INTRODUCTION

Photo 1. Lone Stone Lake, Oneida County, Wisconsin.

Lone Stone Lake is a 171 acre, drained, headwater lake in Oneida County, with a maximum depth of about 30 feet. The invasive Eurasian water milfoil (EWM) was first reported in the lake in 2011. Following consultation with the Wisconsin Department of Natural Resources (WDNR) and Oneida County AIS Coordinator Michele Saduaskas, the Friends of Lone Stone Lake (FLSL) contracted Onterra, LLC to complete a EWM survey in late summer of 2013. This 2013 survey provided data on the extent of EWM within the lake, which was used to develop a project strategy during the winter of 2013/2014. It should be noted that although the EWM was believed to be pure strain, samples of EWM were collected during this survey and sent to a lab in Michigan for genetic testing. The testing confirmed the plants were pure-strain *Myriophyllum spicatum* (EWM) as opposed to a hybrid species between northern water milfoil (*Myriophyllum sibericum*) and the aforementioned EWM. The FLSL were awarded a three-year Aquatic Invasive Species (AIS) Early Detection & Response in February of 2014 to initiate monitoring and hand-removal actions in 2014-2016. This report discusses the third and final year of monitoring and control under this grant-funded project and concludes with recommendations and strategies for going forward.

EARLY SEASON AIS SURVEY (PRE HAND-HARVESTING)

Onterra ecologists visited Lone Stone Lake on June 15, 2016 to complete an Early Season AIS (ESAIS) survey. This survey is completed during the late spring/early summer and consists of a crew meandering over the entire littoral (shallow, plant growing) zone. Eurasian water milfoil, while not at its peak growth stage, is typically taller in the water column than most native plant species and thus is also often quite visible at this time of the growing season. Also during the early summer, algae growth is limited in comparison to late summer when viewing conditions may be less favorable. Early summer is the best time of the year to locate any potential occurrences of another aquatic invasive species found in many Wisconsin lakes, curly-leaf pondweed (CLP). This species reaches its peak growth stage in early summer before senescing around mid-summer. Finally, the timing of this survey allows for data collection for mid-summer control efforts; in this case, hand-harvesting.

When EWM was encountered, data was collected using a Trimble Global Positioning System (GPS) unit with sub-meter accuracy. Mapping was completed using a point-based and polygon-based methodology. Point-based information was collected on EWM occurrences less than 30-40 feet in diameter. All EWM occurrences were assigned a density rating of *Single or Few Plants, Clumps of Plants*, or *Small Plant Colony*. For larger, colony-forming observations, EWM was mapped through the use of a polygon or area-based mapping. Polygons are assigned

a density rating ranging from *Highly Scattered, Scattered, Dominant, Highly Dominant and Surface Matting.*

During the survey, conditions were good with overcast skies and mild winds. The EWM was found to be present in similar locations and densities to previous surveys (Map 1). The majority of the EWM population was found near the eastern end of the lake, with additional occurrences located around the perimeter of the lake (Map 1). Following the 2016 ESAIS survey, a control strategy involving primarily professional but also limited volunteer hand-removal was developed. Aquatic Plant Management LLC, a professional hand-harvesting firm, was contracted to target six control areas totaling 4.66 acres (Map 1). Through this grant funded project, the FLSL purchased a Garmin GPS Map 78 unit that can be updated with the most recent EWM survey information by uploading a file sent over email. They may use this device to navigate to the plant locations and view the control areas, which are outlined on the units' basemap annually. Onterra provided the spatial data from this survey to the professional hand-harvesting firm and to the FLSL to aid in the hand removal efforts.

HAND HARVESTING CONTROL EFFORTS

Divers from APM visited Lone Stone Lake on July 18, 19, and 20, 2016 to complete hand-removal of EWM within the areas outlined on Map 1. A total of 58.5 diver hours (12 hours 55 minutes times (x) number of divers) were spent by APM divers hand-removing EWM on Lone Stone Lake. Table 1 does not take into account the number of divers that worked at each site and thus the total diver effort of 58.5 hours differs from the total time of 12 hours 55 minutes. Table 1 displays the diving time and hand-removal results by control site, while a full EWM harvesting report provided by APM has been attached to this report as Appendix A.

Table 1. 2016 Lone Stone Lake professional hand-harvesting summary. Data summarized from APM, LLC 2016 EWM Harvesting Report (Appendix A). Site locations depicted on Map 1.

Site	Time Underwater (Hours: Minutes)	Cubic Feet Removed
A-16	2:40	25
B-16	:20	4
C-16	7:15	45
D-16	:30	4
E-16	:35	3
G-16	:40	6
Other	:55	0.5
Total	**12:55**	**87.5**

EWM PEAK BIOMASS SURVEY (POST HAND-HARVESTING)

On September 8, 2016, Onterra ecologists visited Lone Stone Lake to complete the EWM Peak Biomass survey. This meander-based survey, which mimics the methodology used in the ESAIS survey, is completed late in the growing season (August/September) when EWM has reached its peak growth stage. Because EWM should be at or near its maximum density, the results of this

survey provide an understanding of where EWM is in the lake and what its full impact on the ecology of the lake may be. As a result, these data are useful in determining the efficacy of control actions used during the summer months as well assisting in the next year's control planning.

Weather conditions during the peak-biomass survey were fair with overcast skies and moderate winds. In some instances, EWM was confirmed through pulling the plants up with a rake. One relatively small (approximately 50' diameter) *highly dominant* EWM colony (polygon) was observed during the survey (Map 2). All other occurrences of EWM were mapped with point based methodologies and consisted of either *small plant colonies, clumps of plants* or *single or few plants*.

EWM Hand-Removal Control Results

All six of the sites prioritized after the June ESAIS survey were visited by APM divers as well as a small group of singles plants located in the northwest corner of the lake referred to as "*single*" in APM's Dive Summary Report. Each control site is evaluated below: Note that the dive time in this summary does not account for multiple divers and during each visit numerous divers were actively harvesting at the sites.

A-16

In June, several *single or few plants* were observed along with two *clumps of plants*, one *small plant colony,* and a *dominant* colony (polygon). APM divers spent 2 hours and 40 minutes hand-pulling plants between two site visits, removing a total of 25 cubic feet of EWM. Following these efforts, the EWM population was found to be approximately the same with several *single or few plants*, one *small plant colony*, and one *highly dominant* colony (polygon) observed within the control area in the late summer (Figure 1).

B-16

This location contained one *clumps of plants* and one *single or few plants* in June. Following the hand-harvesting in which 4 cubic feet of EWM was removed; no EWM was found within the control area in late summer (Figure 1).

C-16

Since the discovery of EWM, this site has held the largest continuous as well as densest EWM colony within the lake. In June of 2016, several scattered *single or few plants* were observed along with three *clumps of plants* and one *small plant colony* (Figure 1). Divers from APM spent a total of 7 hours and 15 minutes at the site and successfully removed 45 cubic feet of EWM. Following these efforts, the site was observed to contain slightly less EWM with scattered *single or few plants* as well as two *clumps of plants* remaining in the site (Figure 1).

D-16

This site, containing two *single or few plants* and two *clumps of plants* within its boundaries in mid-summer, was reduced to two *clumps of plants* by late summer (Figure 2). Divers from APM spent a total of 30 minutes in this location removing 4 cubic feet of EWM.

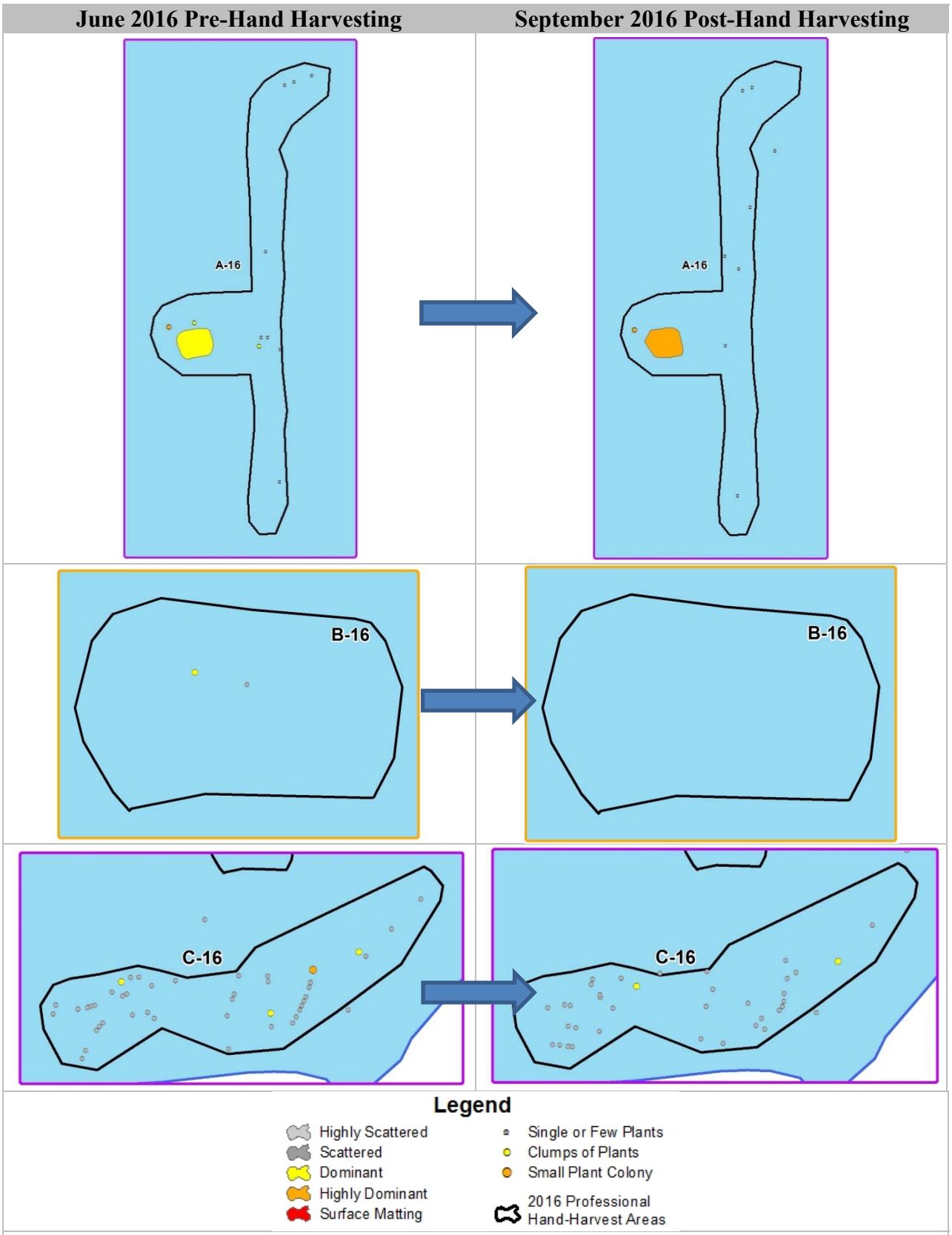


Figure 1. June 2016 pre- and September 2016 Post- Professional Hand-Harvesting EWM Survey Results-Sites A-16, B-16, & C-16.

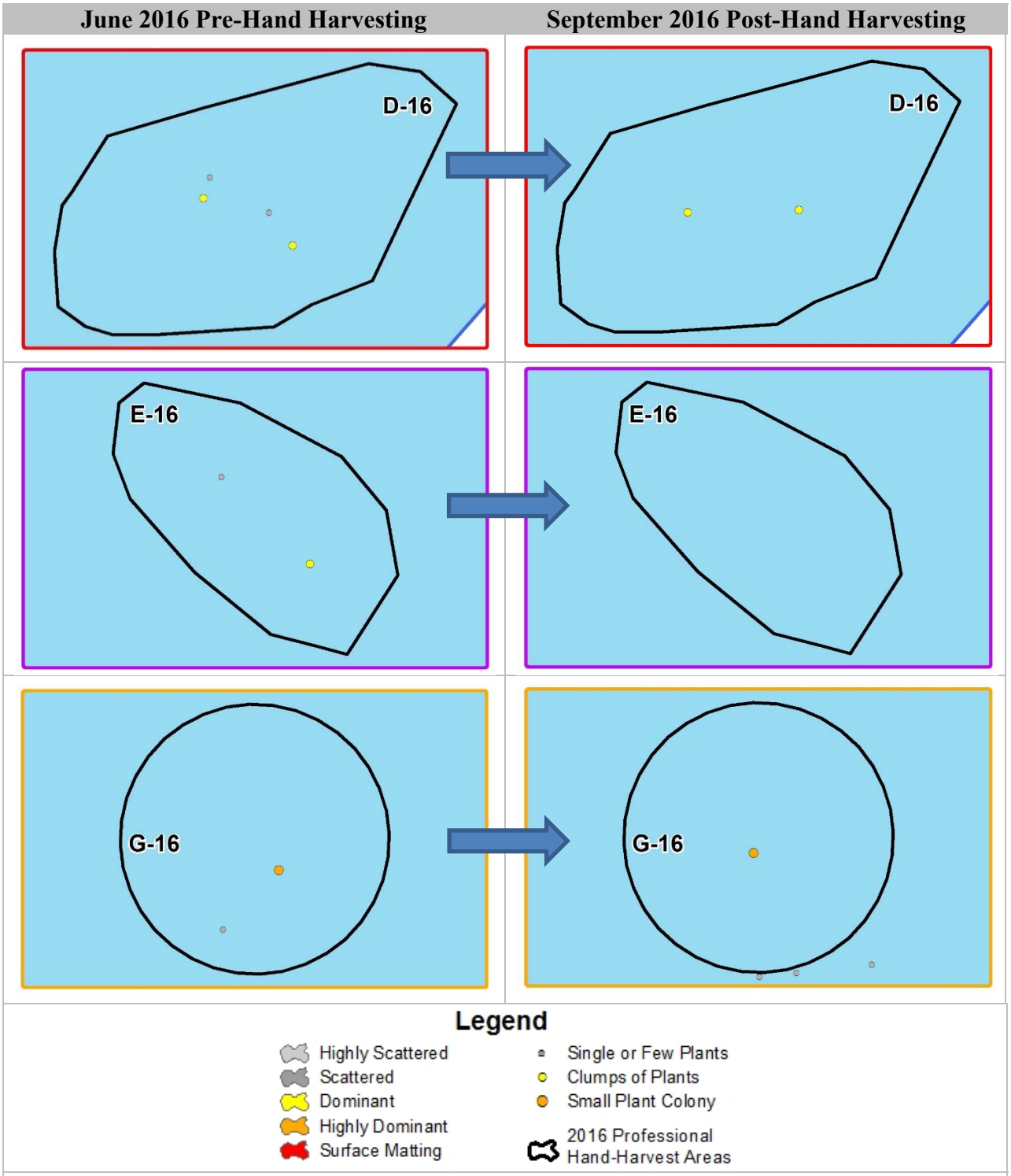


Figure 2. June 2016 pre- and September 2016 Post- Professional Hand-Harvesting EWM Survey Results-Sites D-16, E-16, & G-16.

E-16
During the ESAIS survey, this location was observed to contain one *single or few plants* and one *clump of plants* (Figure 2). Diver from APM spent a total of 35 minutes within the site and removing 3 cubic feet of EWM. By late summer, no EWM was found within the control area, however; one *single or few plants* was found just outside the control area.

G-16
In June this site contained one *small plant colony* and one *single or few plants* within its boundaries (Figure 2). APM divers spent a total of 40 minutes within the site and removed 6 cubic feet of EWM. By late summer the site only contained one *small plant colony* with three *single or Few Plants* found just outside the control area.

Other (Single)
In addition to the six designated hand-harvesting sites, divers worked on one additional location in the northwest corner of the lake. The June ESAIS survey indicated two *single or few plant* occurrences at this location and following the hand-removal efforts in which two plants were removed, no EWM was located at the site, however some *single or few plants* were located in the vicinity (Maps 1&2).

CONCLUSIONS AND DISCUSSION

The professional hand-harvesting activities conducted on Lone Stone Lake in 2016 were overall met with positive results. In each of the six prioritized sites, the EWM population was either maintained at approximately the same density or reduced in density.

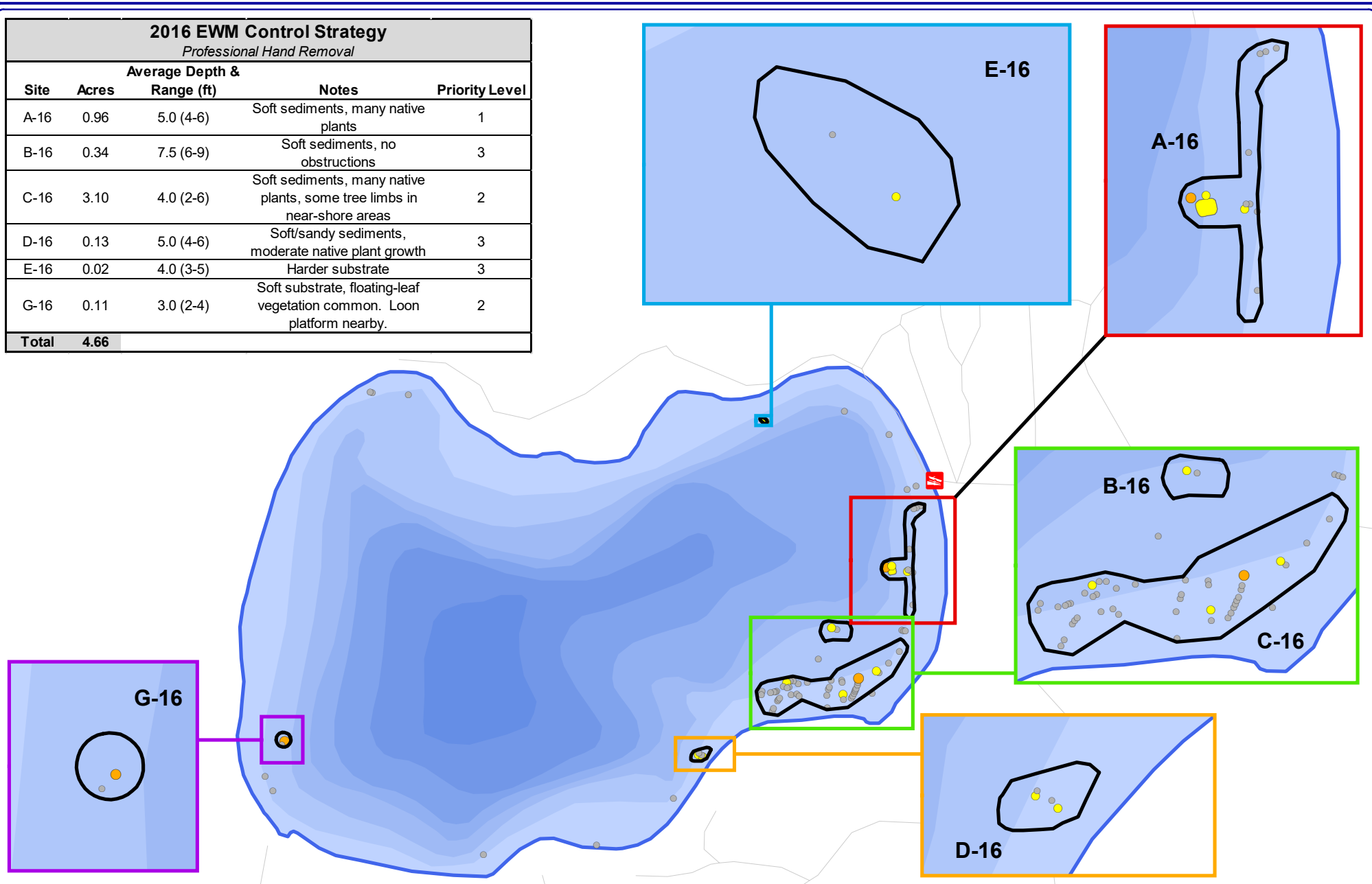
Over the course of the three year monitoring and control program on Lone Stone Lake, much information can be derived in regards to EWM control through a coordinated hand-harvesting program. Professional hand-harvesting was implemented in 2014-2016 on Lone Stone Lake with increasing amounts of effort each year. Over the course of this project the EWM population in Lone Stone Lake has been relatively stable and kept at low density lake-wide (Map 3). It cannot be said what the EWM population may have done in the absence of control actions (hand-harvesting), however it is likely that these efforts have helped to slow the spread and contain the EWM population within Lone Stone Lake. The current EWM population in the lake remains relatively low and at current, is not causing significant ecological impacts within the lake.

Following the conclusion of this early detection and response project, the FLSL needs to consider creating a lake management plan to reflect the success and limitations learned. Along with establishing thresholds (triggers) of when specific control strategies warrant implementation, the lake management planning process could include a holistic understanding of the Lone Stone Lake ecosystem involving assessments of the water quality, watershed, shoreline condition, and stakeholder perceptions of Lone Stone Lake.

2016 EWM Control Strategy

Professional Hand Removal

Site	Acres	Average Depth & Range (ft)	Notes	Priority Level
A-16	0.96	5.0 (4-6)	Soft sediments, many native plants	1
B-16	0.34	7.5 (6-9)	Soft sediments, no obstructions	3
C-16	3.10	4.0 (2-6)	Soft sediments, many native plants, some tree limbs in near-shore areas	2
D-16	0.13	5.0 (4-6)	Soft/sandy sediments, moderate native plant growth	3
E-16	0.02	4.0 (3-5)	Harder substrate	3
G-16	0.11	3.0 (2-4)	Soft substrate, floating-leaf vegetation common. Loon platform nearby.	2
Total	**4.66**			



N W E S

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Feet

Onterra LLC
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Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2016
Map Date: June 21, 2016
Filename: LoneStone_EWM_June16.mxd

Project Location in Wisconsin

Legend

EWM Survey Results *(June 15, 2016)*

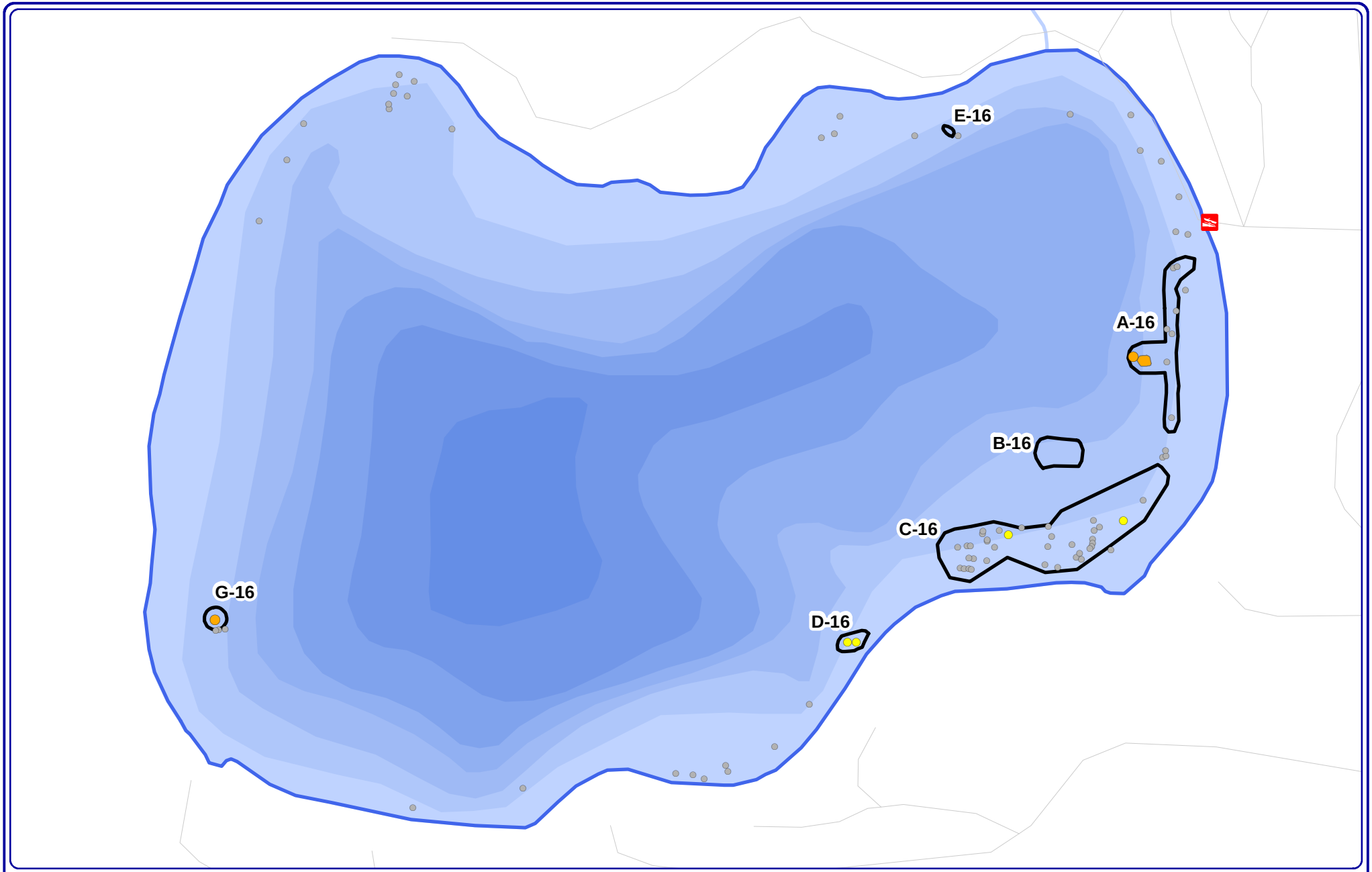
- Highly Scattered *(none found)*
- Scattered *(none found)*
- Dominant
- Highly Dominant *(none found)*
- Surface Matting *(none found)*
- Single or Few Plants
- Clump of Plants
- Small Plant Colony

Hand Removal

Professional Hand-Removal Focus Area

Map 1
Lone Stone Lake
Oneida County, Wisconsin

June 2016 EWM Survey Results & Hand-Removal Strategy



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Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2016
Map Date: October 31, 2016
Filename: LoneStone_EWM_Sept16.mxd

Project Location in Wisconsin

Legend

EWM Survey Results ***(September 8, 2016)***

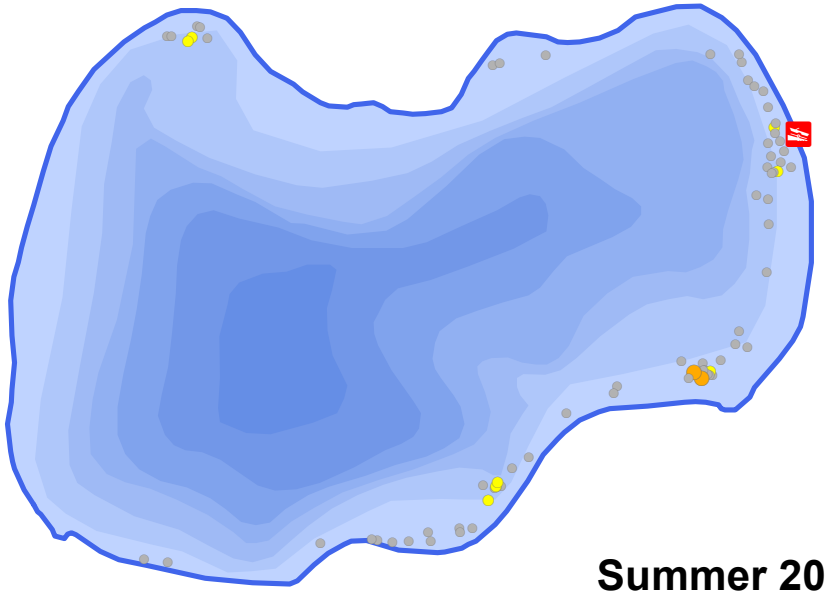
- Highly Scattered *(none found)*
- Scattered *(none found)*
- Dominant *(none found)*
- Highly Dominant
- Surface Matting *(none found)*
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2016 Professional Hand-Harvest Areas

Map 2

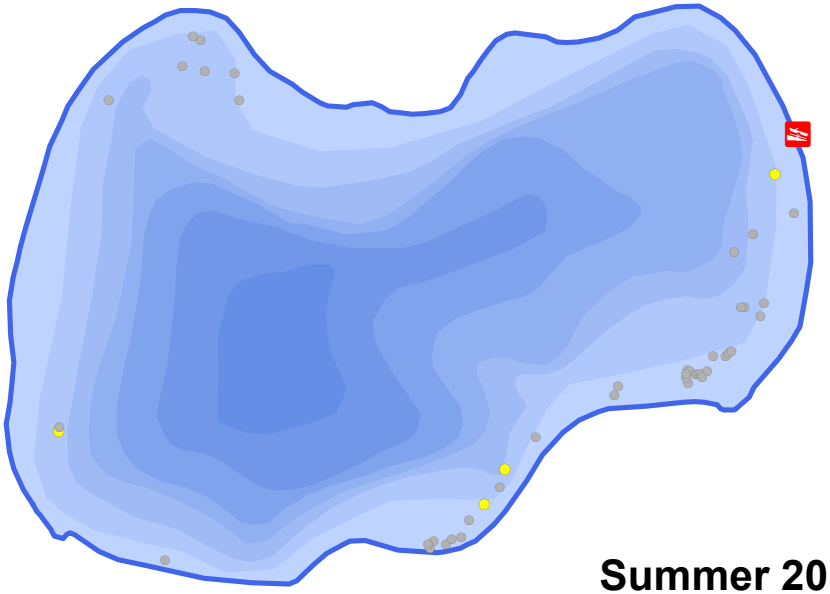
Lone Stone Lake

Oneida County, Wisconsin

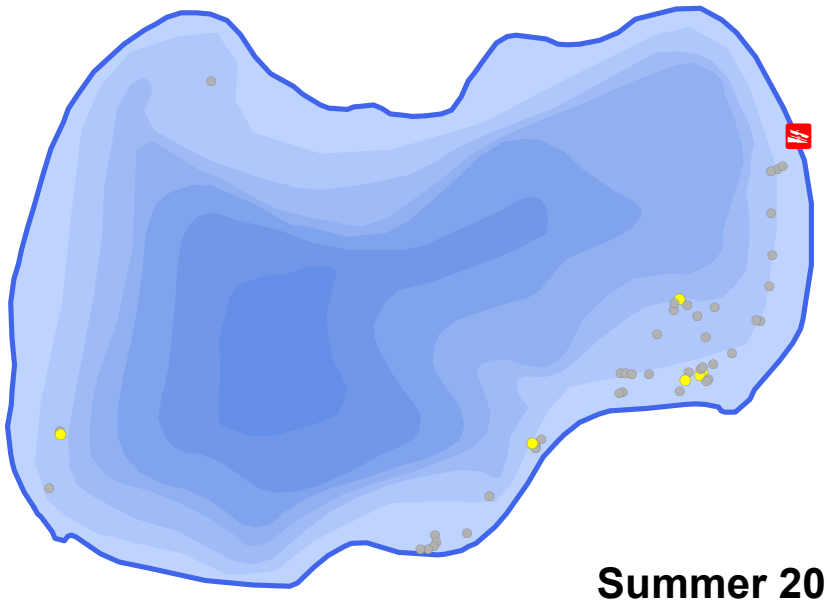
2016 EWM Peak-Biomass Survey Results



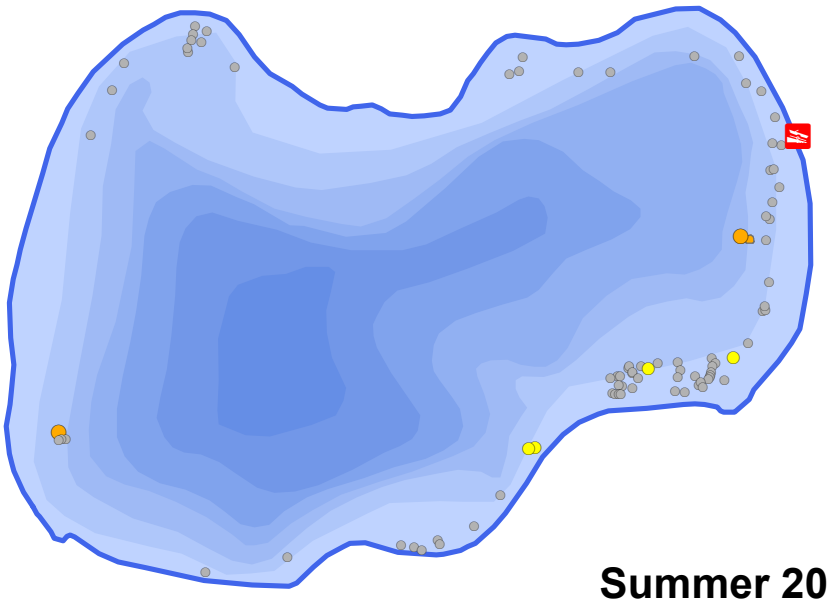
Summer 2013



Summer 2014



Summer 2015



Summer 2016

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Feet

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<Bol>Sources:</Bol>
Roads & Hydro: WDNR
Bathymetry: WDNR
Plant Survey: Onterra, 2013-16
Map Date: December 13, 2016
Filename: LoneStone_EWMPB_2013-16.mxd

Project Location in Wisconsin

Legend

- Highly Scattered *(None)*
- Scattered *(None)*
- Dominant *(None)*
- Highly Dominant
- Surface Matting *(None)*
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Map 3

Lone Stone Lake

Oneida County, Wisconsin

2013-2016 EWM Survey Results