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RED CEDAR LAKES
BARRON COUNTY

2018 AIS EDUCATION, PREVENTION, AND PLANNING PROJECT IMPLEMENTATION SUMMARY REPORT

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February 6, 2019

RED CEDAR LAKES ASSOCIATION
MIKANA, WI 54857

Distribution List

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TABLE OF CONTENTS

FIGURES

TABLES

RED CEDAR LAKES 2018 AIS EDUCATION, PREVENTION, AND PLANNING PROJECT IMPLEMENTATION SUMMARY REPORT

PREPARED FOR THE RED CEDAR LAKES ASSOCIATION

INTRODUCTION

This report discusses aquatic plant management activities completed by the Red Cedar Lakes Association (RCLA) and Lake Education and Planning Services (LEAPS) during the 2018 season associated with the AIS Education, Prevention, and Planning (AEPP) project awarded in early 2018. This project covers waters in four different lakes: Balsam, Mud, Red Cedar, and Hemlock. The following list of education and management actions were completed in 2018.

- 2018 Curly-leaf Pondweed (CLP) Management Planning and Implementation
- 2018 CLP Mapping by Freshwater Scientific Services (FSS)
- 2018 Warm Water Whole-lakes, Point-intercept (PI), Aquatic Plant Survey
- 2018 Rhodamine Dye Study in Balsam Lake
- 2018 AIS Education/Information Event
- 2018 Survey of the Shoreline for Purple Loosestrife
- 2018 Surface Water Quality Monitoring in Balsam, Red Cedar, and Hemlock Lakes
- 2018 Tributary Monitoring and Nutrient Loading from four tributaries and the Outlet
- Water Action Volunteer (WAV) Stream Monitoring
- Nutrient Loading from four tributaries and the Outlet
- Updating of the current Aquatic Plant Management Plan

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

Based on CLP Bedmapping completed by Red Cedar Lake Association (RCLA) volunteers from 2016 and 2017, four areas of CLP management were initially proposed going into the 2018 season. Two CLP treatment plots totaling 9.56-ac were proposed in Red Cedar Lake; and two CLP treatment plots totaling 8.25-ac were proposed in Hemlock Lake. Together these four sites covered 17.81-ac. However, due to lousy growing conditions for CLP in the spring of 2018, the two treatment areas in Hemlock Lake were dropped from the final CLP treatment proposal. The two treatment areas in Red Cedar Lake were left the same (Table 1, Figure 1). Both of these sites were sites that had not been chemically treated before, but had been recognized as moderate to dense areas of CLP growth capable of interfering with lake use and impacting native aquatic plant growth.

Table 1 – 2018 Final Red Cedar Lakes CLP Chemical Treatment Details

2018 Red Cedar Lake FINAL CLP Treatment Details 05-21-2018 (LEAPS)								
Name	ID	CLP Density	Substrate	Acres	Mean Depth (feet)	Acre-ft	Treatment a.i. ppm	Aquathol K (liquid) application (gal)
Red Cedar-FlagpoleBay	RCFlgPlBay	Dense		3.16	6.4	20.2	1.50	20.22
Red Cedar-PigeonCreek	RCPigCrk	Mod/Dense		6.40	6.2	39.6	2.00	52.60
TOTAL				***9.56***		***59.8***		***72.83***

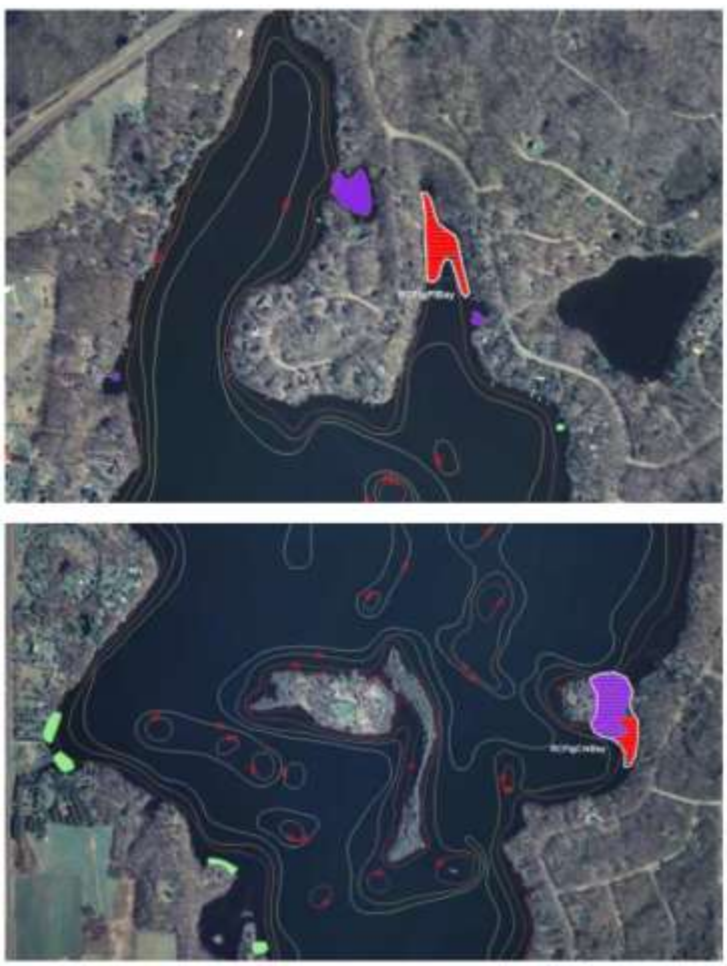


Figure 1 – 2018 Final Red Cedar Lakes CLP Chemical Treatment Map

Pre and post post-treatment surveys were not completed in 2018, however early season CLP observations made by RCLA volunteers were used to finalize the 2018 treatment plan.

Application of Aquathol K was completed by Northern Aquatic Services on May 23, 2018. Wind was 0-4 mph, water temperature was 61°F and air temperature was 75°F.

2018 CLP MAPPING BY FRESHWATER SCIENTIFIC SERVICES (FSS)

The information in this section of this report was taken from the 2018 Curlyleaf Pondweed Delineation Survey Report completed by FSS (Johnson, 2018); 2017 RCLA CLP Bedmapping Results (LEAPS, 2017), and 2011 CLP Delineation (Johnson, 2011).

FSS surveyed the entire nearshore area of the Red Cedar Chain (from shore out to the 15-ft contour) during the first week of June 2018. During this survey, FSS navigated a meandering search path over the search area while using a combination of surface observations, sonar readings, and rake tosses to locate and delineate areas of CLP growth. When CLP was encountered, the location was marked, and the water depth recorded. The density of the growth was rated using visual and rake density scores as described in Table 2. For rake samples, a sampling rake was dragged over approximately 10 square feet of lake bottom and the CLP density recorded based on the number of plants (stem count) retrieved on the rake. The recorded water depths and density scores were linked to the recorded GPS locations and then mapped using desktop GIS software.

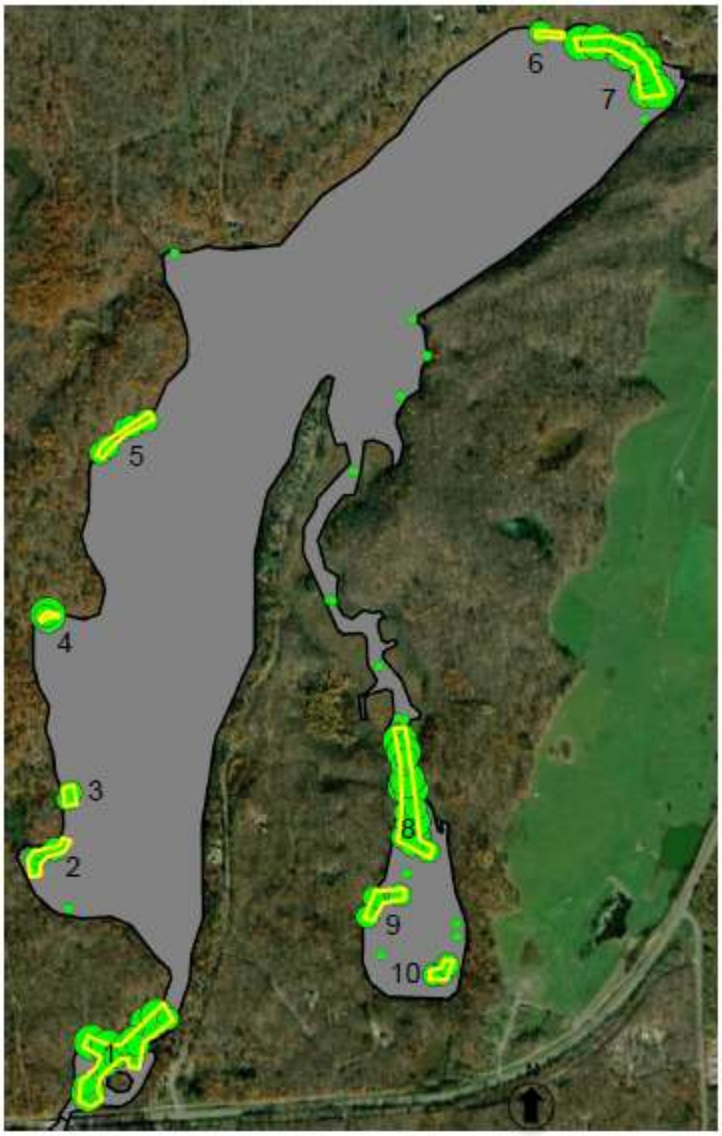
Table 2 – FSS CLP Density Rating Scale

Score	Visual	Rake
1	Light / Solitary plants	1-2 stems
2	Moderate / Scattered dense patches	3 to 9 stems
3	Dense / Uniform dense growth	10+ stems

Based on results from this survey, FSS created maps and tables reflecting what was found. Figures 2-4 show delineation results for each of the lakes. Only 30.3-ac of CLP bed growth was documented, however sparse growth CLP and individual CLP plants remained wide-spread throughout the entire system.

In 2018, the amount of CLP in the Red Cedar Lakes system was down from what was mapped in 2017 by RCLA volunteers (91.58-ac, Appendix A), and from what it was in 2011 when FSS last mapped CLP (152.6-ac, Figures 5-7). Part of this difference is likely due to how the mapping was done and how results were recorded. In both the 2011 FSS survey and the 2017 RCLA survey, CLP was documented and then a total acreage of the surface water where the plant was found was determined. CLP density in those areas documented was noted in the mapping. The 2018 mapping survey only identifies the acreage of the densest areas of CLP. If all the water with CLP in it were mapped with varying levels of density, then the surface areas with CLP would be much higher than what is documented in the 2018 survey results. While the amount of CLP found during the 2018 delineations was down, CLP was still found in pretty much all of the areas mapped by RCLA volunteers from previous years.

That CLP density was down in 2018, while notable, is not entirely surprising given that 2018 was a terrible growing season for CLP in northwestern WI. Ice was thick and covered with deep snow through ice out, which didn't occur until the last week of April. These conditions provided little light for early season, under the ice, CLP growth. Then when the ice finally did go out, air and water temperatures increased rapidly further reducing the time when CLP could grow well. Both 2016 and 2017 were good or great years for CLP growth, as was demonstrated in many lakes in the area. CLP density in 2018 was down in many lakes in the area as well, so this was not only a Red Cedar Lakes phenomenon. Future CLP management considerations will be based mostly on CLP data prior to 2018.



Management Plots

CLP Density

1
2
3

Plot	Acres	Avg Depth (ft)	Avg CLP Density (1 to 3)
1	3.8	3.9	1.9
2	0.8	3.5	1.3
3	0.3	4.1	2.0
4	0.1	2.9	1.8
5	0.7	3.4	1.8
6	0.2	4.5	1.3
7	2.5	4.6	2.4
8	2.7	2.6	2.2
9	0.8	2.7	2.0
10	0.4	1.5	2.0

Surveyed: June 4-5, 2018
Methods: Visual, Sonar, Rake
Surveyor: JA Johnson

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Map produced for the
Red Cedar Lakes Association by:

freshwater SCIENTIFIC SERVICES

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Osseo, MN 55369
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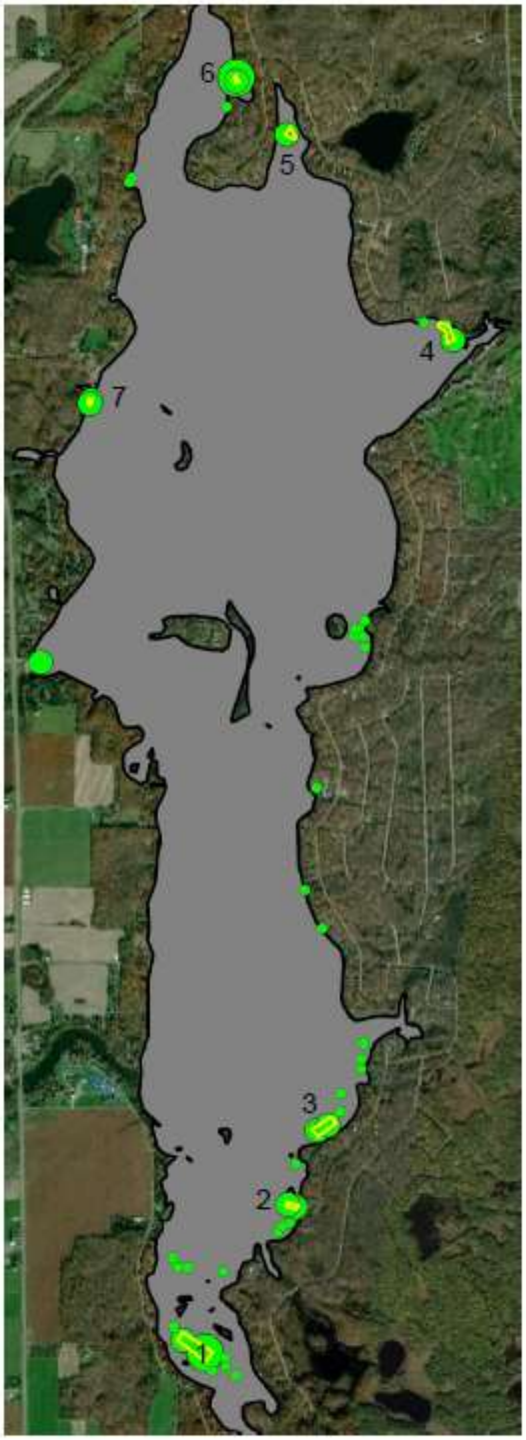
Figure 2 – Balsam and Mud Lake CLP Delineation Results



Plot	Acres	Avg Depth (ft)	Avg CLP Density (1 to 3)
1	2.6	4.1	2.5
2	0.3	6.7	2.0
3	1.4	8.6	1.7
4	0.9	8.4	1.2
5	0.4	9.8	1.3
6	0.1	3.3	2.5
7	0.1	6.6	2.0

Surveyed: June 4-5, 2018
Methods: Visual, Sonar, Rake
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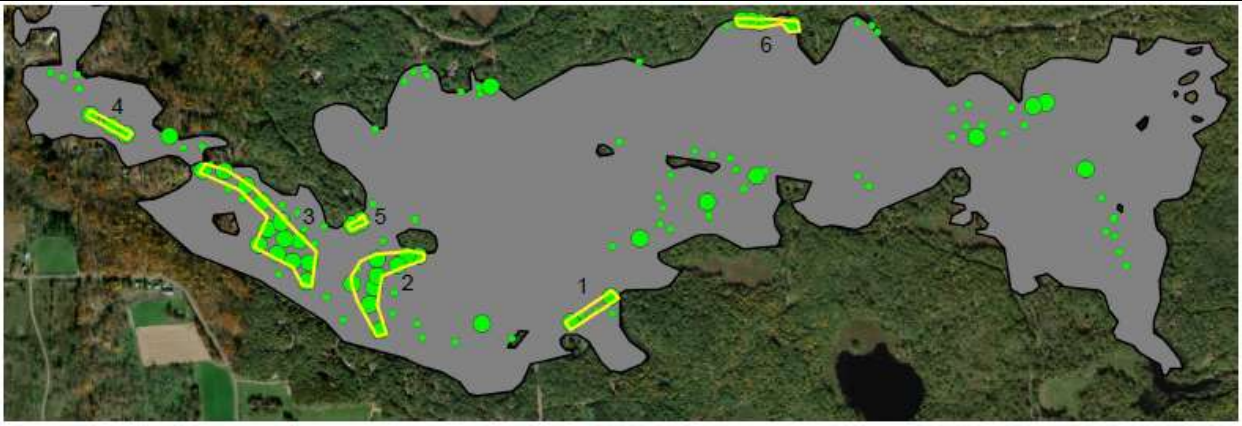
Figure 3 – Red Cedar Lake CLP Delineation Results



Management Plots

CLP Density
1
2
3

Plot	Acres	Avg Depth (ft)	Avg CLP Density (1 to 3)
1	1.0	9.1	1.5
2	4.0	6.7	1.9
3	5.6	6.4	1.8
4	0.6	5.3	1.8
5	0.2	6.3	1.7
6	0.8	4.3	1.6

Surveyed: June 4-5, 2018
Methods: Visual, Sonar, Rake
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Figure 4 – Hemlock Lake CLP Delineation Survey Results

Figure 12. *Curlyleaf Pondweed Beds* in the Red Cedar Lakes; June 2011. Each curlyleaf bed is identified by number. See Table 3 for area of each delineated bed; Figure 13 for curlyleaf density ratings associated with each bed.

Table 3. *Curlyleaf Pondweed Bed* identifiers and delineated areas (acres) in the Red Cedar Lakes; June 2011

Lake	Bed #	Area *(acres)*
Balsam	1	5.1
	2	4.5
	3	5.7
Mud	4	12.0
Red Cedar	5	1.5
	6	6.0
	7	20.7
	8	2.0
	9	20.7
	10	17.1
	11	3.5
Hemlock	12	25.3
	13	13.9
	14	14.6
Total Area		152.6

Figure 5 – 2011 CLP Delineation/Bedmapping Results from FSS

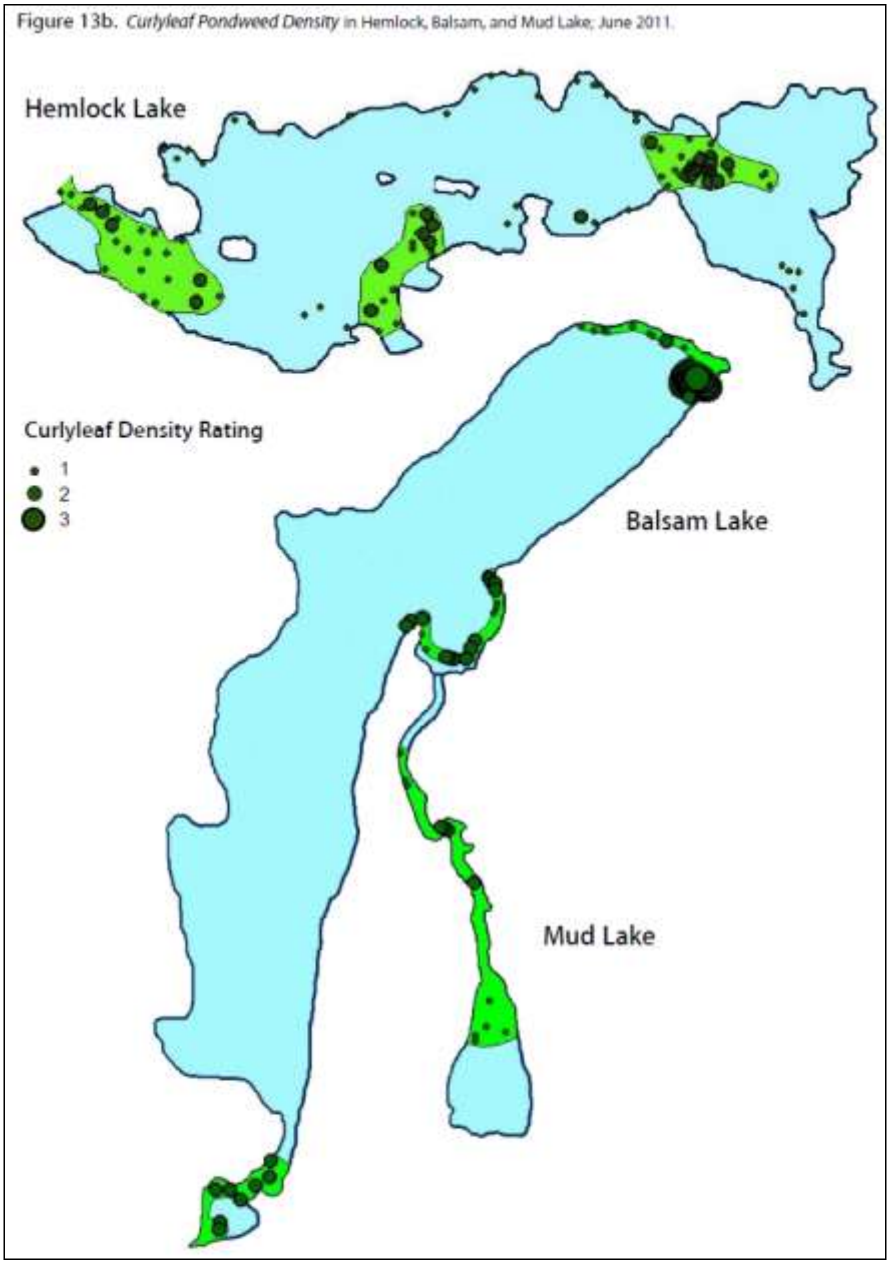

Figure 6 – 2011 CLP Density in Balsam, Mud, and Hemlock Lakes (FSS, 2011)

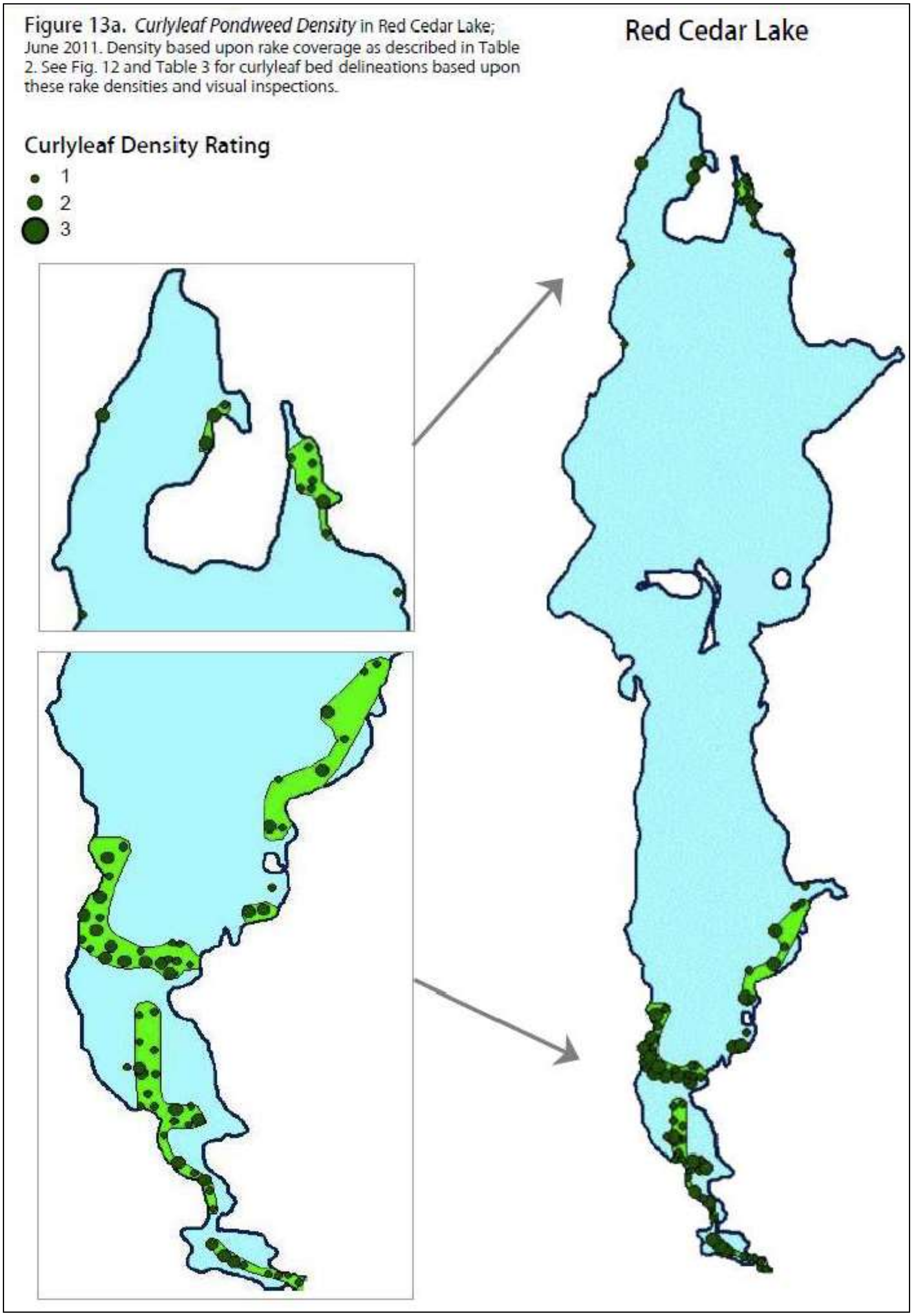

Figure 7 – 2011 CLP density in Red Cedar Lake (FSS, 2011)

2018 WARM WATER WHOLE-LAKES, POINT-INTERCEPT (PI), AQUATIC PLANT SURVEY

The information in this section of this summary report is taken from the 2018 Aquatic Plant Community of the Red Cedar Lakes completed by FSS (Johnson, 2018A): FSS completed lake-wide vegetation surveys for each of the four lakes between Aug 28 and Sep 7, 2018 using the point-intercept method. These surveys incorporated assessments at roughly 100 to 400 points in each lake (Figures 8–10). These points were arranged in a grid across each lake (points provided by WDNR). The sample point locations were loaded onto a handheld GPS unit to enable navigation to each point while in the field. At each designated location, plants were sampled plants using a rake. A double-headed, 14-tine rake on a pole was used for sites shallower than 10-ft. For sites deeper than 10-ft an identical rake head attached to a 50-ft rope was used. To ensure that each sample collected plants from a consistent area of lake sediment, the rake (13 inches wide) was dragged approximately 1-ft along the bottom before retrieving. For each rake sample, all of the retrieved plants were piled on top of the rake head and assigned density ratings from 1 to 3 based upon rake coverage. Shoreland plant species were noted as present when observed growing in the water near the sampled points; however an intensive survey of shoreland plants was not conducted. Rake density ratings for all plants collectively (whole rake density) as well as for each individual plant species retrieved on the rake were recorded. Additional species that were observed growing within 10-ft of a sample point but not retrieved on the rake were given a rating of zero for that site. These “zero” species were included in the final species lists and distribution maps, but were not included in the calculation of plant community metrics and statistics.

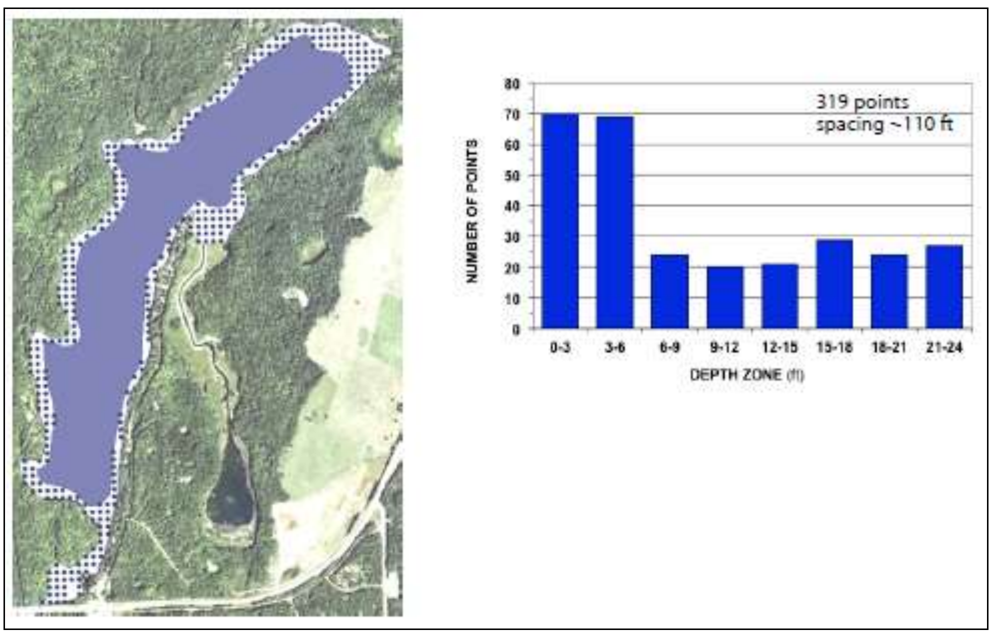

Figure 8 – Balsam Lake 2011 and 2018 PI Survey Points

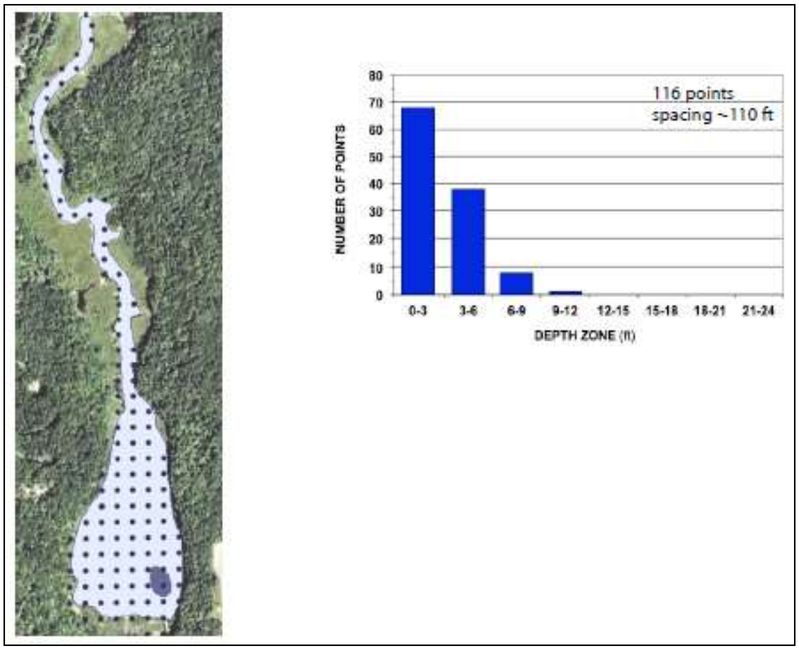

Figure 9 – Mud Lake 2011 and 2018 PI Survey Points

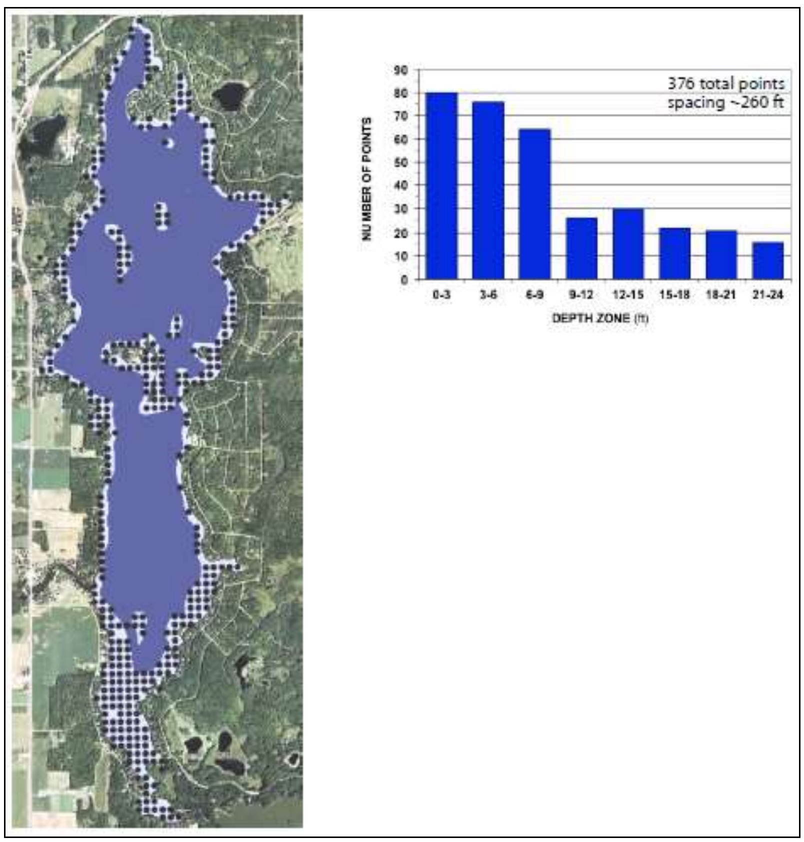

Figure 10 – Red Cedar Lake 2011 and 2018 PI Survey Points

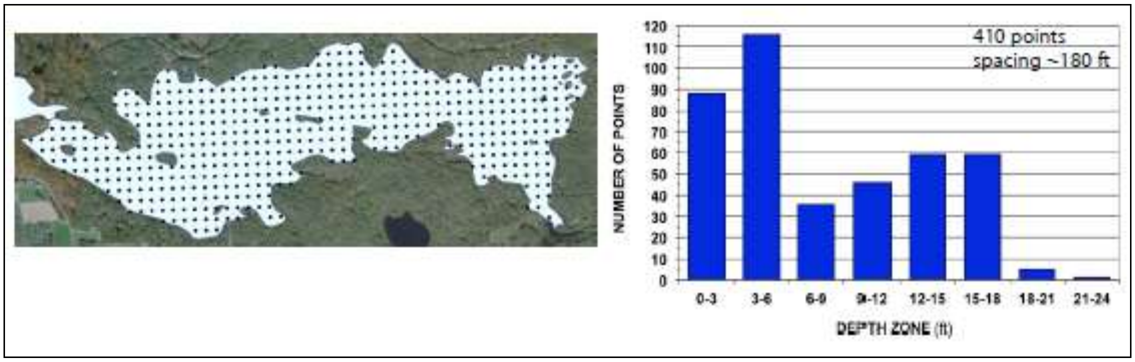

Figure 11 – Hemlock Lake 2011 and 2018 PI Survey Points

One of the goals in the 2012 APM Plan was to enact CLP control without negatively impacting the native aquatic plant community. Basic statistics from the 2011 and 2018 surveys show the following.

BALSAM LAKE (TABLE 3)

In Balsam Lake, 31 aquatic plant species were identified in the 2011 survey. In 2018, 32 species were identified. The Simpsons Diversity Index (SDI) was 89 in 2011 and 91.5 in 2018. The littoral area of the lake was approximately the same in both years at 10% in 2011 and 12% in 2018. The maximum depth of aquatic plant growth was down a bit from 17-ft in 2011 to 13.5-ft in 2018. The Floristic Quality Index (FQI) was up from 26.1 in 2011 to 30.1 in 2018. Only CLP was identified as a non-native, submersed, invasive species in the lake.

MUD LAKE (TABLE 4)

In Mud Lake, 31 aquatic plant species were identified in the 2011 survey. In 2018, 48 species were identified. The Simpsons Diversity Index (SDI) was 88 in 2011 and 90.6 in 2018. The littoral area of the lake was approximately the same in both years at 93% in 2011 and 95% in 2018. The maximum depth of aquatic plant growth was down a bit from 10-ft in 2011 to 6.9-ft in 2018. The Floristic Quality Index (FQI) was up from 24.6 in 2011 to 31.2 in 2018. Only CLP was identified as a non-native, submersed, invasive species in the lake.

RED CEDAR LAKE (TABLE 5)

In Red Cedar Lake, 36 aquatic plant species were identified in the 2011 survey. In 2018, 39 species were identified. The Simpsons Diversity Index (SDI) was 91 in 2011 and 93.2 in 2018. The littoral area of the lake was approximately the same in both years at 14% in 2011 and 16% in 2018. The maximum depth of aquatic plant growth was up a bit from 12-ft in 2011 to 14.1-ft in 2018. The Floristic Quality Index (FQI) was not calculated in 2011, but was 34.1 in 2018. Only CLP was identified as a non-native, submersed, invasive species in the lake.

HEMLOCK LAKE (TABLE 6)

In Hemlock Lake, 31 aquatic plant species were identified in the 2011 survey. In 2018, 48 species were identified. The Simpsons Diversity Index (SDI) was 89 in 2011 and 93.1 in 2018. The littoral area of the lake was approximately up from 2011 when it was about 45% to 61% in 2018. The maximum depth of aquatic plant growth was up a bit from 10-ft in 2011 to 12.8-ft in 2018. The Floristic Quality Index (FQI) was up from 28.8 in 2011 to 38.7 in 2018. Only CLP was identified as a non-native, submersed, invasive species in the lake.

Table 3 – Balsam Lake 2011 and 2018 Aquatic Plant Survey Statistics

STATISTIC / METRIC	Jul 2011
WHOLE LAKE BASIN	
% Lake Area Vegetated	10
% Lake Surface Vegetation	5
Max Depth of Growth *(ft)*	17
LITTORAL *(< max depth of growth)*	
% Littoral Area Vegetated	48
Average Plant Height *(ft, ±1SE)*	4.6 ±0.4
Average Plant Density *(±1SE)*	1.0 ±0.1
Species Richness	31
Simpson's Diversity	0.89
Native Taxa per Sample *(±1SE)*	1.6 ±0.1
Floristic Quality Index *(FQI)*	26.1
AMCI *(Community Index)*	52

WHOLE-LAKE METRICS	2018
Lake Area	291 acres
Total Points Sampled	319
Vegetated Area	34 acres *(12%)*
Area with Veg. to Surface	10 acres *(4%)*
Max Depth of Growth (95%)	13.5 ft
Native Submersed Taxa	17
Native Floating/Emergent Taxa	14
Non-Native Submersed Taxa	1

LITTORAL METRICS	2018
Littoral Area (≤15 ft)	52 acres
Littoral Points Sampled	194
% Littoral Points Vegetated	58%
Mean Plant Height	1.3 ft
% of Max Littoral Biovolume	30%
Mean Native Taxa / Point	2.4
Simpson's Diversity	91.5
Floristic Quality (FQI)	30.1
AMCI Score (Nichols et al. 2000)	52

Table 4 – Mud Lake 2011 and 2018 Aquatic Plant Survey Statistics

STATISTIC / METRIC	Jul 2011
WHOLE LAKE BASIN	
% Lake Area Vegetated	93
% Lake Surface Vegetation	44
Max Depth of Growth *(ft)*	10
LITTORAL *(< max depth of growth)*	
% Littoral Area Vegetated	95
Average Plant Height *(ft, ±1SE)*	2.6 ±0.2
Average Plant Density *(±1SE)*	1.5 ±0.1
Species Richness	29
Simpson's Diversity	0.88
Native Taxa per Sample *(±1SE)*	2.7 ±0.2
Floristic Quality Index *(FQI)*	24.6
AMCI *(Community Index)*	45

WHOLE-LAKE METRICS	2018
Lake Area	34 acres
Total Points Sampled	116
Vegetated Area	33 acres *(95%)*
Area with Veg. to Surface	15 acres *(43%)*
Max Depth of Growth (95%)	6.9 ft
Native Submersed Taxa	22
Native Floating/Emergent Taxa	12
Non-Native Submersed Taxa	1

LITTORAL METRICS	2018
Littoral Area (≤15 ft)	31 acres
Littoral Points Sampled	110
% Littoral Points Vegetated	100%
Mean Plant Height	1.6 ft
% of Max Littoral Biovolume	55%
Mean Native Taxa / Point	4.1
Simpson's Diversity	90.6
Floristic Quality (FQI)	31.2
AMCI Score (Nichols et al. 2000)	44

Table 5 – Red Cedar Lake 2011 and 2018 Aquatic Plant Survey Statistics

STATISTIC / METRIC	Aug 2011
WHOLE LAKE BASIN	
% Lake Area Vegetated	14
% Lake Surface Vegetation	<1
Max Depth of Growth *(ft)*	12
LITTORAL *(< max depth of growth)*	
% Littoral Area Vegetated	58
Average Plant Height *(ft, ±1SE)*	6.2 ±0.4
Average Plant Density *(±1SE)*	1.3 ±0.1
Species Richness	36
Simpson's Diversity	0.91
Native Taxa per Sample *(±1SE)*	2.3 ±0.1

WHOLE-LAKE METRICS	2018
Lake Area	1897 acres
Total Points Sampled	376
Vegetated Area	308 acres *(16%)*
Area with Veg. to Surface	65 acres *(4%)*
Max Depth of Growth (95%)	14.1 ft
Native Submersed Taxa	25
Native Floating/Emergent Taxa	13
Non-Native Submersed Taxa	1

LITTORAL METRICS	2018
Littoral Area (≤15 ft)	384 acres
Littoral Points Sampled	262
% Littoral Points Vegetated	74%
Mean Plant Height	1.9 ft
% of Max Littoral Biovolume	39%
Mean Native Taxa / Point	3.7
Simpson's Diversity	93.2

Table 6 – Hemlock Lake 2011 and 2018 Aquatic Plant Survey Statistics

STATISTIC / METRIC	Jul 2011
WHOLE LAKE BASIN	
% Lake Area Vegetated	45
% Lake Surface Vegetation	26
Max Depth of Growth *(ft)*	10
LITTORAL *(< max depth of growth)*	
% Littoral Area Vegetated	61
Average Plant Height *(ft, ±1SE)*	10.9 ±0.4
Average Plant Density *(±1SE)*	2.1 ±0.1
Species Richness	31
Simpson's Diversity	0.87
Native Taxa per Sample *(±1SE)*	3.2 ±0.1
Floristic Quality Index *(FQI)*	28.8
AMCI *(Community Index)*	48

WHOLE-LAKE METRICS	2018
Lake Area	365 acres
Total Points Sampled	410
Vegetated Area	222 acres *(61%)*
Area with Veg. to Surface	97 acres *(27%)*
Max Depth of Growth (95%)	12.8 ft
Native Submersed Taxa	27
Native Floating/Emergent Taxa	20
Non-Native Submersed Taxa	1

LITTORAL METRICS	2018
Littoral Area (≤15 ft)	226 acres
Littoral Points Sampled	304
% Littoral Points Vegetated	93%
Mean Plant Height	2.1 ft
% of Max Littoral Biovolume	41%
Mean Native Taxa / Point	5.2
Simpson's Diversity	93.1
Floristic Quality (FQI)	38.7
AMCI Score (Nichols et al. 2000)	53

Greater analysis of the native aquatic plant differences between 2011 and 2018 will be completed in the update of the 2012 Aquatic Plant Management Plan.

2018 RHODAMINE DYE STUDY IN BALSAM LAKE

The densest area of CLP in the entire Red Cedar Lake system is on the north end of Balsam Lake at the inlet from Birch Lake. Physical removal was tried in the area, but the amount of CLP present made that ineffective. It has long been wondered how long herbicide applied to this area would remain in place and what concentration would be maintained to get some idea as to how effective a chemical treatment would be. In an attempt to try and answer this question, a rhodamine dye study was completed in that area of densest CLP growth.

Rhodamine Dye WT is a red liquid dye that has been used to mimic chemical applications on lakes with water movement. It can be applied in such a way as to mimic a set chemical treatment based on application concentration. In the case of Balsam Lake, rhodamine dye application was set up to mimic what would be a chemical application of 10-ppb. This concentration is not what would be used in an actual chemical application but can be correlated to what would actually happen using the actual herbicide.

A map if 16 sample sites was created to measure the movement of dye in the proposed treatment area, the main body of Balsam Lake, near the wild rice beds at the mouth of Mud Lake to Balsam, and in Red Cedar Lake downstream of Balsam Lake (Figure 12).

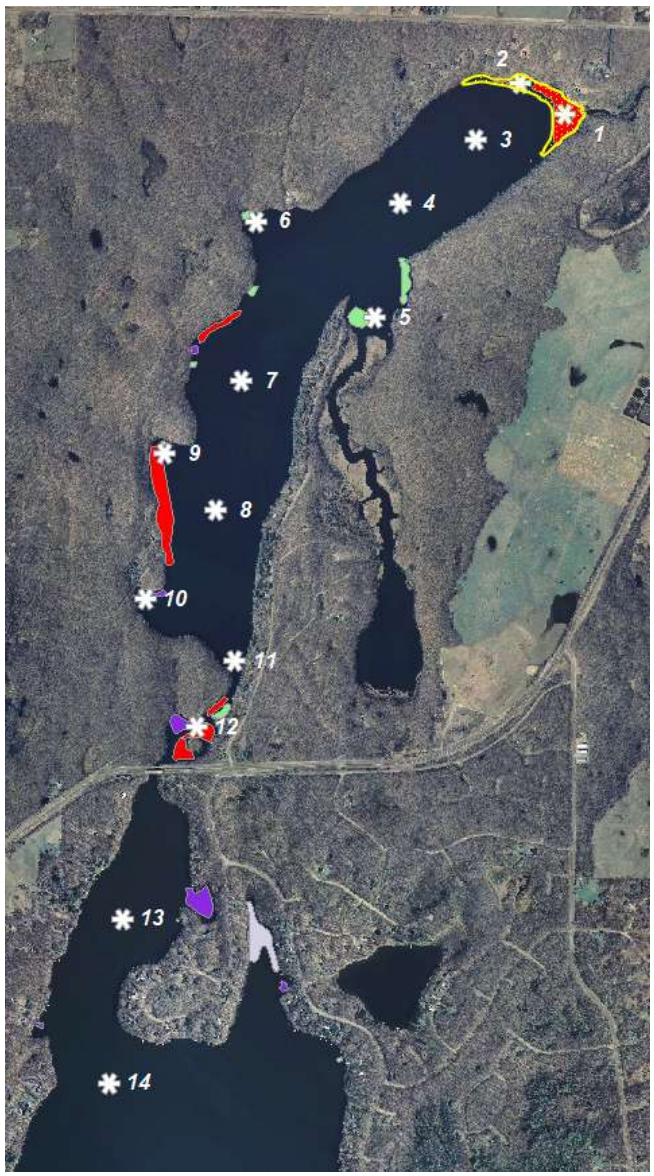

Figure 12 – 2018 Rhodamine Dye Study Sampling Sites (14 in Balsam Lake)

Dye calculations were then carried out that would create a 7.6-ac dye application area with dye applied at the equivalent of 10-ppb. The dye was applied by Northern Aquatic Services on June 7, 2018 in the morning when the water temperature was 69 F, and the air temperature was 72 F. Winds were relatively calm from the north. During the application, the area treated was well protected from the winds (Table 7).

Table 7 – Rhodamine Dye Calculations for Balsam Lake to mimic a 10-ppb Herbicide Application

Dye Requirements Balsam Lake (LEAPS 3-26-2018)						
Treatment Site	**Treatment Area (Acres)**	**Mean Depth (ft)**	**Treatment Volume (acre-feet)**	**Dye Requirement (liters)**	**Dye Requirement (gallons)**	**Dye Requirements (lbs)**
Northern Inlet	7.60	7.13	54.19	2.71	0.72	6.93
Total	7.60		54.19	2.71	0.72	
				Target Concentration= 10 ppb		
Rhodamine Dye WT 20% concentration						
Specific Gravity of Rhodamine Dye = 1.16						
1 gallon of water (Specific gravity = 1.0) weighs 8.343 lbs						
Specific gravity of rhodamine dye (1.16) multiplied by 8.343 lbs = 9.68 lbs						
1 gallon of rhodamine dye weighs 9.68 lbs						
0.72 gallons of rhodamine dye weigh 6.93 lbs.						
7.0 x $35/lb = $245.00						

Once applied, dye readings using a Turner Designs Cyclops-7F probe with Rhadmine WT Optics and a DataBank DataLogger borrowed from the WDNR to take dye readings in the water at 16 different sites at 8 different times (1,2,3,4,8,24, 48, and 72 hours after treatment (HAT)).

Figure 13 – Turner Designs Cyclops-7F and DataBank Datalogger

DYE STUDY RESULTS

Figure 14 reflects the results obtained during the Rhodamine dye study completed in Balsam Lake in 2018. The dye was applied to a sample CLP treatment area of 7.6-ac area in the north end of the lake at the inlet from upstream waters. Sampling site 1 & 2 were on either side of the river channel coming into the lake. The rest of the sampling sites were spread throughout Balsam with a couple in Red Cedar. The fluorimeter was used to collect a reading of dye concentration. That reading was then converted to ppb. The target goal for the dye in the proposed CLP treatment area was 10.0 ppm.

Based on the readings, the target concentration of dye was never reached even in the treated area. It did reach a bit more than half the target concentration in both sites 1 and 2, and that concentration was maintained through 3-HAT. After 3-HAT, the concentration of dye dropped off rapidly, with several sites (those in Red Cedar Lake) never registering any concentration even 3-days after application. Site 5 was located at the mouth of the Mud Lake channel to Balsam Lake. It is in this area that wild rice is present in some abundance. One of the concerns is whether or not herbicide applied north of the Mud Lake channel would reach the wild rice in sufficient quantities to potentially impact its growth. This does not appear to be the case, given that the concentration of dye reached at that site never exceeded 1.0-ppb (its highest level at 48-HAT), and dropped back below 1.0-ppb a day later (Figure 15).

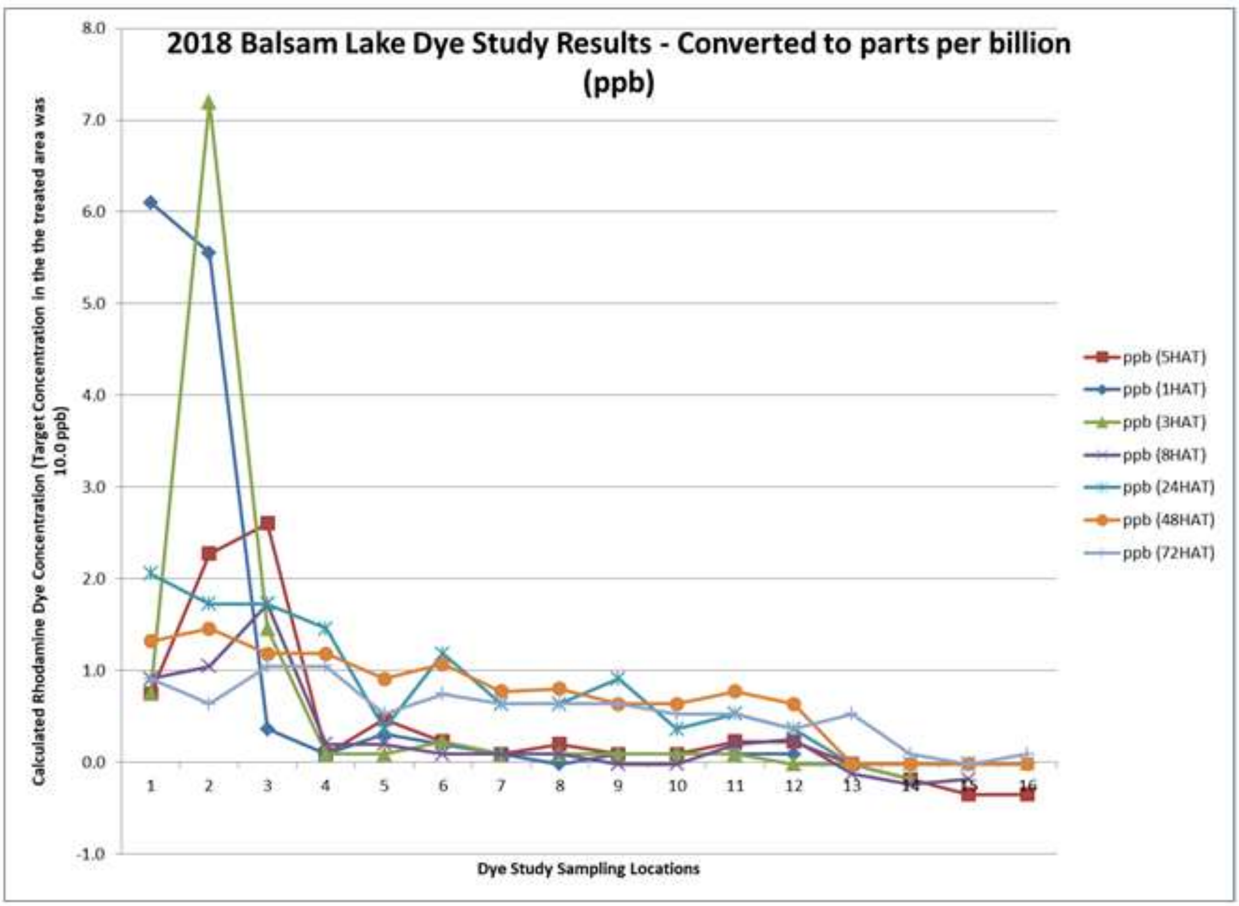

Figure 14 – 2018 Rhodamine Dye Study Results in Balsam Lake

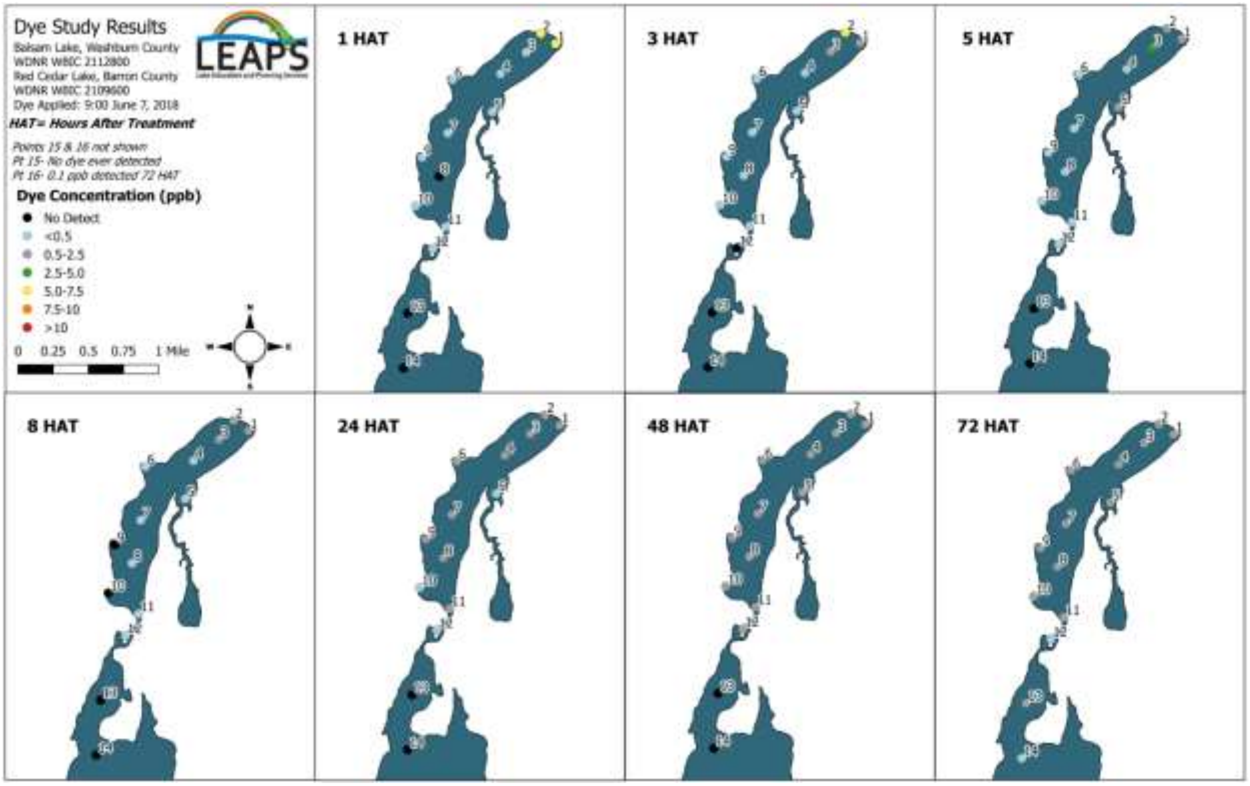

Figure 15 – Simulated herbicide concentrations from a 10.0-ppb Rhodamine Dye Study application at the north end of Balsam Lake

Based on these results, it may be possible to chemically treat CLP in the north end of Balsam Lake but likely only in the back waters on either side of where the channel comes is. The concentration of herbicide used should be higher to accommodate for the dissolution of the herbicide away from the treatment site.

2018 AIS EDUCATION/INFORMATION EVENT

2018 SURVEY OF THE SHORELINE FOR PURPLE LOOSESTRIFE

2018 SURFACE WATER QUALITY MONITORING IN BALSAM, RED CEDAR, AND HEMLOCK LAKES

Three locations in the Red Cedar Lakes system are included in the Citizen Lake Monitoring Network (CLMN) Expanded Water Quality Testing program – Balsam Lake, Red Cedar Lake North, and Hemlock Lake. As a part of this project, regular CLMN water sampling was completed at these sites in 2018, plus total phosphorus (TP) and Chlorophyll-A were added in September and October. In addition, a second site – Red Cedar Lake South – was added with the same sampling schedule and parameters as the other three sites. Figure 16 shows the results for TP and Chl-A for all four sites in 2018. Secchi readings and temperature/dissolved oxygen profiles were collected as well.

Regular CLMN sampling was expanded through October because in many lakes, the late summer and early fall months of September and October show the most drastic changes in water quality regarding TP and Chl-A. If water quality in a lake is likely impacted by internal loading of nutrients, it will be most evident in the late summer and early fall months. TP and Chl-A values will likely see a pretty significant increase in September and October is internal loading is an important factor. This appears to be the case in Balsam and the two Red Cedar sites, but not at the Hemlock Lake site.

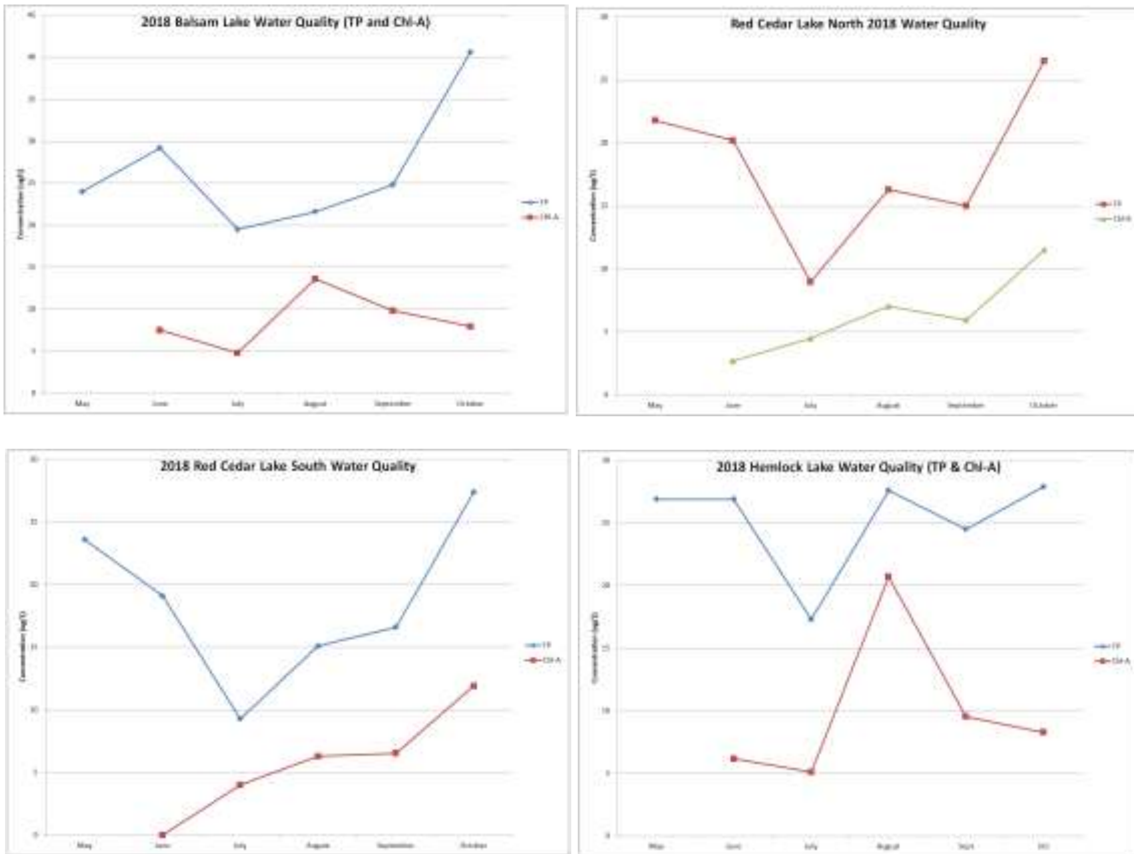

Figure 16 – 2018 Total Phosphorus (TP) and Chlorophyll-A (Chl-A) Sampling Results (May-October)

In the initial project, collection of water quality data was scheduled to begin in April, however, due to late ice out, no sampling was completed in April 2018.

2018 TRIBUTARY MONITORING AND NUTRIENT LOADING FROM FOUR TRIBUTARIES AND THE OUTLET

Because this project is/was a precursor to a larger water quality and aquatic invasive species project, tributary monitoring was included with the inlet from Birch Lake (Cty. D), three tributary sites (Sucker, Pigeon, and Hemlock creeks), and the outlet (25th Ave below the Mikana Dam) were sampled for TP and total suspended solids (TSS) once a month beginning in April, through October. Stream flow data was also collected. Levels 1 and 2 from the Water Action Volunteer (WAV) program including habitat variables were supposed to be collected, but despite several attemps at scheduling a training with the WAV Program Coordinator, this did not get done. It is expected that this will be done in the spring/early summer of 2019. Volunteers from the RCLA, led by a University of St. Thomas (MN) Professor and several of his students led the sampling project. Figures 17 and 18 show the results of TP and TSS sampling in 2018.

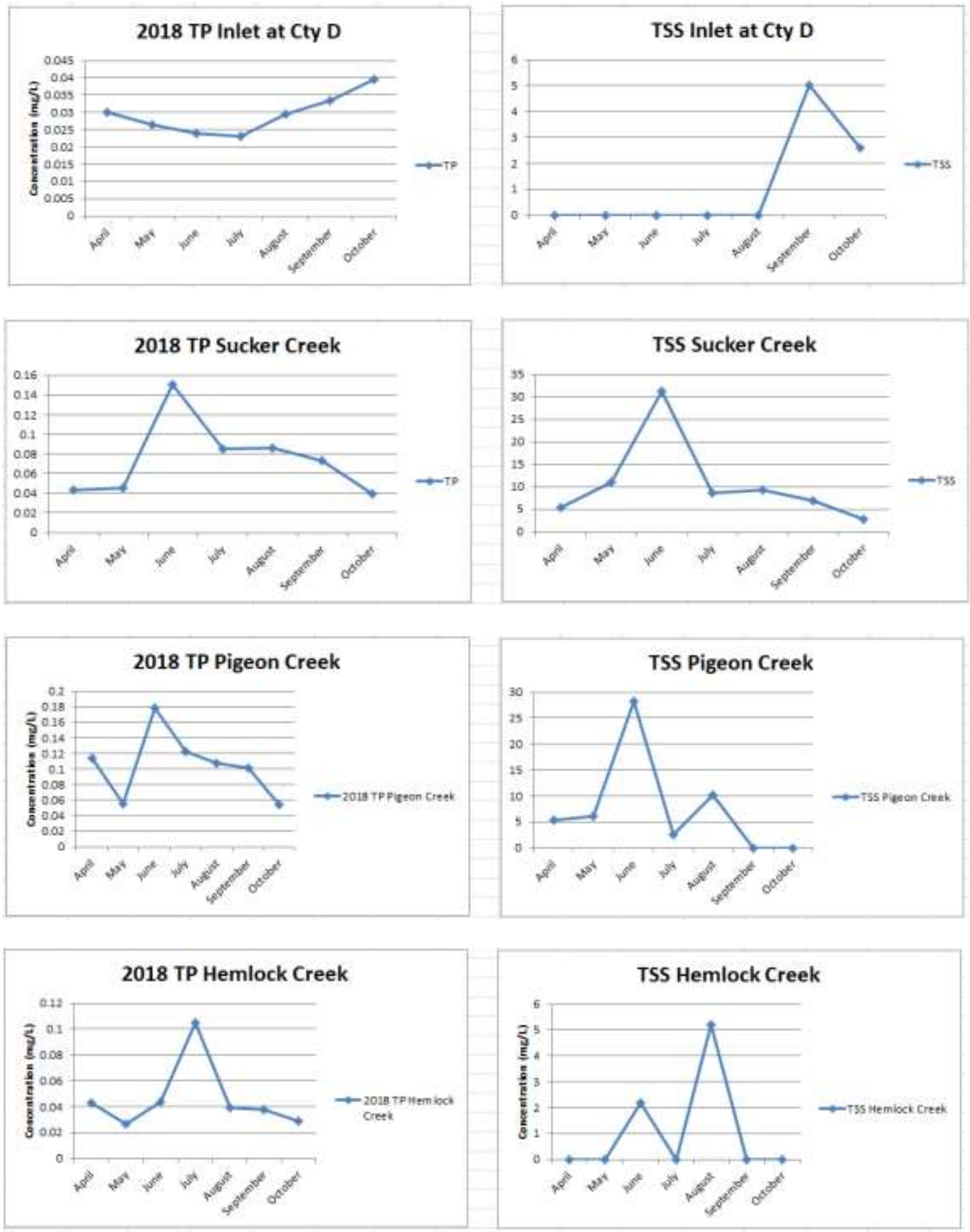

Figure 17 – 2018 Total Phosphorus (TP) and Total Suspended Solids (TSS) from the Inlet and three tributaries to the Red Cedar Lakes (April-October)

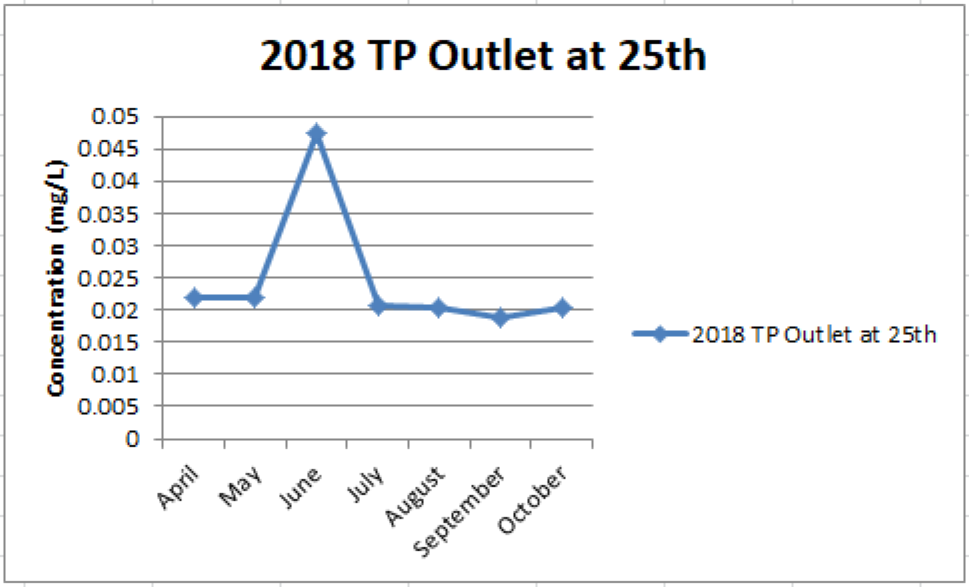

Figure 18 – 2018 Total Phosphorus (TP) for the Outlet of the Red Cedar Lakes (April-October)

Monthly flow readings have been recorded for each site monitored during this project and will be combined with the SLOH results for TP and TSSS to provide a snapshot analysis of nutrient loading in 2018.

The data collected from the tributaries in 2018 will be used along with data collected in a new project scheduled to begin in 2019 to help determine a more complete water and nutrient budget for the Red Cedar Lakes.

WATER ACTION VOLUNTEER (WAV) STREAM MONITORING

As previously mentioned, this activity has not been completed yet.

NUTRIENT LOADING FROM FOUR TRIBUTARIES AND THE OUTLET

As mentioned this activity has not been completed yet.

UPDATING OF THE CURRENT AQUATIC PLANT MANAGEMENT PLAN

The update of the Aquatic Plant Management Plan for the Red Cedar Lakes is well underway. All the background material is complete, as is management alternatives, and a suggested plan for management to move forward beginning in 2019. The final goals, objectives, and actions are not completed yet, but are expected to be done and ready for review before implementation of CLP management in 2019.

The general goal of CLP management in the Red Cedar Lakes is to provide management that will keep CLP from becoming a more dominant early season plant species without causing significant harm to native aquatic plants.

CLP in the RCL was first identified in 1978, but it wasn't until 2009 that it was officially documented. An aquatic plant management planning project started in 2010 evaluated CLP and the native aquatic plant population in the RCL. During 2011 CLP survey work, more than 150-ac of the 3 lakes had CLP growing in it. Not all of this was dense growth, but enough was that from 2013 to 2015 the RCLA implemented a CLP chemical management plan focused on the most dense areas of CLP in the south end of RC and the west end of HL. This project was successful and the amount of CLP in these areas was still down in 2017, a year when the CLP in untreated areas of the RCL increased.

Recommendations in the updated APM Plan are to target areas with moderate to dense growth CLP with 3-yrs of chemical management with the expectation that when done, CLP will no longer have any areas where it might be in competition with native plants, may impair navigation, and may contribute to poorer water quality. The updated APM Plan compliments a 3-yr lake management planning (LPL) project with the final goal of updating the 2003 Red Cedar Lakes Management Plan that focuses on improving water quality.

The Big Chetac and Birch Lakes Association has recently completed updated planning to improve or maintain their water quality, and issues in the lower portions of the Red Cedar River Watershed are currently being addressed by a TMDL. Equally important is the fact that at the present time none of the lakes in the upper Red Cedar River Watershed have EWM or ZMs and the update APM Plan makes recommendations to help keep it that way.

CLEAN BOATS, CLEAN WATERS

A total of 476 hours of Clean Boats Clean Waters boat landing monitoring occurred at the four highest use boat landings throughout the summer, utilizing volunteers from Rice Lake Boy Scout Troup 28, Haugen Boy Scout Troup 104, LEAPS, and hired help.