

1.0 INTRODUCTION

The Unified Lower Eagle River Chain of Lakes Commission (ULERCLC) has been the successful recipients of Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species (AIS) Control Grants for the past eight years as they conduct a project aimed at reducing the Eagle River Chain's Eurasian water milfoil (*Myriophyllum spicatum*; EWM) population. This report specifically discusses the control activities conducted during 2016. The chain-wide results will be presented first followed by results from each lake individually.

Additional information regarding the control actions completed in 2008-2015 can be found in their respective annual reports. Native aquatic vegetation inventories from whole-lake point-intercept surveys are conducted on the chain roughly every 5 years. Through funding from the ULERCLC (and WDNR grant funds), whole-lake point-intercept surveys on all lakes will take place in 2017 during the final phases of the Comprehensive Lake Management Planning Project and compared to surveys conducted in 2006 and 2012.

2.0 2016 CHAIN-WIDE EWM CONTROL STRATEGY RESULTS

From 2007 to 2015, the ULERCLC have coordinated strategically targeted herbicide spot treatments and limited large-scale treatments targeting EWM within the system. The lessons learned over this time period resulted in the ULERCLC developing a strategy where areas would be considered for spot treatment if they meet the following threshold (i.e. trigger):

colonized areas of EWM with a density of *dominant* or greater where a sufficiently large treatment area can be constructed to hold adequate herbicide concentrations and exposure times (CETs)

Based upon this threshold (trigger), no locations in the Eagle River Chain warranted herbicide treatment in 2016. Over the course of control program, EWM colonial acreage has been reduced from 278.2 acres in 2007 to 12.2 acres in 2015 (Figure 1). While no herbicide treatment was conducted in 2016, EWM colonial acreage remained low with a slight increase from 12.2 acres in 2015 to 19.7 acres in 2016 (Figure 1).

Please note that Figures 1 and 2 only represents the acreage of mapped EWM polygons, not EWM mapped within point-based methodologies (*single or few plants, clumps of plants, or small plant colonies*). Taken out of context, this figure can be misleading as large increases in EWM colonial acreage may be the results of low-density point-based data increasing to levels that now are best delineated with EWM colonies.

The colonial acreage from the 2016 EWM Peak-Biomass Mapping Survey was found to be 19.7 acres within the Eagle River Chain, a small increase over 2015 and much lower than when the control program started in 2007 (Figure 1). Approximately 77% of the remaining acreage is within Watersmeet Lake, of which the majority is in areas of high water exchange making attaining necessary herbicide concentration exposure times more difficult.

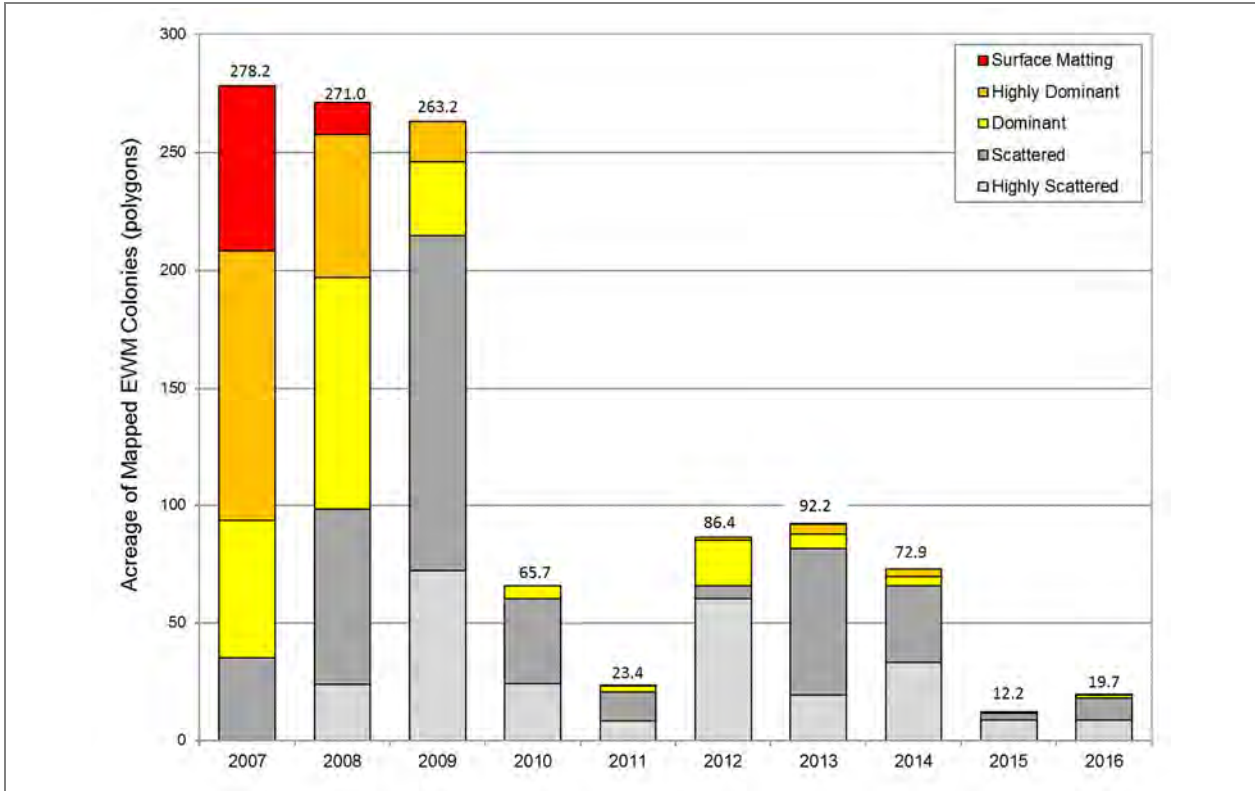


Figure 1. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes from 2007-2016.

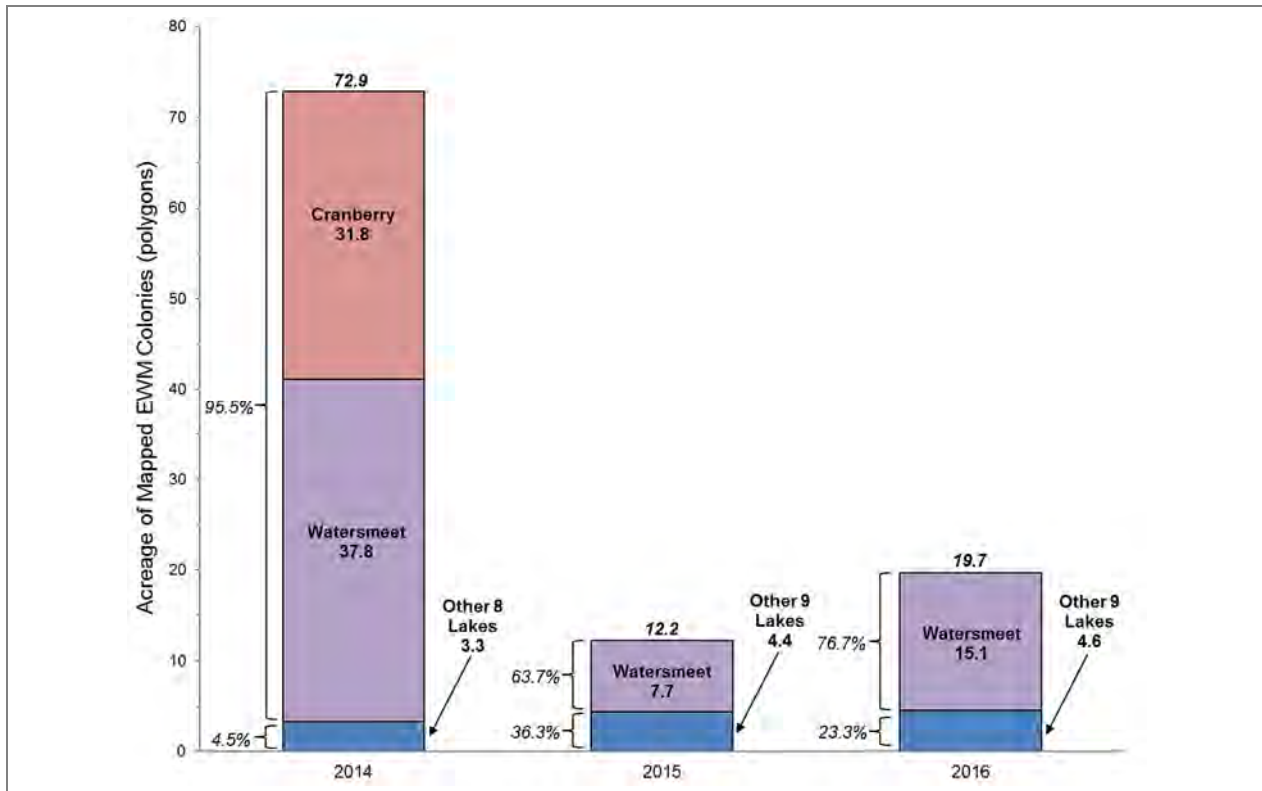


Figure 2. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes from 2014, 2015, and 2016.

Following the 2015 herbicide treatment, the remnant EWM population on the Eagle River Chain of Lakes have been reduced to levels where herbicide treatment strategies are not an effective control strategy. It is extremely difficult in small spot treatment scenarios to keep a sufficient herbicide concentration exposure time (CET) to be effective. Therefore, for the first time since coordinated active management began in 2007, herbicide control strategies did not occur on the Eagle River Chain of Lakes in 2016.

The management strategy for the Eagle River Chain of Lakes has evolved into a strategy to maintain the positive strides in reducing the EWM population. The difficulty of any maintenance strategy is to balance a level of EWM population tolerance while not allowing the population to return to pre-management levels. The ULERCLC did not want to abandon management and simply wait for EWM populations to reach levels that are again applicable for herbicide control. Therefore, the ULERCLC entertained the applicability of a hand-harvesting program for 2016.

The ULERCLC gave consideration to multiple types of hand-harvesting. While volunteer efforts have their role in the management of many lakes, the ULERCLC decided that hiring a third-party firm to conduct these efforts would be appropriate for a pilot program. This would insure they would have an appropriate amount of effort (i.e. person-hours). Traditional hand-harvesting consists of a trained snorkelers or divers to swim to the bottom of the lake and extract an individual EWM plant, roots and all. The plants are transported to the surface one at a time, or are put in a mesh bag underwater until brought to the surface. While on the surface, the plants are placed onto a transport boat until disposal.

Where water clarity is high and target plants are growing in deeper water, a Diver Assisted Suction Harvesting (DASH) program is generally recommended. During this process a scuba diver manually extracts the plant (roots and all) and then feeds the removed plants into vacuum tube that transports the plant to a bin on a boat. They do not, however, simply vacuum the plants up, as that would also take in large amounts of sediment and would be considered suction dredging (requires elaborate permitting). A mechanical harvesting permit from the WDNR is needed (fee of \$30 per acre) to use the DASH system. The DASH system is said to be more efficient, as the diver does not have to go to the surface to hand the pulled plants to someone on a boat. The DASH system also is theorized to cause less fragmentation, as the plants are immediately transported to the surface using the vacuum technology. However, the costs of conducting hand-harvesting with one of these firms is more expensive than just hiring trained divers and/or snorkelers.

Hand-harvesting control methods may pose a challenge on the chain due to dark stained water and plethora of native plants in the targeted areas. Because of these factors, using a DASH system on some parts of the Eagle River Chain of Lakes may not be worth the extra costs of implantation. Also, the agility of having professional divers/snorkelers may be advantageous. For these reasons, the ULERCLC piloted a professional-based hand-harvesting program in 2016 using a traditional hand-harvesting approach. Onterra's initial recommendations were to target areas in Voyageur Lake for this pilot program in 2016. The EWM colonies were relatively small and low-density, ideal for this control strategy. These locations were also within one of the higher areas of flow in the system and may not be applicable to future herbicide control strategies.

During the 2016 Early Summer AIS Survey (ESAIS), the mapping of the EWM populations within this part of the chain were refined and a final hand-harvesting strategy was derived (Map Voy 1). Onterra provided the hand-harvesting firm with the with the spatial data from the ESAIS Survey to coordinate the removal efforts.

As is discussed specifically within the Voyageur Lake Summary and Conclusions Section (4.5), the professional hand-harvesting actions occurred on Voyageur Lake over three days during July. The hand-harvesting strategy appeared to be moderately effective in controlling the EWM

population at the targeted sites with an overall reduction in EWM observed between the early-July ESAIS survey and the August EWM Peak-Biomass survey.

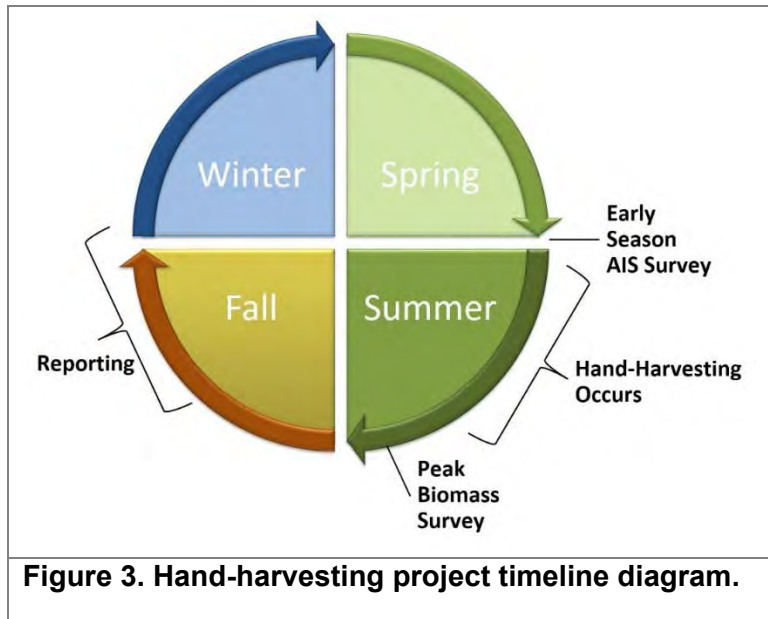


Figure 3. Hand-harvesting project timeline diagram.

3.0 2017 PRELIMINARY CHAIN-WIDE EWM CONTROL STRATEGY

The population of EWM continues to be widespread throughout the Eagle River Chain of Lakes with the majority of occurrences consisting of either point based or low density, polygon based colonies. At current, no areas of the lake exceed the threshold or “trigger” previously developed for implementing herbicide control actions in 2017. Several colonies of EWM in Watersmeet are approaching levels that may meet the predefined trigger. However, these EWM colonies are in areas of high flow where past spot-treatments have produced only short-term successes. Large-scale herbicide efforts have had longer-term results in these areas, but the current level of EWM within Watersmeet is far below levels that would justify this herbicide use pattern. A few locations within the upstream Cranberry Channel are also beginning to see an increase in the EWM population since the spring 2015 treatment, where the plants are forming large enough colonies such that area-based mapping techniques are used.

Based on the results of the 2016 professional hand-harvesting program, the ULERCLC would like to build upon the positive strides gained in 2016 through increasing the amount of professional hand-harvesting effort devoted to EWM control during the 2017 growing season. A preliminary hand-harvesting EWM control strategy for 2017 includes both DASH and traditional hand-harvesting methods. The ULERCLC has identified an EWM population in Scattering Rice Lake in which to implement a DASH harvesting methodology at two sites mapped during the late-summer 2016 survey (Map Scat 1). The ULERCLC would like to target EWM colonies within Voyageur and Watersmeet Lakes through conventional divers in 2017. An Early Summer AIS Survey (ESAIS) will be conducted in 2017 from which a final hand-harvesting strategy would derive. Onterra will provide the hand-harvesting firm with the spatial data from the early-July survey to aid the removal efforts. Following the hand removal efforts, a Late-Summer EWM Peak Biomass Survey will qualitatively assess the hand harvesting efforts (Figure 3).

4.0 INDIVIDUAL LAKE SECTIONS

The remainder of this report will focus on 2016 EWM monitoring and control strategy assessments (if applicable) on a lake-by-lake basis. Some of the text may seem redundant if one reads each lake section. However, this is intentional to ensure the information is portrayed to those that just read the chain-wide sections and their individual lake-specific section.

4.3 Voyager Lake Summary and Conclusions

Following successful treatments in Voyager Lake in 2013, no treatment occurred in 2014 or 2015. Voyager Lake was chosen to pilot a professional based hand-harvesting program on the Eagle River Chain in 2016. The hand-removal program would be considered successful if the density of EWM within the targeted areas was found to have remained approximately the same or decreased from the 2016 ESAIS Survey to the 2016 Late-Summer Peak-Biomass Survey.

During the early-summer survey, the entire littoral zone of the Eagle River Chain of Lakes was searched for EWM by Onterra field staff. Completing the Early-Season AIS (ESAIS) Surveys present numerous advantages. Typically, the water is clearer during the early summer allowing for more effective viewing of submersed plants. While not at their peak growth stage (peak biomass), EWM plants are higher in the water column than most native plants during this time of year which increases the chances that even low-density and isolated EWM occurrences would be located.

During this survey, slightly less EWM was found around Voyager Lake than found in 2015 (Figure 6, lower left). The colonized areas were *highly scattered* and *scattered* and were in similar locations of the denser point-based and colonized data mapped in 2015. The final hand-harvesting strategy was formulated from the results of the ESAIS survey and included five sites in Voyager Lake containing the largest known EWM colonies in the lake (Map Voy 1). The results of Onterra’s ESAIS survey were loaded onto specific ULERCLC GPS units and trained volunteers were challenged to locate additional EWM occurrences within the chain during the remainder of the summer. The volunteer data were provided to Onterra prior to the late-summer 2016 EWM surveys and integrated into the onboard GPS-enabled computer system.

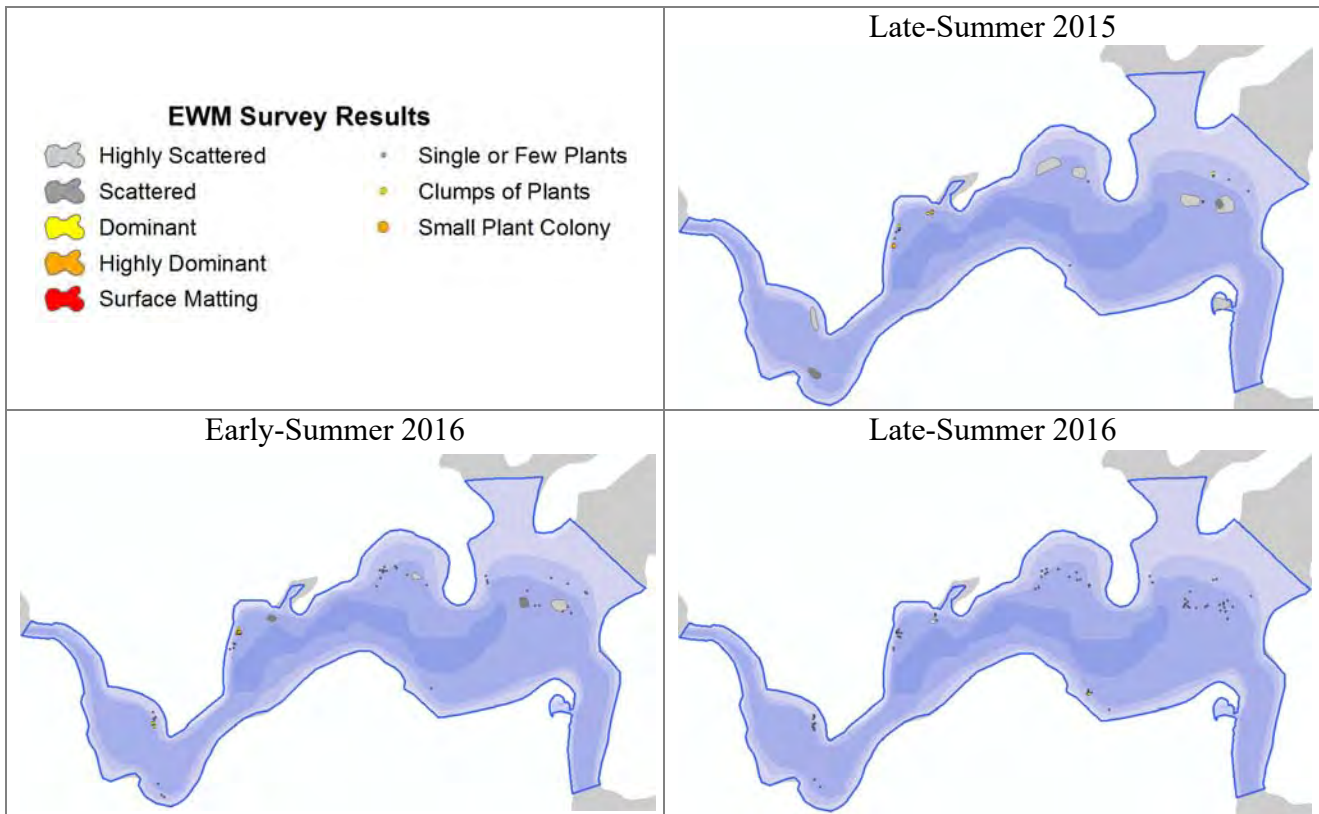


Figure 6. Voyager Lake EWM Population from Late-Summer 2015 to Late-Summer 2016.

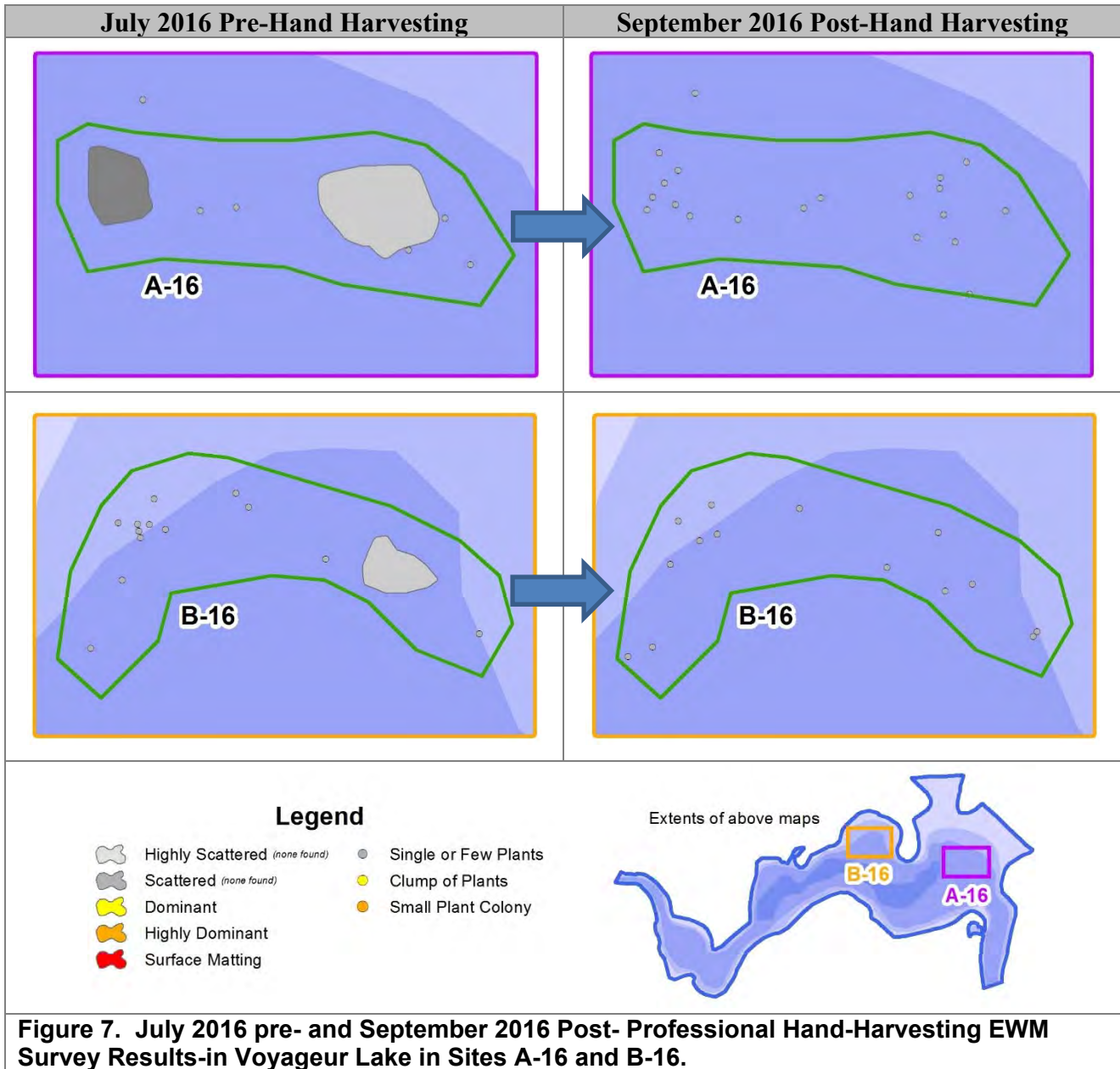
The ULERCLC contracted with Aquatic Plant Management, LLC (APM) to conduct professional hand-harvesting of EWM in 2016. Aquatic Plant Management conducted hand-harvesting activities on July 21st, 22nd, & 28th, 2016, spending a total of 12.8 hours (66.33 combined diver hours) actively hand-harvesting EWM within Voyageur Lake and removing approximately 55 cubic feet of EWM (Table 1). Details of the professional hand-harvesting conducted in 2016 as reported by APM are included with this report as an appendix.

Table 1. Voyageur Lake, 2016 professional hand-harvesting activities

Site	Dive Time (Hours)	Estimated EWM Removed (Cubic Feet)
A-16	3.1	15.0
B-16	2.8	9.0
C-16	1.3	7.0
D-16	2.2	12.5
E-16	1.8	4.0
Other Locations	1.8	7.5
Totals	12.8	55.0

During the Late-Summer 2016 EWM Peak-Biomass Survey, Onterra field crews visited the following areas: all 2016 final hand-harvest sites, all EWM locations that were located during the Early-Summer ESAIS Survey, and all EWM locations the volunteers located during their mid-summer surveys.

Each of the sites in which professional hand-harvesting efforts were undertaken in 2016 was visited during the late-summer survey to qualitatively assess the removal efforts. Following professional hand-harvesting efforts, site A-16 was reduced from a small *scattered* colony, a small *highly scattered* colony, and a few *single or few plants* to only a few highly scattered *single or few plants* (Figure 7). Similarly, site B-16 was reduced from a small *highly scattered* colony and a few *single or few plants* to only a few *single or few plants*. Professional hand-harvesting efforts were successful in reducing the EWM population within site A-16 and B-16 in Voyageur Lake in 2016.



Site C-16 in Voyageur Lake was reduced from a small *scattered* colony to a smaller and less dense *highly scattered* colony with approximately three *single or few plants* (Figure 8). Site D-16 was reduced from a *small plant colony*, two *clumps*, and some *single or few plants* to only a handful of *single or few plants* in 2016. Hand-harvesting efforts in sites C-16 and D-16 were successful in reducing the amount of EWM in the site during 2016 and met control expectations.

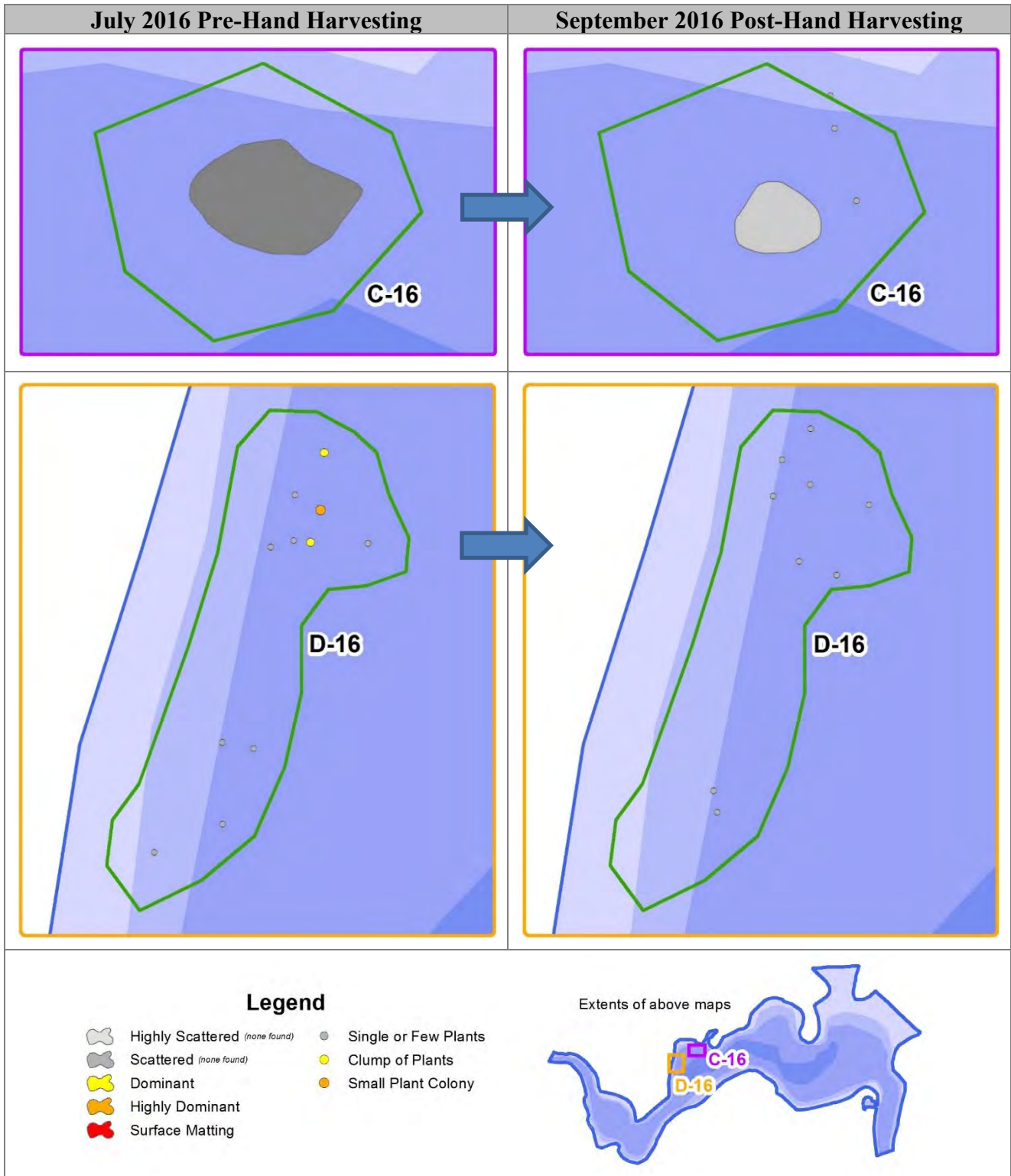


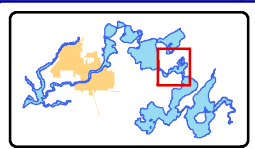
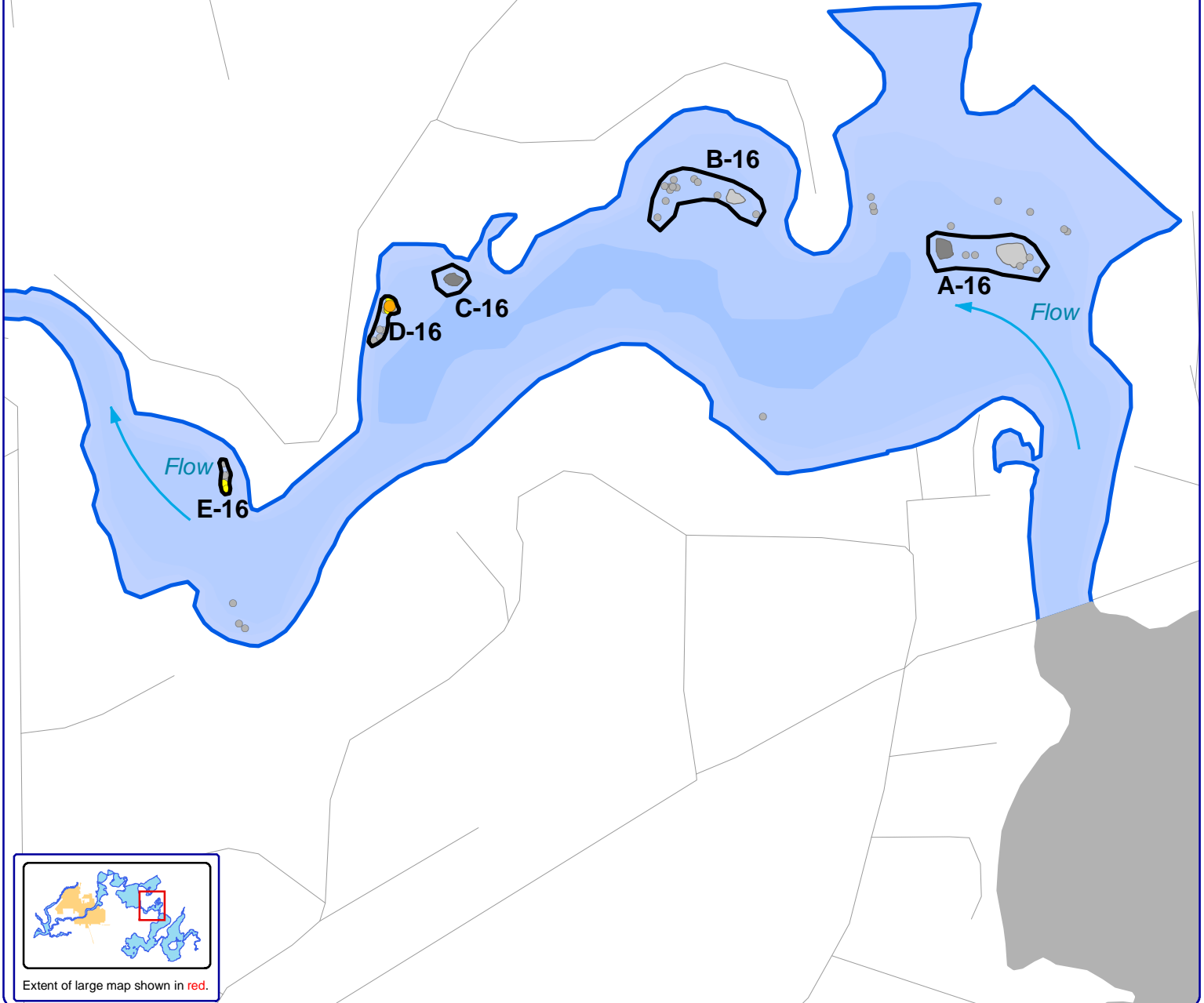
Figure 8. July 2016 pre- and September 2016 Post- Professional Hand-Harvesting EWM Survey Results-in Voyageur Lake in Sites C-16 and D-16.

The professional hand-harvesting actions undertaken in 2016 in Voyageur Lake were effective in controlling the EWM population at the targeted sites with an overall reduction in EWM observed between the July ESAIS survey and the August EWM Peak-Biomass survey. These sites will be monitored in 2017 to determine if control extends beyond the seasonal control observed in 2016. In an effort to preserve the gains from the 2016 hand-harvesting activities, the ULERCLC would like to again conduct professional-based hand-harvesting in Voyageur Lake utilizing conventional divers in 2017. An Early Summer AIS Survey (ESAIS) will be conducted in 2017 from which a final hand-harvesting strategy would derive.

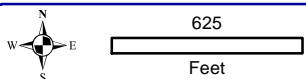
Lake-wide, the EWM population was limited to low density occurrences with the majority of the EWM being mapped as single or few plants. No large continuous areas of EWM were located within Voyageur Lake during the late-summer 2016 survey (Map Voy 2).

**Final 2016 Professional
Hand-Harvesting
Control Strategy**

Site	Acres
A-16	1.6
B-16	1.4
C-16	0.3
D-16	0.3
E-16	0.1
Total	3.7



Extent of large map shown in red.

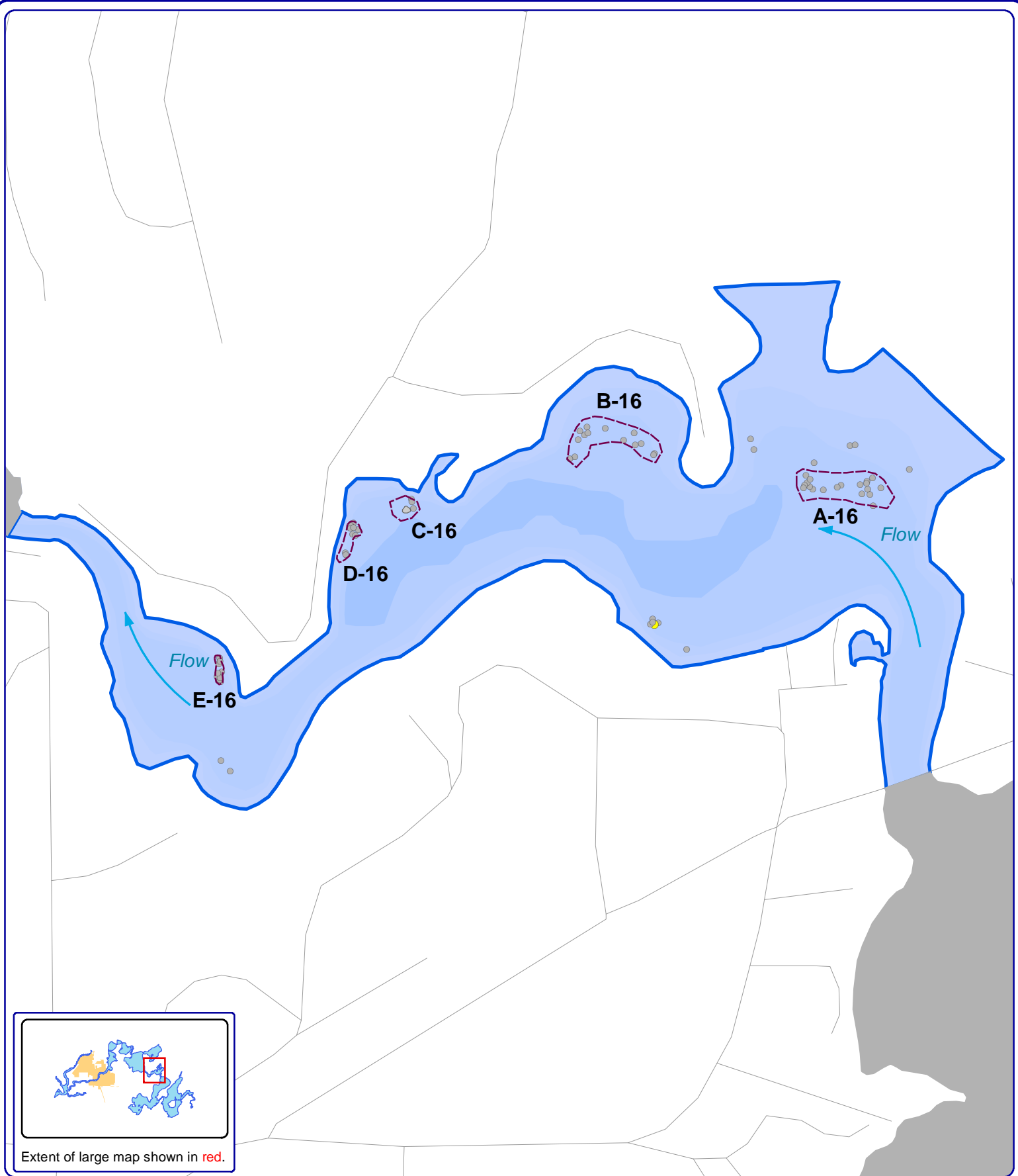


Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

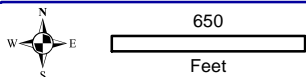
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra, 2016
Map Date: July 14, 2016
Filename: Voy_EWM_ESAIS_2016.mxd

- Legend**
2016 ESAIS Survey (July 2016)
- Highly Scattered
 - Scattered
 - Dominant
 - Highly Dominant
 - Surface Matting
 - Single or Few Plants
 - Clumps of Plants
 - Small Plant Colony
 - 2016 Hand-Harvest Location

Voy 1
Voyageur Lake
Vilas County, Wisconsin
**July 2016 EWM Survey
Results & Final Professional
Hand-Harvesting Control Strategy**



Extent of large map shown in red.



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

Sources:
 Roads and Hydro: WDNR
 Aquatic Plants: Onterra, 2016
 Map Date: October 25, 2016
 Filename: Voy_EWMPB_2016.mxd

- Legend**
2016 EWM PB Survey (September 2016)
- Highly Scattered
 - Scattered
 - Dominant
 - Highly Dominant
 - Surface Matting
 - Single or Few Plants
 - Clumps of Plants
 - Small Plant Colony

Voy 2
 Voyageur Lake
 Vilas County, Wisconsin
**2016 EWM PB
 Survey Results**