INTRODUCTION

Photo 1. Pelican Lake, Oneida County.

Pelican Lake, Oneida County, is a 3,585-acre drainage lake with a maximum depth of 39 feet and a mean depth of 12.9 feet. Water levels were artificially raised via the completion of the South Pelican Lake Dam in 1908 by the Wisconsin Valley Improvement Company to aid in augmenting flow downstream for hydroelectric power and flood control. Eurasian water milfoil (*Myriophyllum* spicatum; EWM) was first discovered by Onterra ecologists during a June 2011 Early-Season Aquatic Invasive Species (ESAIS) Survey. An additional survey was completed in August 2011 and numerous *single plants, clumps of plants*, and a colony of *highly dominant* EWM were mapped near the CTH Q boat landing. With Onterra's assistance, the Pelican Lake Property Owners Association (PLPOA) successfully secured a Wisconsin Department of Natural Resources (WDNR) AIS-Early Detection and Response (EDR) Grant to fund the monitoring and implementation of the control strategy.

During the early-response phase of management, granular 2,4-D treatments occurred in 2012 (14.6 acres at 3.0 ppm ae) and 2013 (2.8 acres at 4.0 ppm ae). As Pelican Lake transitions into a maintenance phase of management, where the goal is to maintain (potentially reduce) the low-density population of EWM, the PLPOA has turned to a coordinated professional hand-harvest control strategy. The hand-harvesting program conducted in 2014 and 2015 proved effective at controlling EWM in the targeted areas, and the lake-wide EWM population remained relatively low in 2015. Professional hand-harvesting was again recommended for EWM control in 2016.

A set of EWM mapping surveys were used within this project to coordinate and qualitatively monitor the hand-harvesting efforts. The first monitoring event on Pelican Lake in 2016 was the ESAIS Survey. This late-spring/early-summer survey provides an early look at the lake to help guide the hand-harvesting management to occur on the system. Following the hand-harvesting, Onterra ecologists completed the Late-Summer EWM Peak-Biomass Survey, the results of which are used as an assessment of the hand-harvesting. The hand-removal program would be considered successful if the density of EWM within the hand-removal areas was found to have decreased from the ESAIS Survey to the Late-Summer Peak-Biomass Survey.

EARLY SEASON AIS SURVEY RESULTS (PRE-HAND-HARVESTING)

On June 8, 2016, Onterra ecologists conducted the ESAIS Survey on Pelican Lake. Conditions were excellent for the survey with partly sunny skies and light winds. A Secchi disk reading hit bottom in 7.5 feet of water indicating good water clarity. To keep costs to a minimum, this survey only focused on locations of the lake that are known to support aquatic plant growth, and include Mud Bay, Outlet Bay, Musky Bay, Treacherous Bay and Guth's Bay (Map 1). Data collected during a 2011 whole-lake

point-intercept survey were used to determine the areas of the lake that supported aquatic vegetation. During the survey, the EWM population was 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 were qualitatively attributed a density rating based upon a five-tiered scale from *Highly Scattered* to *Surface Matting*. Point-based techniques were applied to EWM locations that were considered as *Small Plant Colonies* (<40 feet in diameter), *Clumps of Plants*, or *Single or Few Plants*.

Only a few EWM occurrences were located within the surveyed areas of Pelican Lake and consisted of *single or few plants* or *clumps of plants* (Map 1). Given the low amount of EWM identified during the June survey, it was recommended that the professional hand-harvesting firm target all EWM plant occurrences identified during the June 2016 survey and visit all locations where EWM was located during the previous late-summer survey (2015) if sufficient time allows. Onterra provided the spatial data from this survey to the PLPOA and the professional hand harvesting firm to aid the control efforts.

HAND-HARVESTING MANAGEMENT ACTIONS

The PLPOA contracted with Aquatic Plant Management, LLC (APM) to conduct professional hand-harvesting of EWM in 2016. Divers from APM conducted hand-harvesting activities on June 13 and August 3, 2016 spending a combined total of 37.33 diver hours (6.216 hours times (x) number of divers) on the water. The June 13th visit occurred prior to coordination with Onterra and the hand-harvesting team spent time looking for EWM in areas that historically contained EWM.

During the August 3 hand-harvesting event, removal efforts were undertaken at locations in Musky Bay, Treacherous Bay and Outlet Bay and yielded a harvest of 10.9 cubic feet or between approximately 74-84 plants of EWM. A summary of the diving effort by APM is listed in Table 1. To aid in assessing each of the sites visited by APM, the locations have been assigned a site number from 1-11. Additional details of the hand harvesting efforts as reported by APM are included as an appendix to this report (Appendix A).

Table 1. Pelican Lake, 2016 Professional hand-harvesting activities. Site locations shown in Figures 1-3.

Date	Site	Time Underwater (minutes)	Plants Removed
6/13/2016	1	30	N/A
6/13/2016	2	35	N/A
6/13/2016	3	30	N/A
6/13/2016	4	25	N/A
8/3/2016	5	35	10
8/3/2016	6	53	40-50
8/3/2016	7	30	1
8/3/2016	8	55	20
8/3/2016	9	15	1
8/3/2016	10	30	1
8/3/2016	11	35	1
Total		**373**	**74-84**

LATE-SUMMER PEAK-BIOMASS SURVEY RESULTS (POST HAND-HARVESTING)

The Late-Summer EWM Peak-Biomass Survey was conducted on September 20-21, 2016 to qualitatively assess the hand harvesting efforts as well as to understand the peak growth (peak-biomass) of the EWM population throughout the vegetated areas of the lake.

Figure 1 displays the pre and post hand-harvesting survey results for Musky Bay. Sites 1-4 are sites that have historically contained EWM in the past however EWM was not located at these locations during Onterra's June ESAIS survey. No EWM was located or harvested from Sites 1-4 by APM during a June 13th visit. On August 3rd, 2016, APM harvested EWM from sites 5, 6 & 7 within Musky Bay targeting plants located during the June ESAIS survey. Following the hand-harvesting at these sites, no EWM was located at Site 5, while only *single or few plants* occurrences were located at Sites 6 & 7 (Figure 1).

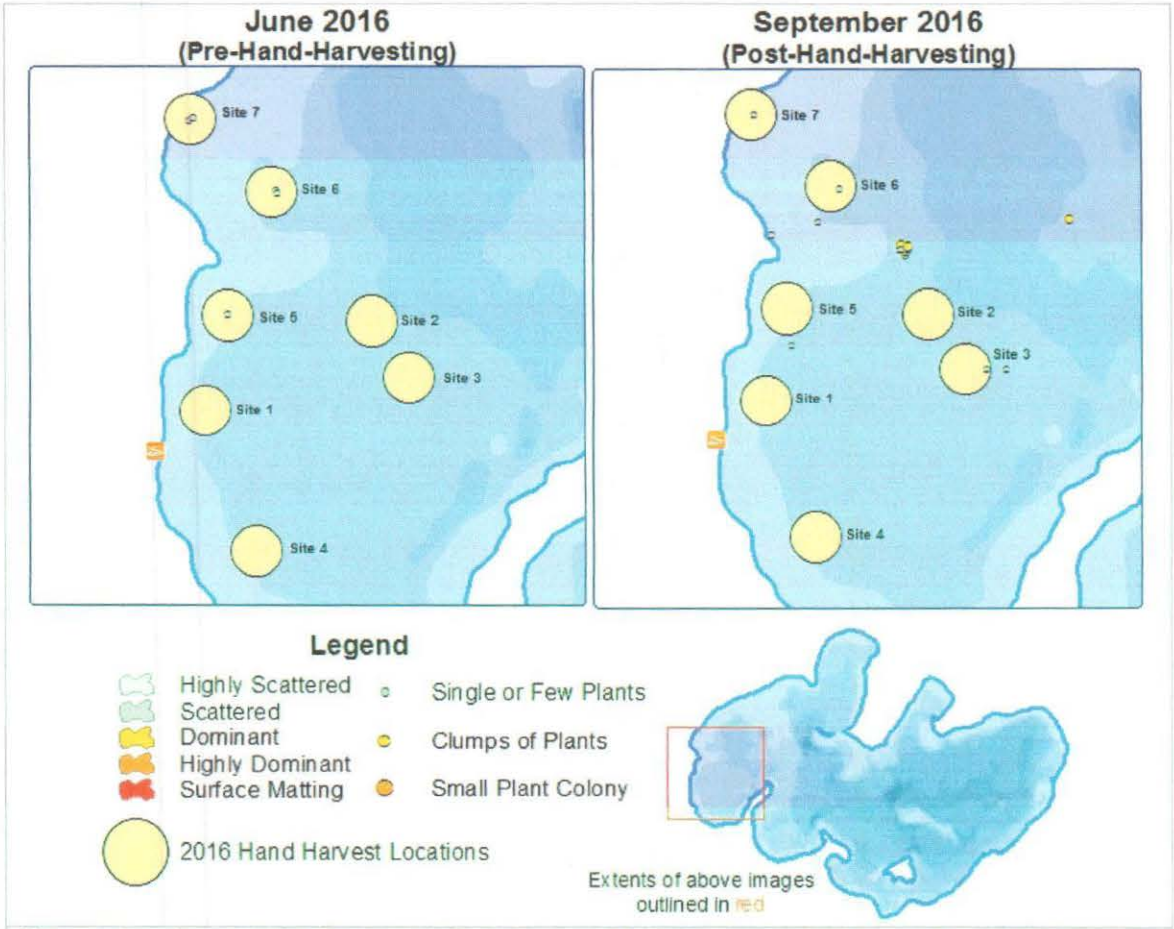


Figure 1. June 2016 Pre- and September 2016 Post Hand-Harvesting EWM Survey Results for Musky Bay in Pelican Lake.

Figure 2 displays the pre and post hand-harvesting EWM survey results for Treacherous Bay in Pelican Lake. A *clump* of EWM plants was located at Site 8 during the June 2016 and following the hand-harvesting effort in which 20 plants were removed during 55 minutes of diving time, no EWM was located during the post-harvesting survey in September. A *single or few plants* EWM occurrence was identified at Site 9 during the June ESAIS survey. APM pulled one EWM plant from Site 9 on August 3rd and the post-harvesting survey located another *single or few plants* EWM occurrence in approximately the same area.

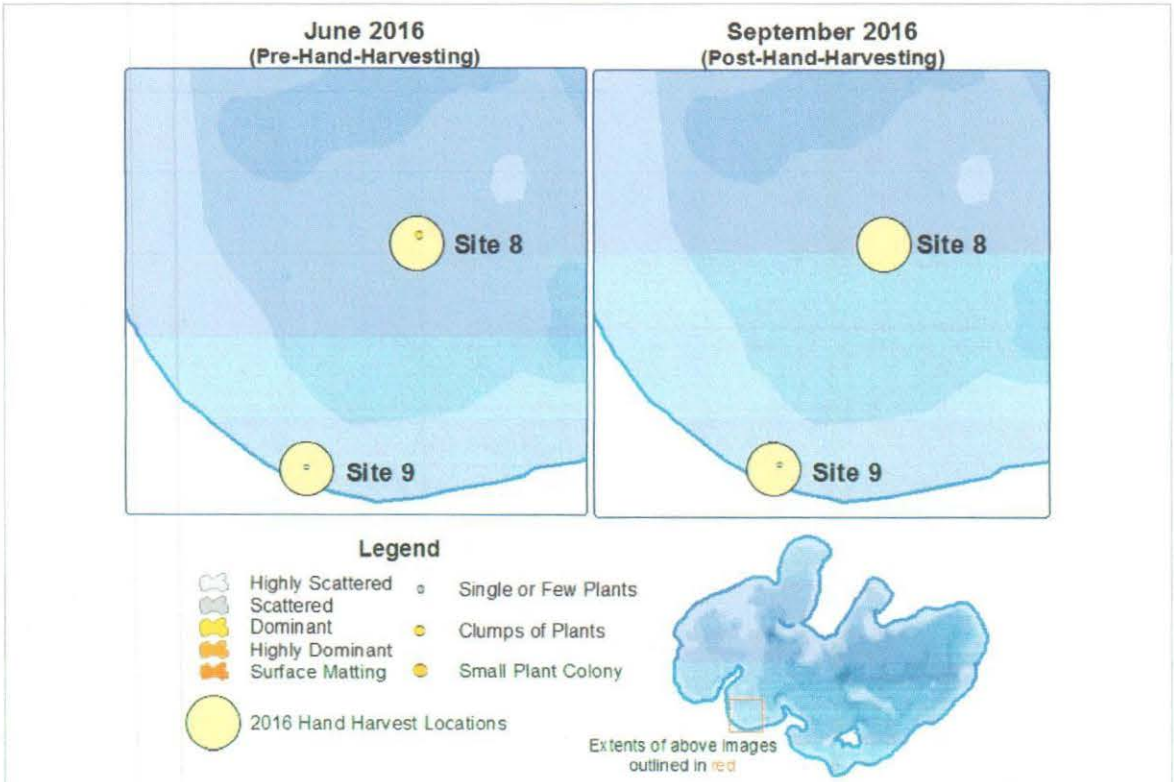


Figure 2. June 2016 Pre- and September 2016 Post Hand-Harvesting EWM Survey Results for Treacherous Bay in Pelican Lake.

A *single or few* EWM plant occurrence was located in Outlet Bay during the June ESAIS survey (Figure 3). APM removed one plant from this location (Site 11) during their August 3rd visit. No EWM was located at Site 11 during the late-summer survey.

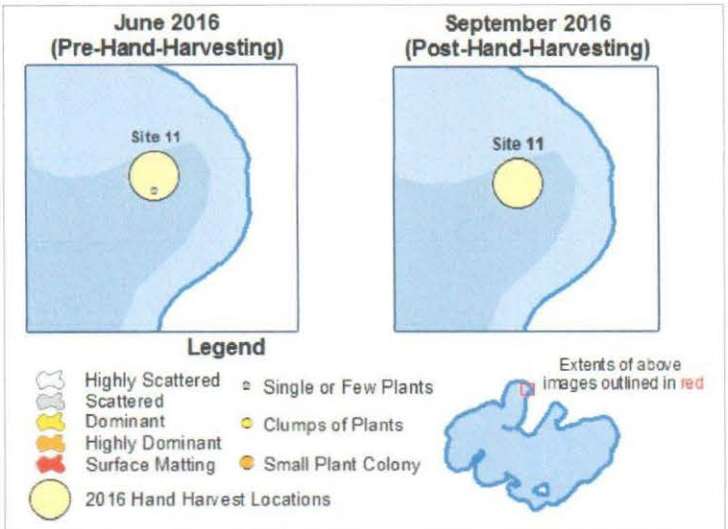


Figure 3. June 2016 Pre- and September 2016 Post Hand-Harvesting EWM Survey Results for Outlet Bay in Pelican Lake.

During the peak-biomass survey, several occurrences of *single or few plants* and *clumps of plants* were located within the lake (Map 2). No large colonized areas of EWM were located anywhere in the lake during the late-summer survey. The majority of the EWM plants located during the survey were found in Musky Bay (Map 2). Just one EWM occurrence was located in Treacherous Bay and two occurrences in Guths Bay (Map 2). No EWM was located within the other surveyed areas of the lake which included Outlet Bay and Mud Bay.

CONCLUSIONS AND DISCUSSION

The 2016 EWM professional hand-harvesting control program on Pelican Lake resulted in effective control at all targeted locations. The EWM population was found to either be approximately the same or reduced at locations in which professional hand-harvesting was undertaken. These sites will be revisited in 2017 to determine if re-growth or re-colonization of EWM is occurring. EWM continues to be present in areas in the western portion of the lake as well as in low densities within other areas of the lake. A coordinated hand-harvesting effort has been able to slow the spread and population increase of EWM throughout Pelican Lake over the past few summers.

With the low level of EWM currently existing in Pelican Lake, the proposed 2017 control strategy once again does not include an herbicide treatment. Building on the hand removal efforts in recent years, it is recommended that a hand harvesting control approach be continued in 2017. Professional hand harvesting is recommended for areas mapped in September 2016 with highest priority given to occurrences described as *clumps of plants*.

The 2016 season marked the end of the WDNR AIS-EDR Grant-funded project. Continued discussions with Onterra, the WDNR, and the PLPOA will occur prior to the 2017 field season. Onterra believes the best way to coordinate a hand-harvesting program is to conduct an Early Season AIS Survey to set priorities for that years' control efforts and then conduct a Late-Summer EWM Peak Biomass Survey to access the results (Figure 4). This has been the annual cycle events that the PLPOA has enacted for the past 3 years. The PLPOA could consider simply using the results of the 2016 Late-Season EWM Peak-Biomass Survey to guide the control efforts and bypass conducting the Early-Season AIS Survey. By not conducting the Early Season AIS Survey, the PLPOA would save approximately $2,200. However, the precision and efficiency of the control project would also be reduced.

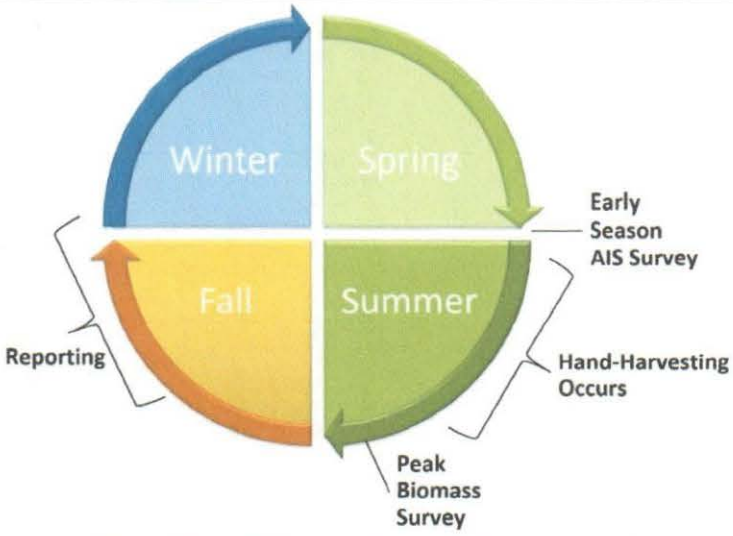
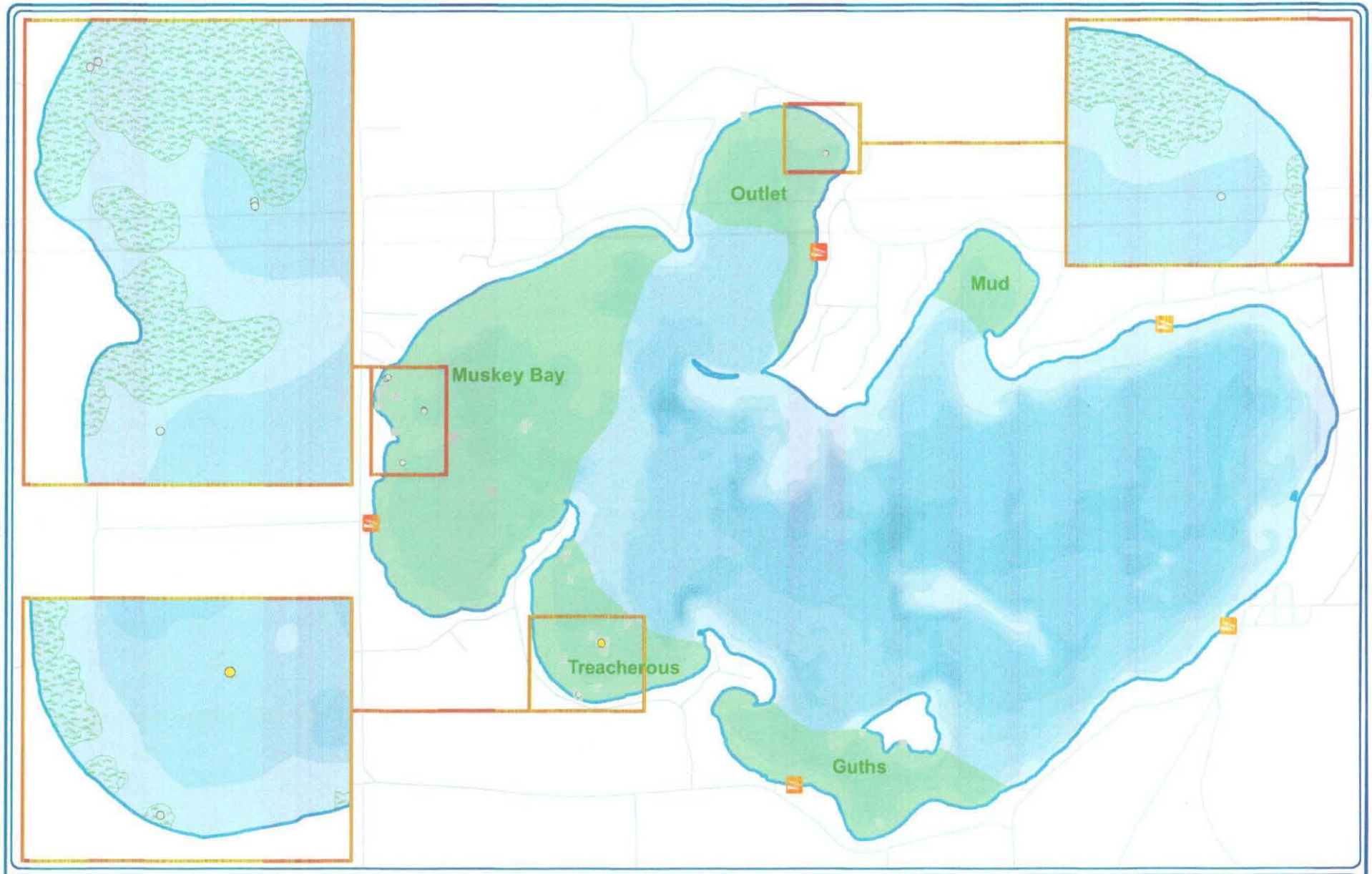


Figure 4. Recommended project timeline.



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Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2015
Map Date: June 13, 2015
Filename: Pelican_EWM_June16.mxd

Project Location in Wisconsin

Legend

EWM Survey Results *(June 8, 2016)*

- Highly Scattered *(none found)*
- Scattered *(none found)*
- Dominant *(none found)*
- Highly Dominant *(none found)*
- Surface Matting *(none found)*
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Summer 2015 EWM Location
- Survey Area
- Emergent Plant Community *(Mapped in 2011)*

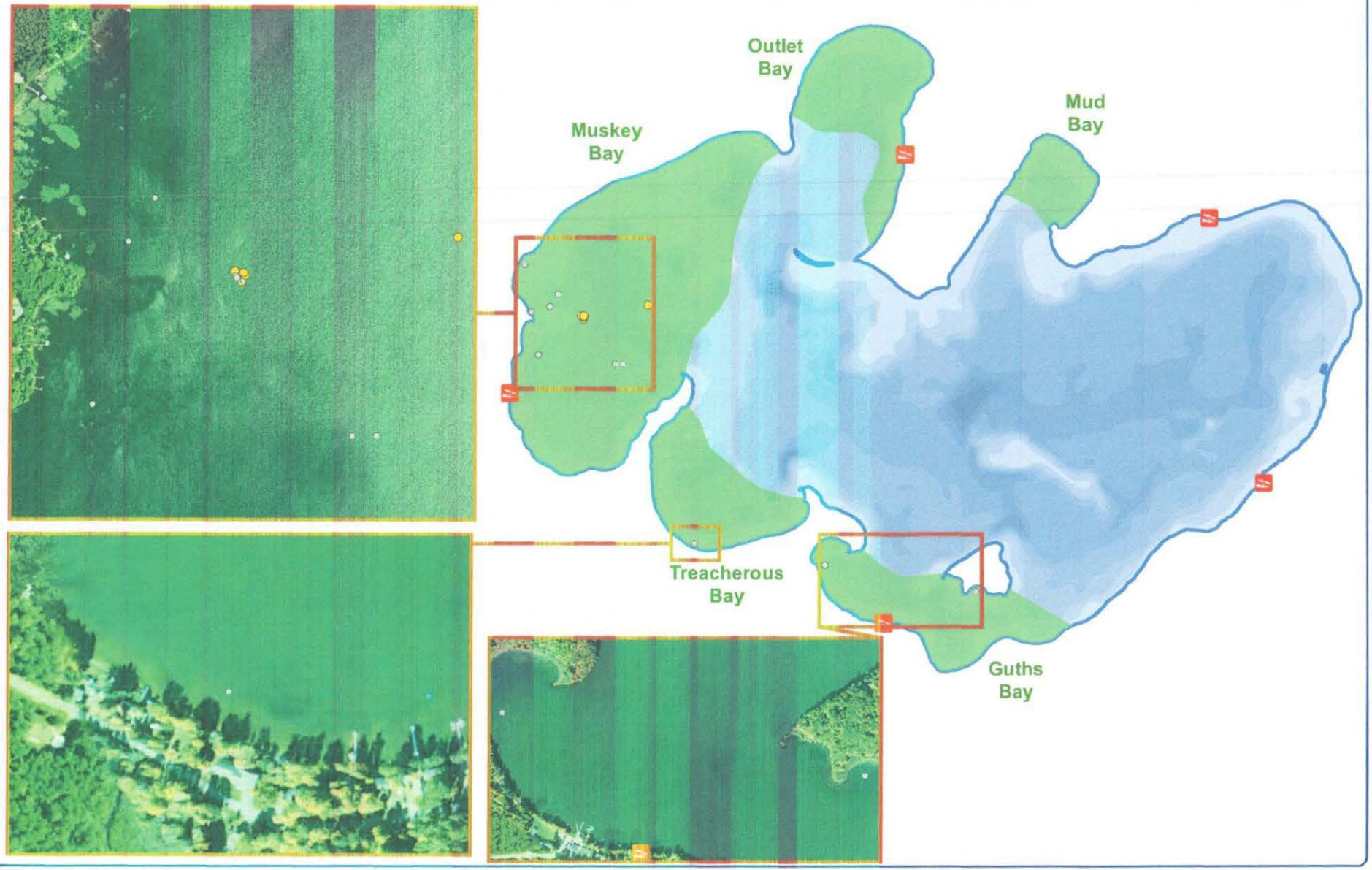
Map 1

Pelican Lake

Oneida County, Wisconsin

June 2016 EWM Survey Results

DECEMBER 2016



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Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2016
Map Date: November 4, 2016
Filename: Pelican_EWM_Sept16.mxd


Project Location in Wisconsin

Legend

EWM Survey Results *(September 2016)*

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

Map 2

Pelican Lake
Oneida County, Wisconsin

September 2016
EWM Survey Results

DECEMBER 2016