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VERMILLION LAKES
BARRON COUNTY

2020 AQUATIC PLANT MANAGEMENT IMPLEMENTATION SUMMARY REPORT WDNR WBIC: LOWER VERMILLION 2098200; UPPER VERMILLION 2098800

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January 21, 2021

VERMILLION LAKES ASSOCIATION
CUMBERLAND, WI 54829

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PREPARED FOR THE VERMILLION LAKES ASSOCIATION

INTRODUCTION

This report discusses aquatic plant management activities completed by the Vermillion Lakes Association (VLA) and Lake Education and Planning Services (LEAPS) during the 2020 season and discusses Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP) management planning and implementation for 2021. In the spring of 2018, the Vermillion Lakes Association (VLA) was awarded a 3-yr AIS Control grant to manage CLP and EWM in both Lower (LVer) and Upper (UVer) Vermillion lakes. Chemical management of CLP and EWM in LVer; and CLP harvesting in UVer was included in the grant.

The following list of education and management actions were completed in 2020.

- 2020 EWM and CLP Management Planning and Implementation
- 2020 Herbicide Concentration Testing in Lower Vermillion Lake
- 2020 Fall EWM Fall Bed-Mapping
- 2020 Management in Upper Vermillion Lake
- 2020 Clean Boats Clean Waters
- 2020 AIS Education and Monitoring
- 2020 Citizen Lake Monitoring Network Water Quality Testing – Lower Vermillion Lake
- 2020 Citizen Lake Monitoring Network Water Quality Testing – Upper Vermillion Lake
- 2021 Plans

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

PROPOSED LVER EWM CHEMICAL TREATMENT

In the grant that covers 2018, 2019, and 2020 it was set up that LEAPS and VLA volunteers would complete fall EWM bedmapping in 2018 and again in 2020, with ERS completing it in 2019. On October 20th, 2019, ERS searched 21.9 kilometers (13.6 miles) of transects within the lake's littoral zone. Although ERS didn't find any true beds, they did locate 24 individual plants and two floating fragments near the lake outlet (Figure 1). This was a significant decline from the 0.31acre that was mapped during the last fall survey done by ERS in 2017.

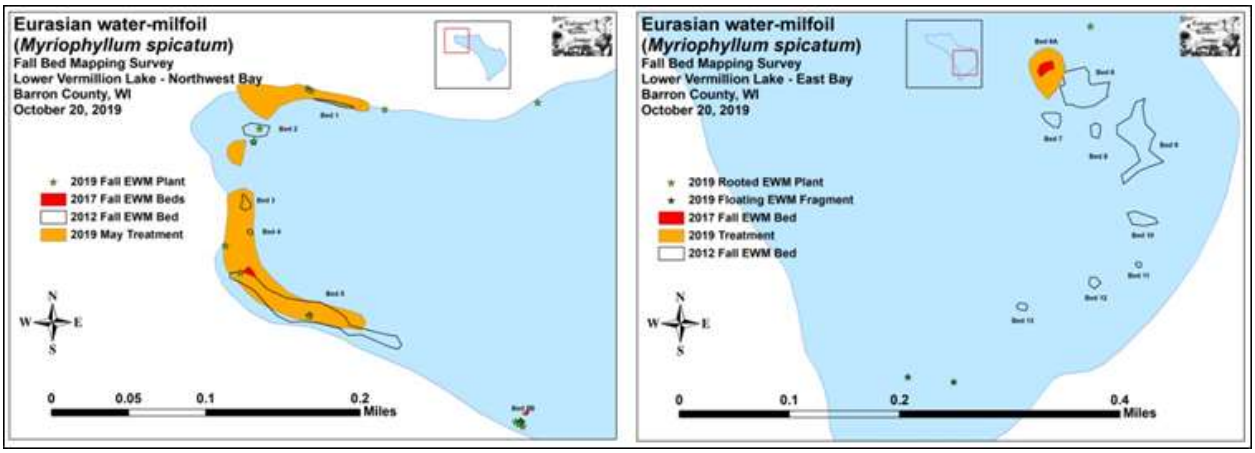


Figure 1: 2018 fall EWM survey results – West Basin

Based on these results, a preliminary chemical treatment proposal for 2020 was set up covering 5.13 acres of the lake. This included 2.26-ac of CLP and 4.64-ac of EWM with 1.77 acres of overlap (Table 1, Figure 2).

Table 1: 2019 EWM chemical treatment proposal

Location/Name	ERS Bed #	Acreage	Mean Depth (feet)	Volume (acre-feet)
RWB-20(EWM); RWB1-20(CLP); RWB2-20(CLP)	Beds 1-5, 5B	3.56	5.0	17.80
REB-20(EWM)	Bed 6A	1.08	8.0	8.64
RNS-20(CLP)	15	0.49	5.0	2.45
Total		***5.13***		***28.89***

Figure 2: 2020 Proposed CLP (green) and EWM (white) chemical treatment map

2020 PRE-TREATMENT SURVEY WORK

Prior to any chemical treatment in 2020, ERS completed a pre-treatment survey in the areas proposed for chemical treatment to document the presence of EWM and CLP. To complete this survey, LEAPS provided proposed treatment area shapefiles to ERS, and then ERS generated pre/post survey points based on the size and shape of the areas. An 80 point sampling grid at 16.5m resolution that approximated to nearly16 pts/acre was set up. Although this was well above the 4-10 pts/acre required by WDNR protocol for pre/post treatment surveys, the high number of points was requested due to the narrowness of the treatment areas and the difficulty in getting enough points in the target depths (Figure 3). ERS completed the pre-treatment survey on May 18, 2020. In hindsight, this may have been too early in 2020 as plants were not as far along in their growth as they usually are at this time. During the survey, EWM was only found as a visual at a single point. However, scattered plants were observed inter-point throughout the proposed treatment areas. Similarly, CLP was scattered throughout the proposed treatment areas. Because of this, it was decided to continue with the treatment as planned.

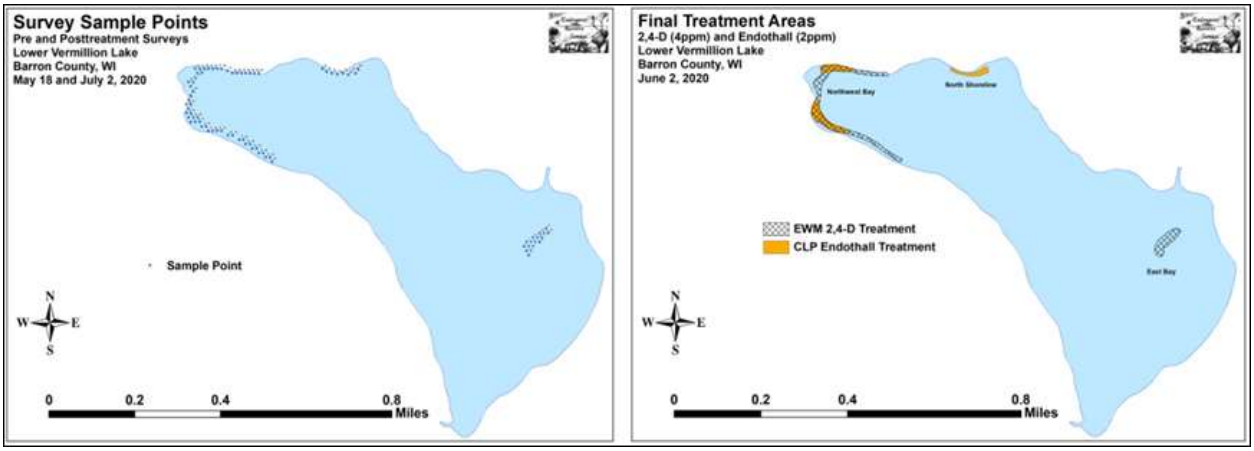


Figure 3: 2020 ERS pre and post treatment survey points and final chemical treatment area

2018 CHEMICAL TREATMENT OF CLP AND EWM IN LOWER VERMILLION LAKE

Chemical treatment was conducted by Northern Aquatic Services (Dresser, WI) on June 2nd. The reported water temperature at the time of treatment was 69°F, while the air temp was 75°F. Winds were out of the west at 3-5mph. Table 2 reflects the details of the 2020 spring CLP and EWM chemical treatments in LVer.

Table 2: 2020 Chemical treatment details

Area	Total Area Acreage	Chemical (Brand), Rate, Total lbs/gal and Coverage
East Bay	1.08	2,4-D (Amine 4) – 4ppm – 24.5 gallons – 1.08 acres
North Shoreline	0.49	Endothall (Aquathol K) – 2ppm – 3.3 gallons – 0.49 acre
Northwest Bay	3.56	2,4-D (Amine 4) – 4ppm – 50.6 gallons – 3.56 acres Endothall (Aquathol K) – 2ppm – 11.7 gallons – 0.65acre/1.12 acres
Total Acres	**5.13**	

Liquid herbicides (2,4D and endothall) were used for all chemical treatment in 2020. During the pre-treatment survey, coontail was the most abundant native plant. Common waterweed, northern watermilfoil, water stargrass, white water crowfoot, and spatterdock were also present along with CLP and EWM.

Both herbicides were applied on the same day.

2020 POST-TREATMENT SURVEY

On June 2nd, ERS completed a post-treatment aquatic plant survey. During the posttreatment survey, a single severely chemically burned EWM was located at a point along the south shoreline of the northwest bay. A couple of other plants were identified inter-point near the southeast border of the treatment area (Figure 4). Each of these was rake removed. Due to the low number of EWM plants found during both surveys, none of our findings demonstrated a statistically significant change.

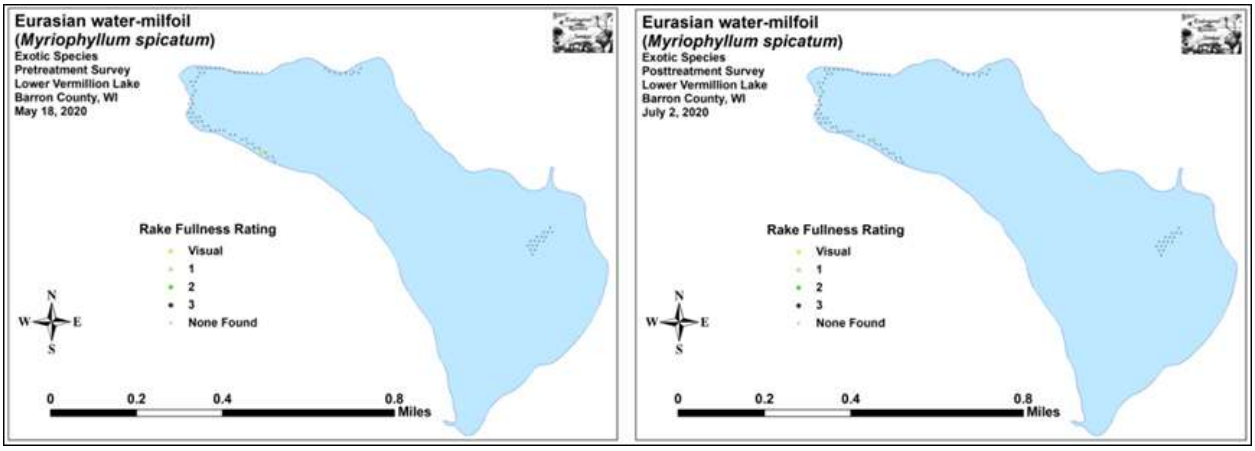


Figure 4: 2020 Pre and post treatment CLP

During the posttreatment survey, it was noted that many CLP plants appeared chemically burned, but survived to form viable turions. In these cases, the plants were counted as being alive. In total, CLP was identified at 13 points (16.3% coverage) with nine additional visual sightings (Figure 5). These results demonstrated a moderately significant increase in visual sightings from the pretreatment survey. None of the other increases were significant, although the total increase was nearly significant.

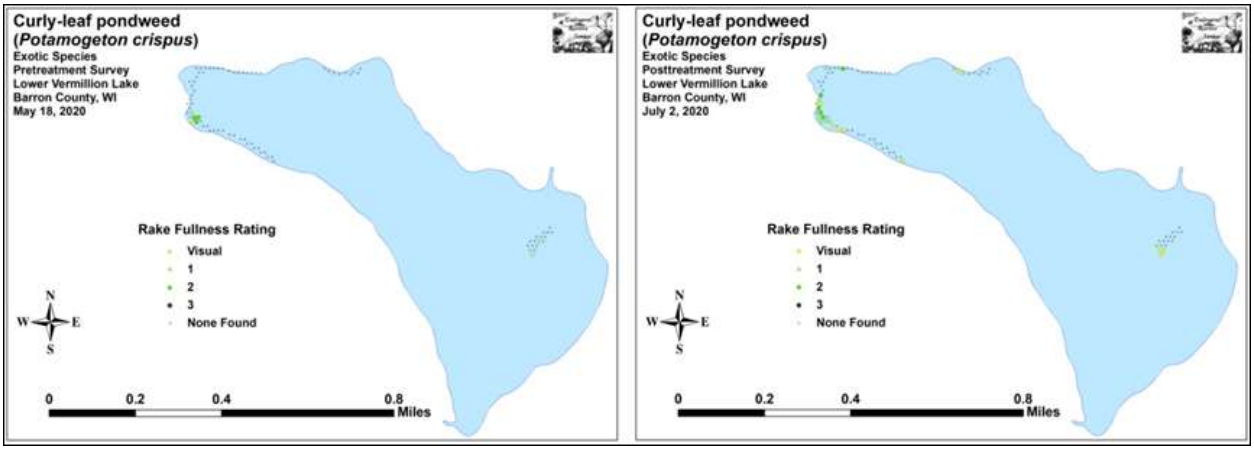


Figure 5: 2020 Pre and post treatment EWM

2020 PRE AND POST DISTRIBUTION OF NATIVE PLANTS

Table 3 reflects the statistics associated with the 2020 pre and post-treatment aquatic plant surveys. Also added to the table are the statistics from the 2019 pre and post-treatment survey. It was mentioned earlier, that the 2020 pre-treatment survey may have been done too early for the existing growing conditions. This is supported by the pre-treatment survey results from both 2019 and 2020. Nearly all of the pre-treatment survey values from 2020 are lower than their counterparts from 2019. Perhaps some of the most significant numbers are only 8 plant species in 2020, while there were 15 in 2019. Frequency of occurrence in 2020 is way lower than what it was in 2019. All of the numbers related to average number of species per site are lower in the 2020 pretreatment survey than they were during the 2019 survey. Taken as a whole, this suggests that the aquatic plant community in May of 2020 just was not as far along in growth as it was at roughly the same time in 2019.

However, when looking at the post-treatment numbers for 2019 and 2020, nearly all of the 2020 numbers are higher than the numbers from 2019. The numbers just for 2020 post-treatment survey are much higher than

the numbers from the pre-treatment survey. This is not the case when looking at pre and post from 2019 – these values are much closer to one another. Again, all of this suggests that the pre-treatment survey was done too early in 2020. If this is the case, then not finding as much CLP and EWM during the 2020 pre-treatment survey also makes sense.

Table 3: Pre/Posttreatment Surveys Summary Statistics Lower Vermillion Lake, Barron County 2020 & 2019

Summary Statistics:	Pre 2020	Post 2020	Pre 2019	Post 2019
Total number of points sampled	80	80	86	86
Total number of sites with vegetation	57	76	80	80
Total number of sites shallower than the maximum depth of plants	80	80	86	86
Freq. of occur. at sites shallower than max. depth of plants (in percent)	71.3	95.0	93.0	93.0
Simpson Diversity Index	0.61	0.84	0.75	0.77
Mean Coefficient of Conservatism	5.3	5.6	6.2	5.8
Floristic Quality Index	13.1	20.2	22.5	19.9
Maximum depth of plants (ft)	11.0	11.0	12.0	12.5
Mean depth of plants (ft)	5.8	5.3	5.4	5.4
Median depth of plants (ft)	5.5	5.0	5.5	5.3
Average number of all species per site (shallower than max depth)	0.98	1.78	1.60	1.59
Average number of all species per site (veg. sites only)	1.37	1.87	1.73	1.71
Average number of native species per site (shallower than max depth)	0.90	1.60	1.40	1.51
Average number of native species per site (sites with native veg. only)	1.26	1.75	1.54	1.65
Species Richness (including visuals)	8	15	15	14
Mean Rake Fullness (veg. sites only)	1.49	1.66	1.84	1.54

Coontail was the most common native species in both the 2020 pre and posttreatment surveys. Present at 47 sites pretreatment, it experience a non-significant decline in distribution to 43 sites posttreatment. Its density saw a nearly significant increase from a mean rake fullness of 1.45 pre to 1.63 post. This is similar to 2019.

Common waterweed was the second most common pretreatment species. Present at seven points with a mean rake fullness of 1.14, it experienced non-significant increases in distribution and density to nine sites with a mean rake of 1.33 posttreatment.

Northern water-milfoil – which is sensitive to 2,4-D – was the only native species that suffered a significant decline in distribution posttreatment. Conversely, several late-growing species experienced significant expansions in distribution – Wild celery and Slender naiad demonstrated highly significant increases; filamentous algae showed a moderately significant increase; and Water star-grass, Muskgrass, and Sago pondweed had significant increases (Figure 6).

The loss of NWM as a result of the treatment is only slightly concerning, given that visual evidence throughout the 2020 open water season showed no lack of this desirable species in the treatment areas and the rest of the lake.

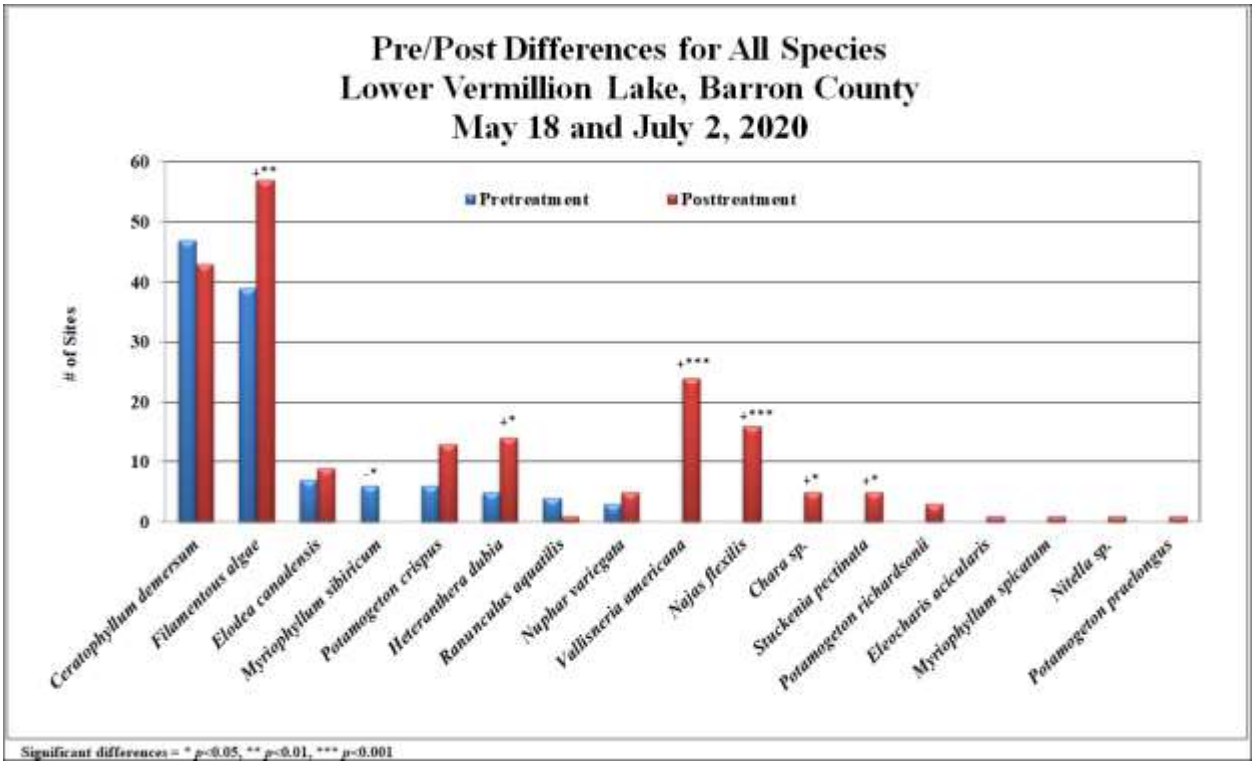


Figure 6: 2019 significant changes in aquatic vegetation from pre to post-treatment

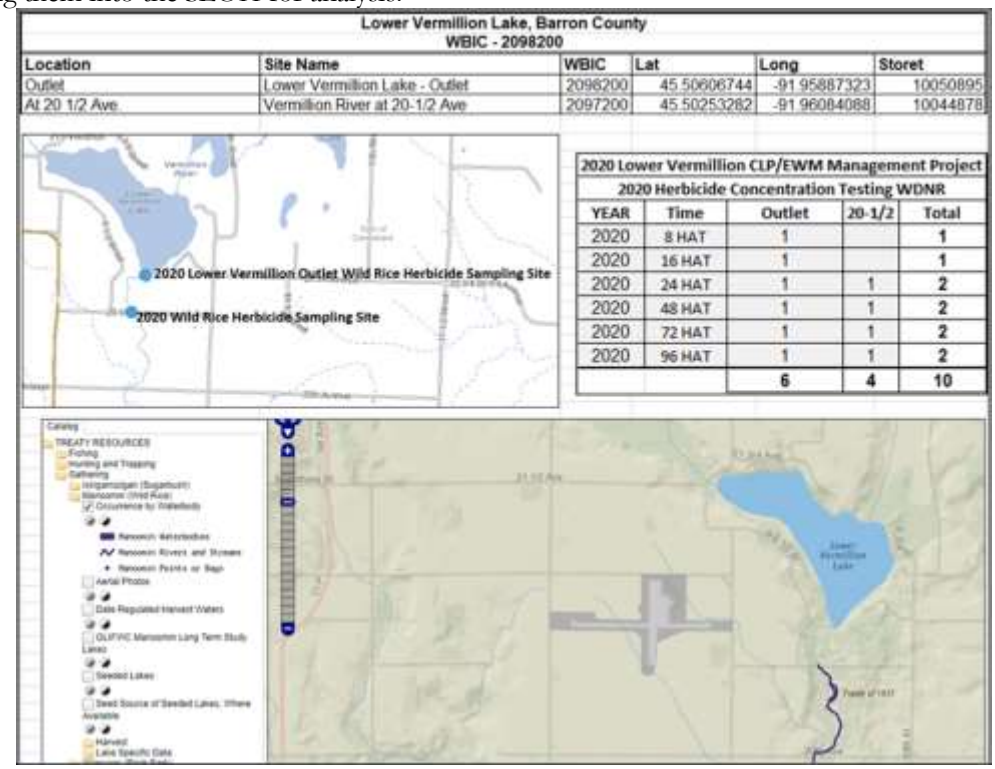
More information about the 2020 pre and post treatment survey results can be found in the 2020 Eurasian water-milfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*) Pre/Posttreatment Surveys Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin authored by Matt Berg, ERS.

2020 HERBICIDE CONCENTRATION TESTING IN LOWER VERMILLION LAKE

As requested in a review letter from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) received April 30, 2020, the Vermillion Lakes Association implemented an herbicide concentration testing program post-treatment in Lower Vermillion Lake in 2020.

"If a permit is issued for this proposed chemical treatment of CLP and EWM at Lower Vermillion then monitoring/analysis of treatment chemicals should include sites: 1) at the southern outlet of the lake (as recommended in an earlier treatment report) and 2) just before the rice bed found on the Vermillion River approximately three-quarters of a mile south of Lower Vermillion Lake, just north of 20th Avenue (Wisconsin Ceded Territory Manoomin Inventory). At the very least, these testing results will help show the movement of the chemicals around and out of Lower Vermillion Lake." Jonathan Gilbert Ph.D. Director, Biological Services Division.

A WDNR permit for chemical management was issued on May 7, 2020. As a result, the following herbicide concentration testing plan was developed for 2020 (Figure 7). It included 6 testing times post treatment, at two different sites: the outlet, and at the bridge on 20-1/2 Ave. Testing for both endothall and 2,4-D was conducted. Sample materials were assembled by LEAPS with a VLA volunteer collecting the water samples and sending them into the SLOH for analysis.



Lower Vermillion Lake, Barron County
WBIC - 2098200

Location	Site Name	WBIC	Lat	Long	Storet
Outlet	Lower Vermillion Lake - Outlet	2098200	45.50606744	-91.95887323	10050895
At 20 1/2 Ave	Vermillion River at 20-1/2 Ave	2097200	45.50253282	-91.96084088	10044878

2020 Lower Vermillion CLP/EWM Management Project
2020 Herbicide Concentration Testing WDNR

YEAR	Time	Outlet	20-1/2	Total
2020	8 HAT	1		1
2020	16 HAT	1		1
2020	24 HAT	1	1	2
2020	48 HAT	1	1	2
2020	72 HAT	1	1	2
2020	96 HAT	1	1	2
		6	4	10

Figure 7: 2020 Lower Vermillion herbicide concentration testing plan

Results from this testing indicated that both 2,4-D and endothall made it to the outlet of the lake, but at very low concentrations. Endothall concentrations less than 10µg/L made it to the outlet of the lake and the bridge at 20-1/2 Ave between 24 and 48 hours after application. No trace of endothall was evident at the 20-1/2 Ave bridge between 48 and 72 hours after treatment.

2,4-D made it to the outlet and the 20-1/2 Ave bridge between 16 and 24 hours after application, however its concentration was also very low at less than 50µg/L. After 96 hours, 2,4-D was still present at the outlet and the 20-1/2 Ave bridge but the concentration was lower than the max between 24 and 48 hours. No testing was completed beyond 96 hours. Also, no concentration testing was completed in the actual treatment sites on the lake.

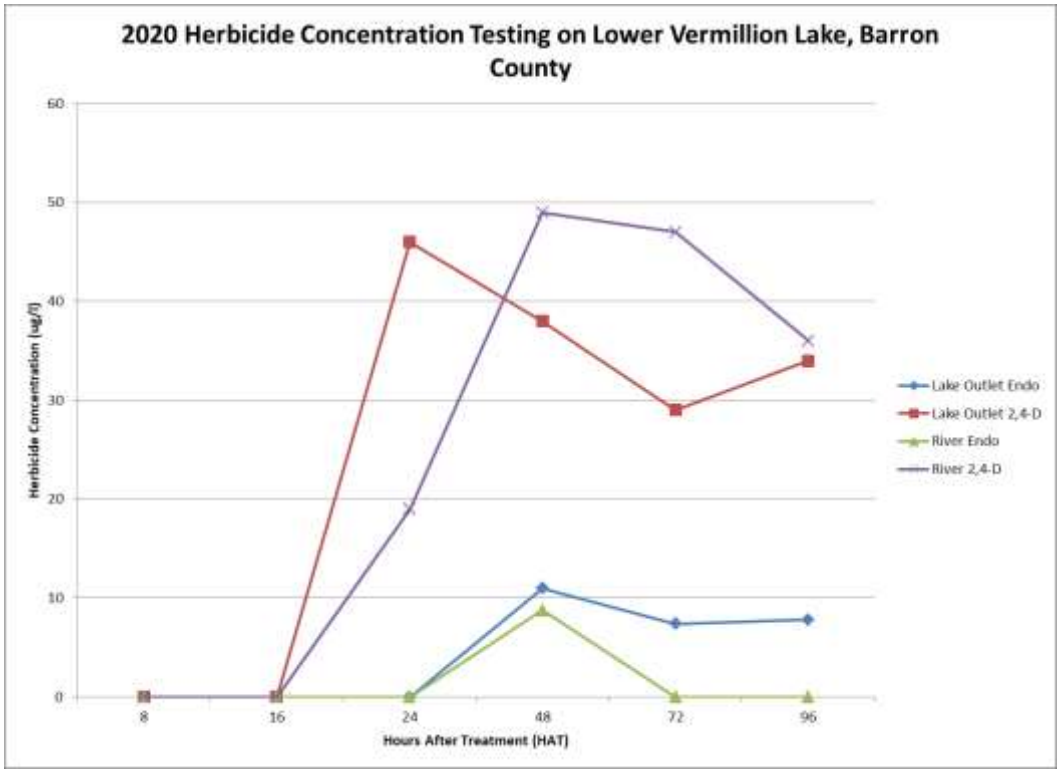


Figure 8: 2020 herbicide concentration testing results on Lower Vermillion Lake

2020 FALL EWM FALL BED-MAPPING

2020 fall EWM bedmapping was completed by LEAPS and VLA volunteers. At no time during the summer and fall season was any EWM found that was considered to be a bed or high density area. However, multiple individual EWM plants were identified and pulled via rake or snorkeler throughout. The most striking find was 3-4 small towers of EWM interspersed in the lily pads near the outlet of the lake. Late in October, multiple plants were again found along the southwest shore. These plants were small is size but fairly spread out. VLA volunteers removed as many of them as they could.

CLP was not formally mapped in either lake in 2020 due to Covid-19 issues.

Going into 2021, there are no plans to use chemicals to manage CLP or EWM in Lower Vermillion Lake. A new grant application has been submitted that will support the greater use of divers, and potentially DASH to manage EWM in 2021. Surveys will get underway in May 2021 to begin the process of documenting and removing EWM in the lake. After 2021, management actions will need to wait to be proposed.

2020 MANAGEMENT IN UPPER VERMILLION LAKE

No management actions were completed on Upper Vermillion Lake in 2020.

2020 CLEAN BOATS, CLEAN WATERS (CBCW)

In 2020, the VLA requested and received a grant to support a CBCW program. The grant required at least 200 hours of time monitoring boats, but this was flexible based on COVID-19 issues in 2020. Between paid and volunteer time, the VLA was able to amass 200 hours meeting the requirement. A total of 172 boats were inspected during this time and 329 people were contacted by watercraft inspectors. These numbers are the highest in five years of monitoring at the landing. All 2020 data is in the WDNR SWIMS database.

As in past years, there has been a fair amount of complaint about the public access site on Lower Vermillion Lake. It has become increasingly impacted with sediment making it difficult to launch a boat and getting to the open water without dragging a boat motor through muck. LEAPS damaged a 25-hp motor in 2020 on Lower Vermillion Lake when the driver got stuck in the sediment bed. The sediment in the area is not dense, but rather loose and flocculent, making it easy to suck up into a boat motor damaging seals and other parts of the motor. The VLA is again trying to pursue actions that could lead to dredging of the boat landing area.

2020 AIS EDUCATION AND MONITORING

The VLA sends out three newsletters a year (spring, summer, and fall) to everybody on the lake. The newsletter is used to announce events, remind property owners of responsibilities and volunteer requests, and update things like CLP and EWM management, plant survey results, loon watch, water quality and other interesting tidbits.

The President of the VLA is on the WDNR list-serv and on the contact list for Barron County. Whenever a publication or notice comes from one of these entities that pertain to the lake or residents on the lake, the information is shared with all of the VLA constituency through a mass email. Over the last several years, the President of the VLA has collected correct emails, for nearly all of the property owners on the two lakes.

The VLA breakfast was canceled in 2020 due to Covid 19.

Tom Margotto, the president of the VLA, several volunteers, and resource people including a LEAPS employee and Matt Berg completed surveys of the two lakes for AIS multiple times during the summer. Physical removal days were completed 4 times during the season. At the end of the season, property owners were reminded to inspect their docks and other structures as they were removed from the lakes.

No new AIS were found in the lake. CLP and EWM continue to be in the places it has been found before, and unfortunately, in at least one new area – mixed in with dense vegetation near the outlet of Lower Vermillion Lake. When these plants were found, they were physically removed. However, there are likely more plants in these areas that were not found. It will be one of the areas where survey and physical removal are concentrated in 2021.

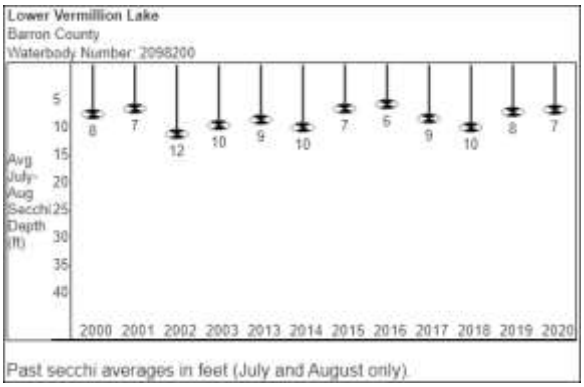
2020 CITIZEN LAKE MONITORING NETWORK (CLMN) WATER QUALITY TESTING – LOWER VERMILLION LAKE

Between the Citizen Lake Monitoring Network (CLMN) and the 3-yr AIS control grant, Lower Vermillion Lake - Deep Hole was sampled 17 different days during the 2020 season. Sampling as a part of the CLMN program ends in August. Through the grant, additional water samples were collected in September and October. Except for spring 2020 turnover water sampling, all other water samples were collected. Parameters sampled included: water clarity, temperature, dissolved oxygen, total phosphorus, and chlorophyll. The average summer (July-Aug) secchi disk reading for Lower Vermillion Lake - Deep Hole (Barron County, WBIC: 2098200) was 7.33 feet (Figure 9). The average for the Northwest Georegion was 8.8 feet. Typically the summer (July-Aug) water was reported as clear and blue. The deepest Secchi disk reading taken in 2020 was 13.75ft on July 5th. The least or shallowest reading was 4.5ft in late July and early August.

Chemistry data was collected on Lower Vermillion Lake - Deep Hole. The average summer Chlorophyll was 21.1µg/l, nearly double what it was in 2019 (11.2µg/l). The Northwest Georegion summer average for 2020 was 15.5µg/l, which was higher than what it was in 2019 (13.2µg/l). The summer Total Phosphorus average was 28.5µg/l, slightly higher than it was in 2019 (27.4µg/l). Lakes that have more than 20 µg/l of total phosphorus may experience noticeable algae blooms (Figure 10). This value was slightly higher than the average for natural lakes, however, for the most part water quality in Lower Vermillion Lake was not as good as it was last year when for the first time ever, the lake was listed as oligotrophic, but it was certainly good enough for people to enjoy the lake.

The highest TP values were in late August and early September suggesting some internal loading of phosphorus. However, as water temperatures cooled in the fall it appears that TP and chlorophyll-a values headed back down.

The overall Trophic State Index (based on chlorophyll) for Lower Vermillion Lake - Deep Hole was 58, five points higher than what it was in 2019. The TSI suggests that Lower Vermillion Lake - Deep Hole was eutrophic. This TSI usually suggests decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only. These characteristics accurately reflect what is evident in Lower Vermillion Lake.



Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
2000	8.13	5	9.75	4
2001	7.1	5	10.5	5
2002	11.89	10	15	9
2003	10.25	9.5	11	2
2013	9.1	8	9.75	5
2014	10.58	8	14.75	3
2015	7.25	5.25	10.25	3
2016	6.31	3.75	8.5	4
2017	9	7	11.5	3
2018	10.5	6.75	14.75	4
2019	7.75	6	10	4
2020	7.33	4.5	13.75	5

Figure 9: 2019 Average summer (July and August) Secchi disk readings at the Deep Hole on Lower Vermillion Lake

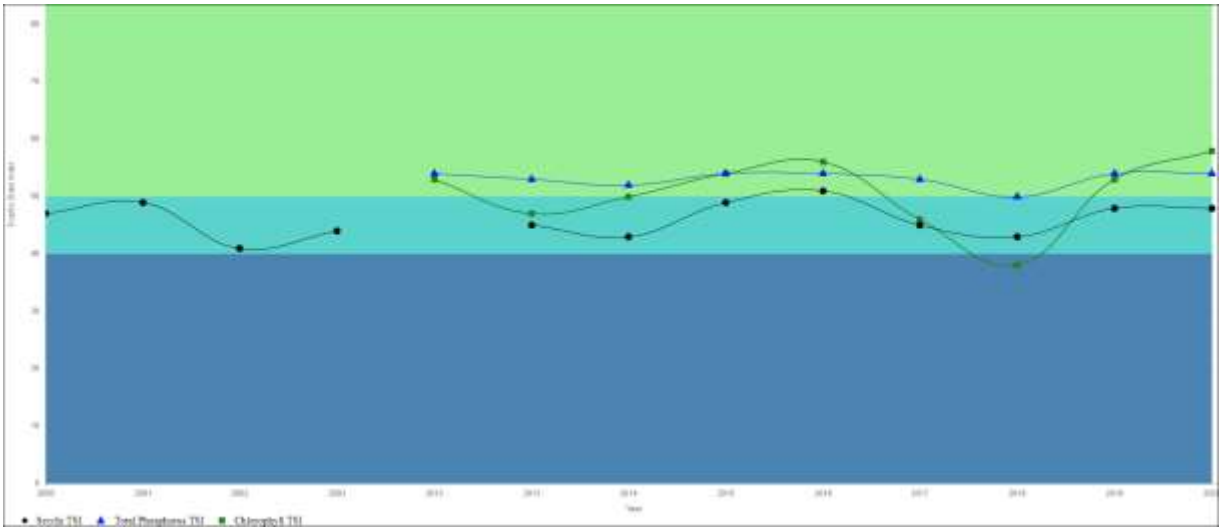


Figure 10: 2019 Summer (July and August) TSI values for total phosphorus and chlorophyll-a at the Deep Hole on Lower Vermillion Lake

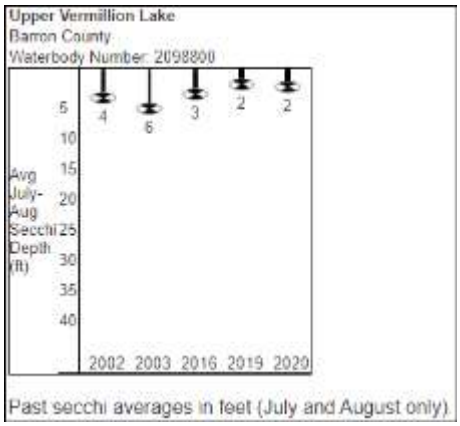
Dissovled oxygen and temperature profiles were collected on Lower Vermillion Lake 10 times in 2020. They indicate that Lower Vermillion Lake is dimictic meaning it has both a spring and fall turnover and stratifies in the summer. Stratification was documented in profiles taken by volunteers June 4 through October 7, 2020. A thermocline was established in early June at a depth of about 24ft. As the summer progressed the thermocline moved up to 12ft at its lowest on August 23. By early September the thermocline again started to deepen and by October 7 it was back to 24ft. , with the waters below that point being mostly devoid of oxtgen. No profiles were collected past October 7, so it is not known exactly when the lake completely remixed in the fall.

2020 CITIZEN LAKE MONITORING NETWORK (CLMN) WATER QUALITY TESTING – UPPER VERMILLION LAKE

Upper Vermillion Lake - Center was sampled 6 different days during the 2020 season. The dates where water samples were collected followed CLMN guidelines and extended monitoring into September and October through the AIS control grant. Parameters sampled included: water clarity, total phosphorus, and chlorophyll. The average summer (July-Aug) secchi disk reading for Upper Vermillion Lake - Center (Barron County, WBIC: 2098800) was 2.0 feet (Figure 11). The average for the Northwest Georegion was 8.8 feet. In 2019, only two Secchi disk readings of water clarity were recorded limiting the reliability of the summer trend analysis. The six readings in 2020 are better, but still not as many as would be liked, particularly during the summer season.

Chemistry data was collected on Upper Vermillion Lake - Center. The average summer Chlorophyll was 84.4µg/l , slightly less that what it was in 2019 (85.2µg/l). The Northwest Georegion summer average was 15.5µg/l. The summer Total Phosphorus average was 128.5µg/l, again lower than what it was in 2019 (132 µg/l), but still way too high. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticable algae blooms. Upper Vermillion Lake is considered a hyper-eutrophic lake meaning it is heavily impacted by the presence of algae in the water (Figure 13). The algae limits light penetration needed to sustain a healthy and robust native aquatic plant community. This is currently missing from Upper Vermillion Lake. As recent as just 5-years ago, the lake seemed to be recovering from a less than desireable aquatic plant community. That trends seems to have gone away in 2019, and continues to decline in 2020.

The overall Trophic State Index (based on chlorophyll) for Upper Vermillion Lake - Center was 68, the same as it was in 2019. The TSI suggests that Upper Vermillion Lake - Center was hyper-eutrophic. This TSI usually suggests blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible. These characteristics accurately reflect what is evident in Upper Vermillion Lake.



Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
2002	3.75	1.5	6	6
2003	5.5	5.5	5.5	1
2016	3.25	3	3.5	2
2019	1.5	1.5	1.5	1
2020	2	2	2	2

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Figure 11: 2020 Average summer (July and August) Secchi disk readings at the Center on Upper Vermillion Lake

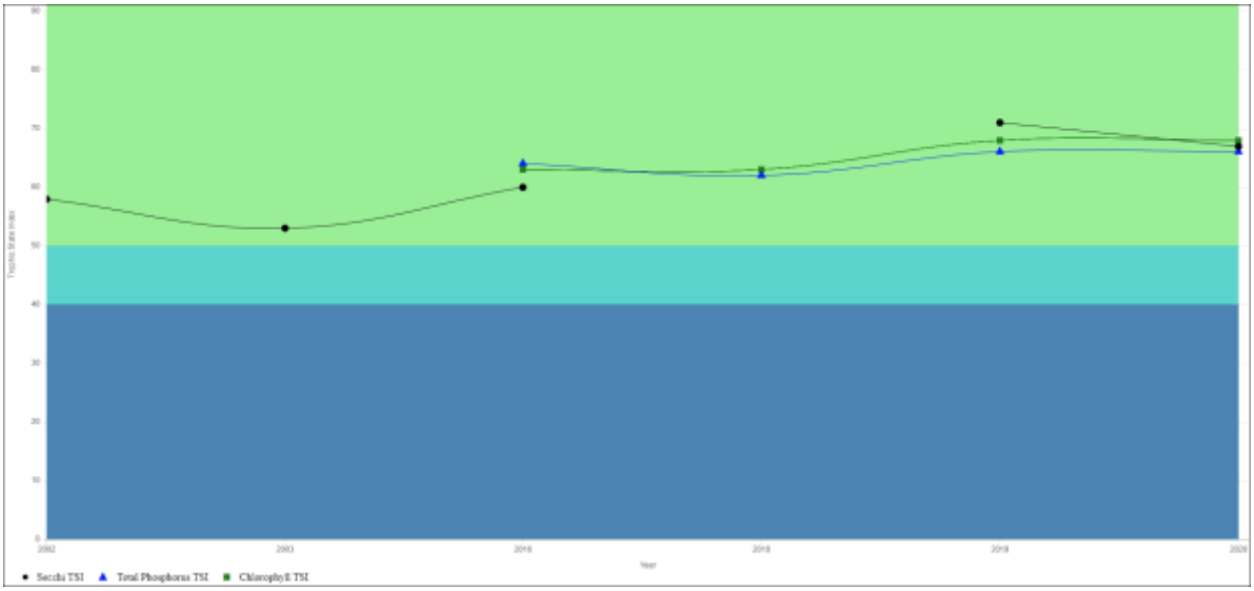

Figure 12: 2020 Summer (July and August) TSI values for total phosphorus and chlorophyll-a at the Deep Hole on Upper Vermillion Lake

Temperature and dissolved oxygen profiles were not taken in 2020 in Upper Vermillion Lake.

2021 PLANS

The VLA for the most part, has wrapped up the 3-yr AIS control grant awarded in 2018. It officially ends June 30, 2021. A new AIS population control grant was applied for in November 2020 to support EWM management over the last two years of the existing Aquatic Plant Management Plan. That plan will be updated if the new grant is awarded.

It is expected that the VLA will do no chemical treatment of either CLP or EWM in 2021. Populations were down enough in late 2020, that it was felt that at least a single year focused on physical removal of EWM through rake-removal, snorkeling, and scuba divers would be enough to keep EWM under control through 2021 and going into 2022.

As in 2019, there are no plans to complete any management activity in Upper Vermillion Lake in 2021. CLP survey work will be completed in both lakes. The VLA has already been awarded another CBCW grant so watercraft inspection will continue in 2021.