

INTRODUCTION

Upper Kaubashine Lake is a 190 acre spring lake in Oneida County. The invasive Eurasian water milfoil (EWM) was first discovered within the lake in July of 2013. Following consultation with the Wisconsin Department of Natural Resources (WDNR), the Upper Kaubashine Lake Property Owners Association (UKLPOA) contracted Onterra, LLC to complete a EWM survey in September 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



Photo 1. Upper Kaubashine Lake, Oneida County, Wisconsin.

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 sibiricum*) and the aforementioned EWM. This hybrid species (termed HWM) has been confirmed in several Wisconsin lakes and may complicate management due to its aggressive nature and suspected decreased susceptibility to herbicides. The Town of Hazelhurst was 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 first year of monitoring and control under this grant-funded project.

Early Season AIS Survey

Onterra ecologists visited Upper Kaubashine Lake on June 17, 2014 to complete an Early Season AIS (ESAIS) survey. This survey is completed during the late spring/early summer (June) and consists of a crew meandering over the entire littoral (shallow, plant growing) zone. At this point in the year, curly-leaf pondweed (CLP) is nearing its peak growth period and should be growing near the surface of the water, thus making it more visible. EWM, while not at its peak growth yet, is typically taller in the water column than native plant species and thus is also quite visible. Furthermore, during the early summer algae growth is limited in comparison to late summer, creating better viewing conditions yet. Finally, the timing of this survey allows for data collection for mid-summer control efforts; in this case, hand-harvesting.

When AIS were 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 AIS occurrences less than 30-40 feet in diameter. Density ratings were assigned to the observed AIS plant groupings in terms of whether a *Single or Few Plants*, *Clump* (5-10 plants), or *Small Plant Colony* (colony ranging from 10-30 ft in size) was observed. For larger, colony-forming observations, AIS were mapped

through use of a polygon or aerial designation. Density was also applied to these observations in categories of *Highly Scattered*, *Scattered*, *Dominant*, *Highly Dominant* and *Surface Matting*.

On June 17, conditions were good for this visual survey with morning clouds breaking apart early on, giving way to mild winds and full sunlight. While no CLP was observed, EWM was located in several areas of the lake (Map 1). EWM was observed in the same areas it was mapped at in 2013, with more occurrences along the lake’s east/northeastern shoreline.

Following the survey, a control strategy involving both volunteer and professional hand-removal was developed. UKLPOA volunteers, eager to keep active within the project, were assigned areas of limited density (Map 2) including several *Single or Few Plant* occurrences. The volunteers would navigate to each EWM occurrence through use of a Garmin GPS Map 78 unit the UKLPOA purchased the past spring through the AIS-EDR grant. Hand-harvesting of EWM from locations A-14, B-14, C-14, D-14 and E-15 would be completed by Aquatic Plant Management, LLC, (APM) a Minocqua-based firm with experience in hand-removing AIS plants from lakes. UKLPOA volunteers would lead APM staff to the colonies depicted on Map 2 using their Garmin GPS unit.

Mid-Summer Control Efforts

An APM crew visited Upper Kaubashine Lake on July 23, 24 and 25, 2014 and again on August 6 to complete hand-removal of EWM within the areas defined following the June ESAIS survey Map 2. Year 1 of the AIS-EDR budget allocated funding for roughly 100 total diver hours on Upper Kaubashine Lake. Staff from APM (four crew members July 23-25, three crew members on August 6) spent a combined total of 67.1 diver hours on the lake in 2014, removing a total of 695 gallons of EWM. Table 1 displays a summary of diving time and hand-removal results from these dates, while an expanded diver report with comments can be viewed in Appendix A.

Table 1: 2014 Upper Kaubashine Lake professional hand-harvesting summary, by control site. Data provided by Aquatic Plant Management, LLC. Site locations depicted on Map 1. In-depth hand-harvest data, with diver comment reports, are attached as Appendix A.

Site	Diver Time (Minutes)	Diver Time (Hours)	Diver Time (Hours:Minutes)	Estimated EWM Removed (Gallons)
A-14	80	1.3	1:20	5
B-14	300	5.0	5:00	25
C-14	1160	19.3	19:20	275
D-14	2275	37.9	37:55	375
E-14	210	3.5	3:30	15
	4025	67.1	67:05	695

As previously mentioned, UKLPOA volunteers were enlisted to participate in EWM monitoring and hand-pulling as an in-kind contribution to the AIS-EDR grant, as well as for engagement into the project and the health of Upper Kaubashine Lake. UKLPOA volunteers met with Michele Saduaskas, Oneida County AIS Coordinator, on August 12 for an introduction to AIS identification and hand-removal techniques.

Unfortunately, the 12th of August was met with unaccommodating weather for EWM hand-removal; winds, cool water temperatures and overcast skies put a damper on even the more ambitious volunteers. Still, volunteers were able to visit some of their designated areas on that date as well as later on in the month, but not to the degree that they had hoped for.

EWM Peak Biomass Survey

On September 11, 2014, Onterra ecologists visited Upper Kaubashine Lake to complete the EWM Peak Biomass survey. This meander-based survey, which mimics the methodology used in the ESAIS survey, is completed in the late growing season (August/September) when EWM has reached its peak growth. Because EWM should be at its maximum density, the results of this survey provide an accurate assessment of where EWM is in the lake and what its full impact on the ecology is. As a result, this data is useful in determining the efficacy of control actions used during the summer months as well as being heavily relied upon for next year's planning.

The weather on September 11th was optimal for the Peak Biomass survey, with full sunlight and mild winds. Onterra staff meandered the littoral region of the lake, marking scattered *Single or Few Plants*, *Clumps of Plants*, along with several *Small Plant Colonies*. A single polygon, assessed as being *Highly Scattered*, remained left over from a *Scattered* June 2014 polygon (Map 3).

EWM Hand-Removal Control Results

Following the ESAIS survey, several volunteer focus areas were created for UKLPOA hand-pullers. Within these volunteer focus areas, more EWM occurrences were observed in the late summer when compared to the June survey results. This is likely remaining plants observed during the June survey in addition to new growth that occurred over the summer months. While these areas still hold very minimal EWM presence, it will be important in 2015 for volunteers to focus their efforts on these locations before additional expansion occurs.

Five areas were delineated for APM to direct their efforts at (Site A-14, B-14, C-14, D-14 and E-14, Map 2). Each treatment site is evaluated below. Maps 1, 2 and 3 may be referred to for a visual aid of before/after hand-harvesting control comparisons.

A-14

In June, several dozen *Single or Few Plants* were observed in this area. Four APM crew members spent 20 minutes (total of 80 minutes or 1.33 diver hours) hand-pulling plants in this area, removing a total of five gallons of EWM. Following these efforts, more *Single or Few Plants* as well as four *Clumps of Plants* were observed later in the summer.

B-14

This area held several *Single or Few Plants* within it, as well as a *Small Plant Colony* roughly 30 ft in size. Four APM crew members spent 60 minutes on July 23rd and 15 minutes on July 25th on this site, for a total of 300 minutes (5.0 diver-hours). During this time, 25 gallons of EWM were removed. According to the late summer peak-biomass survey, roughly the same EWM was found following mid-summer control efforts.

C-14

APM crew members spent nearly 30% of their overall effort (19.3 out of 67.1 hours) on this site between all four visit dates (July 23, 24, 25 and August 6). From this location, 40% of the total harvested EWM was removed (275 of 695 total gallons). During June, several *Single or Few Plants* were observed along with two *Small Plant Colonies*, which were relatively large in size. Following control efforts, roughly the same amount of EWM was observed within the site; however it was apparent that one of the *Small Plant Colonies* had been removed while another colony was spotted to the immediate east.

D-14

During the June 2014 survey, a *Scattered* polygon of EWM was observed in this shallow bay area, along with a *Small Plant Colony*. APM crew members spent the majority of their Upper Kaubashine Lake diving time on this site (57% of total diving time). Appropriately, a majority (54%, or 375 gallons) of the total EWM removed from Upper Kaubashine Lake in 2014 was removed from this location. The results of the September Peak Biomass survey indicate that the *Scattered* polygon was reduced one level to *Highly Scattered*, while a *Small Plant Colony* was also decreased in size/density as well. *Scattered Single or Few Plants* and *Clumps of Plants* were observed within the site during the late summer survey that were not observed in June 2014.

E-14

Due to the level of work being conducted on other sites, E-14 was not visited until August 6th, when three APM staff visited the site. The crew spent 70 minutes at the site with three crew members equates to 3.5 diver hours. During this time, the crew removed 15 gallons of EWM. In June 2014, the site was found to hold several *Single or Few Plants* as well as a single *Clump*. After the control efforts, the site held only several *Single or Few Plants*.

Conclusion and 2015 Monitoring and Control Strategy

The management of EWM can be difficult, because the plant is very aggressive and reproduces numerous times during the summer months. EWM undergoes a process known as auto fragmentation during the summer in which the plant forms root structures at nodes along the stem and then breaks apart at these nodes. If the fragments have actively growing tissue, then upon dispersal they may find open sediment and, if that sediment is accommodating, can form a new plant. This process may occur several times during the summer, so it is possible that new growth may occur in areas where EWM was not previously spotted.

Overall, professional hand-removal control efforts on Upper Kaubashine Lake failed to meet expectations for EWM control in 2014. In comparing EWM survey qualitative data taken before and after the control efforts, it is apparent that the efforts did not result in an observable decrease in EWM abundance and density within the designated control areas. Despite this, it is acknowledged that a substantial amount of EWM (695 gallons) was removed between all sites. Therefore, the lack of observed “control” within the prescribed professional hand-harvest areas may be due to an insufficient amount of hand-harvesting (number of dive hours).

For 2015, it is recommended that the UKLPOA once again make use of professional hand-harvesting in their efforts to control EWM on Upper Kaubashine Lake (Map 4). 67.1 hours were

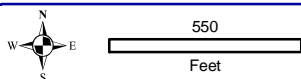
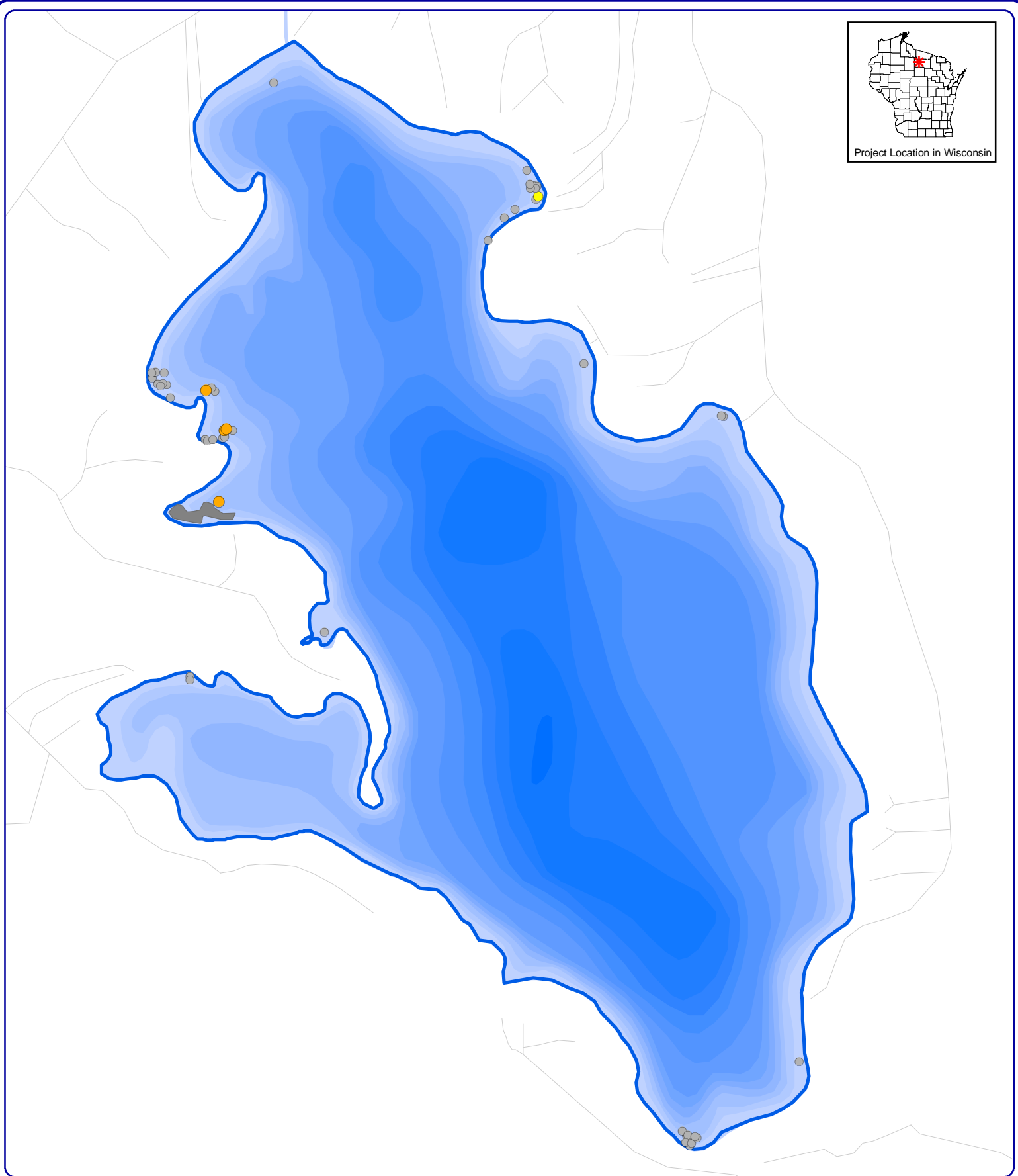
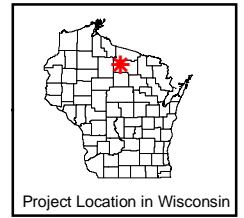
utilized in 2014 to target five control areas through professional hand-removal. It is anticipated that this effort must be increased in order to result in a detectable decrease in EWM abundance within the control areas. Further, the UKLPOA has indicated interest in utilizing more of the funds they were allotted within their AIS-EDR grant for professional hand-removal. It is recommended that the group utilize 100 hours of professional diver time in 2015. Finally, it is recommended that the UKLPOA increase their volunteer hand-removal efforts as well, by targeting smaller populations such as the *Single or Few Plant* or *Clump* observations noted within the western bay and along the southern shorelines of the lake. The project will have a higher probability of success if the UKLPOA can address these smaller populations before expansion to colonies occurs.

Map 4 displays the recommended areas for 2015 professional EWM hand-harvesting control. These areas have been assigned a priority number so that the professional hand-harvesting may focus their efforts on the highly colonized areas that post the most risk to the Upper Kaubashine Lake ecosystem. These areas will be examined during a June ESAIS survey; should the density or extent of these populations change, the resulting changes to the control strategy will be indicated on a final 2015 hand-removal strategy map which would be provided to the hand-harvesting firm as well as the UKLPOA prior to the hand-removal efforts being initiated. Also following this survey, priority locations will be assigned to UKLPOA volunteers for their hand-removal efforts. The association's GPS will be updated with this data so navigation to the plants will be much easier.

Onterra and APM staffs have agreed to a protocol, beginning in 2015, that would ensure the transmittal of spatial data between the two firms. Onterra's ESAIS survey results would be sent to and loaded upon APM GPS units. This will ensure APM is able to more easily locate isolated plants that are within the control areas, while limiting the time APM spends looking for plants and thus increasing their time in hand-removal efforts.

EWM Harvesting Results - Upper Kaubashine Lake

Site	Date	Time Underwater (Min)	Divers	Diver Minutes	Diver Hours	Estimated EWM Removed (Gallons)	Comments
A-14	23-Jul	20	4	80	1.33	5	Sparse, single plants located mostly around the fallen tree that has been turned into structure for fish. Water depth 2-5 feet.
B-14	23-Jul	60	4	240	4.00	20	Minimal plants mostly in one clumpy area near a drop-off. Water depth was 4-8 feet.
	25-Jul	15	4	60	1.00	5	Minimal plants mostly in one clumpy area near a drop-off. Water depth was 4-8 feet.
C-14	23-Jul	70	4	280	4.67	90	Several large clumps of Eurasian surrounding the Southeastern Fish Crib. Patch to the east had 4-6 foot plants that were in sandy/rocky soil. Clump on the opposite side had muckier soil but the plants were only 2-5 feet in length. Water depth was 4-12 feet.
	24-Jul	30	4	120	2.00	25	A couple clumps of plants, but some single plants as well. Plants were not as established as in the bay to the south. Water depth was 3-6 feet.
	24-Jul	85	4	340	5.67	100	Several large clumps of Eurasian surrounding the Southeastern Fish Crib. Patch to the east had 4-6 foot plants that were in sandy/rocky soil. Clump on the opposite side had muckier soil but the plants were only 2-5 feet in length. Water depth was 4-12 feet.
	25-Jul	60	4	240	4.00	35	Several large clumps of Eurasian surrounding the Southeastern Fish Crib. Patch to the east had 4-6 foot plants that were in sandy/rocky soil. Clump on the opposite side had muckier soil but the plants were only 2-5 feet in length. Water depth was 4-12 feet.
	6-Aug	60	3	180	3.00	25	Several large clumps of Eurasian surrounding the Southeastern Fish Crib. Patch to the east had 4-6 foot plants that were in sandy/rocky soil. Clump on the opposite side had muckier soil but the plants were only 2-5 feet in length. Water depth was 4-12 feet.
D-14	23-Jul	120	4	480	8.00	110	Lots of Eurasian in the shallows, but there was more around the two fish cribs in the bay. The bottom was muckier in shallower, but was sandy as we dove deeper. Water depth in the bay ranged from 1-12 feet where we were harvesting Eurasian.
	24-Jul	100	4	400	6.67	85	Large patch of Eurasian with plants only 2-3 feet long. Water depth 4-6 feet.
	24-Jul	35	4	140	2.33	30	Large patch of Eurasian with plants only 2-3 feet long. Water depth 4-6 feet.
	25-Jul	90	4	360	6.00	45	Lots of Eurasian in the shallows, but there was more around the two fish cribs in the bay. The bottom was muckier in shallower, but was sandy as we dove deeper. Water depth in the bay ranged from 1-12 feet where we were harvesting Eurasian.
	25-Jul	85	4	340	5.67	35	Large patch of Eurasian with plants only 2-3 feet long. Water depth 4-6 feet.
	6-Aug	100	3	300	5.00	35	Lots of Eurasian in the shallows, but there was more around the two fish cribs in the bay. The bottom was muckier in shallower, but was sandy as we dove deeper. Water depth in the bay ranged from 1-12 feet where we were harvesting Eurasian.
	6-Aug	85	3	255	4.25	35	Large patch of Eurasian with plants only 2-3 feet long. Water depth 4-6 feet.
E-14	6-Aug	70	3	210	3.50	15	Plants were few and far between in the deeper water, but there was a decent amount in the shallows near the fallen tree. Plants in the shallows were only .5-1 foot in length, and plants out deeper were as long as 5 feet. Water depth was 1-10 feet.



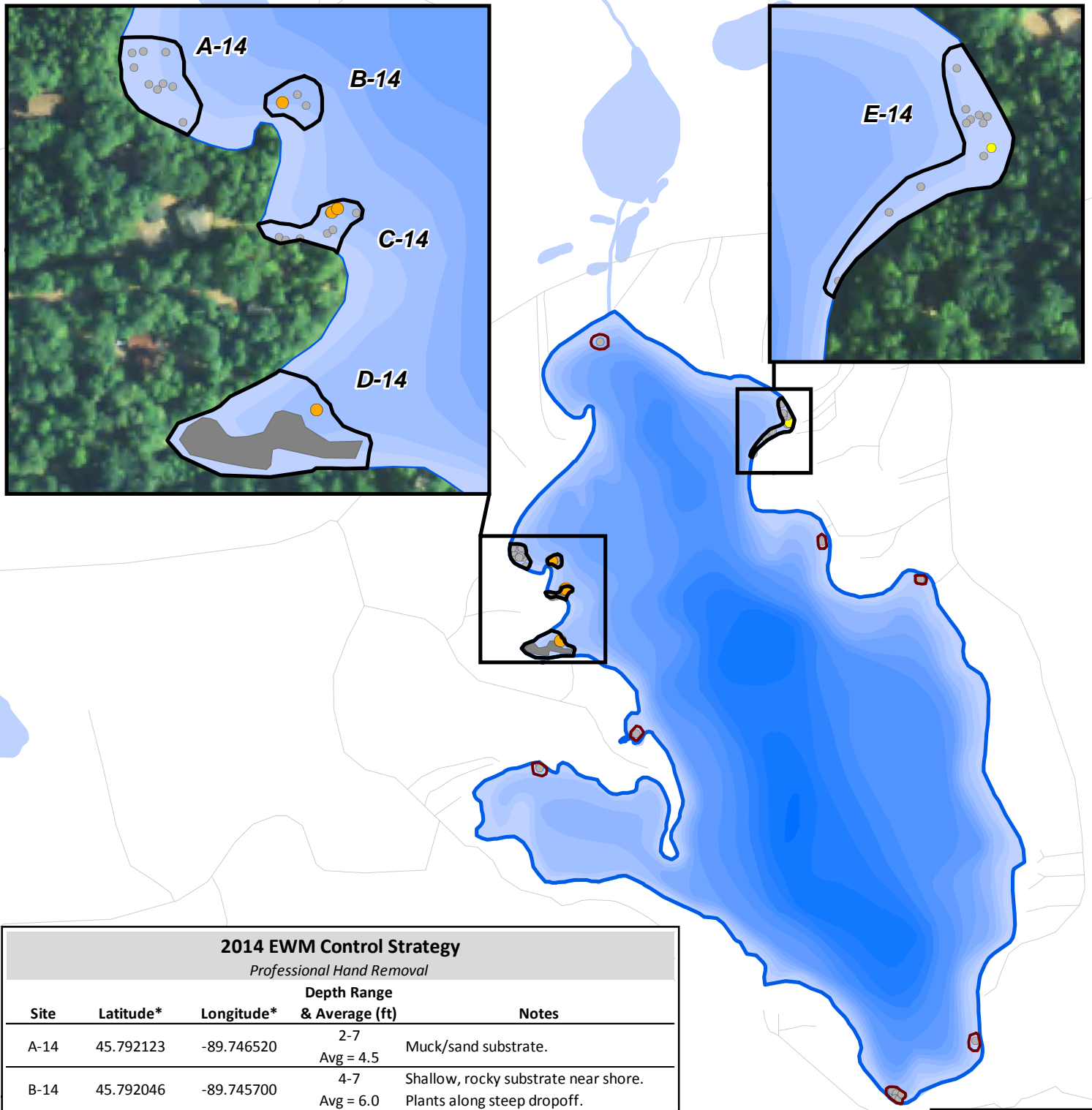
Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro and Roads: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Orthophotography: NAIP, 2013
 Aquatic Plant Survey: Onterra, 2014
Map Date: February 18, 2015
 Filename: Map1_UpKaubOneida_June14_ESAIS.mxd

Legend

- | | | | |
|--|--------------------------------------|--|----------------------|
| | Highly Scattered <i>(none found)</i> | | Single or Few Plants |
| | Scattered | | Clump of Plants |
| | Dominant <i>(none found)</i> | | Small Plant Colony |
| | Highly Dominant <i>(none found)</i> | | |
| | Surface Matting <i>(none found)</i> | | |

Map 1
 Upper Kaubashine Lake
 Oneida County, Wisconsin
June 2014 ESAIS
Survey Results

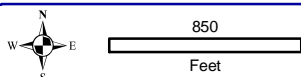
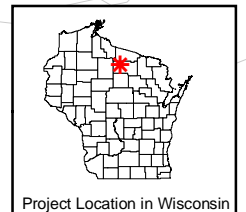


2014 EWM Control Strategy

Professional Hand Removal

Site	Latitude*	Longitude*	Depth Range & Average (ft)	Notes
A-14	45.792123	-89.746520	2-7 Avg = 4.5	Muck/sand substrate.
B-14	45.792046	-89.745700	4-7 Avg = 6.0	Shallow, rocky substrate near shore. Plants along steep dropoff.
C-14	45.791479	-89.745425	2-5 Avg = 3.5	Muck/sand substrate.
D-14	45.790723	-89.745495	1-7 Avg = 3.5	Many plants in shallow (2 ft) water. Mucky substrate.
E-14	45.794446	-89.740163	1-8 Avg = 3.5	Many plants in shallow water near downed tree. Mostly solid substrate.

* Latitude/Longitude of center of Hand-Removal site



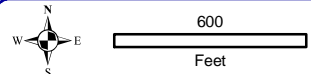
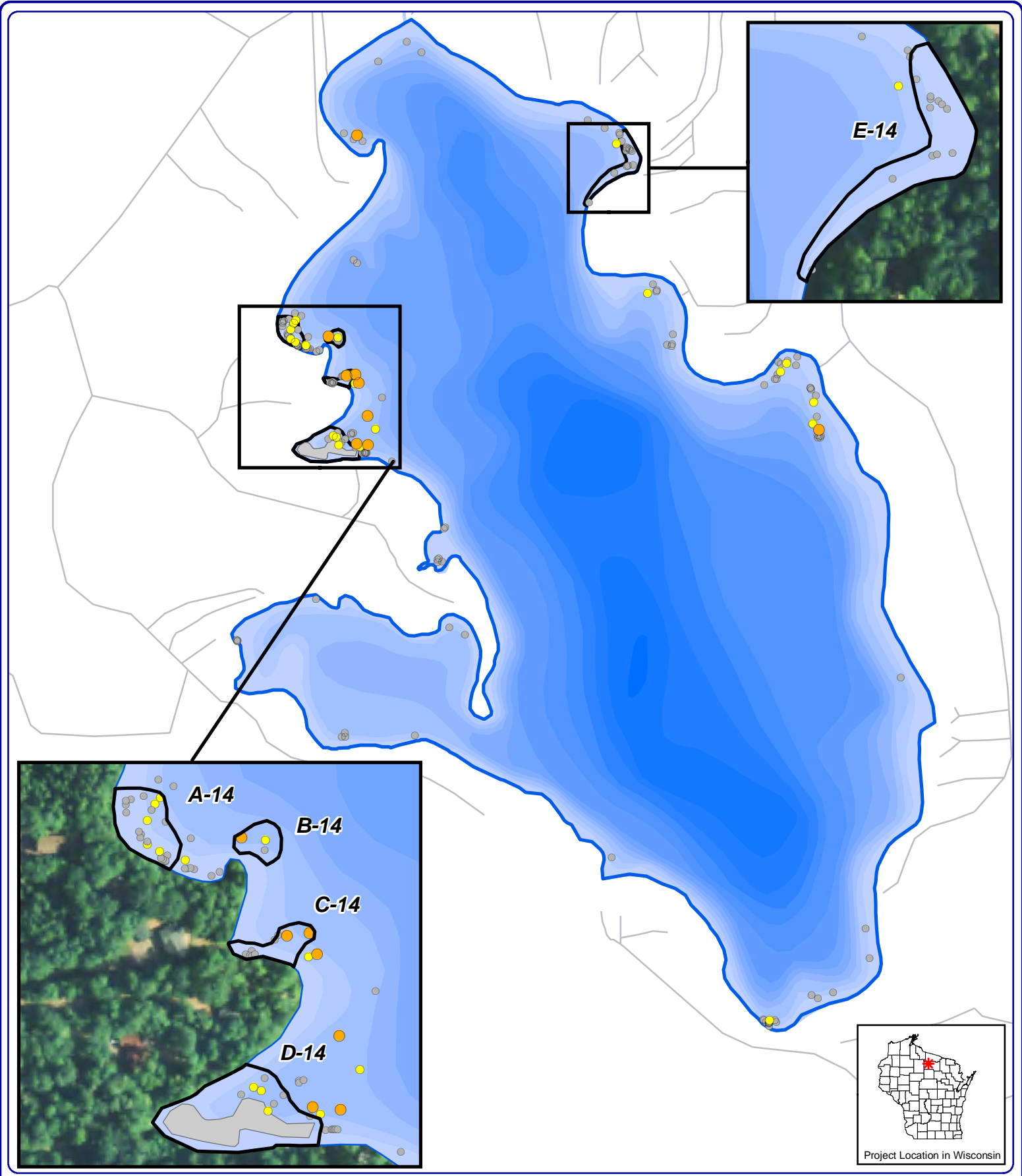
Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Hydro and Roads: WDNR
Bathymetry: WDNR, digitized by Onterra
Orthophotography: NAIP, 2013
Aquatic Plant Survey: Onterra, 2014
Map Date: February 18, 2015
Filename: Map2_UpKaub_Oneida_2014_ControlStrategy.mxd

Legend

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

Map 2
Upper Kaubashine Lake
Oneida County, Wisconsin
**2014 EWM Hand
Removal Strategy**



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

Sources:
 Hydro and Roads: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Orthophotography: NAIP, 2013
 Aquatic Plant Survey: Onterra, 2014
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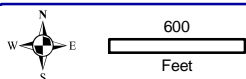
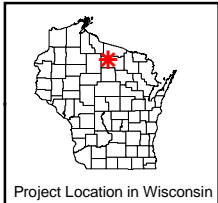
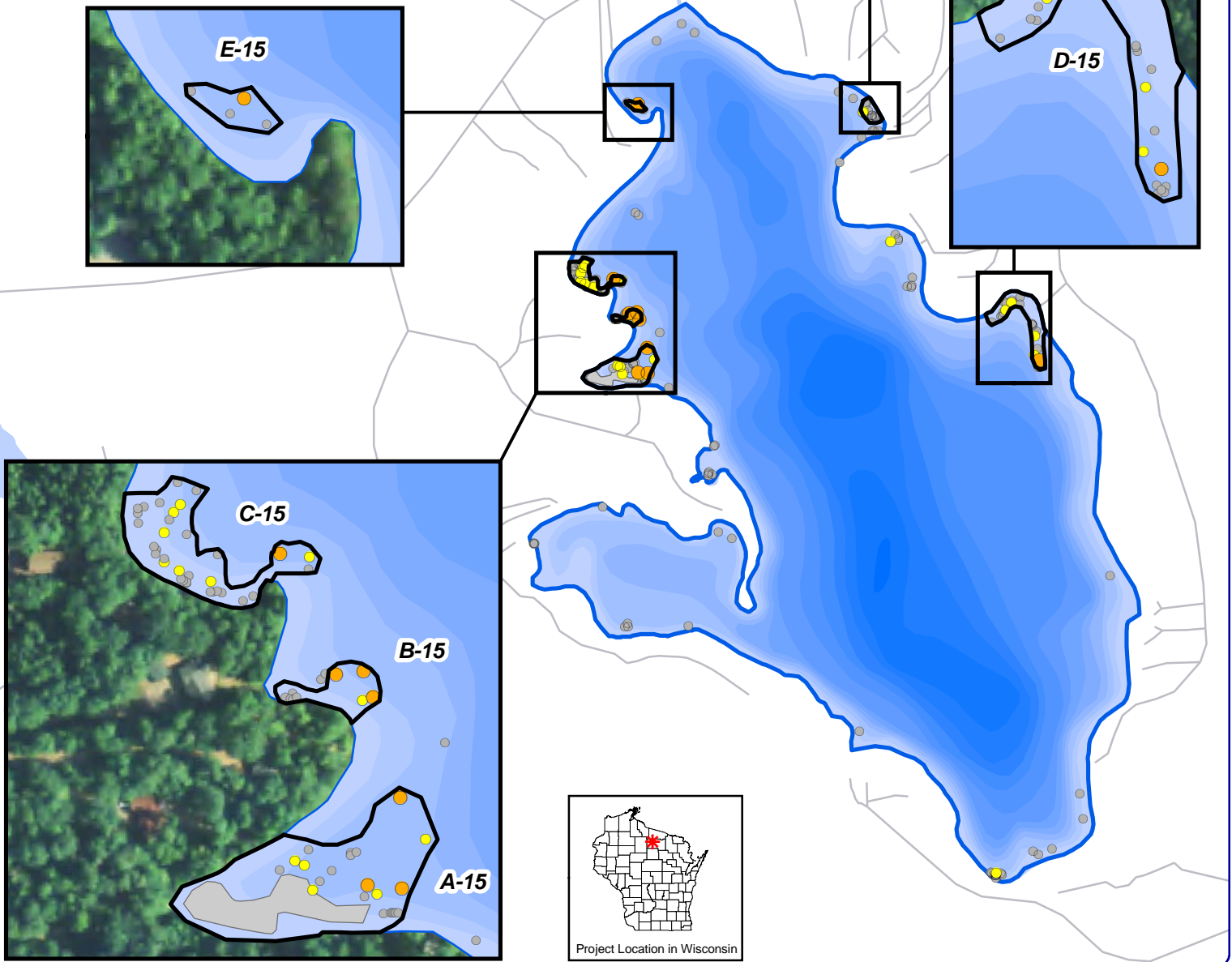
- Highly Scattered
- Scattered (none found)
- Dominant (none found)
- Highly Dominant (none found)
- Surface Matting (none found)
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2014 Professional Hand-Removal Focus Area

Map 3
 Upper Kaubashine Lake
 Oneida County, Wisconsin
September 2014
EWM Survey Results

2015 EWM Conditional Control Strategy

Professional Hand Removal

Priority	Site	Depth Range & Average (ft)	Notes
1	A-15	3-10 Avg = 6.5	Muck/sand substrate, moderate abundance of natives
2	B-15	2-7 Avg = 5.0	Shallow, rocky substrate near shore.
3	C-15	3-12 Avg = 5.0	Muck/sand substrate. Many scattered plants located closer to shoreline
4	D-15	5-10 Avg = 7.0	Many plants in shallow (2 ft) water. Mucky substrate.
5	E-15	3-12 Avg = 5.0	Soft substrate, few-moderate native plants
6	F-15	3-7 Avg = 5	Mostly solid substrate.



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Orthophotography: NAIP, 2013
Aquatic Plant Survey: Onterra, 2014
Map Date: September 22, 2014
Filename: UpKaub_Oneida_EWMPB_Sept14.mxd

Legend

- Highly Scattered
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2014 Professional Hand-Removal Focus Area
- Scattered (*none found*)
- Dominant (*none found*)
- Highly Dominant (*none found*)
- Surface Matting (*none found*)

Map 4
Upper Kaubashine Lake
Oneida County, Wisconsin
**Conditional 2015
Hand-Removal Strategy**