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SAND LAKE, BARRON COUNTY

2017 AQUATIC PLANT MANAGEMENT SUMMARY REPORT
WDNR WBIC: 2661100

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January 12, 2019

SAND LAKE MANAGEMENT DISTRICT
CUMBERLAND, WI 54829

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Table of Contents

Figures

Tables

2017 AQUATIC PLANT MANAGEMENT SUMMARY REPORT-SAND LAKE

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) during the 2017 season and provides details of the 2017 Eurasian watermilfoil (EWM) control plan. The following list of education and management actions were completed in 2017.

- 2017 preliminary EWM treatment proposal
- EWM readiness survey
- 2017 early season EWM treatment
- Post-treatment summer littoral zone survey
- Clean Boats Clean Waters
- Purple loosestrife monitoring, removal, and biological control
- 2018 EWM management planning
- Citizen Lake Monitoring Network water quality testing
- Grant funded project and grant applications
- Lake Fair and Annual Meeting

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

Based on 2016 summer littoral point-intercept survey data (Berg, 2016), a proposal for treating 10 areas totaling 13.70 acres was made by LEAPS in March 2017. After EWM readiness survey work, the proposed treatment was modified to a final proposal of beds ranging in size from 0.4 – 6.64 acres covering a total of 13.6 acres. All of these areas were proposed to be treated with DMA 4 (liquid 2, 4-D) at the maximum label rate of 4.0 ppm (Table 1).

Table 1: 2017 Final EWM treatment proposal

2017 Sand Lake FINAL Spring EWM Treatment Plan 5/14/2017 (LEAPS)							
New Name	**2016 Name**	**Acres**	**Mean Depth (feet)**	**Acre-feet**	**Target 2,4-D (DMA 4) (ppm a.e.)**	**Application rate (gal/acre-feet)**	**DMA 4 (gallons)**
NBtLdBay-17	Beds 1-16&20-16	6.64	8.00	53.12	4.00	2.84	150.86
EastBay-17	Bed 19-16	0.61	7.10	4.33	4.00	2.84	12.30
NPtStmpBay-17	Not treated in 2016	0.40	8.70	3.48	4.00	2.84	9.88
NWBay2-17		0.43	7.70	3.31	4.00	2.84	9.40
SiloBay-17	Beds 13-16 & 14-16	3.40	8.90	30.26	4.00	2.84	85.94
StumpBay-17	Bed 6-16	1.26	8.80	11.09	4.00	2.84	31.49
NEBay1-17		0.86	6.50	5.59	4.00	2.84	15.88
Total Primary		**13.60**	**7.96**	**111.18**			**315.75**

EWM READINESS SURVEY, TREATMENT, AND POST-TREATMENT SUMMER LITTORAL POINT-INTERCEPT AQUATIC PLANT SURVEY

EWM READINESS SURVEY

With the implementation of a new Aquatic Plant Management Plan (APMP) for Sand Lake, pre and post-treatment surveys were no longer being done. Instead, as EWM readiness survey was completed in May of 2017 by LEAPS. A EWM readiness survey involves visually inspecting proposed treatment areas and rake throws to determine if EWM in the proposed treatment areas is ready to treat. At the same time, the rest of the lakes' littoral zone is searched for EWM beds that may have been missed in the previous year. Based on this visual inspection and several rake samples, treatment areas are modified.

2017 EWM SPRING TREATMENT

Northern Aquatic Services (NAS) completed the 2017 early season EWM treatment on Sand Lake on May 22nd. NAS treated a total seven beds ranging in size from 0.4 acres up to 6.64 acres totaling to 13.60 acres. Water temperature was 52°F, air temperature was 53°F. There was a light breeze of 2-5 mph out of the west. All of the areas were treated with DMA 4 (Liquid 2,4-D) with a target concentration of 4.0 ppm. During the treatment, coontail, large-leaf pondweed, northern watermilfoil, white waterlily, and white-stem pondweed were present in the treatment areas.

EWM SPOT TREATMENTS

In most previous years of EWM management, spring treatments have been followed up with chemical treatments of individual EWM plants or small clumps of plants later in the season. With the approval of the new APM Plan in 2016, spot treatments were discontinued in 2017.

POST-TREATMENT SUMMER LITTORAL ZONE POINT-INTERCEPT SURVEY OF AQUATIC PLANTS

A change that was made in the 2016 revision of the APMP was replacing the post-treatment plant survey in just the treated areas with a larger point-intercept survey that covers the entire littoral zone. All EWM and native plants are documented during this survey. Annual results can more accurately compare the results and impacts of each year's treatment.

On July 23 and 24, 2017 ERS conducted a summer warm water full point-intercept survey based on a survey grid established in 2016 that included 518 points within the 20-ft contour of the lake at a distance apart of 25 meters, more than double the number of points in the littoral zone included in the original WDNR survey grid (Figure 1). Using this grid, each point was located with a handheld mapping GPS unit, a depth reading (Figure 2) was recorded with a metered pole rake or hand held sonar, and a rake was used to sample an approximately 2.5ft section of the bottom. Substrate (bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake. Organic and sandy muck in the lake's sheltered bays and flats accounted for 42.9% (222 points) of the substrate within the littoral zone. Pure sand shorelines that ringed the majority of the central basins composed 45.0% (233 points) of the bottom, and scattered gravel and cobble areas, especially on the south shoreline adjacent to the lake's deepest point, made up the remaining 12.1% (63 points) (Figure 2). All plants on the rake, as well as any that were dislodged by the rake, were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 3). Visual sightings of all plants within six feet of the sample point but not found in the rake were also recorded. In addition to a rake rating for each species, a total rake fullness rating was also noted.

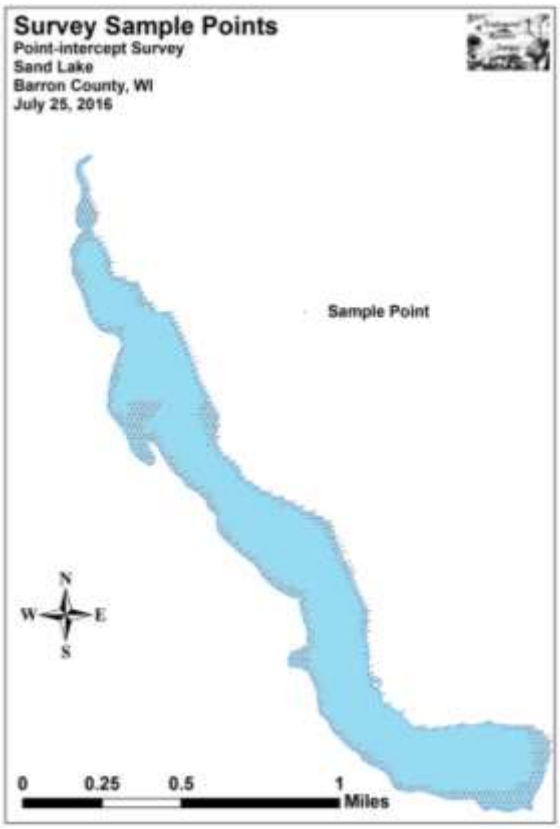

Figure 1: Summer PI survey points (Berg, 2016)

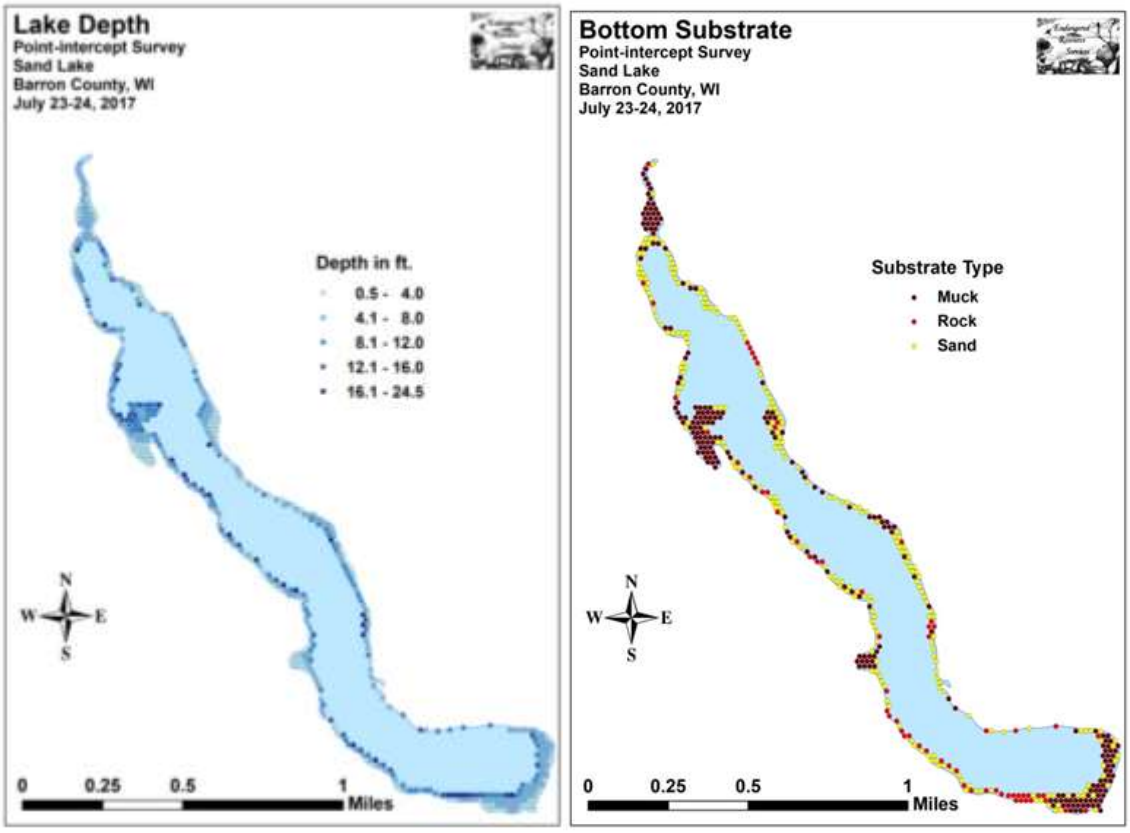

Figure 2: Lake depth and bottom substrate (Berg, 2017)

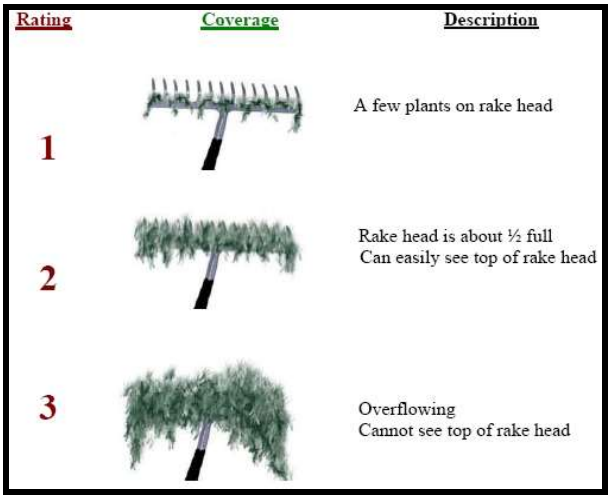

Figure 3: Rake-fullness ratings

The intent of this survey was to compare the aquatic plant community within the lake in 2017 to the one found in 2016 to determine what, if any, changes had occurred. Table 2 shows the statistical comparison of the 2016 and 2017 surveys.

Table 2: 2016 and 2017 Survey Statistic Comparison (Berg, 2017)

Summary Statistics:	2016	2017
Total number of points sampled	518	518
Total number of sites with vegetation	470	474
Total number of sites shallower than the maximum depth of plants	517	516
Frequency of occurrence at sites shallower than maximum depth of plants	90.91	91.86
Simpson Diversity Index	0.94	0.94
Maximum depth of plants (ft)	18.5	19.0
Mean depth of plants (ft)	6.3	6.6
Median depth of plants (ft)	6.0	6.0
Average number of all species per site (shallower than max depth)	3.32	3.71
Average number of all species per site (veg. sites only)	3.65	4.03
Average number of native species per site (shallower than max depth)	3.29	3.67
Average number of native species per site (veg. sites only)	3.62	4.01
Species richness	43	44
Species richness (including visuals)	47	49
Species richness (including visuals and boat survey)	51	52
Mean rake fullness (veg. sites only)	2.16	2.19

Significant differences = * $p < .05$, ** $p < .01$, *** $p < .001$

EURASIAN WATERMILFOIL

Eurasian water-milfoil was found at 15 points during the 2016 survey (3.19% of littoral points with plants). Of these, three points had a rake fullness of 3, five were a 2, and the remaining seven were a 1 for a mean rake fullness of 1.73. EWM was recorded as a visual at eight points. During the 2017 survey, EWM was present at 20 points (4.22% of points with vegetation) and accounted for 1.05 of the total relative frequency. Six points had a rake fullness of 3, three were a 2, and 11 were a 1 for a mean rake of 1.75. EWM was also recorded as a visual at five points. Although both the distribution and density increased in 2017, none of these values represented a significant change over the 2016 survey. Likewise, none of the changes in rake fullness were significant (Figure 4).

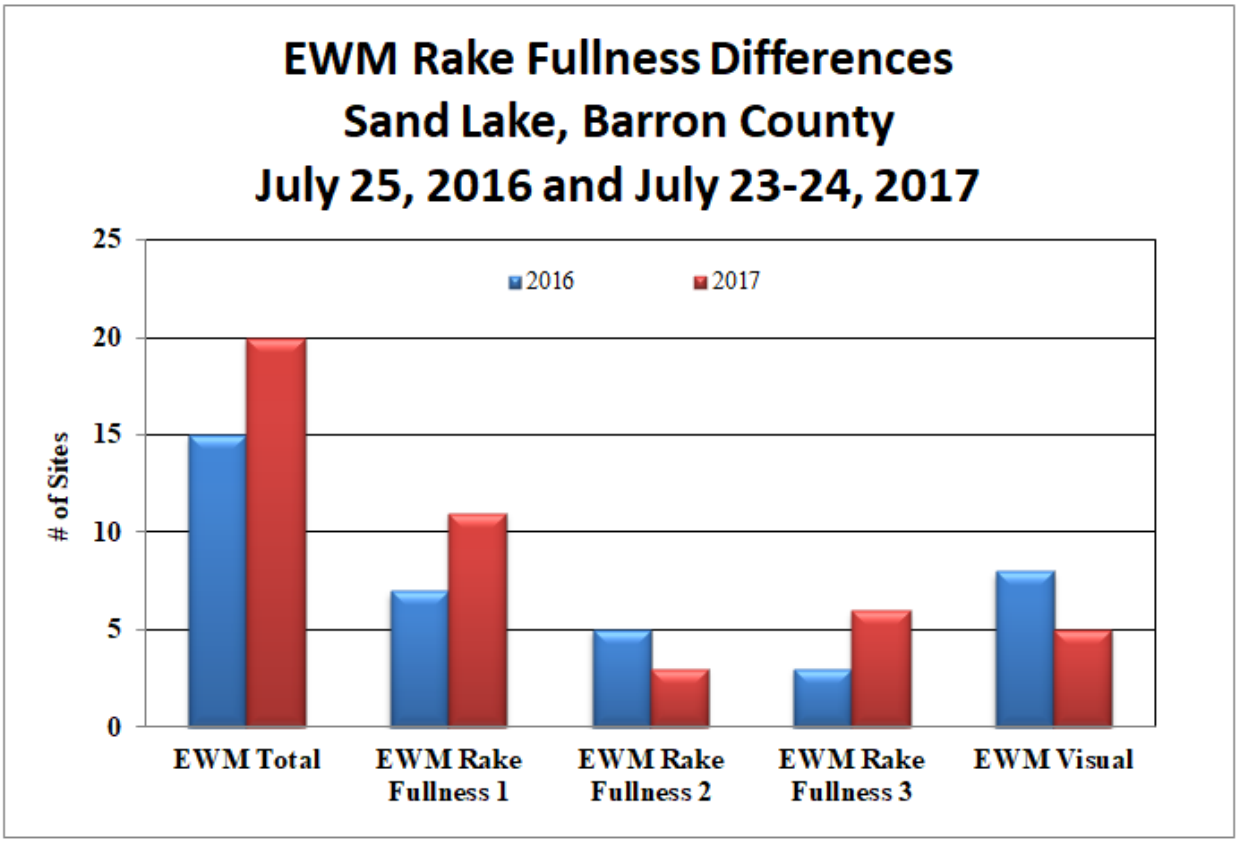

Figure 4: Comparison of EWM Density 2016 and 2017 (Berg, 2017)

The July 2017 survey noted two significant EWM beds – both of which were located along the western shoreline in the southern third of the lake (Figure 5). This was down from six significant beds found in July 2016. Despite a general decline in coverage noticed following treatment of these beds on the northern third of the lake, each bed documented in 2016 still had EWM present in 2017.

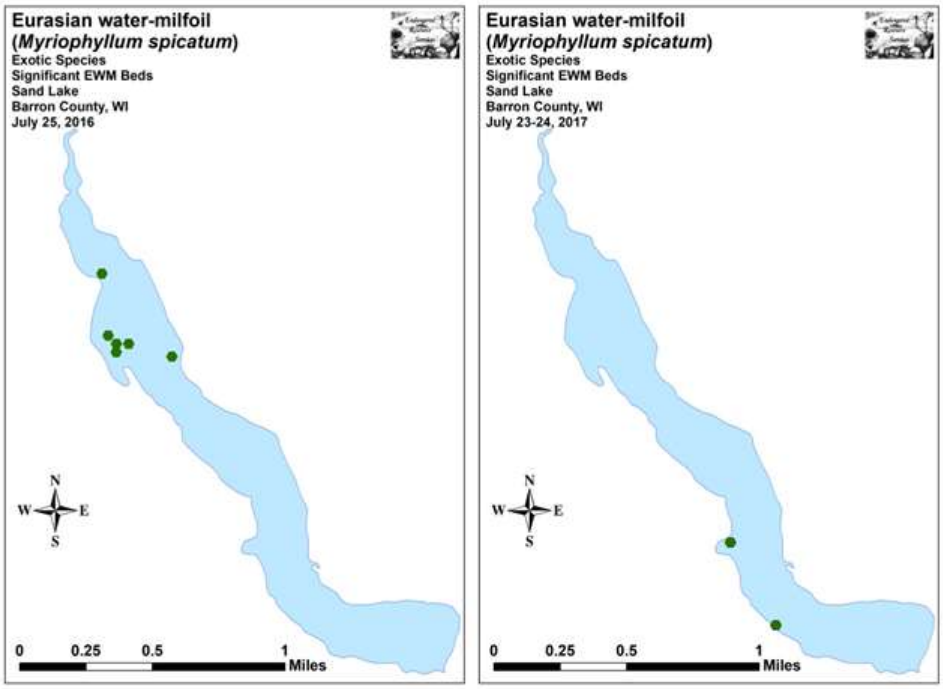

Figure 5: 2016 and 2017 Significant EWM beds (Berg, 2017)

PURPLE LOOSESTRIFE AND REED CANARY GRASS

Purple loosestrife is present at several locations around the lake. Gallerucella beetles have been release on the lake for many years, but if a self-replicating population exists, it is small. Reed canary grass continues to be widely distributed in undeveloped shoreline areas of the lake, but this ubiquitous plant does provide some habitat for wildlife, and there is no easy or cheap way to eliminate it. During the point-intercept survey several purple loosestrife plants were found along the northeastern shoreline near the inlet, and were removed by surveyors.

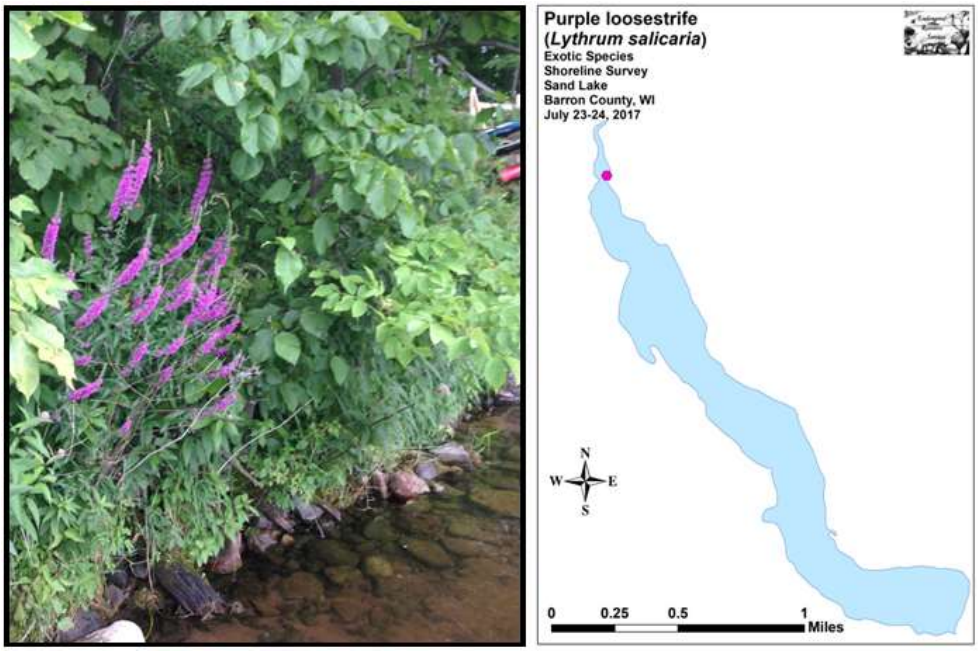

Figure 6: Purple loosestrife flowers and 2017 location (Berg, 2017)

At the time of the survey, Secchi disc readings of water clarity were around 10-ft. This good water clarity produced a littoral zone that extended to 18.5ft with the mean and median depths of plants being 6.3ft and 6.0ft respectively. Plant coverage was extensive with 470 out of 517 littoral points (90.9%) having at least some macrophytes present (Figure 7). The majority of areas without plants occurred over rock in water >10ft deep.

Plant diversity was exceptionally high with a Simpson Diversity value of 0.94 each year. Total species richness increased from 51 in 2016 to 52 in 2017. Although the number of species was little changed, mean species richness at sites with native vegetation demonstrated a highly significant increase ($p<0.001$) from a moderate 3.62 species/site in 2016 to a high 4.01 species/site in 2017 (Figure 7).

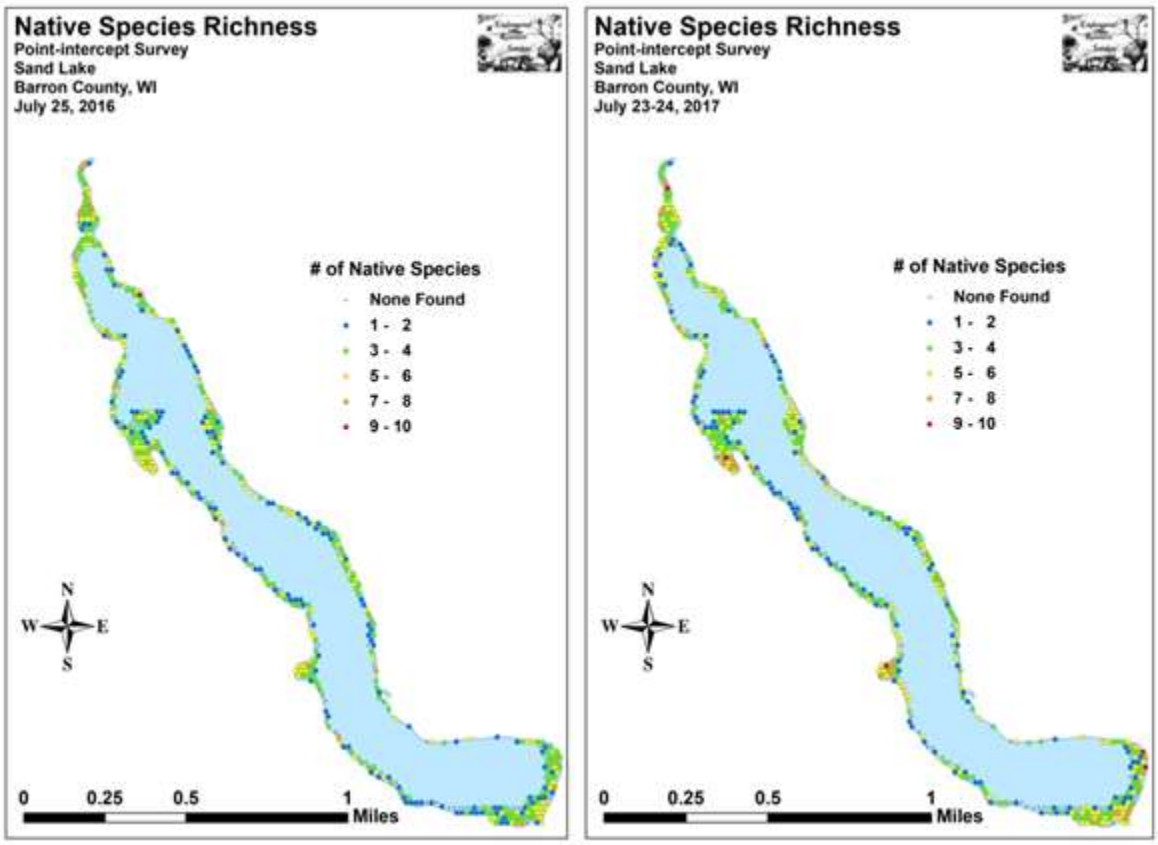

Figure 7: Native species richness 2016 and 2017 (Berg, 2017)

Overall plant density in 2016 was moderate with a mean rake fullness of 2.16 at sites with vegetation this was relatively unchanged in 2017 at 2.19 (Figure 8). In 2016, Coontail, Flat-stem pondweed, Small pondweed, and Northern water-milfoil were the most common species. Found at 49.79%, 41.06%, 30.21% and 28.51% of survey points with vegetation respectively, they accounted for 40.94% of the total relative frequency. Muskgrass, Illinois pondweed, Clasping-leaf pondweed, Forked duckweed, Common waterweed, and Slender naiad were the only other species with relative frequencies over 4.00. During the 2017 survey, these same four species were again the most common with Coontail present at 52.95% of sites with vegetation, Flat-stem pondweed at 39.66%, Small pondweed at 35.02%, and Northern water-milfoil at 26.16%. Collectively, they accounted for 38.13% of the total relative frequency. Common waterweed, Muskgrass, Clasping-leaf pondweed, Variable pondweed, Forked duckweed, and Fries' pondweed also had relative frequency values over 4.00

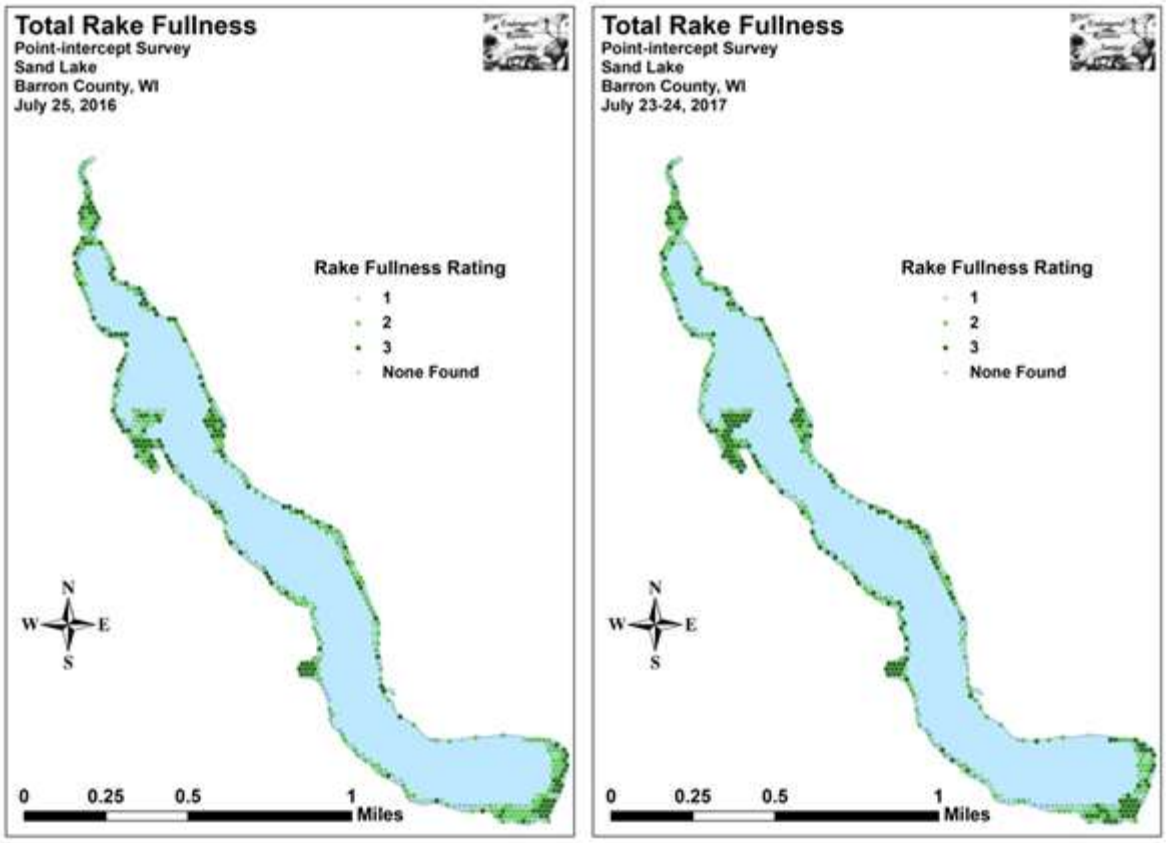

Figure 8: Total rake fullness 2016 and 2017 (Berg, 2017)

When considering only distribution, nine species experienced significant changes. ERS documented a highly significant decline in Illinois pondweed; and a significant decline in Slender naiad. Conversely, they found highly significant increases in Common waterweed and filamentous algae; moderately significant increases in Fries' pondweed, Fern pondweed, Small duckweed, and Nitella; and a significant increase in Large duckweed (Figure 9).

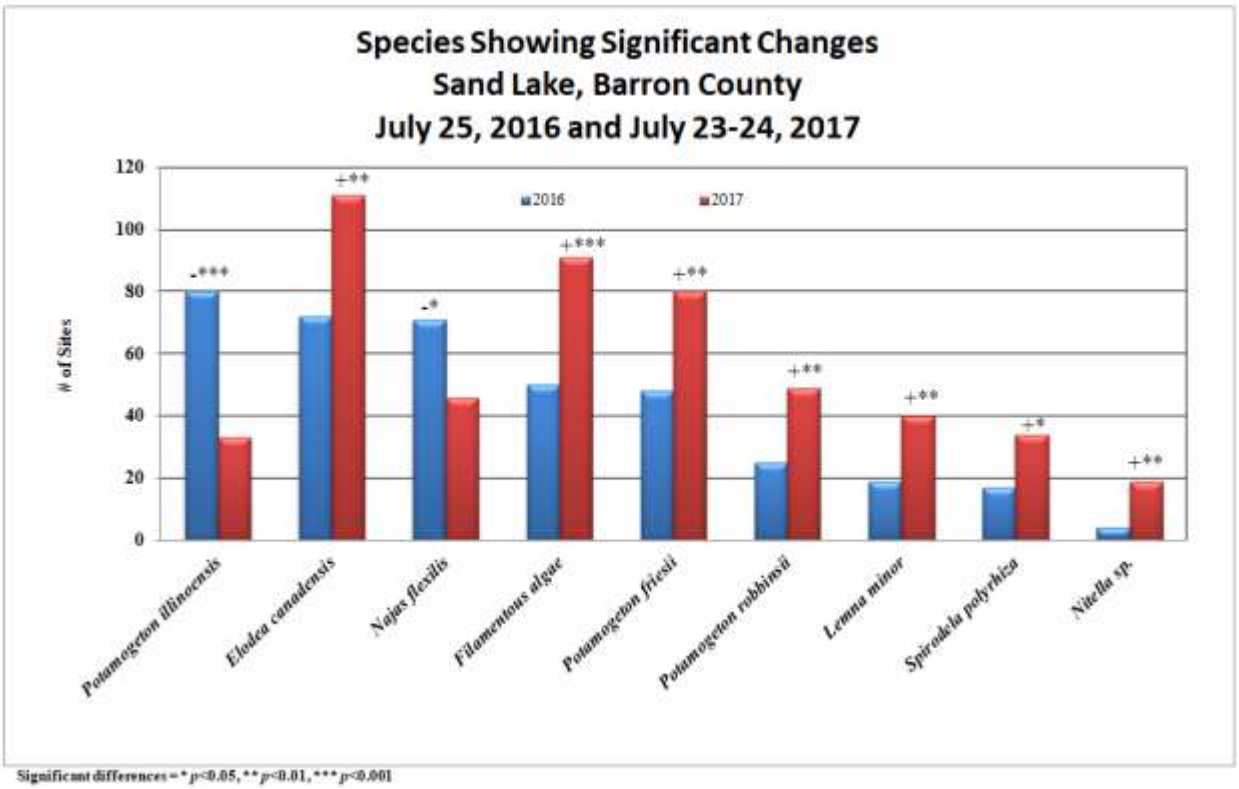

Figure 9: Species with a significant change from 2016 to 2017 (Berg, 2017)

In 2016, a total of 41 native index plants in the rake were identified during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.0 and a Floristic Quality Index of 38.3. In 2017, a total of 43 native index plants were found in the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.1 and a Floristic Quality Index of 39.8. These numbers were well above average in both 2016 and 2017. Three exceptionally high value index plants found both years included Wild calla (C = 9), Crested arrowhead (C = 9), and Creeping bladderwort (C = 9).

CLEAN BOATS, CLEAN WATERS

There were 138 hours of watercraft inspection time recorded at the Sand Lake public boat landing in 2017. Most of the time was put in by a paid watercraft inspector. The remaining time was put in by SLMD. At least 263 people in 126 boats were contacted during this time. Data recorded during watercraft inspection showed boats coming from 13 different lakes in the area – 2 of these lakes have EWM in them.

AIS MONITORING

Sand Lake volunteers completed AIS monitoring on Sand Lake in 2017, but there are no official dates recorded. During the 2017 Sand Lake Management District in late July, LEAPS took several volunteers out on a pontoon ride of the lake to point out AIS and other aquatic plants in the lake. Clean Boats Clean Waters inspectors checked the area immediately adjacent to the public boat landing for AIS however no formal recording of these events was undertaken in 2017. This will be improved in 2018.

PURPLE LOOSESTRIFE MONITORING, REMOVAL, AND BIOLOGICAL CONTROL

Purple loosestrife was found and removed by ERS during the summer point-intercept survey. They reported finding a few 10's of individual plants all scattered along the northeastern shoreline near the inlet. ERS removed every plant they found in that area, but there is likely a No beetles were released around the lake in 2017.

2018 EWM PRELIMINARY MANAGEMENT PLANNING

In the fall of 2017, LEAPS completed an informal meandering visual survey of EWM in Sand Lake. What was found was disturbing to say the least. EWM had increased greatly from the levels it was found at during the summer PI survey. During this three year EWM control project, a new way of tracking herbicide impacts to EWM and to native aquatic plant is being employed. The summer PI surveys in the littoral zone of Sand Lake have taken the place of a more formal pre and post-treatment survey followed by a fall bed-mapping survey approach that has been used in the past. Based on the 2017 informal meandering survey results, using only a summer PI survey to document imapcts is not enough.

Figure 10: 2017 fall EWM meandering survey results (green dots = summer PI points with EWM; red dots =fall meandering survey points with EWM)

Based on results from the 2017 summer point-intercept survey of the littoral zone and the fall meandering survey, a preliminary treatment proposal was created in February 2018 that included 8 treatment areas ranging in size from 0.37 acres to 3.55 acres totaling 14.65 acres (Table 3). After the EWM readiness survey the initial proposal was not modified. The summer spot treatment program will not be continued in 2018.

Table 3: 2018 Sand Lake Preliminary (and Final) Spring EWM Treatment Proposal

2018 Sand Lake Preliminary Spring EWM Treatment Proposal (2/14/2018 (LEAPS)											
New Name	2017 Name	Acres	Mean Depth (feet)	Acre-feet	Target 2,4-D (liquid) (ppm a.e.)	Application rate (gal/acre-feet)	Liquid 2,4-D (gallons)	Target 2,4-D (granular) (ppm a.e.)	Application rate (lbs/acre-feet)	Granular (lbs)	2018 Treatment Notes
BtLdBay1-18	NBtLdBay-17	2.66	6.50	17.29	4.00	2.84	49.10				
BtLdBay2-18		2.79	9.70	27.06	4.00	2.84	76.86				
EstBay6-18	NEBay1-17	1.08	7.30	7.88	4.00	2.84	22.39				
StmpBay3-18	NPtStmpBay-17	1.96	7.60	14.90	4.00	2.84	42.30				
WtSh4-18	not treated in 2017	0.38	11.75	4.47				4.00	56.80	292.01	could be left untreated in 2018
SilBay5-18	SiloBay-17	3.55	8.90	31.60	4.00	2.84	89.73				
EstShr7-18	EastBay-17	1.86	8.60	16.00	4.00	2.84	45.43				
SWShr8-18	not treated in 2017	0.37	10.38	3.84				4.00	56.80	251.18	could be left untreated in 2018
Total		**14.65**	**8.84**	**123.03**			**325.82**			**543.19**	

There are three water quality monitoring sites in Sand Lake that are a part of the CLMN monitoring program. However, only the main site "Near Deepest Pt" in the southern-most basin had data collected from it in 2017. In 2017, water clarity readings were collected at the deep hole on seven different dates. Chlorophyll data was collected on two dates, and TP date was collected on three dates. Figure 11 shows the average summer (July-August) Secchi disk readings since CLMN began. The 2017 average summer (July-Aug) Secchi disk reading for Sand Lake - Near Deepest Pt (Barron County, WBIC: 2661100) was 12.5 feet, very similar to 2016. The average for the Northwest Georegion was 8.1 feet. Summer (July-Aug) water was reported as CLEAR and GREEN suggesting that the Secchi depth may be mostly impacted by algae. Algal blooms are generally considered to decrease the aesthetic appeal of a lake because people prefer clearer water to swim in and look at. Algae are always present in a balanced lake ecosystem. They are the photosynthetic basis of the food web. Algae are eaten by zooplankton, which are in turn eaten by fish.

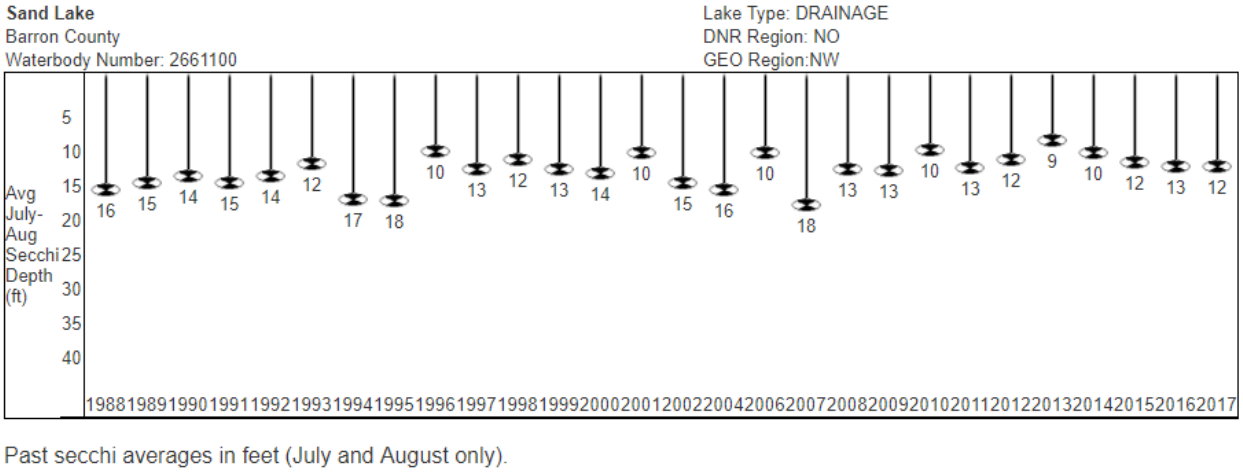

Figure 11: Average summer (July-August) Secchi disk readings at the Near Deepest Pt

Chemistry data was collected on Sand Lake - Near Deepest Pt. The average summer Chlorophyll was 3µg/l, an increase of 0.7µg/l from 2016. The Northwest Georegion summer average was 15.3µg/l. The summer total phosphorus average was 20µg/l. This is also an increase from the values seen in 2016. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticeable algae blooms.

Figure 12 shows the average summer Trophic State Index (TSI) value for total phosphorus, chlorophyll, and Secchi disk readings. The overall Trophic State Index (based on chlorophyll) for Sand Lake - Near Deepest Pt was 43. This TSI suggests that Sand Lake - Near Deepest Pt was mesotrophic. Despite being 2 points higher than the TSI found in 2016, Sand Lake is still on the low side of being mesotrophic. 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 2017.

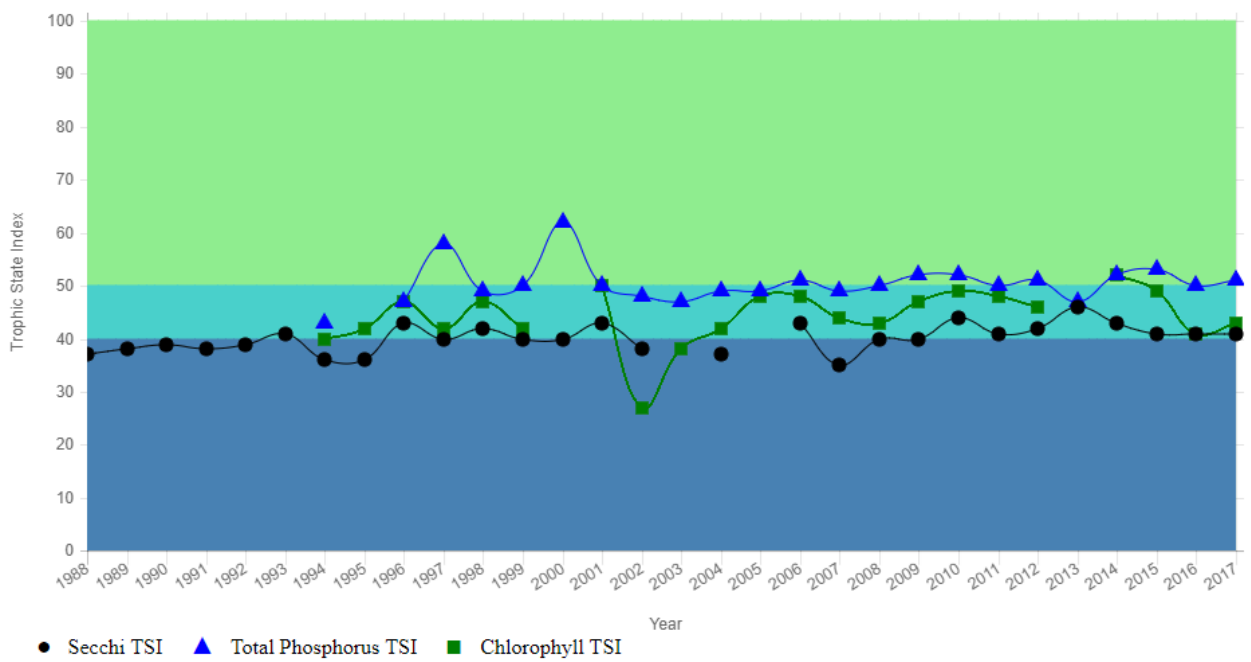

Figure 12: 2017 Summer (July and August) TSI values for total phosphorus and chlorophyll-a at the Near Deepest Pt on Sand Lake

GRANT FUNDED PROJECTS AND GRANT APPLICATIONS

The Lake Protection Grant to cover the repair of the NW Wash was again extended through the end of 2019 to accommodate additional runoff monitoring in it. Monitoring results from 2018 and 2019 will be used to determine if a repair or improvement project is necessary in the NE Wash.

The Healthy Lakes Grant to support several lakeshore improvement and Fishsticks projects is in its second year in 2017. Five of six Fishsticks installations were completed in the winter of 2016-17. Two additional Fishsticks installations were completed in the winter of 2017-18. All other projects were completed and a request for reimbursement was submitted.

PICNIC AND LAKE FAIR

Every year the SLMD holds a picnic/lake fair event to focus on AIS and other actions being completed by the Lake District. In 2017 this event was held on July 29. More than 50 people attended the Lake Fair/Picnic. Information was provided by LEAPS about the 2017 EWM management actions and a pontoon tour of the lake was completed.

The SLMD held its annual Membership Meeting on August 20, 2016 at 9:00am in the Maple Plain Town Hall. Approximately 25 people were in attendance at the meeting.

Respectfully Submitted by LEAPS on January 12, 2019

REFERENCES

Berg, M. (2016). *Warm-water Point-intercept Macrophyte Survey – Sand Lake WBIC: 2661100 Barron County, WI*. St. Croix Falls, Wisconsin: Endangered Resource Services, LLC.

Berg, M. (2017). *Warm-water Point-intercept Macrophyte Survey – Sand Lake WBIC: 2661100 Barron County, WI*. St. Croix Falls, Wisconsin: Endangered Resource Services, LLC.