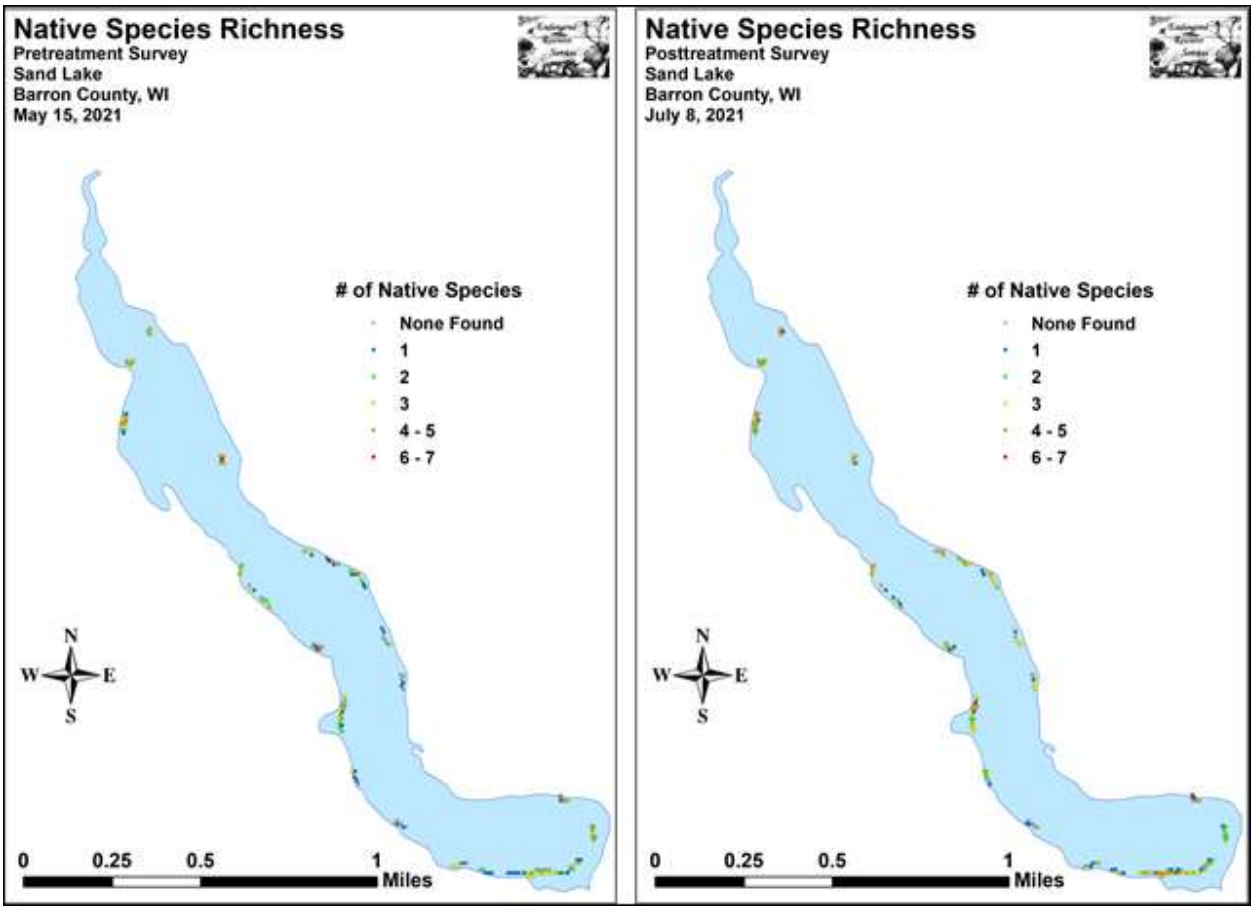

Figure 5: Pre and Post-treatment native species richness

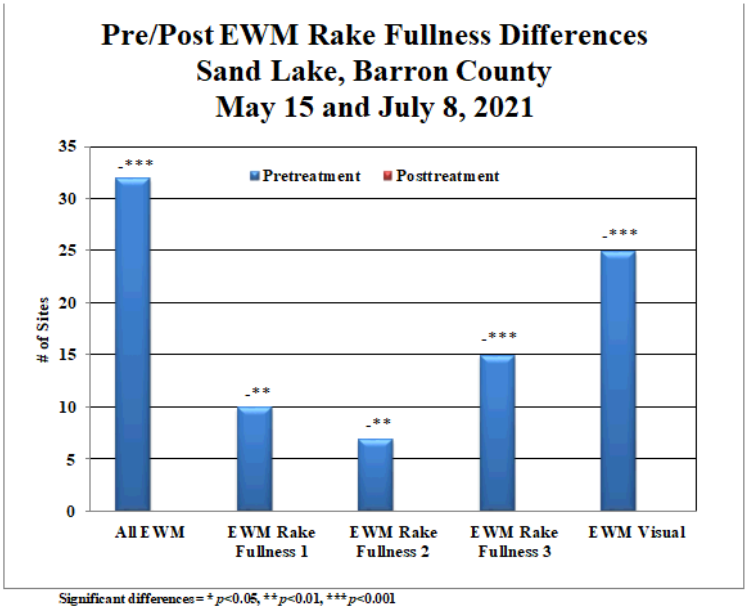

Figure 6: Pre and post-treatment rake fullness differences

2021 FALL EWM BED MAPPING

ERS performed a fall bed mapping survey for EWM on September 26th, 2021. They found no evidence of EWM near or within the spring 2021 treatment areas. The only EWM found was eight scattered plants in the navigation channel in the beaver lodge bay in the southeast corner of the lake. The 2021 fall survey represented a -100% reduction in EWM from the 2020 fall survey (Figure Fall EWM).

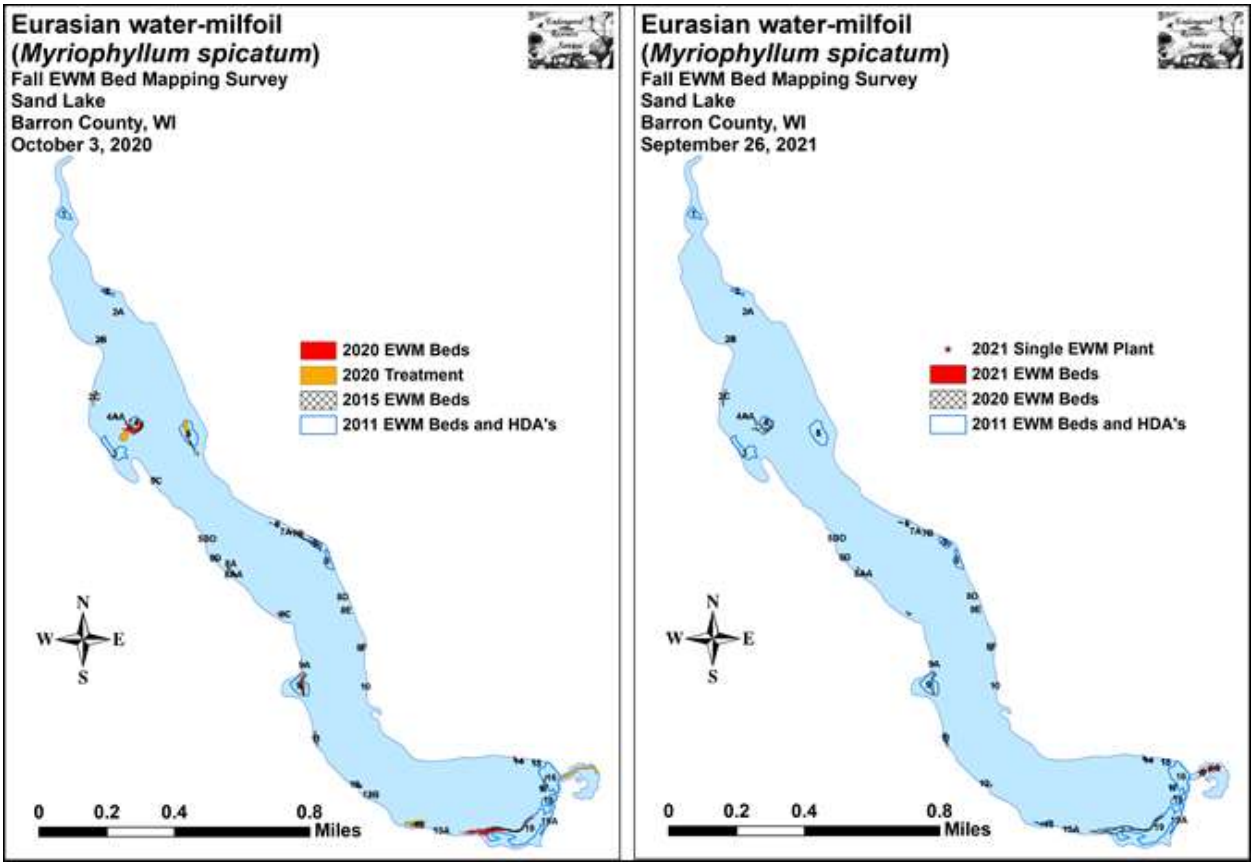

Figure 7: 2021 Fall EWM bedmapping results

2021 EWM BOUY PLACEMENT

In April, 2021, buoys were placed around high density areas of EWM located in a high boat traffic area to limit driving through the bed. LEAPS assisted in determining where the bouys should be placed, as well as their actual placement. Bouys were placed around the bed in Silo Bay near the northwest corner of the lake. Additional bouys were placed across the lake-ward side of the control bed in the southwest corner of the lake near the boat landing. The goal of their placement was to limit boat traffic and the cutting of EWM by boat props to limit its spread by fragmentation.

2022 EWM PRELIMINARY MANAGEMENT PLANNING

Using the EWM Management Planning and Implementation Project grant obtained in 2021, EWM management has been planned for 2022. The results of the fall bedmapping survey and the lack of EWM

found suggest that chemical management is not likely to be necessary in the spring of 2022. This also allows LEAPS and ERS to evaluate the long-term impacts of using ProcellaCOR. If areas of dense EWM are found in 2022, diver removal will be the primary treatment recommendation so long as the beds do not exceed the capacity of divers to remove them.

CLEAN BOATS, CLEAN WATERS

In 2021, 204 hours of CBCW inspection time were put in by paid works hired by LEAPS at the Sand Lake WDNR landing. At least 78 boats were inspected and 152 people were contacted during this time. Data recorded during watercraft inspection showed boats coming from 17 different lakes in the area. Of these lakes, 6 had EWM or hybrid EWM, 9 had curly-leaf pondweed, and 2 had purple loosestrife.

AIS MONITORING

AIS monitoring has been completed by volunteers on Sand Lake since 2016, and no new AIS have been discovered. Volunteers and LEAPS personnel identified purple loosestrife and EWM during the 2021 surveys. Japanese knotweed was present on the shoreline, but was removed prior to formal AIS monitoring efforts, and it has not returned. There is no curly-leaf pondweed in Sand Lake. What could be Chinese Mystery Snails have been seen, but are few and far between. No rusty crayfish, zebra mussels, or spiny waterflea have been discovered.

PURPLE LOOSESTRIFE MANAGEMENT

There are dense areas of purple loosestrife along the shoreline of Sand Lake. To treat these areas, the SLMD and LEAPS raised Galerucella beetles to be released. LEAPS released the beetles on July 3rd, 2021. On August 5th, 2021, LEAPS personnel and volunteers from the SLMD circled the lake and removed the flower heads of several large areas of purple loosestrife, as well as several scattered plants.

CITIZEN LAKE MONITORING NETWORK (CLMN) WATER QUALITY TESTING

The SLMD have actively taken part in the CLMN program since 1988. In 2021, monitoring continued at the deep hole site (Station ID: 033143) in the southern-most basin. In 2021, water clarity readings were collected at the deep hole on eighteen different dates throughout the growing season, and readings averaged 11.3 feet. Chlorophyll data was collected on three dates, averaging 6.4 ug/L. Total phosphorus (TP) was collected on four dates and averaged 26.4 ug/L. The collection date in September was quite high for chlorophyll and TP, 11.7 and 42.3 ug/L, respectively. These values greatly skew the summer average but are normal for late summer readings. Summer (July-Aug) water was reported as CLEAR and GREEN, suggesting that the Secchi depth may be mostly impacted by algae.

The overall average summer Trophic State Index (TSI) value for total phosphorus, chlorophyll, and Secchi disk readings was 44.8, indicating that the lake is of mesotrophic status (Figure TSI). This is consistent with previous years (Figure TSI). Mesotrophic lakes are characterized by moderately clear water, but have an increasing chance of low dissolved oxygen in deep water during the summer. These conditions accurately describe Sand Lake in 2021.

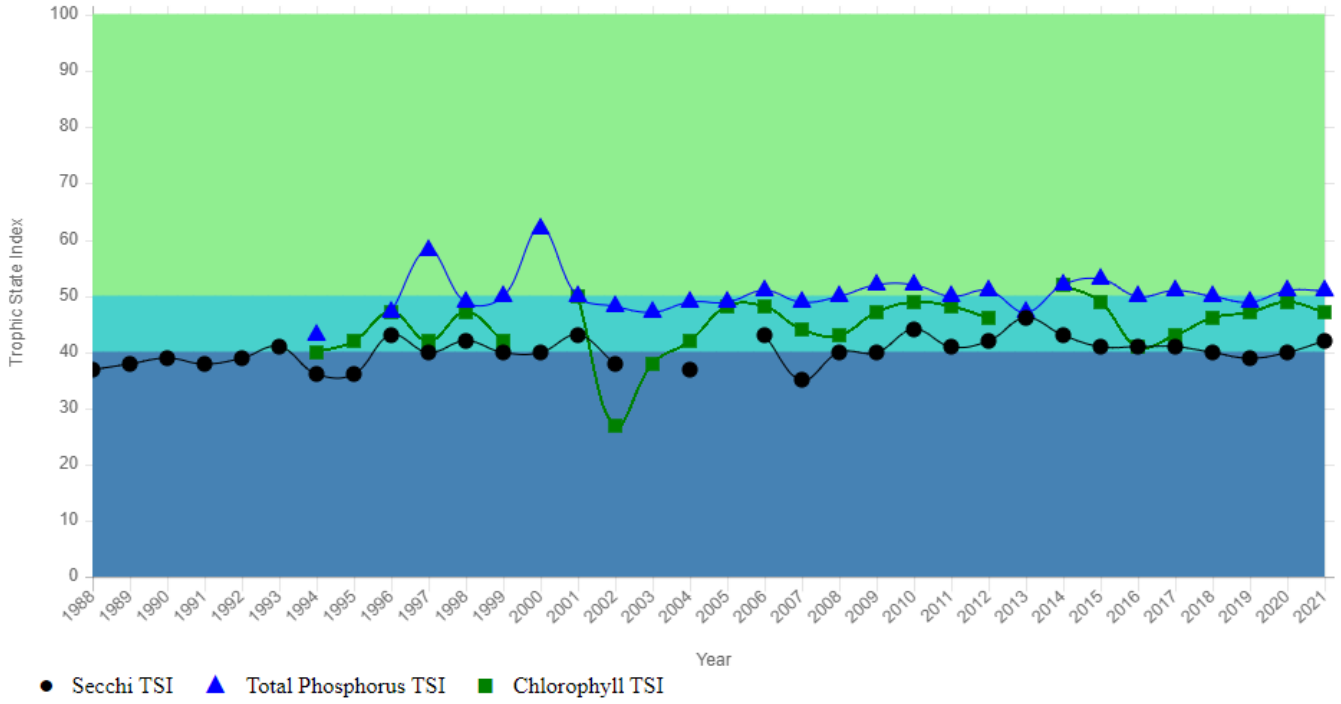

Figure *TSI*: 1988-2021 Summer (July and August) TSI values for total phosphorus and chlorophyll-a at the Near Deepest Pt on Sand Lake

2021 FISHSTICKS

In 2020, a Healthy Lakes Grant for Fishsticks was granted for three properties around Sand Lake. In January, a meeting was held about the installation of the fishsticks. In February, the fishsticks were installed at the Tinker, Held, and Janka properties (Figure Fishsticks). LEAPS assisted in the grant application process, as well as the installation.

Figure 8: February 2021 Fishsticks Installations – Tinker (left), Held (center), and Janka (right)

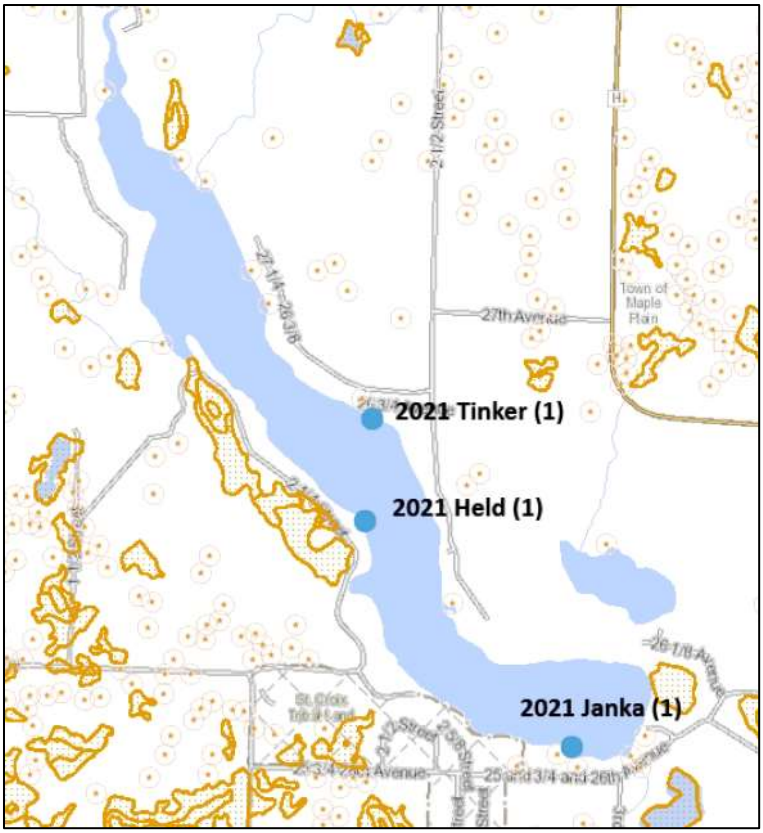

Figure 9: 2021 Fishsticks locations on Sand Lake

2021 SLMD MEETINGS AND LEAPS PARTICIPATION

The SLMD has an active membership that meet throughout the year to discuss issues pertinent to the lake and to make decisions to improve the lake and educate the membership. On March 27th, June 12th, and July 31st, the SLMD held board meetings. On September 4th, the SLMD held its annual meeting, and an educational event was put on by LEAPS. On December 11th, the SLMD held its district meeting. LEAPS attended each of these meetings and contributed by presenting updates on events around the lake and providing general information on lake management.

REFERENCES

Berg, M. (2020). *Eurasian water-milfoil (Myriophyllum spicatum) Fall Bed Mapping Survey Sand Lake – (WBIC: 2661100) Barron County, Wisconsin.* St. Croix Falls, Wisconsin: Endangered Resource Services, LLC.

Berg, M. (2021). *Eurasian water-milfoil (Myriophyllum spicatum) Pre/Posttreatment and Bed Mapping Surveys Sand Lake (WBIC: 2661100) Barron County, Wisconsin.* St. Croix Falls, Wisconsin: Endangered Resource Services, LLC.