1.0 INTRODUCTION

[Big] Silver Lake, Waushara County, is a seepage lake with a maximum depth of 48 feet and a mean depth of 21 feet. The lake area as determined through a heads-up digitization of the lake from a 2015 aerial photograph is approximately 360.3 acres, whereas the WDNR website lists the lake as 328 acres. This mesotrophic lake has a relatively small watershed when compared to the size of the lake (3.5:1). When water levels are near full pool, water exchange occurs with Irogami Lake via a culvert under State Hwy 21 (Figure 1.0-1). Four exotic species are known to exist in Silver Lake: banded mystery snail, curly-leaf pondweed (*Potamogeton crispus*, CLP), Eurasian water milfoil (*Myriophyllum* spicatum, EWM), and zebra mussel. Genetic analysis confirms that the invasive milfoil population is comprised of both EWM and hybrid water milfoil (*M. spicatum x sibiricum*, HWM). Subsequent discussion using "HWM" will represent the collective invasive milfoil population of Silver Lake unless specifically referenced otherwise.

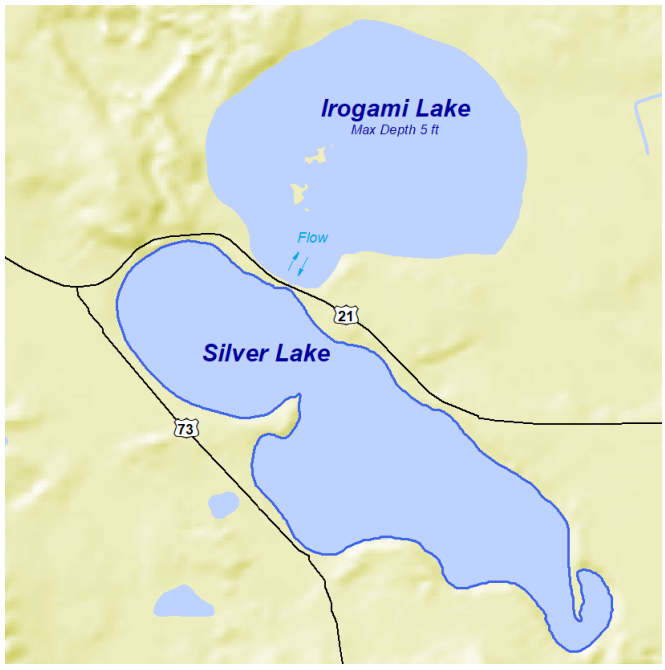


Figure 1.0-1. Silver Lake, Waushara County, Wisconsin.

Water levels in 2019 were at some of the highest levels ever recorded in the lake and resulted in the enforcement of a slow-no-wake ordinance to limit shoreland erosion that could be exacerbated by waves created by boaters. Data from recent point-intercept surveys indicate that the water levels in Silver Lake increased by approximately two feet between 2015 and 2017, and increased another foot between 2018 and 2019 (Figure 1.0-2). Water levels remained at a high level for the duration of the 2020 growing season with the point-intercept data showing a slight increase in average depth of sampled points compared to 2019.

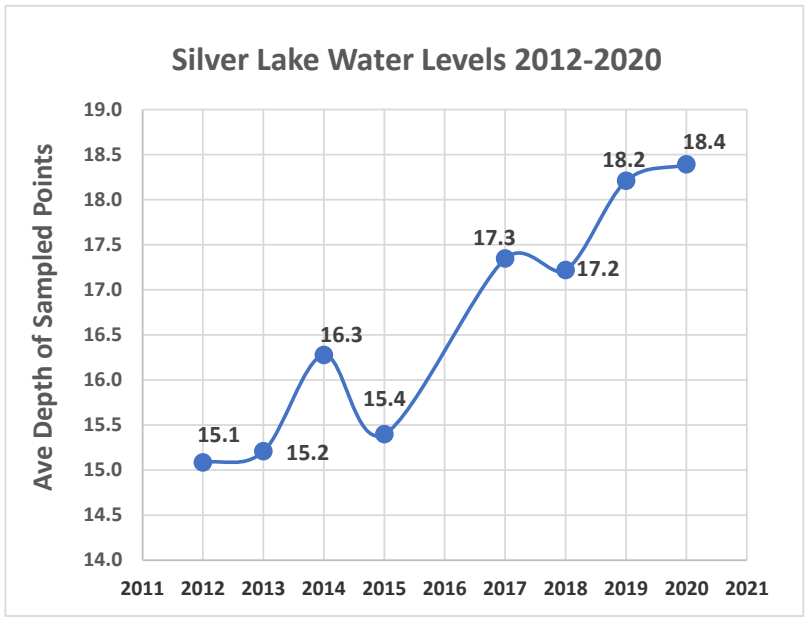


Figure 1.0-2. Water levels in Silver Lake from 2012-2020 based on data collected from annual point-intercept surveys.

The Silver Lake Management District (SLMD) is the local citizen-based organization leading the management of Silver Lake. The group has worked for years to protect and enhance the lake, including an increased effort in recent years

to control HWM within the lake. The 2014 Aquatic Plant Management Plan recommended the SLMD initiate a large-scale (aka whole-lake) herbicide treatment targeting HWM in Silver Lake. A whole-lake granular triclopyr treatment occurred in June 2014 targeting 180-200 ppb acid equivalent (ae) lake-wide. Triclopyr concentrations fell short of achieving target levels in the main basin of the lake, but were found at higher concentrations in Foxtail Bay. A 20.0% frequency recorded in the 2015 point-intercept survey (*year after treatment*) indicates that the 2014 treatment resulted in only seasonal HWM control. Native plant impacts were relatively limited from the 2014 whole-lake triclopyr treatment.

1.1 2016 Fluridone Treatment Summary

The SLMD contracted with Onterra, LLC during May 2015 to provide technical direction as they pursued their goal to implement a large-scale herbicide treatment strategy during spring of 2016. Onterra developed a three-year control and monitoring strategy in which a large-scale herbicide treatment would occur in year two of the project. Following alternatives analysis, the SLMD decided to move forward with a pelletized fluridone treatment to target HWM in Silver Lake in 2016. Fluridone is a systematic herbicide that requires long exposure times (>90 days) to cause mortality to watermilfoils.

The 2016 treatment included application of pelletized fluridone over 86.4 acres of the littoral zone. The initial herbicide treatment was conducted on May 26, 2016. Based upon reviewing the measured herbicide concentration during the summer as well as technical advice from SePRO, 2 ppb bump treatments of pelletized fluridone (Sonar One®) were conducted on July 21 and September 1. The final dosing of these treatments was based on a mixing zone down to 21 feet and includes application of pelletized fluridone over the same 86.4 acres where the initial application occurred. The measured fluridone concentrations in the time period during and after the treatments are displayed on Figure 1.1-1. Note that fluridone concentrations persisted at a consistent level during the winter months and were detectable as late as July 2017. More specific details related to the 2016 fluridone treatment have been reported on in recent annual reports as a part of this project.

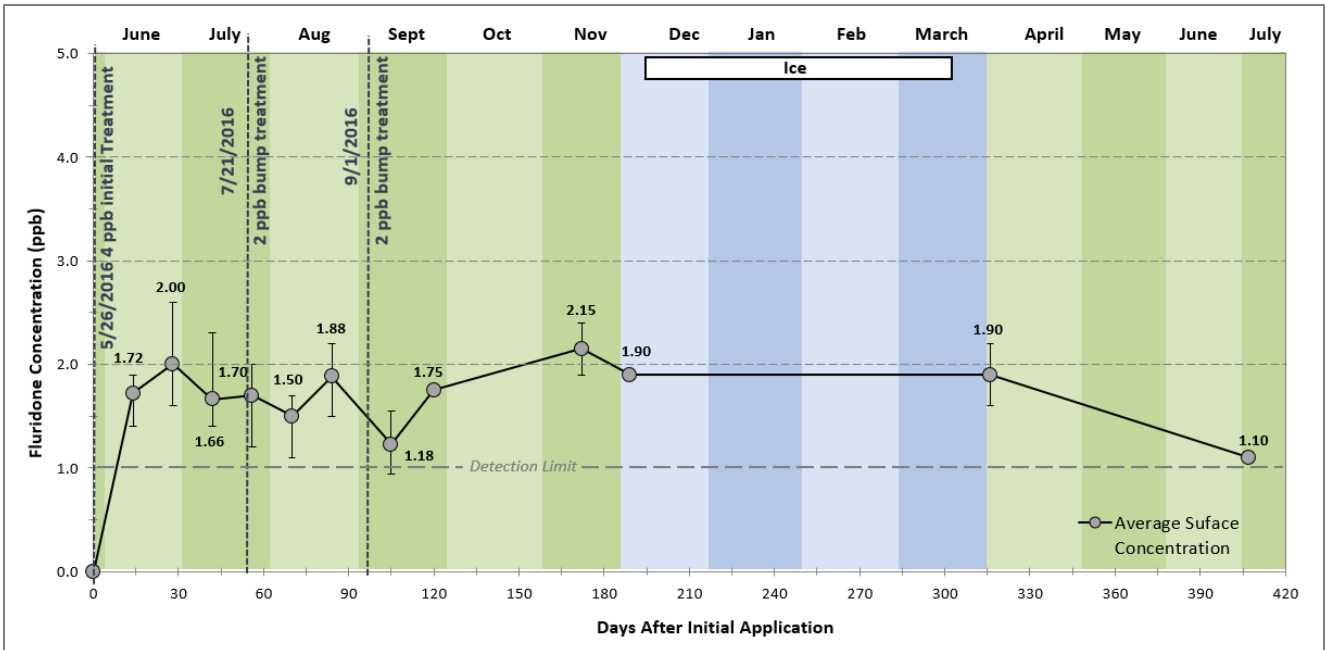


Figure 1.1-1. Fluridone concentrations measured in Silver Lake in association with a 2016 whole-lake treatment.

1.2 Integrated Pest Management (2017-Current)

Many lake groups initiate a large-scale herbicide strategy with the intention of implementing smaller-scale control measures (e.g. herbicide spot treatments, hand-removal) when HWM begins rebounding. This is referred to as Integrated Pest Management (IPM) and the approach has shown promise on many lakes. However, the HWM population rebounds on many lakes in a lake-wide fashion that may not always lend well to implementing IPM.

The SLMD initiated a professional hand-harvesting strategy beginning in 2017 targeting the HWM as it begins to rebound following the fluridone treatment. Professional hand-harvesting efforts in 2017 likely aided in maintaining the HWM population at a relatively low level. Details of the 2017 HWM management and monitoring efforts were reported within the *2017 HWM Monitoring and Control Strategy Assessment Report* (Jan2018).

The SLMD continued with an IPM HWM management strategy in 2018 that utilized an increased amount of professional DASH efforts. The professional DASH efforts in 2018 were able to effectively maintain or reduce the HWM population in all of the sites in which efforts were undertaken with the exception of Foxtail Bay. Details of the 2018 HWM management and monitoring efforts were reported within the *2018 HWM Monitoring and Control Strategy Assessment Report* (Feb2019).

An IPM strategy utilizing a combination of professional hand-harvesting as well as a spot herbicide treatment were initially proposed to manage HWM in 2019. A preliminary strategy of ProcellaCOR™ herbicide treatment in Foxtail Bay for 2019 was presented to local WDNR biologists in mid-January 2019. Ultimately, the herbicide treatment strategy was postponed due to concerns of limited quantitative pretreatment data, low abundance of target plants in that area, and a newer herbicide requiring additional WDNR technical review.

The SLMD was awarded a WDNR AIS-Established Population Control grant during the February 2019 grant cycle. The grant includes funding assistance for a three-year project (2019-2021) to aid in the implementation of an IPM strategy utilizing a combination of professional hand harvesting and spot herbicide treatment in Foxtail Bay with ProcellaCOR™.

During the first year of the project (2019), the SLMD contracted for 40 days of professional hand harvesting services at a cost that exceeded $100,000. During the course of the removal efforts, a total of 1,246 cubic feet of HWM was harvested from the permitted areas. The greatest amount of DASH effort took place in Foxtail Bay. The extended use of DASH was intended to help delay the need for herbicide control strategies in the future. The 2019 DASH efforts met or exceeded lake managers expectation in each of the five designated priority sites. However, the HWM population continued to expand within Foxtail bay and DASH removal efforts fell short of meeting expectations. Overall, the hand-harvesting efforts were effective at managing the HWM populations in most areas where it was applied, however some HWM population increases were observed in areas of the lake that were outside of the targeted areas. Additional details of the 2019 HWM management and monitoring efforts were reported within the *2019 HWM Monitoring and Control Strategy Assessment Report* (Jan2020).

1.3 2020 IPM Strategy: Professional Hand Harvesting

In addition to the herbicide management strategy outlined below, the SLMD continued to manage the lake-wide HWM population with a coordinated hand harvesting/DASH control strategy in 2020. No DASH efforts were planned to be directed at Foxtail Bay which would free up time to cover more locations in the main body of the lake. A DASH strategy that targets all known HWM that is a *clump of plants* or greater includes 21 sites and totals approximately 16.8 acres with sizable buffers on each work area is displayed on Map 1. The 2020 DASH sites were further prioritized by either 1st, 2nd, or 3rd level priority based on the HWM population in the site. Sites with colonized HWM, mapped with polygons, were given first priority. Sites with at least a *small plant colony* were given second priority and sites with *clumps of plants* or less HWM were given third priority.

In 2020, DASH efforts would begin as soon as conditions are favorable based off of the permit developed from the 2019 HWM Mapping Survey results. Onterra would conduct a mid-summer HWM mapping survey around mid to late-July unless prompted earlier based on the progression of the DASH efforts. The mid-summer survey serves to locate any new HWM populations in the main body of the lake that were outside of the originally permitted DASH locations. The results of the survey would allow for a chance to adjust the prioritization strategy for the remaining hand harvesting efforts during the season, including making any modifications to the DASH permit. This would allow for ensuring the professional harvesting efforts are directed as efficiently as possible during the 2020 season.

1.4 2020 IPM Strategy: Herbicide Treatment

Foxtail Bay has contained some dense populations of HWM in recent years and was originally considered for herbicide treatment in 2019. Hand-harvesting in this area of Silver Lake in 2018 proved to be challenging as dense native aquatic plants hindered the professional diver's removal efforts and resulted in falling short of meeting control expectations. Substantial DASH efforts in 2019 showed that this management technique has limits in its capabilities to reduce the HWM population in this site. It had become clear over the past two years that DASH alone cannot keep up with the rate of HWM expansion in Foxtail Bay. The SLMD initiated a quantitative monitoring plan at an increased intensity during the summer of 2019 to serve as a pretreatment dataset for herbicide treatment proposed to occur within Foxtail Bay during spring of 2020. An increased sampling intensity was developed for 2019 that used a 20-meter spacing for a sub point-intercept survey and resulted in 89 sampling locations.

The protected nature of this bay of the lake is believed to aid in limiting herbicide dissipation out of the application area and is theorized to allow for sufficient concentration exposure times to result in HWM control. However, this area has a history of various herbicide treatments with mixed results. Because of the stage of recovery/rebound of the HWM population, the SLMD considered a potentially more aggressive management approach to this population. This included evaluation of several herbicides that require short exposure times (diquat, florpyrauxifen-benzyl [ProcellaCOR™]) and herbicide combinations (diquat/endothall, 2,4-D/endothall, etc.). The SLMD selected ProcellaCOR™ to implement a control strategy in Foxtail Bay in 2020.

1.5 Pre-Treatment Confirmation and Refinement Survey

Onterra ecologists completed the pre-treatment confirmation and refinement survey on June 2, 2020. The purpose of the visit was to verify application area extents and inspect the condition of the HWM colonies targeted for treatment through the use of a combination of visual surveys, rake tows, and submersible video monitoring. Parameters such as plant growth stage, water temperature, and water depth were investigated to confirm the final treatment strategy.

Photo 1.5-1. HWM observed during a June 2, 2020 pre-treatment survey on Silver Lake. Photo by Onterra, LLC

During the survey, surface water temperatures were measured at 70°F in the treatment area and 67°F at mid-depth. Actively growing HWM was confirmed within the proposed treatment site characterized by green growth (Photo 1.5-1). Native aquatic plant growth in the treatment area was mainly comprised of pondweed species and coontail. An underwater camera transect was completed through the targeted area which can be viewed on Onterra's YouTube webpage (Click Here). Based upon the survey, no modifications were made to the treatment strategy. The field crew also delivered the herbicide concentration monitoring supplies to a volunteer from the SLMD during the visit. Map 2 reflects the final treatment strategy using ProcellaCOR™ with an application rate of 3.5 PDU's over one site totaling 11.6 acres.

Significant growth of HWM within Foxtail Bay was also documented during a pre-treatment site visit conducted by the applicator on June 7, 2020 (Photos 1.5-2). The herbicide application was completed on June 8, 2020 by Clarke Aquatic Services, formerly Clean Lakes, Inc.

Photos 1.5-2. HWM growth observed during a pre-treatment site visit on Silver Lake. Photos by Clarke Aquatic Services, Inc.

2.0 2020 AQUATIC PLANT MONITORING RESULTS

It is important to note that two types of surveys are discussed in the subsequent materials: 1) point-intercept surveys and 2) HWM mapping surveys. The point-intercept survey provides a standardized way to gain quantitative information about a lake's aquatic plant population through visiting predetermined locations and using a rake sampler to identify all the plants at each location. The survey methodology allows comparisons to be made over time, as well as between lakes. It is common to see a particularly plant species, such as HWM, very near the sampling location but not yield it on the rake sampler. Particularly in low-density colonies such as those designated by Onterra as *highly scattered* and *scattered*, large gaps between EWM plants may exist resulting in EWM not being present at a particular pre-determined point-intercept sampling location in that area. The point-intercept survey can be applied at various scales. The point-intercept survey is most often applied at the whole-lake scale. The whole-lake point-intercept survey has been conducted on Silver Lake annually since 2012, with the exception of 2016.

If a smaller area is being studied, a modified and finer-scale point-intercept sampling grid may be needed to produce a sufficient number of sampling points for comparison purposes. This sub-sample point-intercept survey methodology is often applied over management areas such as herbicide application sites. This type of sampling is used within this project as a part of the Foxtail Bay herbicide treatment monitoring.

While the point-intercept survey is a valuable tool to understand the overall plant population of a lake, it does not offer a full account (census) of where a particular species exists in the lake. During the HWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 2.0-1). Field crews supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The HWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to AIS locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.

Photograph 2.0-1. EWM mapping survey on a Waushara County, WI lake. Photo credit Onterra.

Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project. A whole-lake point-intercept survey, a sub-sample point-intercept survey within Foxtail Bay, and HWM mapping surveys occurred in 2020 on Silver Lake and are discussed within this report.

2.1 Early-Season AIS Survey (ESAIS)

In order to ensure the ideal timing of Onterra's next HWM mapping survey SLMD, APM, and Onterra maintained a line of communication during early summer. Based on the progress of the harvesting efforts and condition of the lake, it was decided to conduct the mapping survey on Silver Lake on July 20, 2020. The main purpose of the survey was to assess the HWM population and then update the hand harvesting/DASH strategy for the rest of the summer. During the survey, the crews encountered excellent conditions with mostly sunny skies. The water was very clear as indicated by a Secchi disk reading of 16.0 feet. Earlier reports of an algae bloom on the lake during June had ended. Crews meandered through the littoral areas of the lake and could see the bottom of the lake out to around 12' and native plants were visible out to approximately 16'. Many native plants were observed throughout the lake with substantial populations of native pondweeds, coontail, sago pondweed, water marigold and more. Following the visual survey, crews deployed submersible cameras in 33 of the areas that had been used as "dive reconnaissance sites" in past years, with particular focus on the slightly deeper extents of the sites where short-statured plants could be missed during the visual survey. These particular sites had harbored some of the densest HWM colonies prior to the 2016 fluridone treatment.

The results of the mapping survey are displayed on Map 3. Crews located less HWM than expected in the lake with no colonized areas detected anywhere in the lake. All occurrences that were located consisted of individual plants, or small clumps of plants. Essentially all of the singles and clumps of HWM were in the northern half of the lake. The largest concentration of singles and clumps were in the northwest end of the lake as displayed on the inset view of Map 3. No HWM was located in the southern half of the lake, including a survey of Foxtail Bay, where no HWM was located in optimal survey conditions with exceptionally clear water and protection from any wind at the time.

No changes were made to the DASH permitted areas as a result of the survey. Onterra provided the spatial data reflecting the ESAIS results to the professional harvesting firm in the form of a GPS compatible basemap to aid in the removal efforts.

2.2 Professional Hand-Harvesting Actions

The SLMD contracted with Aquatic Plant Management, LLC in 2020 to provide professional DASH services. Diving activities began on June 15, 2020, and through June 26th, efforts were focused on known HWM colonies identified during the 2019 Late-Season HWM Mapping Survey. Divers initially focused much of the effort on site A on the north end of the lake where high AIS density resulted in significant harvest totals (Appendix A). After June 26th, harvesting efforts were halted until after Onterra's 2020 Early Season AIS Survey could be completed and the lake-wide HWM population could be understood. Harvesting resumed on July 28th, and continued on an intermittent basis through September 17. In total, APM reported completing 177 dives in Silver Lake, totaling 171.5 hours underwater. A total of 536 cubic feet of HWM was harvested over the course of the season of which over half came from site A. Additional details related to the professional harvesting actions are included in a summary dive report created by APM, LLC as an appendix to this report.

2.3 Late-Summer HWM Mapping Survey

The results of the Late-Summer HWM Mapping Survey are displayed on Map 4. The HWM population mapped during September 2019 (pre-treatment), indicated that much of Foxtail Bay contained colonized HWM including some particularly dense areas denoted as either *dominant* or *highly dominant* colonies (Figure 2.3-1 left frame). No HWM was located within Foxtail Bay during the 2020 Late-Summer HWM Mapping Survey (Figure 2.3-1 right frame). The reductions of HWM in the treatment site met control expectations for the year-of-treatment.

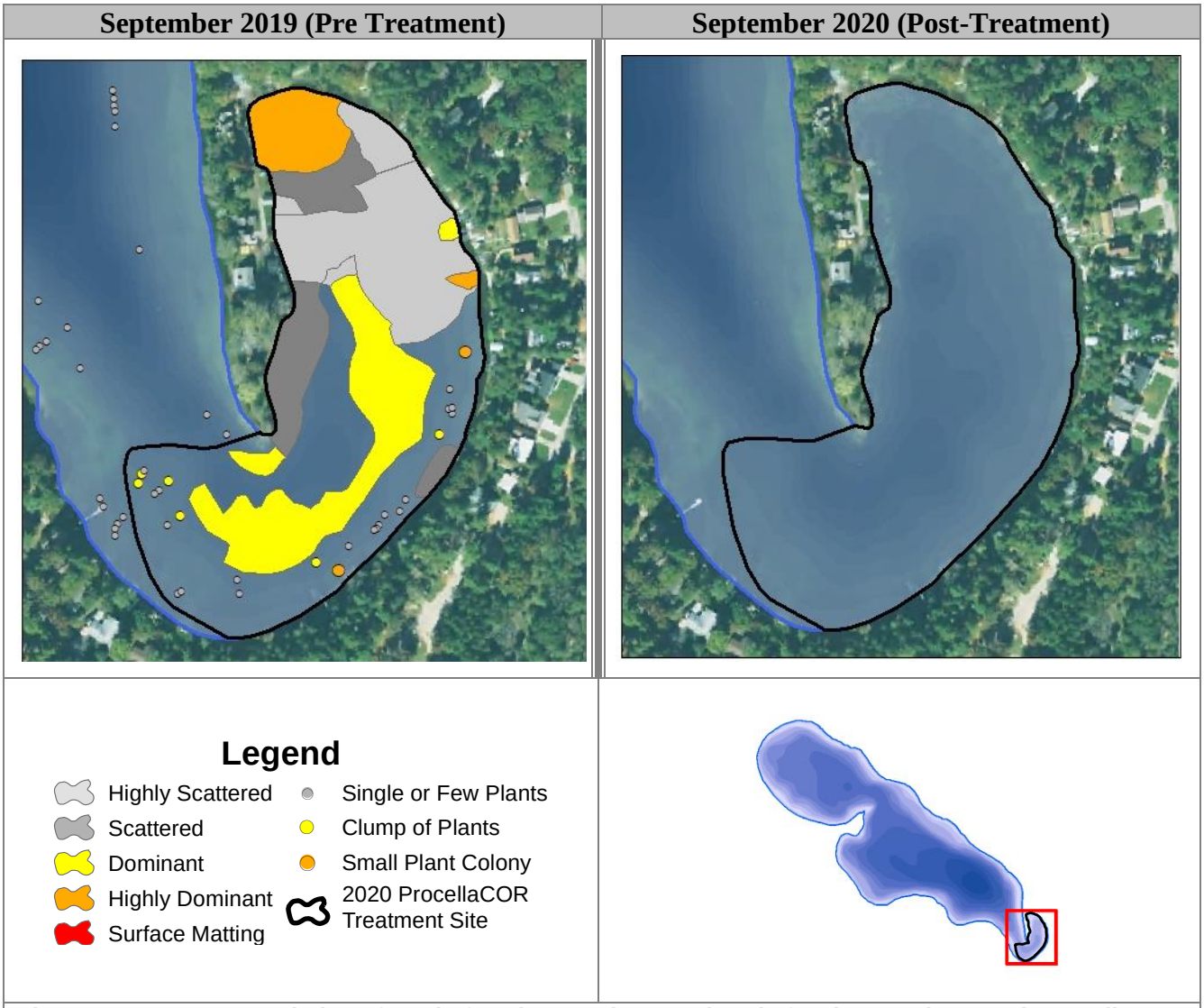


Figure 2.3-1. HWM populations from before (September 2019) and after (September 2020) ProcellaCOR treatment in Foxtail Bay in Silver Lake.

Four sites were given first priority for professional hand harvesting removal efforts during 2020 based on the having the largest HWM population, consisting of colonized HWM, at the time of the late-summer 2019 survey. These first priority sites are highlighted in Figures 2.3-2 and 2.3-3 where the top frames show the pre-harvesting HWM population mapped in late-summer 2019 and the bottom frames show the post-harvesting HWM population mapped in late-summer 2020.

In September 2019, site A contained a highly dominant colony of HWM as well as a number of *singles*, *clumps of plants*, and a *small plant colony*. Professional harvesting efforts within this site totaled 63.6 hours resulting in the harvest of 298.5 cubic feet of HWM. After the harvesting efforts, the 2020 late-summer HWM Mapping Survey indicated that the HWM population had been almost entirely eradicated from the site with only five *single plant* occurrences remaining.

Site C-20 was prioritized for removal efforts as it contained a dominant colony of HWM as well as other *singles*, *clumps of plants*, and *small plant colonies* in the vicinity. Professional harvesting efforts in the site totaled over 10 hours and resulted in the harvest of 52 cubic feet of HWM. The post-harvesting mapping survey indicated a reduction of HWM in the site with only a remnant *clump of plants* and a few *single plants*.

Site F-20 was given first priority for hand harvesting efforts in 2020 based on the presence of a *dominant* density colony of HWM mapped in late-summer 2019. Professional hand harvesting efforts in the site totaled 11.2 hours and yielded 26.5 cubic feet of HWM. No HWM was detected in the site during the 2020 Late-Season HWM Mapping Survey.

Site T-20 was given first priority for harvesting efforts based on the presence of a *scattered* HWM colony in the site as well as *single plants* and *clumps of plants* in the vicinity. The professional harvesting efforts totaled just over 7 hours and resulted in the harvest of 16 cubic feet of HWM from the site. The 2020 Late-Season HWM Mapping Survey indicated that the HWM population in the site had been reduced with just *one small plant colony* and a *single plant* detected within the site.

Many more sites were included in the 2020 hand harvesting program and given either second or third priority based on the HWM population in the site.

Based on conversations between the SLMD, Aquatic Plant Management, LLC, and Onterra, a success criterion for the 2020 hand harvesting program was determined and presented within the *2019 HWM Monitoring and Control Strategy Assessment Report* (Jan2020). Defining control expectations for the hand harvesting program for 2020 would be done in two ways: a site-by-site basis as well as on a lake-wide basis.

> **Site-by-Site Success Criteria:** The 2020 DASH strategy would be evaluated on a site-by-site basis by comparing the pre-harvesting population mapped during the late-summer 2019 survey to the late-summer 2020 post-harvesting survey. This evaluation would be specific to the priority areas that were included on the 2020 DASH permit.
>
> **1)** Sites that contained colonized HWM in late-summer 2019 would meet success criteria if the post-harvesting survey indicates that no colonized areas of HWM were present in the site and any remaining HWM in the site could be mapped using point-based mapping methods (i.e. *singles*, *clumps*, or *small plant colonies*).
>
> **2)** The 2020 priority sites that contained *small plant colonies* or *clumps of plants* in the late-summer 2019 survey would meet control expectations by exhibiting a decrease in the HWM population as demonstrated by a reduction in the size or number of HWM *small plant colonies* or *clumps of plants* occurrences present in the site between the 2019 and 2020 late-summer surveys.

By applying these success criteria to the 2020 strategy, all sites met the success criteria (Table 2.3-1).

> **Lake-wide Success Criteria:** The goal of the 2020 DASH strategy on a lake-wide scale is to manage the HWM population in the main body of the lake at relatively low levels such that there is likely to be minimal negative impacts to the riparian's use of the lake for activities like boating or swimming. This excludes the HWM population in Foxtail Bay which was not a part of the hand harvesting strategy in 2020. A realistic outcome for this goal may be met by suppressing the lake-wide population such that no HWM colonies reach a size over one acre and a density of *dominant* or greater by the time of the September 2020 survey.

The results of the 2020 HWM monitoring show that the lake-wide professional hand harvesting program success criteria were met.

Table 2.3-1. 2020 Professional HWM Hand-Harvesting Summary & Success Criteria Evaluation

2020 HWM Hand-Harvest Control Strategy			DASH & Hand Harvesting Summary		September 2019 (Pre Hand-Harvest)	September 2020 (Post Hand-Harvest)	Success Criteria Met?
Site	Acres	Priority (SLMD)	Time (hours)	Harvest (cubic feet)	AIS Density	AIS Density	
A-20	2.9	1st	63.6	298.5	PG (Highly Dominant)	Pnts (S)	Yes
B-20	0.9	3rd	13.8	27.5	Pnts (SPC, S)	Pnts (S)	Yes
C-20	2.0	1st	10.3	52.0	PG (Dominant)	Pnts (CL, S)	Yes
D-20	1.5	2nd	14.5	21.5	Pnts (SPC, C, S)	Pnts (S)	Yes
E-20	1.1	2nd	2.2	<1.0	Pnts (SPC, S)	None	Yes
F-20	1.4	1st	11.2	26.5	PG (Dominant)	None	Yes
G-20	0.3	3rd	1.6	0.5	Pnts (C, S)	None	Yes
H-20	0.8	2nd	0.8	0.5	Pnts (SPC, S)	None	Yes
I-20	0.6	2nd	5.6	5.0	Pnts (SPC)	None	Yes
J-20	0.5	3rd	6.8	4.0	Pnts (C, S)	None	Yes
K-20	0.1	3rd	0.9	0.5	Pnt (C)	None	Yes
L-20	0.6	3rd	1.9	1.5	Pnts (C, S)	None	Yes
M-20	0.1	3rd	4.0	1.5	Pnt (C)	None	Yes
N-20	0.3	2nd	1.7	2.5	Pnts (SPC, S)	None	Yes
O-20	0.1	3rd	4.2	7.0	Pnt (C)	None	Yes
P-20	0.3	2nd	2.1	5.5	Pnts (SPC, S)	None	Yes
Q-20	0.2	3rd	1.4	4.5	Pnts (C, S)	None	Yes
R-20	0.2	2nd	3.4	14.0	Pnt (SPC)	None	Yes
S-20	0.7	2nd	9.5	36.0	Pnts (SPC, S)	Pnt (S)	Yes
T-20	1.5	1st	7.1	16.0	PG (Scattered)	Pnts (SPC, S)	Yes
U-20	0.5	2nd	5.1	11.0	Pnts (SPC, C)	Pnt (S)	Yes
Total			**171.7**	**536.0**	*Pnts= Only Point-Based Mapping, PGs = Includes Polygon-Based Mapping SPC = Small Plant Colony, CL = Clumps of Plants, S = Single or Few Plants*		

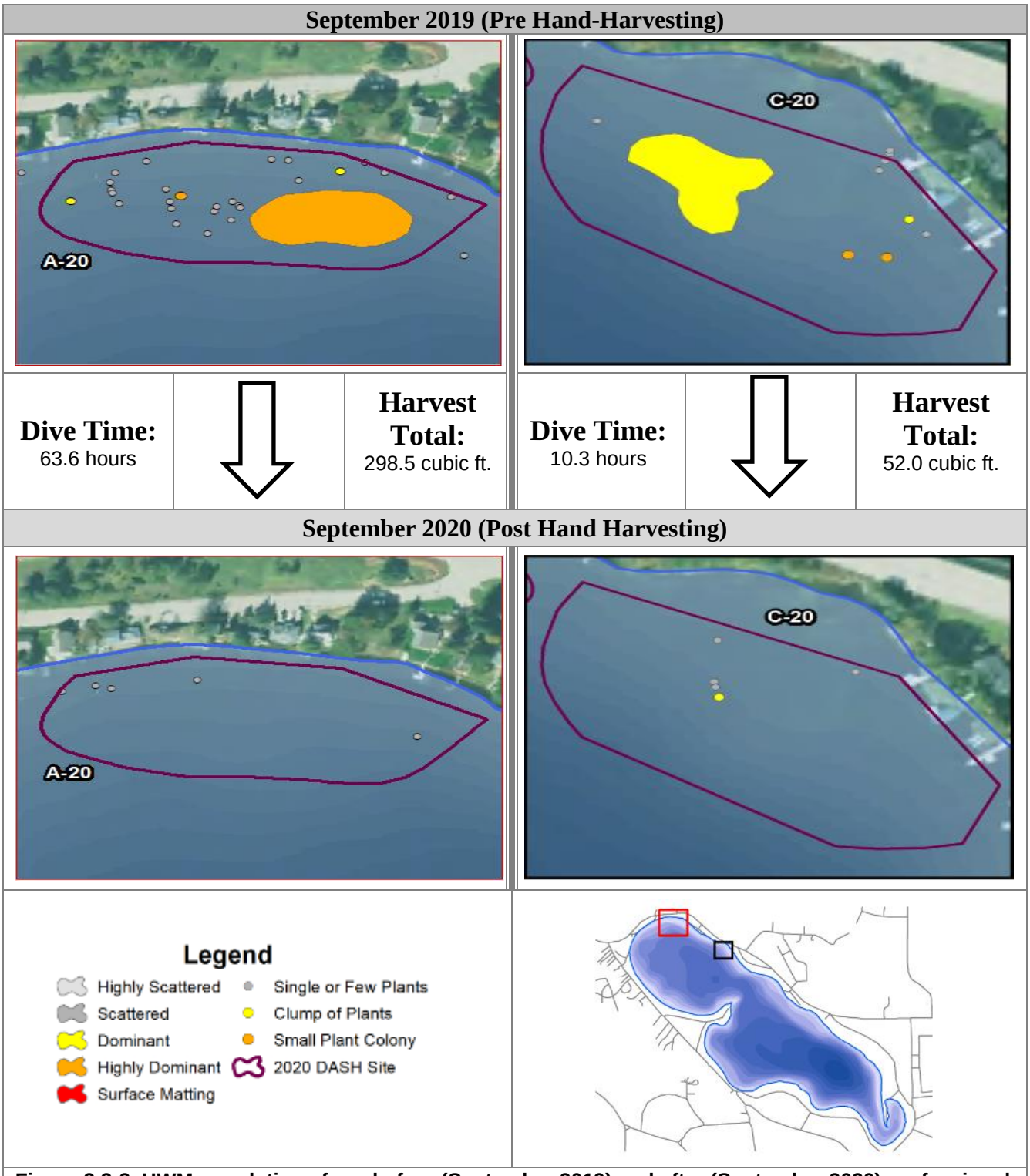
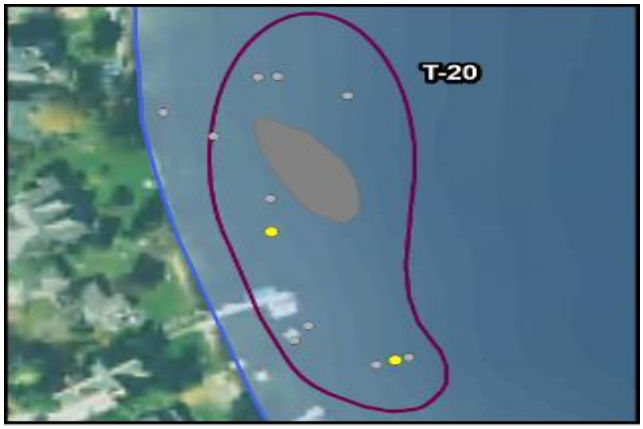


Figure 2.3-2. HWM populations from before (September 2019) and after (September 2020) professional hand-harvesting efforts at sites A-20 & C-20 in Silver Lake.

September 2019 (Pre Hand-Harvesting)



Dive Time: 11.2 hours	**Harvest Total:** 26.5 cubic ft.	**Dive Time:** 7.1 hours	**Harvest Total:** 16.0 cubic ft.

September 2020 (Post Hand Harvesting)

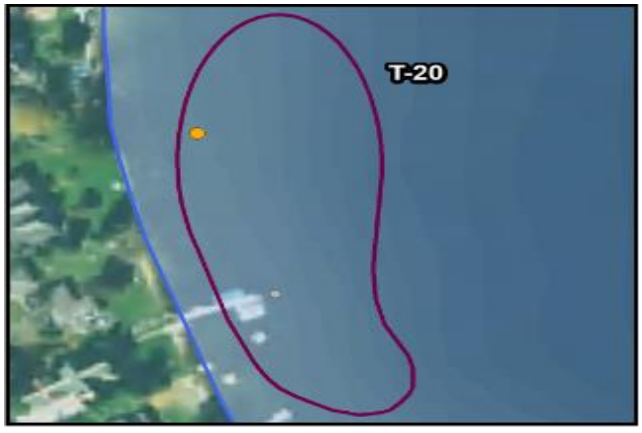


Figure 2.3-3. HWM populations from before (September 2019) and after (September 2020) professional hand-harvesting efforts at sites F-20 & T-20 in Silver Lake.

2.4 Quantitative Analysis

Sub-sample Point-Intercept Survey (Foxtail Bay)

Figure 2.4-1 displays the results of the sub-sample point-intercept surveys from before and after the herbicide treatment. HWM was not found at any of the 89 sampling locations during the post-treatment survey compared to a 36% occurrence in the pretreatment survey. The native species response to the treatment is also displayed on Figure 2.4-1. One species, water stargrass (*Heteranthera dubia*), exhibited a 100% decrease in occurrence between the two surveys. Flat-stem pondweed (*Potamogeton zosteriformis*) and common waterweed (*Elodea canadensis*) exhibited statistically valid increases in occurrence between the two surveys. Most native species did not show a statistically valid change in occurrence between the two surveys.

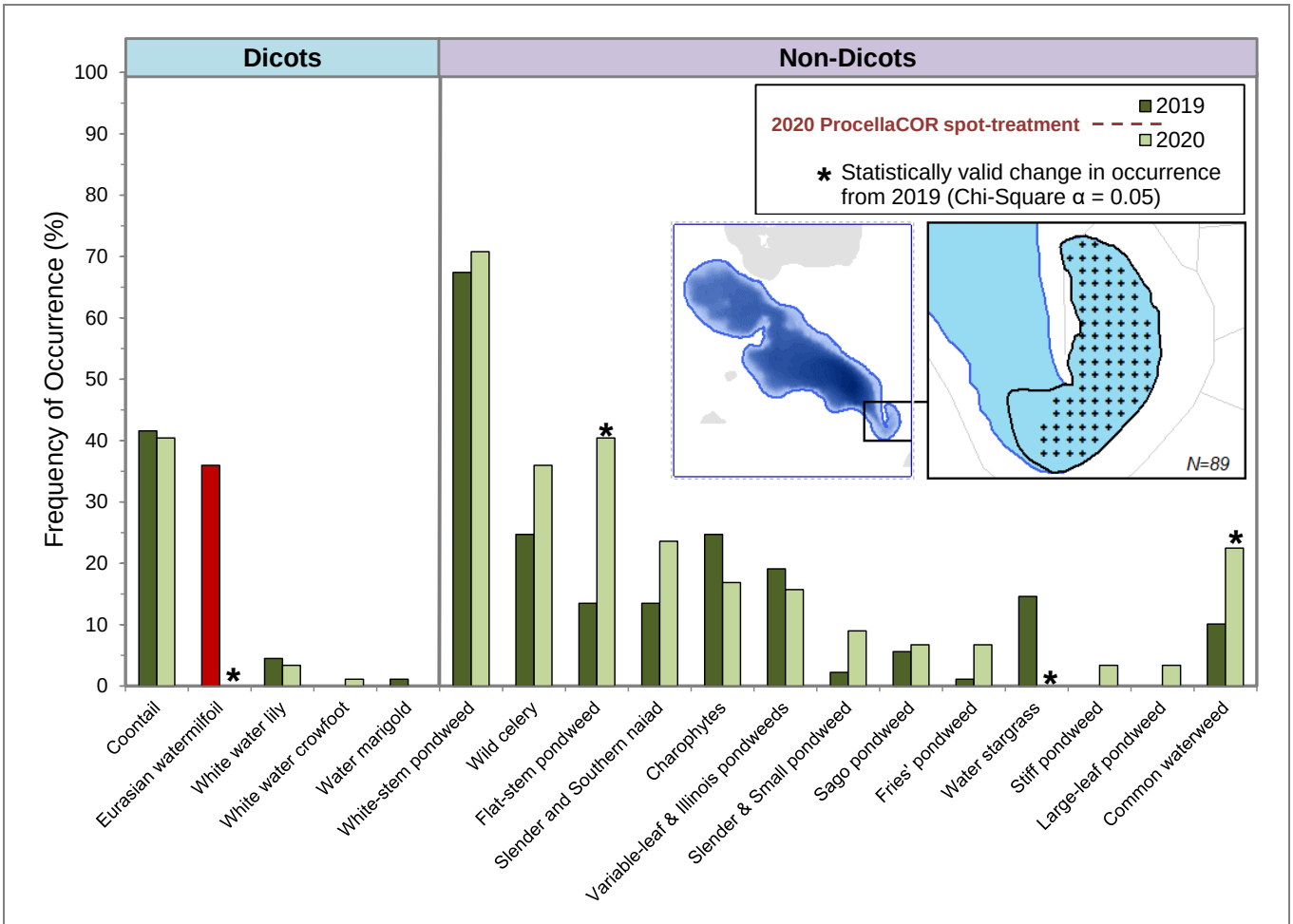


Figure 2.4-1. Frequency of occurrence of aquatic plants from a September 2019 & September 2020 sub-sample point-intercept survey within a 2020 ProcellaCOR™ treatment area in Silver Lake. Asterisk represents statistically valid change from 2019 to 2020 (Chi-Square α = 0.05).

Whole-Lake Point-Intercept Survey

Whole-lake point intercept surveys have been conducted on Silver Lake every year since 2012, with the exception of 2016, with the purpose of quantitatively monitoring the aquatic plant population during a period of active HWM management. The survey was replicated in 2020 to allow for further

understanding of the aquatic plant population dynamics during a period of time of active management coupled with continuing high water levels. Although native aquatic plant data was recorded during the 2020 whole-lake point-intercept survey, these data are not specifically detailed within this report. A chi square analysis for all available point-intercept survey results from 2012 to 2020 is included with this report as an appendix.

Figure 2.4-2 displays the littoral frequency of occurrence of HWM in Silver Lake from 2012-2020. Following the 2016 fluridone treatment, the data show that the littoral frequency of HWM was initially as low as 0.2% in 2017 and increased incrementally with a 1.7% occurrence in 2018 and 2.3% occurrence in 2019. During the 2020 survey, HWM exhibited an occurrence of 0.2%, which represents a statistically valid decrease in occurrence compared to the previous survey. The HWM population has been maintained at a relatively low level during the course of the last four years as the SLMD enacted an integrated pest management strategy following the 2016 whole-lake fluridone treatment.

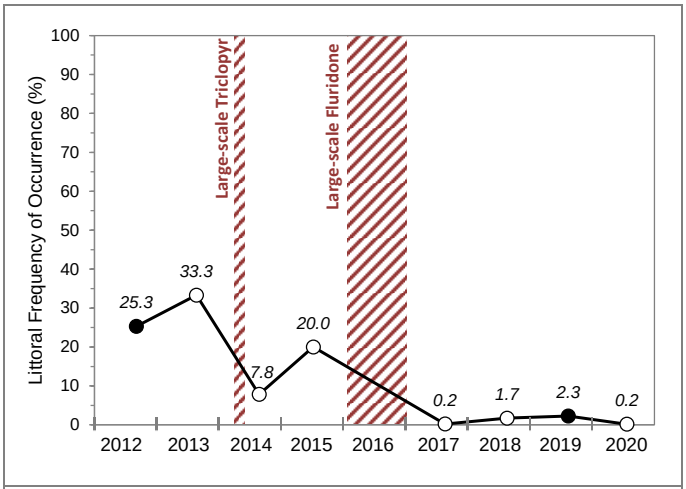


Figure 2.4-2. Littoral frequency of occurrence of HWM in Silver Lake. Open circle represents statistically valid change from previous survey (Chi-Square α = 0.05).

2.5 Herbicide Concentration Monitoring

The herbicide concentration monitoring plan associated with the treatment was developed by Onterra and the WDNR, with the intent of gaining sufficient data to aid in understanding the concentrations of florpyrauxifen-benzyl that were achieved in the treatment area in the hours and days after treatment. Samples were collected from two sites within the herbicide application area at seven time intervals after treatment. Samples were collected by volunteer members of the SLMD and upon completion of the sampling, were shipped to EPL Bio Analytical Services in Niantic Illinois for analysis. This lab was identified by the WDNR as being able to detect the florpyrauxifen-benzyl at lower levels than the herbicide manufacturer's facility – 1 part per billion (ppb). A copy of the herbicide concentration monitoring plan is included as Appendix C.

Figure 2.5-1 displays the results of the post treatment herbicide concentration monitoring. The application rate is converted to parts per billion of florpyrauxifen-benzyl and is displayed as dashed red line on the graph. The first samples collected after treatment at 1 HAT (Hour After Treatment) showed concentrations near or slightly above the application rate at the monitoring sites. Samples collected from site FT-2 were consistently higher that from site FT-1, likely due to the more protected location within Foxtail Bay. By the time of the last sample collection at 48 HAT, the herbicide concentrations at each monitoring location were below 0.5 ppb.

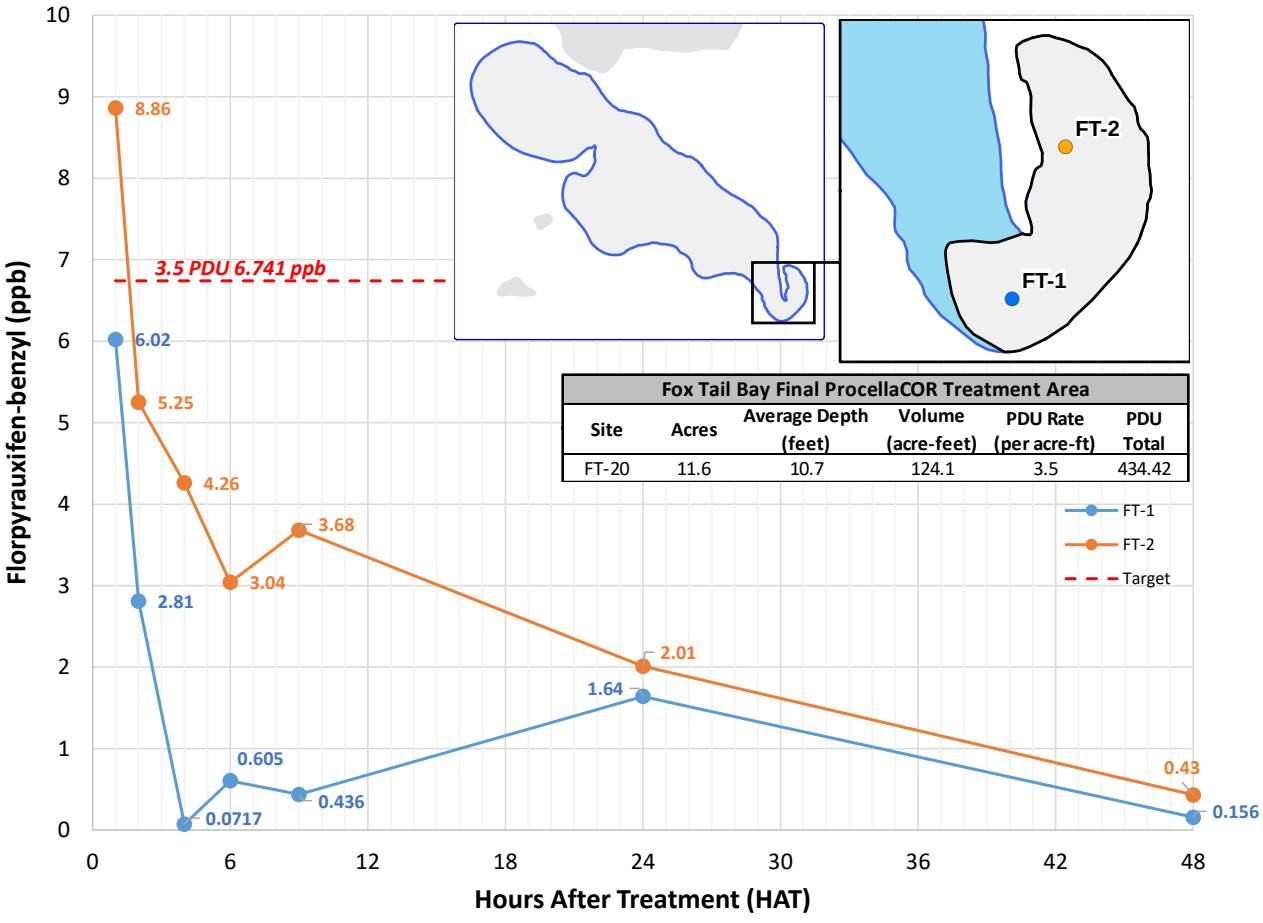


Figure 2.5-1. Herbicide concentration monitoring results following a 2020 florpyrauxifen-benzyl (ProcellaCOR™) treatment in Silver Lake. .

3.0 CONCLUSIONS AND DISCUSSION

The 2020 herbicide treatment site shows promising results during the *year of treatment* with reductions in HWM demonstrated through comparative mapping surveys and point-intercept sub-sampling surveys. No significant impacts to the native plant community were detected in the post-treatment point-intercept survey. A replication of the mapping survey and sub-set point-intercept survey within Foxtail Bay are planned for 2021 and will allow for an understanding of the longer-term efficacy of the treatment as well as an assessment of the native plant community's population dynamics one year after treatment.

The impacts of dispersion of ProcellaCOR™ in lakes after treatment is a topic for further study. In nearly every one of the ProcellaCOR™ treatments that Onterra monitored in 2020, EWM reductions were observed beyond the targeted area. Weak-acid herbicides, like those used in the past on Silver Lake (i.e. 2,4-D), are known to quickly dissipate from the application area. When these herbicides dissipate out of the treatment site, the concentrations and exposure times in these adjacent areas are typically insufficient to cause any meaningful impacts. Because ProcellaCOR™ can produce plant impacts at such low concentrations, the effects of herbicide dissipation and drift may be more meaningful with this chemistry. ProcellaCOR™ has a high binding affinity with organic materials and therefore was not thought to move off site as much as other herbicides. Future research will likely include conducting herbicide concentration monitoring outside of the application areas to understand the

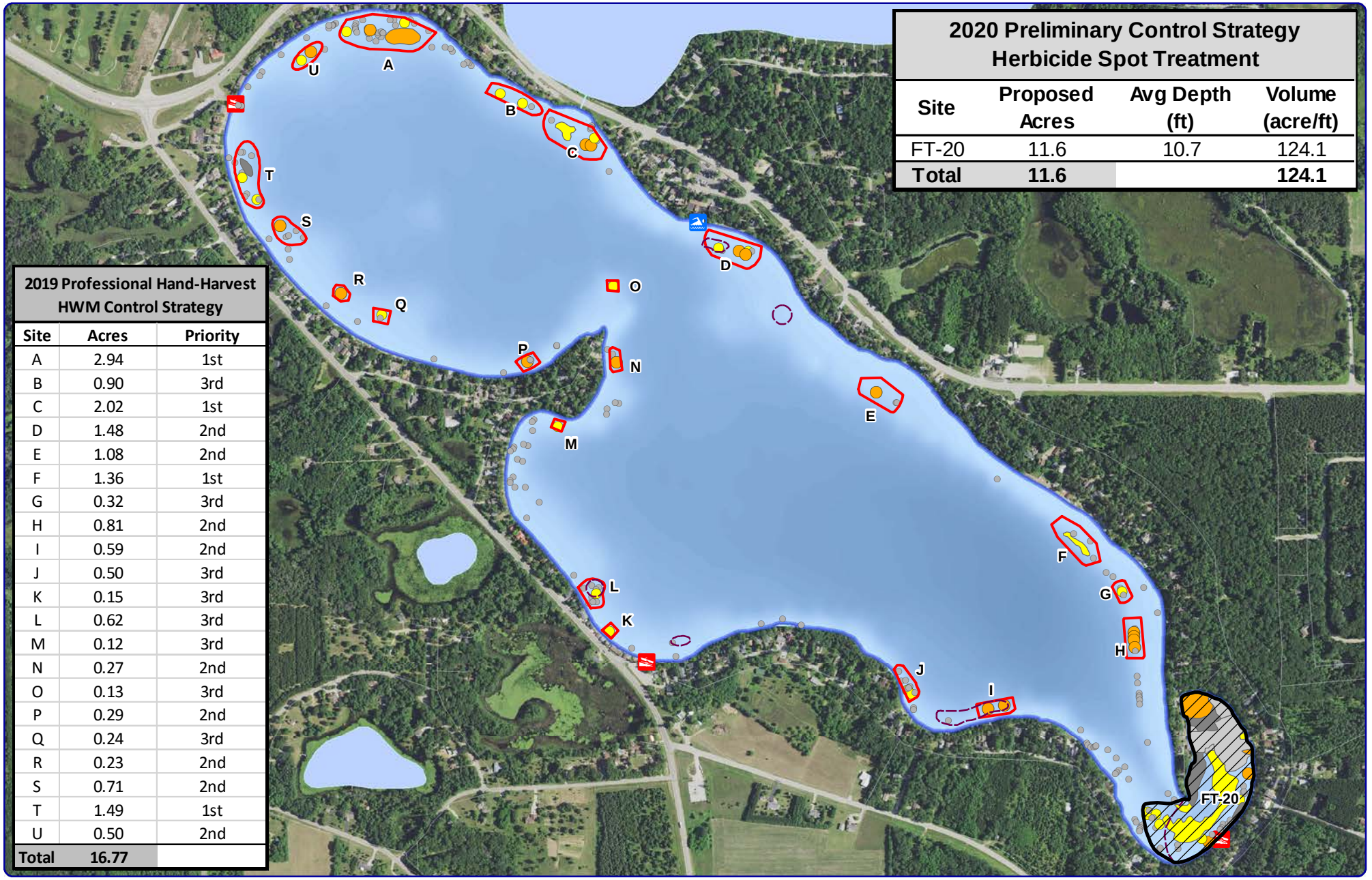
dissipation of the product and concentrations in adjacent areas. It is suspected that the 2020 ProcellaCOR™ treatment likely resulted in some level of HWM control outside of the targeted area of Foxtail Bay. While it is not possible to know the full extent of the impact of the treatment outside of the targeted area, at least some of the HWM reductions within the main portion of the lake towards the southern end of the lake are believed to be related to the treatment. Notes from APM's DASH summary report (Appendix A) indicate that HWM plants were laying down and appeared to be dead in some of the hand harvesting sites.

The professional hand harvesting efforts that took place during 2020 contributed to the reduction of HWM around Silver Lake. All sites that were included in the 2020 hand harvesting strategy met the pre-determined success criteria. Reductions in the HWM population were observed in all of the 21 sites included on the hand harvesting strategy during 2020.

Environmental factors naturally influence aquatic plant populations as well and it is not known to what extent this played a role in the reduction of the HWM population in Silver Lake. It is suspected that the herbicide treatment, as well as the targeted professional hand harvesting efforts were the largest drivers in the reductions of HWM in the lake, however environmental factors such as increased water levels in 2020 may have also contributed. It is unknown whether the HWM reductions observed in Silver Lake in 2020 will be sustained through the 2021 growing season. Concern exists that some HWM in Silver Lake, particularly outside of Foxtail Bay, may have been injured by the 2020 herbicide treatment, but root crowns may have survived and could rebound with new growth during 2021.

Based on the known HWM population in Silver Lake, herbicide management is not warranted in 2021. Having experience in managing HWM in recent years, the SLMD has developed an increasingly clear understanding of the capabilities and limitations in implementing a coordinated hand harvesting strategy as a tool to manage HWM in Silver Lake. The SLMD will use this experience in determining the appropriate application of this management technique in Silver Lake in 2021 based on the most up-to-date HWM mapping survey results.

It is recommended that the 2021 ESAIS survey be scheduled during approximately early-June to allow for detection of any early season growth of HWM. The final hand harvesting strategy will be determined based on the results of the 2021 ESAIS survey. A Late-Season HWM Mapping Survey in 2021 will serve to assess the hand harvesting control strategy as well as help to develop a preliminary management strategy for 2022. A whole-lake point-intercept survey is also scheduled to occur in 2021 to assess the entire aquatic plant population in the lake.



2020 Preliminary Control Strategy Herbicide Spot Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre/ft)
FT-20	11.6	10.7	124.1
Total	**11.6**		**124.1**

2019 Professional Hand-Harvest HWM Control Strategy

Site	Acres	Priority
A	2.94	1st
B	0.90	3rd
C	2.02	1st
D	1.48	2nd
E	1.08	2nd
F	1.36	1st
G	0.32	3rd
H	0.81	2nd
I	0.59	2nd
J	0.50	3rd
K	0.15	3rd
L	0.62	3rd
M	0.12	3rd
N	0.27	2nd
O	0.13	3rd
P	0.29	2nd
Q	0.24	3rd
R	0.23	2nd
S	0.71	2nd
T	1.49	1st
U	0.50	2nd
Total	**16.77**	

N W E S

900

Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: Onterra, 2015
Aquatic Plants: Onterra, 2019
Map Date: December 10, 2019 TWH

Project Location in Wisconsin

Legend

September 2019 HWM/EWM Locations

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony

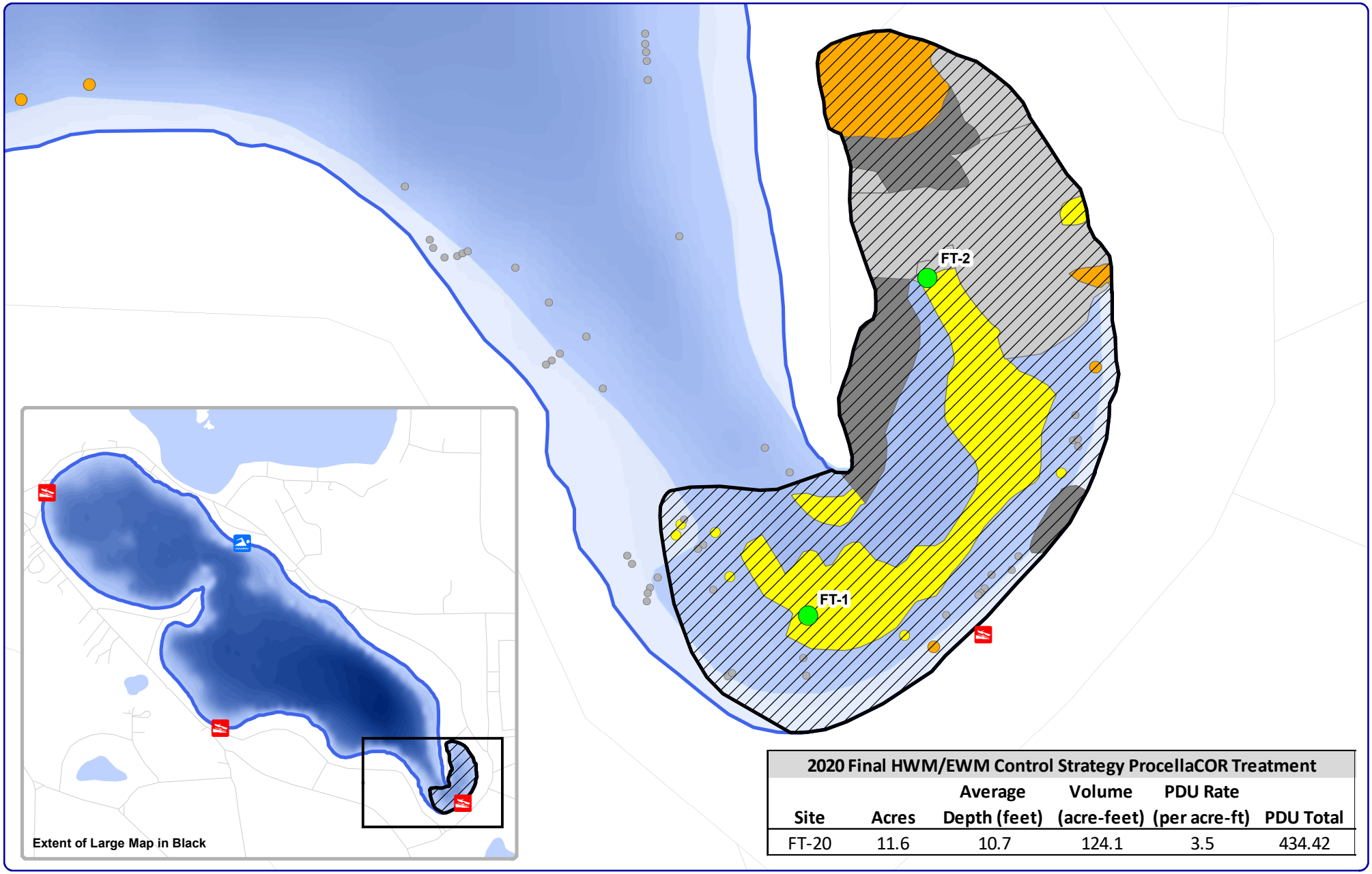
- 2020 Priority Hand-Harvest Site
- 2019 Priority Hand-Harvest Site
- Proposed 2020 Herbicide Treatment Area

Map 1

Silver Lake

Waushara County, Wisconsin

Proposed 2020 HWM Management Strategy



2020 Final HWM/EWM Control Strategy ProcellaCOR Treatment					
Site	Acres	Average Depth (feet)	Volume (acre-feet)	PDU Rate (per acre-ft)	PDU Total
FT-20	11.6	10.7	124.1	3.5	434.42

N
W E
S

220
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: Onterra, 2015
Aquatic Plants: Onterra, 2019
Map Date: June 6, 2020 JMB


Project Location in Wisconsin

Legend

September 2019 HWM/EWM Locations

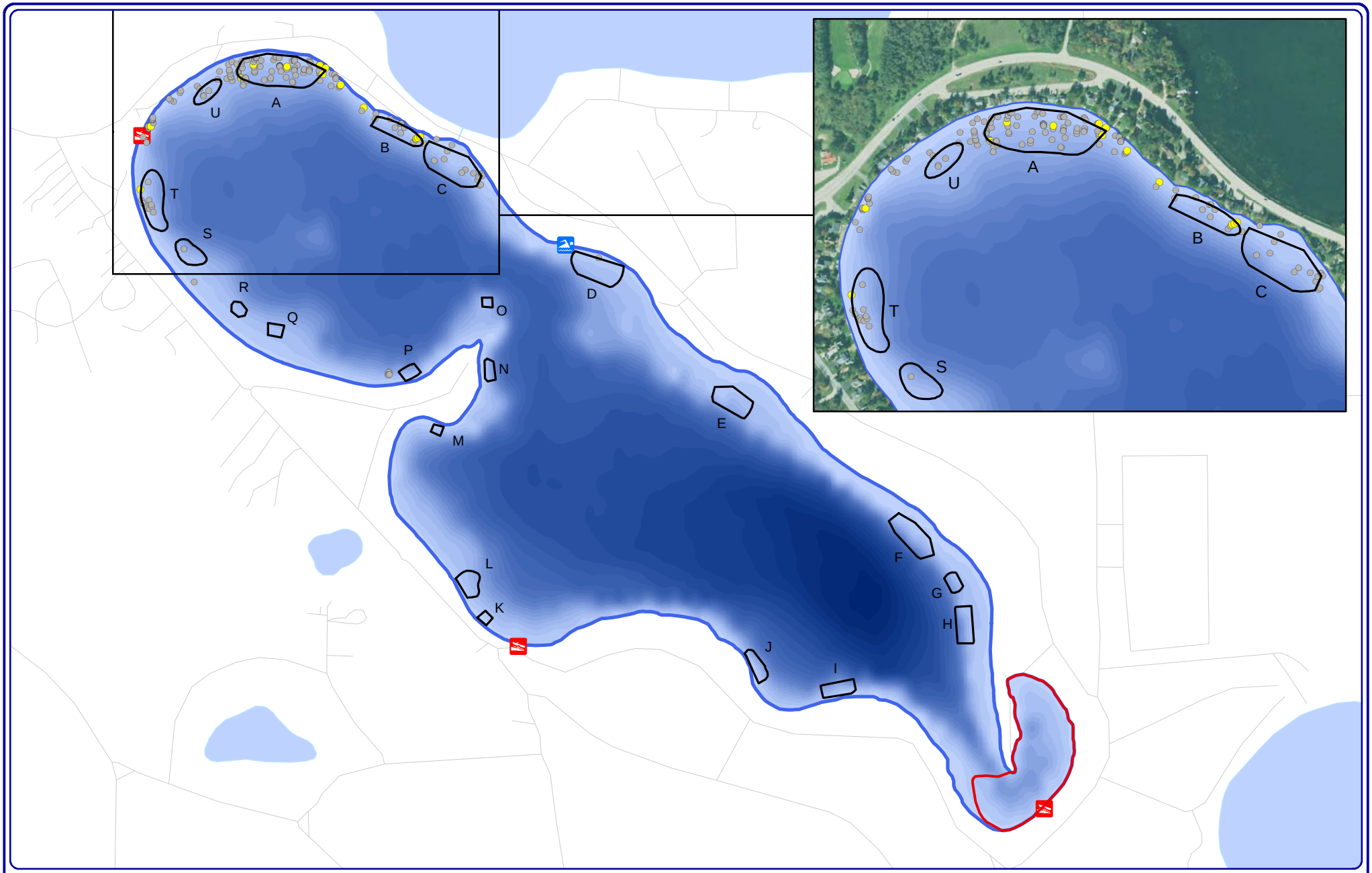
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Herbicide Concentration Monitoring Site
- Herbicide Application Area

Map 2

Silver Lake

Waushara County, Wisconsin

Final 2020 HWM/EWM Control Strategy



N
W E
S

1,000
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: Onterra
Aquatic Plants: Onterra, 2020
Orthophotography: NAIP, 2017
Map Date: July 23, 2020 HAL
Filename:SilverWaushara_EWM_July20.mxd


Project Location in Wisconsin

Legend

- Highly Scattered (none)
- Scattered (none)
- Dominant (none)
- Highly Dominant (none)
- Surface Matting (none)
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony (none found)
- 2020 Herbicide Treatment Area
- 2020 Priority Hand-Harvest Site

Map 3
Silver Lake
Waushara County, Wisconsin

July 2020 EWM Survey Results

900
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: Onterra, 2015
Aquatic Plants: Onterra, 2020
Map Date: October 20, 2020 JMB

Project Location in Wisconsin

Legend

HWM Survey: September 8, 2020

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site
- 2020 Priority Hand-Harvest Sites

Map 4

Silver Lake

Waushara County, Wisconsin

September 2020 HWM Survey Results

A

APPENDIX A

Silver Lake 2020 Dive Summary Report – Aquatic Plant Management, LLC

Site Summary

Silver

Dates: 6/15 - 9/18

Dive Location	Avg. Water Depth	# of Dives	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	Commentary
A	10.0	59	63.6	298.5	Plants are laying down and unhealthy; noticed possible regrowth in September
C	9.3	12	10.3	52.0	Healthy HWM growth
S	10.5	10	9.5	36.0	Lots of algal growth making removal more challenging
B	7.8	15	13.8	27.5	A few clumps of HWM surrounded by scattered single plants
F	14.7	8	11.2	26.5	Plants were laying down, and looked dead
D	8.6	12	14.5	21.5	Very dense native plant growth; HWM plants had only green fragmenting tips at the end of the stems
T	10.2	9	7.1	16.0	Large amount of algae present at this site somewhat slowing down HWM removal
R	9.7	6	3.4	14.0	HWM seemed ready to auto-fragment early in the year
U	8.3	8	5.1	11.0	Scattered dense pockets of native plant growth containing single HWM plants
O	14.3	4	4.2	7.0	HWM looked dead on the lakebed, difficult to remove in gravel; mostly removing root crowns from laying down HWM plants
P	14.8	3	2.1	5.5	
I	13.6	5	5.6	5.0	
Q	8.0	3	1.4	4.5	
J	17.0	4	6.8	4.0	
N	16.3	3	1.7	2.5	
L	9.0	2	1.9	1.5	Algae was thick, making removal difficult
M	15.0	3	4.0	1.5	
K	6.5	2	0.9	0.5	
G	10.7	3	1.6	0.5	
H	10.5	2	0.8	0.5	
E	9.9	4	2.2	0.0	A few bare HWM stems emerging from lakebed. Lots of zebra mussels on stems.
Grand Total	**10.4**	**177**	**171.5**	**536.0**	

Aquatic Plant Management LLC

Site Summary

Silver

Dates: 6/15 - 9/18

Date	Dive Location	Latitude	Longitude	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	AIS Density	Avg Water Depth (ft)	Native Species	Substrate Type	Autofragmentation
6/15/2020	A	44.06187	-89.24186	2.83	47.0	High	14.0	Pondweeds	Organic	Late Stage - Most Plants
6/15/2020	A	44.06187	-89.24186	1.83	25.0	High	15.0	Pondweeds	Organic	Late Stage - Most Plants
6/15/2020	A	44.06187	-89.24186	1.50	26.0	High	15.0	None	Organic	Late Stage - Most Plants
6/16/2020	A	44.06207	-89.24171	1.83	36.0	High	13.5	Coontail	Organic	Late Stage - Most Plants
6/16/2020	C	44.06022	-89.23740	1.17	16.5	Medium	8.0	Chara	Gravel	Early Stage - Few Plants
6/16/2020	U	44.06163	-89.24424	0.67	5.5	Medium	10.0	Chara	Organic/Sand	Early Stage - Few Plants
6/16/2020	T	44.05949	-89.24587	0.83	7.5	Low	19.0	Pondweeds	Organic	Early Stage - Few Plants
6/16/2020	F	44.05204	-89.22370	1.17	9.5	High	13.0	Pondweeds	Organic	Early Stage - Few Plants
6/16/2020	F	44.05209	-89.22379	0.58	3.0	Medium	14.0	None	Organic	Early Stage - Few Plants
6/16/2020	A	44.06200	-89.24147	0.83	3.5	Medium	11.0	None	Organic/Gravel	Late Stage - Most Plants
6/17/2020	A	44.06191	-89.24192	1.67	19.0	Medium	16.0	Coontail	Organic	Late Stage - Most Plants
6/17/2020	A	44.06207	-89.24293	1.08	24.0	Medium	18.0	Coontail	Organic	Late Stage - Most Plants
6/17/2020	C	44.06015	-89.23742	1.75	23.0	Medium	18.0	Pondweeds	Organic/Gravel	Late Stage - Most Plants
6/17/2020	N	44.05569	-89.23608	1.00	2.0	Low	19.0	None	Organic	Not Present
6/17/2020	R	44.05698	-89.24315	0.67	1.0	Low	9.0	None	Organic/Sand	Not Present
6/17/2020	A	44.06207	-89.24186	1.25	7.5	Medium	15.5	Chara	Organic	Late Stage - Most Plants
6/18/2020	A	44.06207	-89.24293	1.50	7.0	Low	9.5	None	Organic	Late Stage - Most Plants
6/18/2020	A	44.06215	-89.24162	0.67	3.5	Medium	12.5	None	Organic	Late Stage - Most Plants
6/18/2020	D	44.05784	-89.23330	1.08	9.0	Medium	12.5	Chara	Organic	Early Stage - Few Plants
6/18/2020	L	44.05125	-89.23666	1.17	1.0	Low	10.0	Chara	Organic	Not Present
6/18/2020	F	44.05209	-89.22377	2.00	5.0	Medium	20.0	None	Organic	Not Present
6/18/2020	D	44.05775	-89.23273	0.92	3.0	Low	10.5	None	Organic/Sand	Early Stage - Few Plants
6/19/2020	G	44.05119	-89.22267	1.00	0.5	Low	11.5	None	Organic	Not Present
6/19/2020	F	44.05226	-89.22409	0.58	3.0	Low	21.0	None	Organic	Not Present
6/19/2020	F	44.05209	-89.22379	0.75	5.0	Low	16.5	None	Organic	Not Present
6/22/2020	A	44.06190	-89.24149	1.33	7.0	Low	15.0	Pondweeds	Organic	Not Present
6/22/2020	B	44.06091	-89.23898	0.92	6.5	Low	12.0	Pondweeds	Organic	Early Stage - Few Plants
6/22/2020	B	44.06067	-89.23851	1.25	6.0	Low	12.0	Elodea	Organic	Early Stage - Few Plants
6/22/2020	O	44.05715	-89.23615	1.25	2.5	Medium	15.0	None	Gravel	Not Present
6/23/2020	I	44.04895	-89.22628	1.58	2.0	Low	15.0	Chara	Organic/Gravel	Not Present
6/23/2020	I	44.04902	-89.22583	1.08	2.0	Low	18.0	Chara	Organic/Gravel	Not Present
6/23/2020	J	44.04926	-89.22829	1.42	2.0	Low	20.0	Pondweeds	Organic	Not Present
6/23/2020	M	44.05447	-89.23766	0.42	0.5	Low	15.0	Pondweeds	Organic	Not Present
6/23/2020	S	44.05835	-89.24501	1.25	4.0	Medium	10.0	Chara	Organic	Not Present
6/23/2020	R	44.05706	-89.24340	0.67	4.0	Medium	10.0	Chara	Organic	Not Present
6/23/2020	Q	44.05663	-89.24231	0.50	4.0	Low	10.0	Chara	Organic	Not Present
6/23/2020	P	44.05571	-89.23846	0.58	4.0	Medium	15.0	Chara	Organic	Not Present
6/24/2020	F	44.05213	-89.22388	1.25	0.5	Low	15.0	Pondweeds	Organic	Not Present
6/24/2020	H	44.05026	-89.22237	0.50	0.5	Low	12.0	Pondweeds	Organic	Not Present
6/24/2020	I	44.04902	-89.22610	1.08	0.5	Low	15.0	Pondweeds	Organic	Not Present
6/24/2020	J	44.04947	-89.22836	0.58	0.5	Low	18.0	Pondweeds	Organic	Not Present
6/24/2020	K	44.05056	-89.23628	0.50	0.5	Low	5.0	Pondweeds	Organic	Not Present
6/24/2020	L	44.05125	-89.23679	0.75	0.5	Low	8.0	Pondweeds	Organic	Not Present
6/24/2020	M	44.05445	-89.23774	0.58	0.5	Low	15.0	Pondweeds	Organic	Not Present
6/24/2020	N	44.05563	-89.23605	0.33	0.5	Low	15.0	Pondweeds	Organic/Sand	Not Present
6/24/2020	O	44.05711	-89.23611	0.92	3.0	Medium	12.0	Pondweeds	Gravel	Not Present
6/25/2020	P	44.05575	-89.23833	1.17	1.5	Low	17.5	Elodea	Organic	Not Present
6/25/2020	Q	44.05666	-89.24239	0.58	0.5	Low	9.0	Coontail	Sand	Not Present
6/25/2020	R	44.05706	-89.24336	0.67	0.5	Low	9.0	Pondweeds	Organic	Not Present
6/25/2020	R	44.05749	-89.24375	0.75	8.0	High	12.0	Elodea	Organic	Late Stage - Few Plants
6/25/2020	S	44.05820	-89.24461	1.00	12.0	Medium	13.0	Elodea	Organic	Late Stage - Few Plants
6/25/2020	S	44.05820	-89.24461	0.25	1.0	Low	14.0	Elodea	Organic	Late Stage - Few Plants
6/25/2020	T	44.05894	-89.24560	0.50	0.5	Low	15.0	None	Organic	Late Stage - Few Plants
6/25/2020	U	44.06166	-89.24422	0.58	0.5	Low	17.0	None	Organic	Not Present
6/25/2020	A	44.06203	-89.24145	0.58	2.0	Low	18.0	Pondweeds	Organic	Not Present
6/25/2020	B	44.06074	-89.23891	0.50	0.0	Low	15.0	None	Organic	Not Present
6/25/2020	C	44.05996	-89.23695	0.58	0.5	Low	10.0	None	Organic	Not Present
6/25/2020	D	44.05771	-89.23283	0.25	0.0	Low	9.0	None	Organic/Sand	Not Present
6/25/2020	E	44.05503	-89.22916	0.25	0.0	Low	12.0	None	Organic	Not Present
6/25/2020	G	44.05119	-89.22267	0.25	0.0	Low	10.0	None	Organic/Sand	Not Present
6/26/2020	K	44.05054	-89.23624	0.42	0.0	Single or Few	8.0	None	Sand	Not Present
6/26/2020	R	44.05734	-89.24360	0.42	0.5	Single or Few	9.0	None	Organic/Sand	Late Stage - Few Plants
6/26/2020	T	44.05906	-89.24596	0.50	0.5	Single or Few	16.0	None	Organic	Not Present
6/26/2020	O	44.05709	-89.23617	1.42	1.0	Clumps	15.0	None	Gravel	Not Present
7/28/2020	D	44.05807	-89.23291	1.25	1.5	Highly Scattered	5.0	Pondweeds	Organic	Early Stage - Few Plants
7/28/2020	C	44.05975	-89.23640	1.17	5.0	Highly Scattered	5.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/28/2020	B	44.06050	-89.23795	0.92	6.0	Highly Scattered	6.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/28/2020	B	44.06104	-89.23939	1.08	1.0	Highly Scattered	5.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/28/2020	B	44.06093	-89.23946	0.83	0.0	Highly Scattered	5.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/28/2020	A	44.06200	-89.24096	0.83	4.5	Clumps	4.5	Pondweeds	Organic/Gravel	Early Stage - Few Plants
7/28/2020	A	44.06219	-89.24158	0.42	4.0	Clumps	6.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/29/2020	A	44.06198	-89.24218	1.08	6.0	Clumps	9.0	Pondweeds	Organic/Gravel	Early Stage - Few Plants
7/29/2020	A	44.06196	-89.24168	1.42	4.0	Clumps	9.0	Pondweeds	Organic	Early Stage - Few Plants
7/29/2020	A	44.06187	-89.24179	0.83	1.0	Scattered	9.0	Pondweeds	Organic	Early Stage - Few Plants
7/29/2020	A	44.06191	-89.24268	0.58	2.0	Scattered	9.0	Coontail	Organic/Sand	Early Stage - Few Plants
7/29/2020	A	44.06224	-89.24297	0.67	2.5	Clumps	5.0	Pondweeds	Organic	Early Stage - Few Plants
7/29/2020	A	44.06217	-89.24235	0.58	1.5	Scattered	4.0	Pondweeds	Organic	Early Stage - Few Plants
7/29/2020	A	44.06198	-89.24338	1.00	1.0	Scattered	7.0	Pondweeds	Organic	Early Stage - Few Plants

Aquatic Plant Management LLC

Site Summary

Silver

Dates: 6/15 - 9/18

Date	Dive Location	Latitude	Longitude	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	AIS Density	Avg Water Depth (ft)	Native Species	Substrate Type	Autofragmentation
7/29/2020	A	44.06204	-89.24295	0.50	2.5	Scattered	8.0	Pondweeds	Organic	Early Stage - Few Plants
7/30/2020	A	44.06211	-89.24192	1.08	8.0	Small Plant Colony	5.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/30/2020	A	44.06215	-89.24134	0.75	2.0	Scattered	7.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
7/30/2020	A	44.06207	-89.24110	1.00	3.0	Clumps	7.0	Pondweeds	Organic	Early Stage - Few Plants
7/30/2020	B	44.06060	-89.23817	0.33	0.0	Single or Few	4.5	Pondweeds	Organic/Sand	Not Present
7/30/2020	U	44.06166	-89.24435	0.58	0.5	Scattered	7.0	Pondweeds	Organic	Not Present
7/30/2020	U	44.06138	-89.24454	0.33	0.0	Single or Few	8.5	None	Organic	Not Present
7/30/2020	T	44.05938	-89.24598	0.33	0.0	Single or Few	5.0	None	Organic	Not Present
7/30/2020	S	44.05837	-89.24509	0.75	2.0	Clumps	10.0	Pondweeds	Organic	Not Present
7/30/2020	S	44.05824	-89.24477	1.00	3.0	Small Plant Colony	10.0	Coontail	Organic	Early Stage - Few Plants
7/31/2020	S	44.05833	-89.24482	1.25	1.5	Scattered	9.0	Pondweeds	Organic	Early Stage - Few Plants
7/31/2020	R	44.05700	-89.24342	0.25	0.0	Highly Scattered	9.0	Pondweeds	Organic	Early Stage - Few Plants
7/31/2020	Q	44.05657	-89.24231	0.33	0.0	Highly Scattered	5.0	Northern Milfoil	Organic	Not Present
7/31/2020	P	44.05573	-89.23851	0.33	0.0	Single or Few	12.0	None	Organic	Not Present
7/31/2020	O	44.05719	-89.23619	0.58	0.5	Single or Few	15.0	None	Gravel	Not Present
7/31/2020	N	44.05565	-89.23606	0.33	0.0	None	15.0	None	Organic/Gravel	Not Present
7/31/2020	E	44.05505	-89.22913	1.08	0.0	None	12.5	None	Organic	Not Present
7/31/2020	F	44.05219	-89.22392	1.42	0.0	None	9.5	None	Organic/Sand	Not Present
7/31/2020	G	44.05119	-89.22276	0.33	0.0	None	10.5	None	Organic/Sand	Not Present
7/31/2020	H	44.05035	-89.22237	0.33	0.0	Single or Few	9.0	None	Organic/Sand	Not Present
7/31/2020	I	44.04909	-89.22520	0.17	0.0	None	10.0	None	Organic	0
8/5/2020	D	44.05769	-89.23228	3.33	1.0	Highly Scattered	12.0	Pondweeds	Organic	Late Stage - Most Plants
8/5/2020	D	44.05775	-89.23263	3.33	1.5	Scattered	11.0	None	Organic	Late Stage - Most Plants
8/4/2020	F	44.05213	-89.22398	3.42	0.5	Single or Few	8.5	None	Organic/Sand	Late Stage - Few Plants
8/4/2020	M	44.05429	-89.23788	3.00	0.5	Single or Few	15.0	Chara	Organic	Late Stage - Few Plants
8/4/2020	I	44.04900	-89.22636	1.67	0.5	Single or Few	10.0	None	Organic	Late Stage - Few Plants
8/3/2020	J	44.04895	-89.22804	2.25	0.5	Single or Few	10.0	Chara	Organic	Not Present
8/3/2020	J	44.04962	-89.22836	2.50	1.0	Single or Few	20.0	None	Organic	Not Present
8/27/2020	A	44.06199	-89.24168	1.33	1.5	Clumps	13.0	Pondweeds	Organic	Late Stage - Few Plants
8/27/2020	A	44.06191	-89.24177	1.08	1.5	Clumps	12.0	Pondweeds	Organic	Late Stage - Few Plants
8/27/2020	A	44.06216	-89.24222	0.92	1.0	Scattered	10.0	Pondweeds	Organic	Late Stage - Few Plants
8/27/2020	A	44.06191	-89.24247	1.92	1.0	Highly Scattered	12.5	Pondweeds	Organic	Late Stage - Few Plants
8/27/2020	A	44.06186	-89.24228	2.25	1.0	Clumps	12.0	Pondweeds	Organic	Late Stage - Few Plants
8/26/2020	B	44.06054	-89.23820	1.83	3.0	Clumps	9.0	Pondweeds	Organic	Late Stage - Few Plants
8/26/2020	B	44.06192	-89.24096	1.58	2.0	Clumps	6.0	Pondweeds	Organic	Late Stage - Few Plants
8/26/2020	A	44.06222	-89.24293	1.42	2.5	Scattered	8.5	Pondweeds	Organic	Late Stage - Few Plants
8/26/2020	A	44.06216	-89.24189	1.25	1.0	Highly Scattered	10.5	Pondweeds	Organic	Late Stage - Few Plants
8/26/2020	A	44.06221	-89.24135	0.92	2.5	Clumps	10.5	Pondweeds	Organic	Late Stage - Few Plants
8/25/2020	A	44.06192	-89.24318	1.50	4.5	Highly Scattered	8.5	Pondweeds	Organic	Late Stage - Few Plants
8/24/2020	A	44.06204	-89.24258	1.00	0.5	Single or Few	11.0	Pondweeds	Organic	Late Stage - Few Plants
8/24/2020	A	44.06217	-89.24233	1.00	1.0	Single or Few	11.0	Pondweeds	Organic	Late Stage - Few Plants
8/24/2020	A	44.06208	-89.24226	1.58	2.5	Scattered	13.0	Pondweeds	Organic	Late Stage - Few Plants
8/24/2020	A	44.06209	-89.24199	1.33	2.5	Scattered	13.0	Pondweeds	Organic	Late Stage - Few Plants
8/24/2020	A	44.06213	-89.24177	2.33	6.0	Scattered	13.0	Pondweeds	Organic	Late Stage - Few Plants
9/8/2020	A	44.06211	-89.24348	1.17	3.0	Highly Scattered	7.0	Chara	Organic	Late Stage - Most Plants
9/8/2020	S	44.05816	-89.24480	1.42	5.5	Highly Scattered	12.0	Chara	Organic	Late Stage - Most Plants
9/9/2020	S	44.05837	-89.24475	0.33	2.0	Highly Scattered	9.0	Pondweeds	Organic	Late Stage - Most Plants
9/9/2020	S	44.05827	-89.24488	0.92	3.0	Scattered	9.0	Pondweeds	Organic	Late Stage - Most Plants
9/9/2020	S	44.05812	-89.24464	1.33	2.0	Scattered	9.0	Chara	Organic	Late Stage - Most Plants
9/9/2020	T	44.05912	-89.24464	1.17	1.0	Highly Scattered	5.5	Chara	Organic	Late Stage - Most Plants
9/10/2020	T	44.05960	-89.24590	1.25	1.0	Highly Scattered	8.0	Pondweeds	Organic	Late Stage - Most Plants
9/10/2020	T	44.05983	-89.24587	1.33	2.5	Scattered	8.0	Pondweeds	Organic	Late Stage - Most Plants
9/10/2020	T	44.05985	-89.24604	0.50	2.0	Scattered	8.0	Pondweeds	Organic	Late Stage - Most Plants
9/10/2020	T	44.05994	-89.24590	0.67	1.0	Scattered	7.5	Chara	Organic	Late Stage - Most Plants
9/10/2020	U	44.06153	-89.24443	1.17	1.5	Highly Scattered	6.5	Chara	Organic/Sand	Late Stage - Few Plants
9/10/2020	U	44.06168	-89.24417	0.58	1.0	Highly Scattered	6.0	Chara	Organic/Sand	Late Stage - Few Plants
9/10/2020	U	44.06178	-89.24396	0.50	1.0	Highly Scattered	6.0	Chara	Organic/Sand	Late Stage - Most Plants
9/10/2020	U	44.06189	-89.24385	0.67	1.0	Highly Scattered	5.5	Chara	Organic/Sand	Late Stage - Few Plants
9/10/2020	A	44.06204	-89.24287	0.75	1.5	Clumps	5.5	Chara	Organic/Sand	Late Stage - Few Plants
9/11/2020	A	44.06224	-89.24287	1.67	1.0	Clumps	5.0	Coontail	Organic	Late Stage - Few Plants
9/11/2020	A	44.06211	-89.24244	0.67	1.0	Single or Few	7.0	Northern Milfoil	Organic	Late Stage - Few Plants
9/11/2020	A	44.06215	-89.24229	0.50	0.5	Single or Few	6.5	Chara	Organic	Late Stage - Few Plants
9/11/2020	A	44.06219	-89.24203	0.75	1.0	Highly Scattered	8.0	Chara	Organic	Late Stage - Few Plants
9/11/2020	A	44.06217	-89.24179	0.58	1.5	Highly Scattered	9.0	Coontail	Organic	Late Stage - Most Plants
9/11/2020	A	44.06200	-89.24158	1.00	2.0	Small Plant Colony	8.0	Chara	Organic	Early Stage - Few Plants
9/11/2020	A	44.06198	-89.24136	0.75	1.0	Clumps	8.5	Wild Celery	Organic	Early Stage - Few Plants
9/11/2020	A	44.06198	-89.24136	0.67	1.0	Clumps	8.5	Wild Celery	Organic	Early Stage - Few Plants
9/18/2020	A	44.06185	-89.24261	1.00	1.5	Scattered	10.0	Pondweeds	Organic	Late Stage - Few Plants
9/18/2020	A	44.06187	-89.24235	0.67	0.5	Scattered	10.0	Coontail	Organic/Gravel	Late Stage - Most Plants
9/18/2020	A	44.06191	-89.24211	0.83	0.5	Highly Scattered	10.0	Coontail	Organic	Late Stage - Most Plants
9/18/2020	A	44.06198	-89.24203	1.00	0.5	Highly Scattered	10.5	Pondweeds	Organic	Late Stage - Few Plants
9/18/2020	A	44.06207	-89.24100	0.83	0.5	Highly Scattered	11.0	Coontail	Organic	Early Stage - Few Plants
9/18/2020	A	44.06185	-89.24141	0.58	0.0	Single or Few	11.0	Coontail	Organic	Early Stage - Few Plants
9/18/2020	A	44.06191	-89.24326	0.75	0.5	Clumps	10.0	Coontail	Organic	Late Stage - Few Plants
9/18/2020	A	44.06200	-89.24358	0.33	0.0	Highly Scattered	5.0	Pondweeds	Organic	Early Stage - Few Plants
9/15/2020	A	44.06191	-89.24081	0.75	1.0	Clumps	8.0	Coontail	Organic	Late Stage - Few Plants
9/15/2020	B	44.06101	-89.23928	0.58	1.0	Highly Scattered	7.5	Pondweeds	Organic	Late Stage - Few Plants
9/15/2020	B	44.06093	-89.23904	0.83	1.0	Highly Scattered	6.5	Coontail	Organic	Late Stage - Few Plants

Aquatic Plant Management LLC

Site Summary

Silver

Dates: 6/15 - 9/18

Date	Dive Location	Latitude	Longitude	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	AIS Density	Avg Water Depth (ft)	Native Species	Substrate Type	Autofragmentation
9/15/2020	B	44.06077	-89.23865	0.92	0.5	Single or Few	6.5	Coontail	Organic	Late Stage - Few Plants
9/15/2020	B	44.06062	-89.23832	1.17	0.5	Highly Scattered	7.0	Northern Milfoil	Organic	Late Stage - Few Plants
9/15/2020	B	44.06065	-89.23859	0.42	0.0	Single or Few	7.0	Coontail	Organic	Late Stage - Few Plants
9/16/2020	B	44.06059	-89.23812	0.67	0.0	Single or Few	7.5	Pondweeds	Organic	Not Present
9/16/2020	C	44.06022	-89.23759	0.75	1.5	Clumps	9.5	Coontail	Organic	Late Stage - Few Plants
9/16/2020	C	44.06005	-89.23748	1.08	1.5	Scattered	11.5	Coontail	Organic	Late Stage - Few Plants
9/16/2020	C	44.06005	-89.23718	0.75	0.5	Highly Scattered	7.5	Pondweeds	Organic	Late Stage - Most Plants
9/16/2020	C	44.05983	-89.23718	0.75	1.5	Clumps	12.0	Coontail	Organic	Late Stage - Most Plants
9/16/2020	C	44.05983	-89.23690	0.75	0.5	Clumps	7.5	Pondweeds	Organic/Sand	Late Stage - Most Plants
9/16/2020	C	44.05977	-89.23688	0.67	1.0	Highly Scattered	7.0	Pondweeds	Organic/Sand	Early Stage - Few Plants
9/16/2020	C	44.05962	-89.23660	0.58	0.5	Single or Few	8.0	Pondweeds	Organic/Gravel	Late Stage - Most Plants
9/16/2020	C	44.05964	-89.23650	0.33	0.0	Single or Few	8.0	Pondweeds	Organic/Gravel	Late Stage - Most Plants
9/17/2020	D	44.05801	-89.23357	0.83	1.0	Clumps	6.0	Coontail	Organic/Sand	Early Stage - Few Plants
9/17/2020	D	44.05788	-89.23334	1.08	1.5	Clumps	6.5	Coontail	Organic/Sand	Early Stage - Few Plants
9/17/2020	D	44.05777	-89.23334	1.00	1.5	Scattered	8.5	Coontail	Organic/Sand	Late Stage - Few Plants
9/17/2020	D	44.05769	-89.23296	0.75	1.5	Scattered	8.0	Pondweeds	Organic/Sand	Late Stage - Few Plants
9/17/2020	D	44.05760	-89.23272	0.42	0.0	Single or Few	7.5	Coontail	Organic	Not Present
9/17/2020	D	44.05766	-89.23250	0.25	0.0	Single or Few	6.5	Pondweeds	Organic/Sand	Early Stage - Few Plants
9/17/2020	E	44.05515	-89.22952	0.50	0.0	Single or Few	7.5	None	Organic/Gravel	Not Present
9/17/2020	E	44.05500	-89.22894	0.33	0.0	None	7.5	None	Organic/Gravel	0
9/17/2020	A	44.06178	-89.24186	0.83	1.5	Clumps	9.5	Coontail	Organic	Early Stage - Few Plants

B

APPENDIX B

Littoral Frequency of Occurrence of Aquatic Plants from whole-lake point-intercept surveys of Silver Lake from 2012-2020.

			LFOO (%)								2019-2020	
	Scientific Name	Common Name	2012	2013	2014	2015	2017	2018	2019	2020	% Change	Direction
Dicots	*Ceratophyllum demersum*	Coontail	32.9	32.9	42.5	36.3	20.4	25.5	21.9	14.7	-32.7	▼
	Myriophyllum spicatum	Eurasian w atermilfoil	25.3	33.3	7.8	20.0	0.2	1.7	2.3	0.2	-92.2	▼
	Bidens beckii	Water marigold	0.0	0.0	0.2	0.0	0.4	1.1	2.3	2.8	24.3	▲
	Myriophyllum sibiricum	Northern w atermilfoil	0.6	5.4	0.7	0.2	0.0	0.0	0.0	0.0		-
	Ranunculus aquatilis	White w ater crow foot	0.0	0.0	0.2	0.4	0.0	0.0	0.2	0.5	179.8	▲
	Nymphaea odorata	White w ater lily	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4		▲
	Nuphar variegata	Spatterdock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		▲
	Utricularia geminiscapa	Tw in-stemmed bladderw ort	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0		-
Non-dicots	*Chara & Nitella*	Charophytes	33.8	25.1	30.0	23.9	25.7	33.5	23.6	16.9	-28.6	▼
	Chara spp.	Muskgrasses	28.7	15.9	19.2	17.4	22.2	31.3	16.6	14.6	-12.1	▼
	Najas flexilis & N. guadalupensis	Slender and Southern naiad	27.4	22.8	25.3	19.3	3.7	13.0	9.7	7.8	-19.5	▼
	Najas guadalupensis	Southern naiad	24.7	21.3	22.6	16.5	3.7	9.7	7.0	7.1	0.8	▲
	Elodea canadensis	Common w aterw eed	27.8	35.1	28.2	19.1	0.0	1.3	2.3	2.5	8.8	▲
	Vallisneria americana	Wild celery	11.0	8.9	11.6	12.4	9.8	14.3	13.9	12.4	-10.6	▼
	Potamogeton gramineus	Variable-leaf pondw eed	20.7	13.6	10.7	11.1	3.5	15.1	10.7	7.5	-30.1	▼
	Fissidens spp. & Fontinalis spp.	Aquatic Moss	5.5	10.1	7.4	4.8	0.0	9.7	18.3	6.9	-62.1	▼
	Potamogeton friesii	Fries' pondw eed	2.1	3.4	2.2	11.7	4.6	3.9	8.2	11.5	41.0	▲
	Stuckenia pectinata	Sago pondw eed	6.5	5.1	6.5	8.9	7.4	10.4	4.4	4.3	-2.7	▼
	Nitella spp.	Stonew orts	8.0	9.4	11.4	8.5	3.7	2.2	7.2	2.5	-65.6	▼
	Potamogeton zosteriformis	Flat-stem pondw eed	1.5	2.2	2.0	2.6	6.1	7.3	6.9	7.3	6.2	▲
	Potamogeton praelongus	White-stem pondw eed	4.6	4.0	8.5	4.8	1.5	4.1	4.2	4.1	-2.5	▼
	Potamogeton berchtoldii & P. pusillus	Slender and Small pondw eeds	0.0	2.0	2.2	4.8	3.5	8.9	6.5	0.7	-89.0	▼
	Potamogeton pusillus	Small pondw eed	0.0	2.0	2.2	4.8	3.5	8.9	6.5	0.7	-89.0	▼
	Potamogeton foliosis & P. strictifolius	Leafy and Stiff pondw eed	3.6	0.2	2.9	0.7	3.3	1.1	4.4	4.1	-6.7	▼
	Potamogeton illinoensis	Illinois pondw eed	4.6	2.7	4.7	5.4	1.5	0.6	1.5	1.1	-30.1	▼
	Najas flexilis	Slender naiad	3.2	1.8	3.8	3.0	0.0	3.2	3.0	0.7	-76.7	▼
	Potamogeton strictifolius	Stiff pondw eed	0.0	0.0	0.0	0.0	1.5	0.9	1.9	3.9	105.2	▲
	Potamogeton foliosus	Leafy pondw eed	3.6	0.2	2.9	0.7	1.7	0.2	2.5	0.2	-92.8	▼
	Heteranthera dubia	Water stargrass	0.6	0.2	0.2	0.0	2.4	4.3	1.7	0.2	-89.6	▼
	Potamogeton natans	Floating-leaf pondw eed	0.0	0.7	0.4	0.9	0.0	0.2	0.4	0.9	133.1	▲
	Potamogeton amplifolius	Large-leaf pondw eed	0.6	0.0	0.7	0.0	0.0	0.6	0.2	0.2	-6.7	▼
	Potamogeton crispus	Curly-leaf pondw eed	0.2	0.0	0.0	0.2	1.1	0.0	0.2	0.2	-6.7	▼
	Eleocharis acicularis	Needle spikerush	0.0	0.0	0.2	0.7	0.4	0.2	0.0	0.2		▲
	Potamogeton richardsonii	Clasping-leaf pondw eed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4		▲
	Spirodela polyrhiza	Greater duckw eed	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0		-
	Potamogeton spirillus	Spiral-fruited pondw eed	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0		-
	Potamogeton berchtoldii	Slender pondw eed	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-100.0	▼
	Elodea nuttallii	Slender w aterw eed	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0		-
	Acorus americanus	Sw eetflag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		▲
	Schoenoplectus pungens	Three-square rush	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0		-

▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

C

APPENDIX C

Silver Lake 2020 Herbicide Concentration Monitoring Plan

(Big) Silver Lake, Waushara County (WBIC: 107900)
2020 Herbicide Sample Plan
Onterra, LLC

(Big) Silver Lake, Waushara County, is an approximately 328-acre seepage lake and has a mean depth of 21 feet and a maximum depth of 50 feet. Florpyrauxifen-benzyl (commercially as ProcellaCOR™) is proposed to be applied to 11.6 acres of the lake in spring 2020 to control Hybrid/Eurasian watermilfoil. Herbicide concentration sampling will be conducted in order to monitor the herbicide concentrations in the hours immediately following the application.

Water samples will need to be collected at the sites and depths listed below. Data are in decimal degrees and the datum is WGS84. A map of the herbicide sample site locations is attached.

Silver Lake Herbicide Sample Sites				
Site	**Station ID**	**Latitude**	**Longitude**	**Sample Depth**
FT-1	10053774	44.046521	-89.221225	Integrated (0-6 feet)
FT-2	10044710	44.048087	-89.220435	Integrated (0-6 feet)

Please note that a single sample is to be collected before the treatment as a 'control' for the lab analysis. Please collect the pre-treatment sample from site FT-1 at a time that is most convenient for the volunteer but as close to the treatment date as possible. Samples will need to be collected at seven different time intervals (Hours After Treatment – HAT) after the treatment and are listed below. If a sample cannot be collected at the interval listed below, please collect the sample as soon as reasonably possible and record the change.

Interval (HAT)	FT-1	FT-2
Pre-Treatment	X	
1 HAT	X	X
2 HAT	X	X
4 HAT	X	X
6 HAT	X	X
9 HAT	X	X
24 HAT	X	X
48 HAT	X	X
Total Samples: 15		

All water samples will be collected using an integrated sampler (Photo 1). A video tutorial demonstrating the proper sample collection methodology is available on Onterra's YouTube web page: https://www.youtube.com/channel/UCHj5OSdj1axlA9NYuXRXybw.

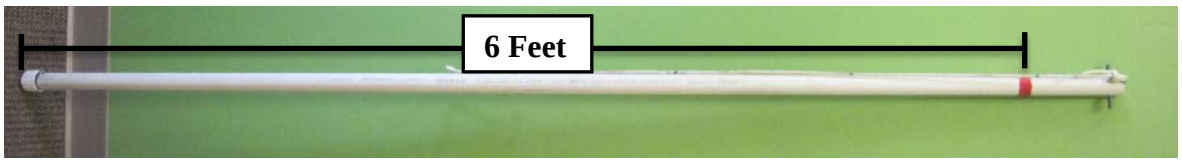


Photo 1. Integrated sampling device.

It is important to rinse the integrated sampler and the custom mixing bottle with the water from each sampling site upon arrival at the site. Water is collected by pushing the integrated sampler straight down to a depth of six feet; or in water shallower than six feet, down to approximately one foot above the bottom sediment. The sampler is brought to the surface and emptied into a customized mixing bottle by pushing open the stop valve at the end of the integrated sampler (Photo 2). Water from the custom mixing bottle should be used to triple rinse the clear glass bottle. After the clear glass bottle is triple rinsed, it is to be filled for a fourth time with the water from the custom mixing bottle and then carefully poured into the brown glass bottle which has a preservative solution already inside (Photo 3). The sticker on the brown glass bottle must be appropriately labeled with the site label and time interval for which the sample was collected (Example: FT-1, 1 HAT). The final sample (in the brown bottle) as well as the emptied clear glass bottle should be carefully placed within the provided bubble wrapped pouch to protect from accidental breakage.

Photo 2. Emptying the water sample from the integrated sampler device into the custom mixing bottle.

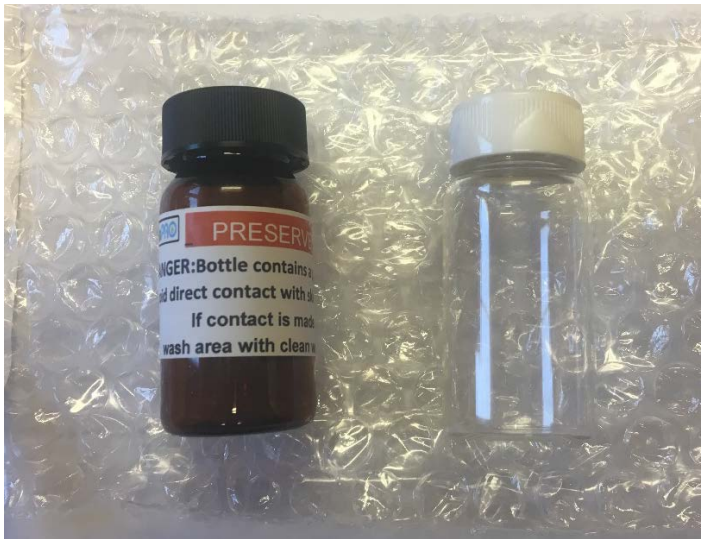


Photo 3. Clear glass mixing bottle (right) and final brown glass bottle (left).

While the samples are being collected, they should be kept cold and out of direct sunlight by keeping them in a small cooler on the boat. Samples should be kept refrigerated until shipping.

Onterra will provide all of the necessary supplies to complete the sampling and provide training to the volunteer(s) collecting the samples. Onterra has a supply of GPS units, temperature probes, and integrated sampler devices available to loan out for the duration of the sampling upon request. All other materials, including sampling bottles with labels, a customized mixing bottle and necessary paperwork will be provided.

Fill out one Chain of Custody data sheet for each sample interval and fill in the highlighted fields including the following:

Sampler: (Volunteer Name)
Number of samples to be analyzed: (number of samples being sent in with the form)
Client Sample ID: (example: FT-1, FT2)

Date sample collected
Shipped by: (name and date/time samples were shipped)

The samples should be shipped by overnight currier along with the Chain of Custody data sheets to:

EPL Bio Analytical Services
9095 W. Harristown Blvd.
Niantic, IL 62551

Samples should not be shipped on loose ice. Ice packs or frozen water bottles (contained in a zip bag) may be shipped with the samples to keep them cool. Samples should not be shipped on a Friday, but rather refrigerated and shipped on the following Monday.

If you have any questions, please call or email one of the contacts listed below.

Project specifics, logistics and sampling methods	
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