Final Report to the
Wisconsin Department of Natural Resources
AIS Coordinator Program – West Central
AEPP-407-13

Golden Sands RC&D helped plan and implement the first annual "Water's Edge" event in Wausau, to educate the community about the importance of Central Wisconsin's water resources, and threats facing these resources.

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Overview:

Goals and Objectives:

All counties:

1. **Provide CBCW interns.** Two full-time summer Limited Term Employees were hired to perform boat inspections in all counties. These inspectors were trained indoors and in the field on biology and identification of aquatic invasive species, and common native aquatic plants. The primary focus of inspections was on the busiest landings on waterbodies >100 acres. Inspectors were also placed at landings during local events such as fishing tournaments and ski shows, as well as during the July 4th Landing Blitz. Inspectors spent over 314 hours and talked to 348 separate boats, many of which had multiple people receiving the message.

2. **CBCW, CLMN workshops.** Golden Sands staff continued to offer CBCW and CLMN-AIS Monitoring workshops to lake groups and citizens in all of our counties. CLMN-Milfoil Weevil Monitoring training offered statewide, but no weevil monitoring trainings were requested. Two CBCW workshops were requested at Wadley Lake in Marathon County and McDill Pond in Portage County. Maps of participating CBCW/CLMN participants are provided in **Appendix 1.**

3. **Biological control of purple loosestrife promotion.** Golden Sands RC&D collaborated with the Wisconsin River Academy at SPASH, and a local landowner, to dig purple loosestrife rootstocks in the Okray Wildlife Management Area. These roots were supplied to local volunteers to raise purple loosestrife beetles. The students harvested 50 plants for use in Portage and Marathon Counties, and dug extras for use in Waupaca County.
   Volunteers in Portage, Marathon, and Wood Counties represented groups including McDill Pond (Portage County), Marathon County Land Conservation Department, Jordan Pond (Portage County), and Paul J Olson Wildlife Area (Portage/Wood County). The rootstocks were given to volunteers to use as hosts for purple loosestrife beetles.
   414 beetles were collected and placed on the plants grown by volunteers in Portage and Marathon Counties. 414 X 100= 41,400 beetles were released in Portage, Wood and Marathon Counties.

4. **Invasive plant identification and hand removal training.** Train lake groups in proper plant identification and removal techniques. Coordinate and support volunteer work parties. A map of the lakes with EWM or CLP in this project area is attached in **Appendix 2**.

   13 volunteer AIS removal trainings were hosted by Golden Sands, resulting in the removal of seven different species of invasives.

   
   The last plant is removed from a Japanese knotweed stand on Lake

   <u>Lake Nepco Japanese Knotweed removal</u>
   Lake Nepco has had a patch of Japanese knotweed on its west side that local residents are concerned about. It is on the side of a ditch between a county highway and a cranberry bog. The local land conservation department staff joined to learn about removal techniques. The

highway department has been generous in removing the plants cut in the project.

Jim Moore Creek Japanese knotweed removal

A stand of Japanese knotweed along Jim Moore Creek at 10th St. on the north side of Wausau was visited and confirmed. The patch was very large, well-established, and growing through a large pile of concrete and other construction debris. To date, no group has attempted to remove these plants.

Springville Pond Japanese knotweed

Another patch of Japanese knotweed on the shoreline of Springville Pond, Portage County was removed with the cooperation of the landowner. The landowner continued to remove new shoots that sprouted up. Currently, the knotweed appears to be gone.

Springville Pond Japanese knotweed stand before volunteer hand removal

Springville Pond Japanese knotweed stand after volunteer hand removal

Reed canary grass removal at Boston School Forest

Paul and Kaycie hosted a reed canary grass hand removal at Boston School Forest. The goal of the project was to remove and drown out some plants that were scattered around the lake before they were able to fill in.

Lake Helen Japanese knotweed removal

A local County Conservationist that had gone through an AIS training put on by Golden Sands RC&D had called and reported Japanese knotweed on a property on Lake Helen. Kaycie worked with 10 people on the lake to remove the patch of knotweed. The landowners were grateful for the hand-on lesson and subsequently found another small patch of Japanese knotweed on a different property and removed it without assistance. While checking on the first property, the landowner was confident in his identification and removal skills and has since not needed assistance in removing the knotweed from his property.

Volunteers have continued to remove and treat a small Japanese knotweed patch on Lake Helen after their training.

McDill Pond Japanese knotweed removal

A press release that Kaycie had written on Japanese knotweed was responded to almost immediately. There were three sets of small patches of Japanese knotweed directly on the shoreline of McDill Pond. The landowner was eager for the opportunity to learn how to remove the plants, and two other volunteers also joined to learn as well. All the plants were removed and treated, and the landowner followed up the next year with the few plants that had come back.

Lime Lake Eurasian watermilfoil manual removal training

Volunteers from Lime Lake joined Golden Sands staff for a lesson in identifying and manually removing EWM from their lake. The location of the EWM was near the boat landing, where all of the plants present were removed. The landowners recognized the plants again near their dock, called to confirm the identification, and hosted a removal work time near their dock as well.

Sunset Eurasian watermilfoil manual removal training

Sunset Lake has had active volunteers interested in removing Eurasian watermilfoil for many years. They had received a chemical treatment near their boat landing, where no EWM returned. However, EWM was found on the west side of the lake. An elderly, but active landowner swam and waded in the water to remove the plants. Others from around the lake joined in to learn how to identify and remove the plants. The Central Wisconsin Environmental Station (CWES) provided volunteers to snorkel and remove plants as well. Volunteers from the lake continue to monitor for EWM and remove it on their own. For the larger, deeper beds volunteers come out with Golden Sands staff to remove the plants, to ensure it is being done correctly.

Sunset Lake volunteers are trained on EWM manual removal, and proper disposal. Volunteers monitor the lake throughout the year.

Collins Lake Eurasian watermilfoil manual removal training

A student intern joined Kaycie on Collins Lake for a manual removal of a few Eurasian watermilfoil plants that were to the west of the boat landing. They spoke to a landowner about the process and how to be involved in lake management.

Camp volunteers are being trained on Phragmites removal. They then taught the campers the same skills.

Pickerel Lake Phragmites removal training

During a visual survey of the lake, Kaycie discovered some Phragmites on the south shore of the lake. She worked with employees at Camp Helen Brachman, who wanted to teach students about invasive species, to remove the plants. The volunteers removed and treated the patch of Phragmites, and disposed of the plants. Since that removal training, the camp employees surveyed the area with campers and discovered another patch of Phragmites. The employees then taught the students how to properly remove and treat the plants.

Riverside Park Riparian AIS removal day

October 9th, 12 students from Wausau West and 10 students from Lincoln Hills School for Boys came together at Riverside Park, in order to take on the non-native buckthorn and honeysuckle shrubs that have taken over the riparian areas of that park. Surveys prior to the field trip found infested by found the percent cover of invasive shrubs at an average of 15% cover, and as bad as 50% cover.

A student hauls buckthorn away from the river at Riverside Park riparian clean-up day.

A total area of nearly 16,000 square feet was rid of invasive shrubs by the students, with the intermixed native shrubs left intact to thrive once more. The huge piles of cut shrubs were later chipped for disposal by the Marathon County Parks, Recreation, & Forestry Department. The Department also supplied a crew leader to assist students for the day, as did Wausau West, Lincoln Hills School for Boys, Golden Sands RC&D, and Marathon County Land and Water Conservation Department. This was the first field trip of its kind to Riverside Park, thanks to new funding from the Community Foundation of North Central Wisconsin.

Fern Island Riparian AIS removal day

October 11th, 22 students from Wausau East converged on Fern Island for the eighth annual battle against invasive shrubs there, continuing the battle that began seven years ago to eradicate them from Fern Island. Student crews learned first-hand how invasive non-native buckthorn and honeysuckles can be, and honed their plant identification skills through hands-on field work. An estimated total of four acres were cleared of the invasive shrubs by the students. Monitoring surveys have found that the maximum percent cover of invasive shrubs on the island has dropped from 65% in 2010 to 20% in 2013.

A student shows off her cutting skills at Fern Island Park.

Wisconsin River Academy riparian invasive species removal training and work day

Golden Sands worked with SPASH high school students involved in the National Honor Society, and the nonprofit CARE (Cancer Awareness and Research Enrichment) to combat invasive species on the Green Circle Trail. About ten trailer loads of invasive species were collected, and disposed of by the City of Stevens Point. The students are excited to continue removing invasive species on the Green Circle, to improve it for years to come.

Students clear Japanese barberry from the wetland area off the side of the trail.

5. **Milfoil weevil surveys.** As one of our services to lake groups, we offer population density surveys for the native milfoil weevil, *Euhrychiopsis lecontei* for lake groups interested in exploring biological control as a method of treating their EWM problem.

On July 8, 2013 a total of 51 EWM stem samples (10 from each sample bed, from across all depth zones) were collected from Springville Pond in Portage County, where EWM is patchy throughout the lake. A lake-wide average of 2.47 N/stem, although there was great variability between beds, as is usual in Springville Pond. The far eastern bed has an average density of 4.9 N/stem, well above the statewide average of 0.65 N/stem. In this area, the EWM was only a rake fullness ranking (a measure of relative abundance) of 1, where EWM was scattered and mixed in with native plants, such as coontail and elodea. In contrast, the bed on the far western end of the pond, where the water is about 9 to 12 feet deep and EWM may not reach the water surface, the average weevil density is often found to be 0.5 N/stem or lower, even 0 N/stem. Indeed, the average weevil density was found to be 0.4 N/stem again in 2013, and EWM was still dense. Weevil survey map is in **Appendix 3.** Data collected in 2014 by the UWSP Milfoil Studies (Dan Miller) found the lakewide weevil density average to be 1.7 N/stem, with densities higher than usual on the west end; an exciting new trend.

The use of chemical controls is controversial with the residents of Springville Pond, who have shifted away from reactionary management towards a more pro-active, multi-pronged approach to managing the aquatic plants on Springville Pond. This approach includes the use of biological control, hence Golden Sands' continued monitoring of the weevil population.

Data was provided to the lake residents prior to their 2013 meeting, and presentation of the historical EWM and weevil data was given to the residents at their July 29, 2014 meeting.

Although much of the shoreline of Springville Pond is developed, many landowners maintain a healthy shoreland buffer suitable for weevil overwintering habitat. Springville Pond has been recorded to have a naturally-occurring milfoil weevil population that is often near or above the statewide average of 0.65 N/stem. Weevil survey data by Golden Sands staff (2004-2014) and UWSP Milfoil Studies (2014) is shown in Table 1 with EWM Point Intercept survey data collected by the UWSP Center for Watershed Science & Education. The data shows EWM declining, and weevil populations remaining strong. We recommend continued monitoring to both provide quality management data to the residents of Springville Pond and collect valuable data about the interaction between EWM and its natural enemy, the milfoil weevil.

Table 1
Springville Pond Survey Data
Milfoil Weevil Survey Data = Golden Sands RC&D, UWSP Milfoil Weevil Studies
EWM Point Intercept Data = UWSP Center for Watershed Science & Education

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EWM Freq of Occur in Vegetated Areas (%)			100	80	85	78	50				
EWM Relative Frequency (%)			92	40	52	46	40				
EWM Average rake fullness (Scale of 0 to 3)			1.51	1.13	1.43	1.29	1.13				
Weevil population density (N/stem)	1.65	0.54	0.24	0.20			1.04		1.88	2.47	1.7

Phytobius leucogaster, another native weevil, is also naturally-occurring at Springville Pond. While this species of weevil does not appear to be very useful in controlling EWM on its own, it does damage EWM flowers and is hypothesized to possibly be useful in combination with other biological control agents. It is recommended that *Phytobius* occurrences, if they are found, to continue to be recorded in the surveys as well, but recorded separately from *E. lecontei*.

6. **AIS early detection response and monitoring services.** Investigate reports of pioneer infestations, map, collect voucher samples. Report to DNR, SWIMS, and respective lake management units and municipalities. Follow-up monitoring after control efforts (hand-pulling or otherwise). Many reports of AIS to the DNR are a direct result of the AIS program. A region-wide list of AIS in Marathon, Wood, and Portage Counties is attached in **Appendix 4**.

AIS surveys and mapping on Wazeecha, Nepco, Dexter, Kaunewinne, and Manakiki Lakes

A survey of Lake Wazeecha was conducted on July 23rd. Curly-leaf pondweed, Eurasian watermilfoil, zebra mussels, rusty crayfish, and banded mystery snails were found. Other low-priority non-native species included aquatic forget-me-not and narrow-leaf cattail, which were more common at the upstream end of the lake. EWM was fairly common, and was most dense in the NW corner of the lake. CLP, banded mystery snails, and rusty crayfish occurred sporadically throughout the lake but were not observed anywhere in high density. Zebra mussels were abundant on most logs and rocks throughout the system, especially along the north shore. A map of the EWM distribution is available.

Sunset AIS monitoring lesson

Local residents around Sunset Lake were eager to learn how to identify and manually remove Eurasian watermilfoil from their lake. Kaycie went to the lake with live specimens to show the differences in natives and invasives. She also took the residents out on the water to show them how to identify the plants from the surface of the water.

Giant Hogweed Report along Hwy 10

We received a call from the Wisconsin Department of Transportation (WisDOT), indicating that a local resident had reported giant hogweed along Hwy 10 near Lake Emily. WisDOT requested assistance in visiting the site to confirm or deny the report. The reported plant turned out to be giant ragweed (*Ambrosia trifida*), a native species.

AIS stream surveys

Kaycie and Paul sampled multiple streams in Marathon County for AIS, collecting sediment samples. Following DNR methods, they reported invasive species such a purple loosestrife, which had gone unreported in the past. Streams sampled included: Scotch Creek at Hilldale Drive; Big Eau Pleine River at Cherokee Park; Little Trappe River at Shady Lane Road; Plover River at Hwy C; Roberts Creek at Hwy KK, Black Creek at Hwy KK, and Fourmile Creek at Hwy KK. This was in response to New Zealand mudsnails discovered in Black Earth Creek, and an increased effort by the DNR to monitor for them.

Paul collects stream samples on the Plover River. Samples will be checked for invasive species, including New Zealand mudsnail.

In Portage County, the Plover River was monitored from Hwy HH to Tommy's Turnpike, and AIS detected included Eurasian watermilfoil hybrid, curly-leaf pondweed, Chinese mystery snail, and purple loosestrife. Rusty crayfish have been observed here before but were not found during this survey.

The Plover River at Hwy 66 was also surveyed. AIS detected included only rusty crayfish. The Tomorrow River was surveyed at Buchholz Road, to the southeast of Amherst. AIS detected

included banded mystery snails, purple loosestrife, and rusty crayfish.

Lime, Pickerel, Helen, Collins, and Tree Lake surveys – Early detection surveys were conducted on these lakes to gauge the levels of infestation by AIS. Lime Lake and Lake Collins had low levels of Eurasian watermilfoil (EWM) that could be manually removed, Pickerel had no EWM, but had Phragmites that could be manually removed and treated. Tree Lake had Curly leaf pondweed that the lake association chose to control with a harvester. Lake Helen is looking into hiring divers for manual removal in combination with chemical treatments. Golden Sands assisted in the survey to measure the abundance of EWM in the lake.

Mayflower Lake meeting
Mayflower Lake is one of the lakes in Marathon County that is going through the planning stages for a lake management plan. Golden Sands RC&D is advising the lake associations on AIS identification, inventory, options for prevention and removal, as well as tools and resources to utilize for their plan.

AIS Stream Monitoring training- New Zealand mudsnails
New Zealand mudsnails quickly became a hot topic in 2013 with their discovery in Dane County. We participated in discussions about how to best monitor for New Zealand mudsnails throughout Wisconsin, and conducted monitoring activities in streams across our region. No New Zealand mudsnails were detected during our monitoring activities. We also assisted other AIS staff with examination of substrate samples from Wisconsin streams to look for presence of New Zealand mudsnails. Only samples from Black Earth Creek in Dane County have contained New Zealand mudsnails.

7. **Point Intercept surveys for high-needs lakes.** No point-intercept surveys were requested by lake groups during this project period.

8. **Survey purple loosestrife biocontrol sites.** Starting in 2001, Golden Sands RC&D began participating in the statewide effort to teach volunteers how to raise biological control beetles for purple loosestrife. As part of that effort, sites were photographed and documented to establish baseline documentation about the populations. In 2013, staff went back to these sites, located in various counties, and re-surveyed and photographed those populations. Also surveyed were a selection of new sites in the project area, those most easily accessible and publicly visible, to establish baseline data at these sites. **Appendix 5** includes the report on all the sites surveyed.

9. **Education/outreach program.** Take AIS lessons into class rooms. Public education via public speaking opportunities. Equip volunteers to present AIS info/lessons to citizens and youth. Distribution of AIS materials to lake groups for dissemination. Write news blurbs for local newspapers and newsletters. Provide a display/informational booth at events, as requested. Golden Sands staff hosted, planned, or participated in **22 AIS outreach and education events**. Outreach was also conducted in the form of polls and AIS handouts as well. Multiple news releases were written and printed for various projects, events, and pertinent AIS information.

New AIS Handouts
20 new handouts were created, addressing a need for a set of concise, easy-to-read informational materials on common AIS of Wisconsin. These handouts are available for free download on our website, and are attached to this document in **Appendix 6.**

Little Plover River kids day
Fifth grade students from multiple schools in the Plover area gathered for a field day to explore and learn about different aspects of the Little Plover River ecosystem. From investigating invertebrates, learning to fly fish, exploring groundwater, or learning about invasive species, students had many

different activities in which to participate.

DC Everest School Forest Kids Day

Kaycie was invited to speak at DC Everest School Forest for their outdoor summer class. Students ranging from first to sixth grade spent the morning with Kaycie learning about plants, animals, and their effect on the ecosystem. Students had learned a small amount about invasive species prior to the class and really retained and used the information to answer questions about ways to stop the spread of invasive species, as well as how to identify certain plants and animals.

McDill Pond Days

Kaycie and Paul participated in McDill Pond's celebration of their lake. Maps of the lake and its invasive species were provided, along with live specimens for people to learn about. Both Kaycie and Paul hosted trips around the lake in pontoon boats, speaking about how the lake had changed, and what invasive species were still threats and how to identify and monitor for them. Over 200 people were in attendance.

Waterfowl Hunters Conference

Kaycie was invited back to speak for the second year on invasive species, their impacts to waterfowl, and ways that waterfowl hunters can prevent their spread. Efforts by DNR and AIS coordinators around the state are growing for a comprehensive prevention steps for waterfowl hunters. The beginning of this process took place by creating and distributing a survey for waterfowl hunters. AIS educational signs also were designed for waterfowl hunters, and they went up at Mead & McMillan Wildlife Areas.

AIS are on display at the Waterfowl Hunters Conference.

Central Waters Brewery Bash

Golden Sands provided an AIS education booth at this local event that features local organizations and businesses. Over 100 people attended this event in 2013.

Trigs Day

Golden Sands hosted a booth at the local grocery store, selling brats, and giving away AIS materials and information. Live specimens and keychains with watchcards got people's attention and many questions were answered about AIS in the surrounding area.

County Land and Water Conservation Department meetings

Both Kaycie and Paul presented at County Land and Water Conservation Department meetings on activities Golden Sands offered, what work was expected for the season, where assistance was needed, and avenues of outreach throughout the county. Paul also presented at the Marathon County Lakes forum meeting.

Wisconsin Lakes Convention

Several oral presentations, poster presentations, and workshops on AIS and milfoil weevils were presented at the 2013 and 2014 Wisconsin Lakes Conventions.

UW-Stevens Point Guest Lectures

Golden Sands was asked to conduct several guest lectures on AIS at UWSP, to groups including the Students for Wetland Awareness, Management, and Protection; American Water Resources

Association; the Plant Communities of the Upper Midwest class; and the Invasive Species class.

Earth Day Port Edwards
An aquatic invasive species lesson was given as a part of the Earth Day Celebration that Port Edwards has every year. Live samples were brought and children were showed how invasive species can affect them, and how to prevent the spread of AIS.

AIS Outreach at Trappers Convention
An important portion of outreach involving AIS is hunters and trappers. Kaycie was part of a growing statewide effort to reach out to these user groups and give them information on prevention and containment of invasive species while hunting and trapping. Kaycie worked with local trappers to develop cleaning techniques, and alternatives to utilize to prevent spreading invasive species. Thousands of people attended the convention, and hundreds of people were engaged in the setup presented.

Boston School Forest AIS Removal Activity
Paul conducted a lesson on AIS at Boston School Forest in Portage County, to educate 4th graders about the effects of aquatic invasive species in Wisconsin. Following the indoor activity, the group went down to the pond within the school forest to remove several small patches of reed canary grass that were invading the shallow water. The kids removed these plants by hand by simple hand-pulling. Students throughout the season continued to hand remove any plants that came back.

Students remove reed canary grass at Boston School Forest in Portage County.

CBCW/CLMN Train the Trainer meetings
Golden Sands RC&D staff attended the Train the Trainer meetings for the Clean Boats, Clean Waters and Citizen Lake Monitoring Network programs. Golden Sands was also asked to train the audience on identification of AIS and native look-alike species. This presentation was also requested at the statewide AIS LTE training workshops, organized by UW-Extension Lakes.

Water's Edge
Golden Sands RC&D assisted with the planning and implementation of "Water's Edge: A Celebration of Central Wisconsin Waters". This event aimed to educate residents of Central Wisconsin about the importance of groundwater and surface water, and to inform them of the threats facing those water resources.

Ace Hardware-Schofield Site Visit
We visited the Ace Hardware store in Schofield to investigate a report of Brazilian waterweed (Egeria densa) being sold in their pet supplies section. This report was confirmed, and the current NR40 rules were discussed with the manager. All Brazilian waterweed plants were immediately removed from the tanks and thrown in the garbage. The store was visited again several months later, and no Brazilian waterweed was observed in their aquaria.

DC Everest AIS Lesson Planning
Golden Sands staff met with a teacher from DC Everest High School to walk along the Eau Claire River and determine the best locations to teach a class about AIS. The goal of the lesson was to allow the

students to capture AIS and identify them.

Aquatic Invasive Plant Identification Training

Paul was requested to provide a presentation on aquatic invasive plants as part of the WDNR's aquatic plant identification training in Lake Tomahawk in both 2013 and 2014. Species such as Eurasian watermilfoil, Brazilian waterweed, Hydrilla, flowering rush, and others were included. A similar presentation was also given at WDNR's AIS Early Detection training workshop.

AIS volunteer poll

Golden Sands staff created an online poll to ask lake residents about their opinions on early detection and removal trainings. The overwhelming majority expressed that they learned a great deal from the trainings. They also said that they felt much more comfortable removing invasive species when a Golden Sands staff member showed them how to conduct the removal the first time. Without the staff working with them the first time, many respondents said they probably would not have felt comfortable removing the invasives, for fear they weren't doing it correctly.

AIS display/informational booth with live samples, educational materials, as well as many free fun items for kids and attendees was stationed at the following events:

Celebrate Amherst
Lake Fair AIS booth
Wisconsin Wetlands conference
Farm Technology days
Local Food Fair

10. **Assist lake residents as needed.** Connect lake residents with needed technical, planning, and grant proposal support. Provide technical and training support needed to fulfill their DNR-approved AIS Plans.

Lake Emily Post-treatment EWM Survey Request

A post-treatment EWM survey was conducted on Lake Emily, Portage County at the request of the lake association. A map was created to display the distribution of EWM throughout Lake Emily.

Mayflower Lake AIS Survey Request

A resident from Mayflower Lake requested a survey of the lake to document the distribution of EWM and CLP. A survey was conducted via kayak, but the area of reported "EWM" was northern watermilfoil (*Myriophyllum sibiricum*), and the areas reported to contain CLP only contained native pondweeds, including clasping-leaf pondweed (*Potamogeton richardsonii*), which the lake district had mis-identified.

Eurasian Watermilfoil Mapping and Removal

Eurasian watermilfoil in several local lakes has been monitored by Golden Sands RC&D, and pioneer populations have been removed via manual methods. Rocky Run Pond in Portage County has been free of EWM since 2011, and has been officially removed from the WDNR's list of EWM-infested lakes. Collins Lake in Portage County contains a small amount of EWM, and has been mapped each year since 2009. Golden Sands has worked with lake residents and community members to remove EWM from Lake Collins and Lime Lake, but a small number of plants continue to be found each year.

Lake Emily survey and permit assistance

Golden Sands staff arrived at Lake Emily to survey Eurasian watermilfoil to gauge the amount of effort needed to remove it. A manual removal was suggested and a training session was offered to the lake group. The Lake Association chose to go with a chemical treatment. Golden Sands staff assisted in the

permitting process for the lake association's application for an herbicide permit on Lake Emily.

11. **Improve and update public access maps.** Land Conservation and Zoning staff from each county continue to search for and document additional public access locations and plot them on their public access maps.

12. **Annual review and update of County AIS Plans.** County AIS plans were reviewed by Golden Sands and updates were discussed with the respective county staff. Each county's AIS Management Plan has been updated with current AIS distribution lists and emerging issues.

13. **Work Party "Hit List".** AIS incident reports have been compiled into a prioritized "hit list" for volunteer work parties. A list was developed of efforts put forth for each lake, whether a manual removal, or a comment to contact the landowner in the spring, this spreadsheet makes listing goals and follow-up more streamlined and helps target priority lakes. Golden Sands staff coordinates work parties to "hit" those sites, one by one.

14. **Smart Prevention Promotion.** The Smart Prevention model and suitability maps were promoted to lake groups, and links to the Smart Prevention program website were shared with our local lake groups.

15. **Outreach to bait dealers and garden centers.** In 2011, the Department of Natural Resources (DNR) started a statewide initiative to provide AIS outreach and education both for and through licensed Wisconsin bait dealers. Each bait shop would receive a visit from an AIS coordinator who would give them informative AIS and bait brochures, along with giveaway items for their customers. Cooperating bait shops would receive a certificate of cooperation, as well as have their name listed in an article about the topic for Outdoor News.
    Out of the 28 bait shops that cooperated with the program in 2012, we were able to contact and supply information to 11 of them in 2013. The other shops had outdated contact information, were out of business, did not currently sell live bait, were closed much of the season, or were wholesale only. The rest of the shops remaining had expressed an initial interest, but then decided not to put out the information. In addition to the licensed bait dealers provided by the DNR, there are also places such as Kwik Trip which sell bait. Those locations were visited again in 2013. (Cooperating bait shops are listed in **Appendix 7**)

16. **Assist DNR with Early Detection and Monitoring Surveys.** Golden Sands staff assisted DNR with point-intercept surveys on McDill Pond, Portage County, and Wadley Lake, Marathon County. These surveys were conducted to document the post-drawdown distribution of EWM in McDill pond and assess the efficacy of the EWM herbicide treatment in Wadley Lake.
    Golden Sands staff also assisted UWSP with a point-intercept survey of Lake Joanis in Portage County. This survey was being conducted as part of a milfoil weevil research project.

17. **Assist DNR with new AIS sign installations.** Landing signs are inventoried annually by AIS interns, as well as county staff. New signs have been installed where they were needed. Trout stream sign installation began in 2012, and has continued throughout each county.

18. **Engage Enforcement.** A collaboration of staff and local law enforcement was formed to host a group check. Many boaters were seen on this day, and Golden Sands will continue to offer group checks in the area.

MARATHON COUNTY

1. **Collaborate with Lake Management Plan Project.** Marathon County received a grant to write lake management plans for 15 public access lakes in the county over two years. AIS activities will be part of these plans. The Regional AIS Program will continue to assist in coordinating and carrying out the needed volunteer trainings.

2. **Monitor Plover River at Hatley.** The Plover River at Hatley has been identified by U.S. Army Corps of Engineers as a potential pathway/connection between the Great Lakes and Mississippi River basin during flood stages (i.e. Asian carp). Golden Sands staff surveyed this area of the Plover River, and found rusty crayfish, banded mystery snails, purple loosestrife, and aquatic forget-me-not.

PORTAGE COUNTY

1. **Update AIS inventory, 2012.** Surveys of all public access lakes in all five counties have been completed in past years. Updated surveys are due for Portage County in 2012. Update records accordingly in SWIMS. Maps and plant lists are provided in **Appendix 8**.

2. **Collaborate with Lake Management Plan Project.** Portage County received a grant to write lake management plans for 29 lakes in the county over two years. AIS activities are part of these plans. The Regional AIS Program will continue to assist in coordinating and carrying out the needed volunteer trainings.

WOOD COUNTY

1. **Rusty crayfish trapping as an educational program.** Golden Sands worked with Tracy Arnold and the Pittsville High School to give a lesson on Rusty Crayfish biology, and their effects on waterways, especially the Yellow River. Students set and bait traps to capture the crayfish in an attempt to test how successful the trapping method is for crayfish reduction. They measure the crayfish, and sex them. The students are eager to participate in this experiment each year, although a few waders do get flooded.

The Yellow River near Pittsville High School is the trapping location the students use.

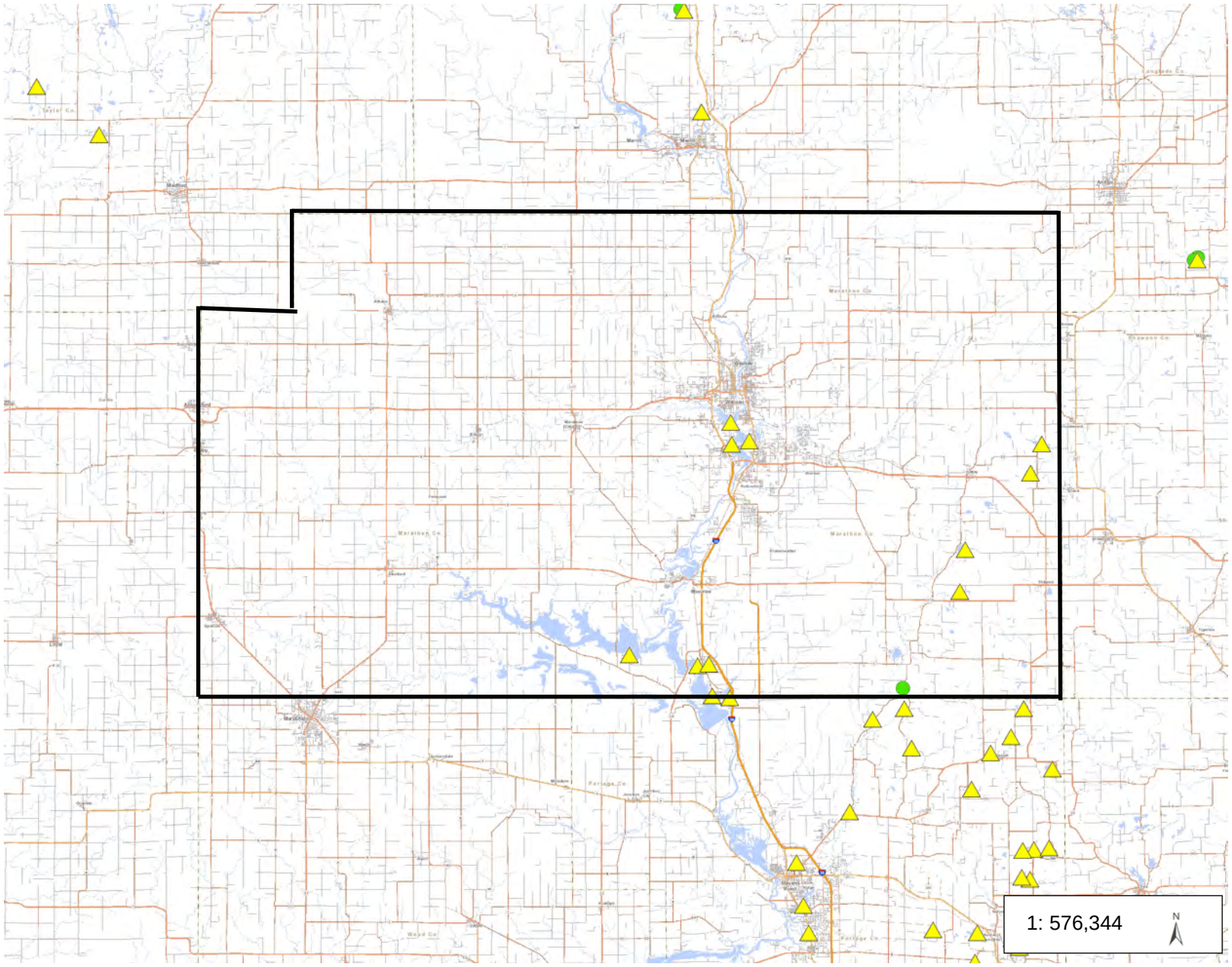
2. **Lake cleanup day.**
Golden Sands hosted a lake cleanup day in the spring at Lake Nepco in Wood county. Citizens were invited to help pick up trash in and around the lake, present AIS booth with invasive and native plant displays. Since Wood County has no lake groups, this event was used to gather citizen support for Wood County lakes.
Over 20 volunteers and local residents gathered at Nepco County Park, next to the boat landing to participate in a park/lake cleanup. Volunteers came both in kayak, dive gear, and on foot to pick up bags and bags of garbage both in the lake and along the shorelines. The local newspaper came out and joined and interviewed volunteers during the cleanup day as well! Volunteers who came out for the cleanup have continued to be involved in AIS events throughout Wood County.

Volunteers on foot, kayak, and in dive gear cleaned up trash from Lake Nepco.

3. **AIS surveys in Wood County**
AIS surveys were conducted on all Wood County Lakes in 2013. Updated maps and summary reports are provided in **Appendix 9.**

Appendix 1

Marathon County CLMN and CBCW Volunteers



Legend

- Volunteer Water Quality Monit
- Watercraft Inspection Sites (Vo

Notes

18.2 0 9.10 18.2 Miles

NAD_1983_HARN_Wisconsin_TM

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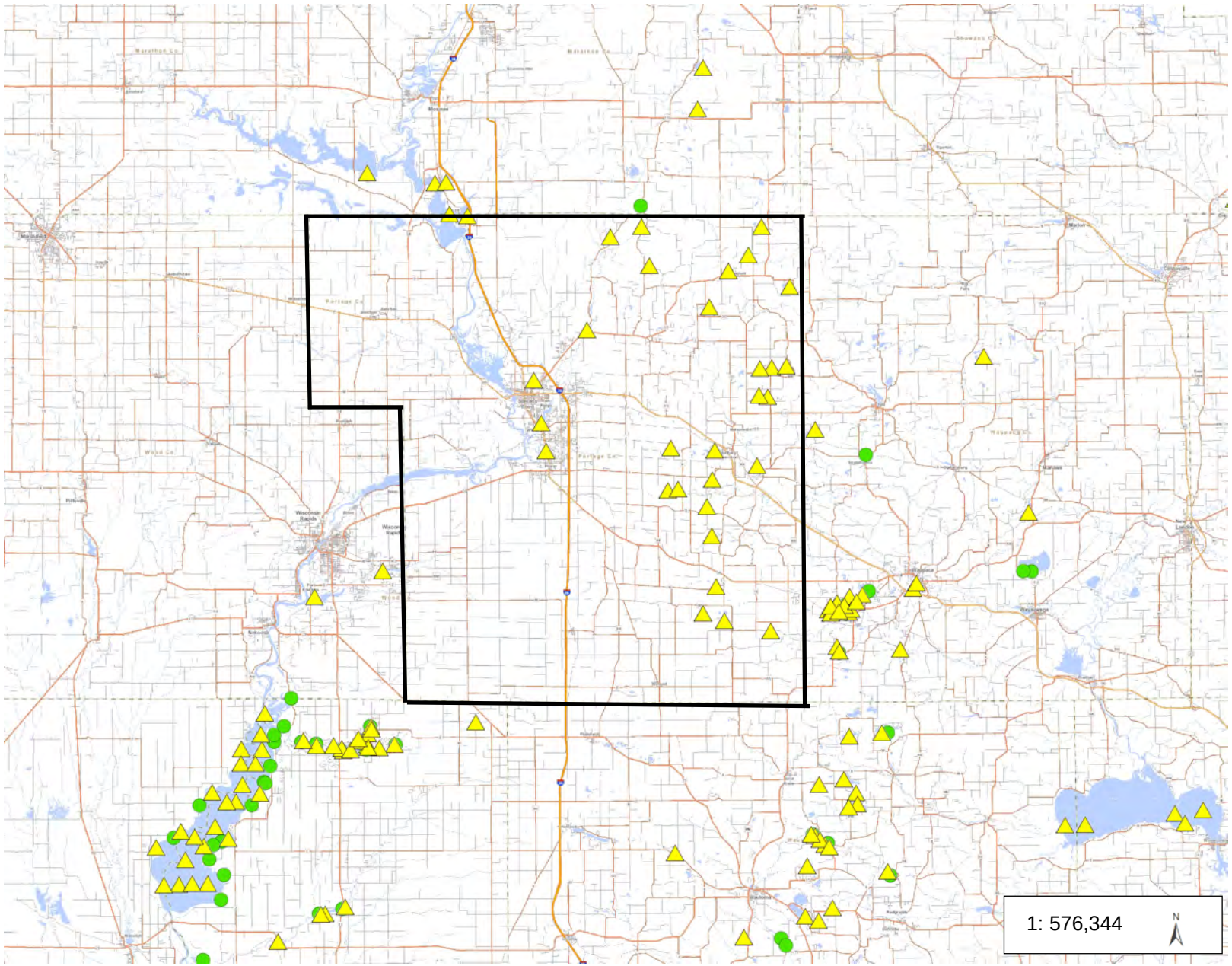
Portage County CLMN and CBCW Volunteers



Legend

- Volunteer Water Quality Monit
- Watercraft Inspection Sites (Vo

Notes

18.2 0 9.10 18.2 Miles

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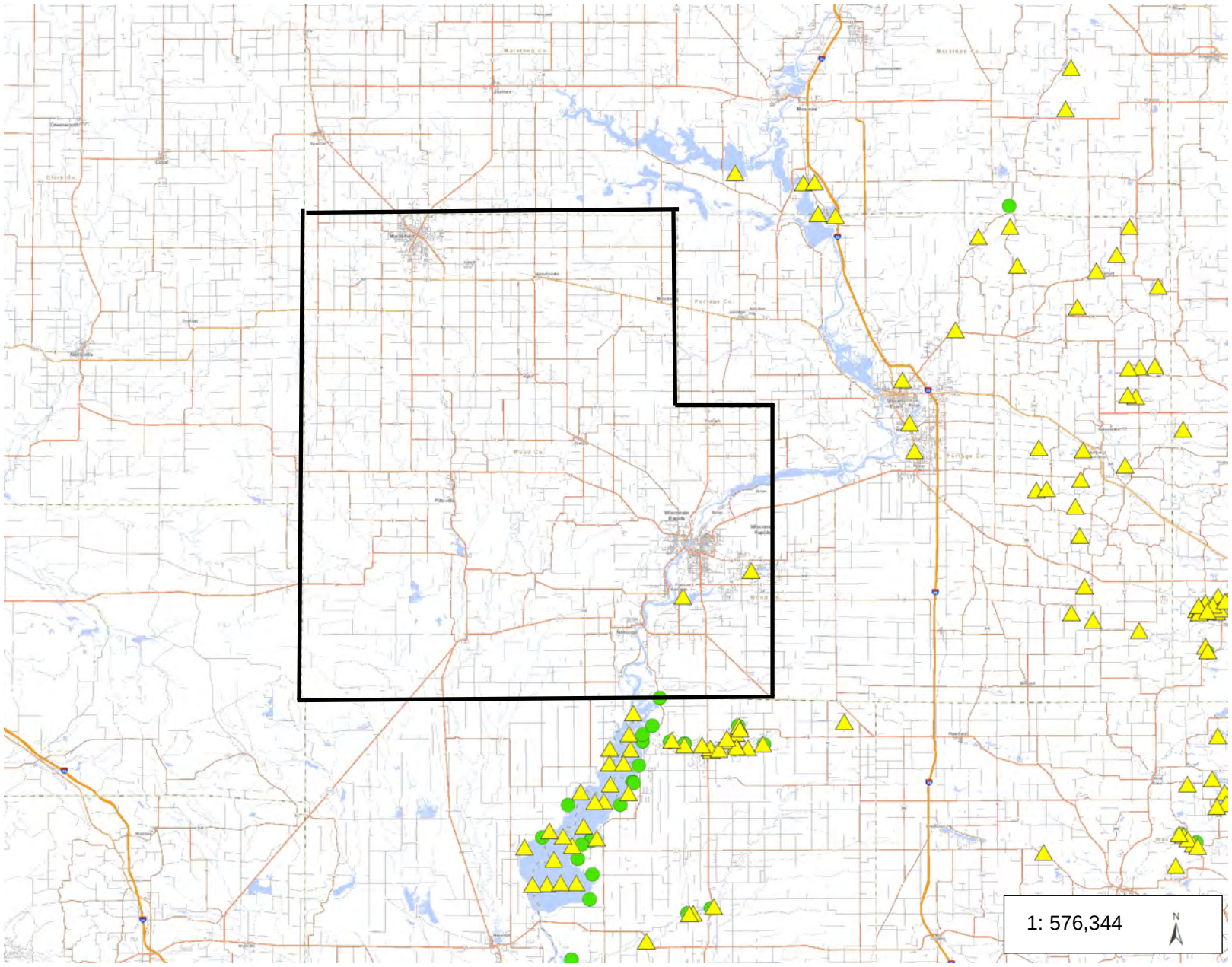
Wood County CLMN and CBCW Volunteers



Legend

- Volunteer Water Quality Monit
- Watercraft Inspection Sites (Vo

Notes

18.2 0 9.10 18.2 Miles

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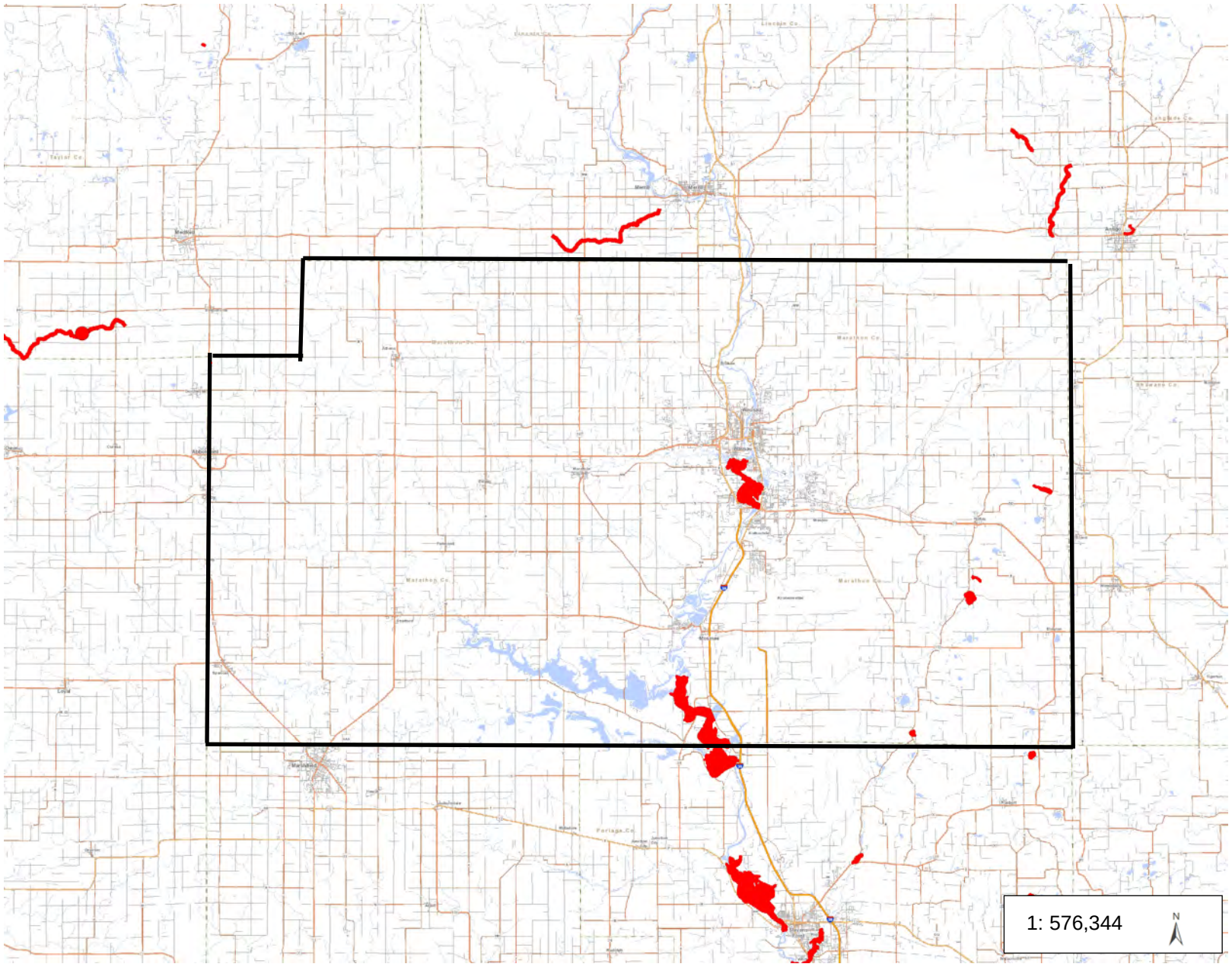
Appendix 2

Marathon County Curly leaf Pondweed



Legend

- Curly-Leaf Pondweed Points
- Curly-Leaf Pondweed Lines
- Curly-Leaf Pondweed Areas

1: 576,344

N

Notes

18.2 0 9.10 18.2 Miles

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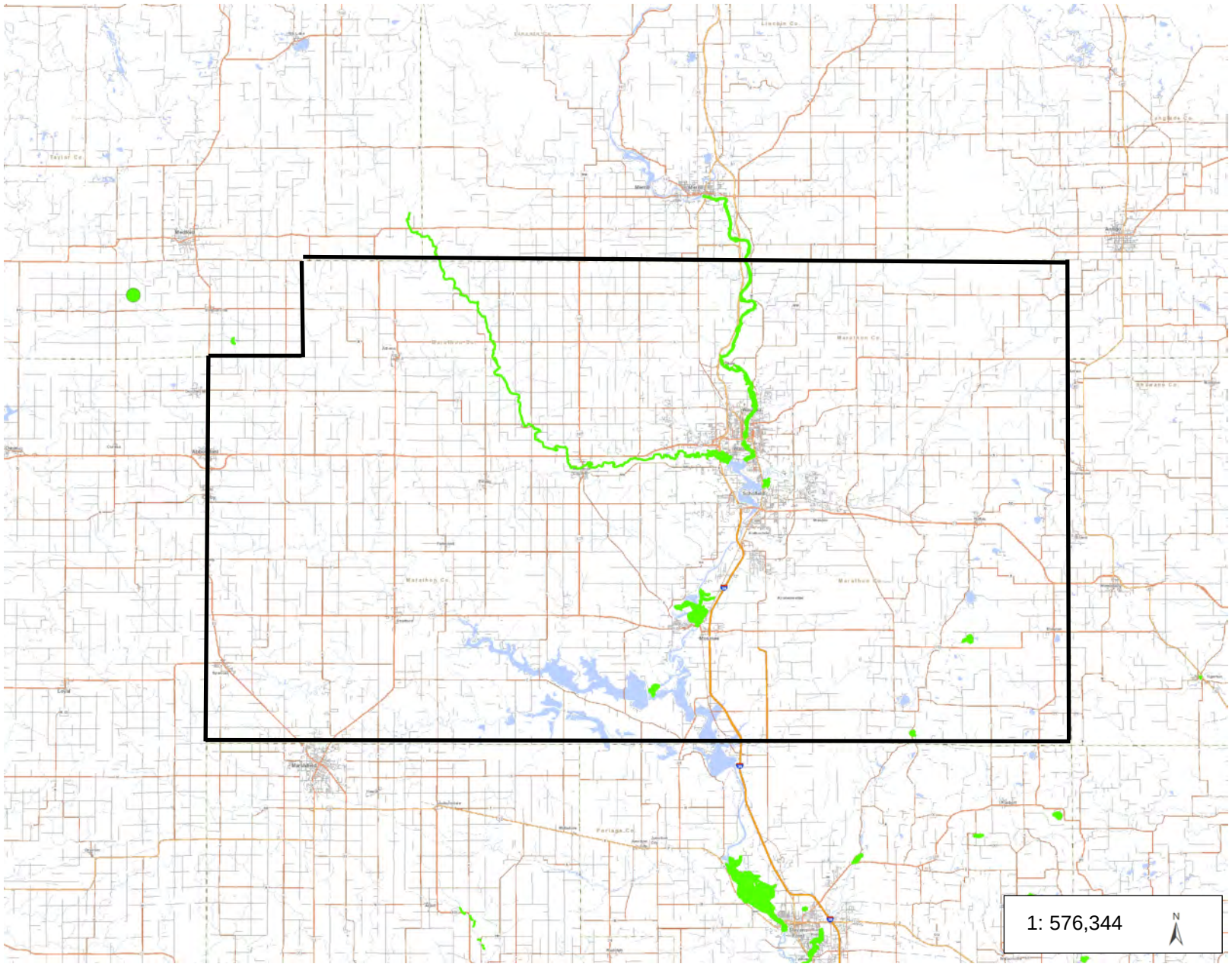
Marathon County Eurasian Watermilfoil



Legend

- Eurasian Water-Milfoil (include Points
- Eurasian Water-Milfoil (include Lines
- Eurasian Water-Milfoil (include Areas

1: 576,344

N

Notes

18.2 0 9.10 18.2 Miles

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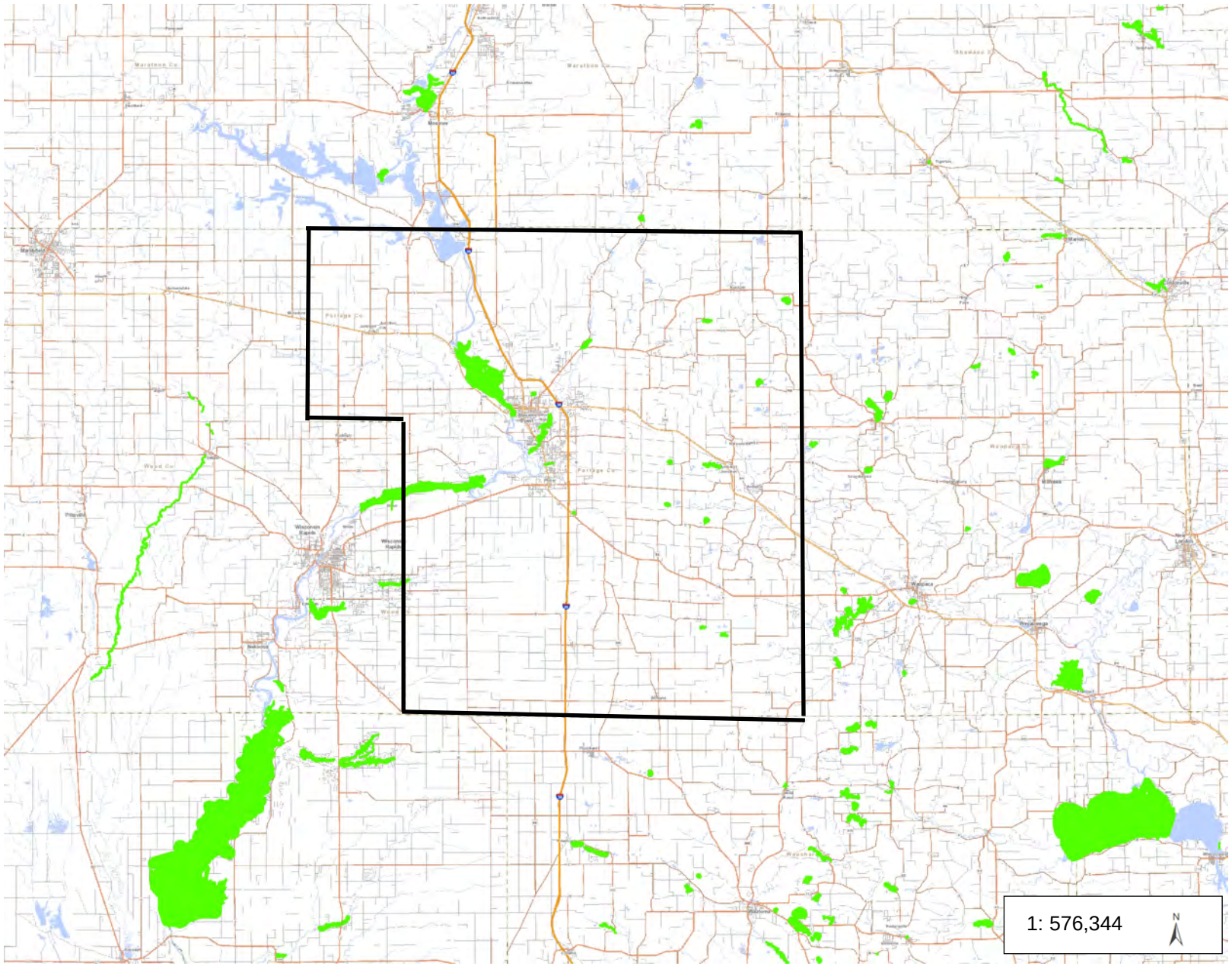
Portage County Eurasian watermilfoil



Legend

- Eurasian Water-Milfoil (include Points
- Eurasian Water-Milfoil (include Lines
- Eurasian Water-Milfoil (include Areas

1: 576,344

N

Notes

18.2 0 9.10 18.2 Miles

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Portage County Curly leaf Pondweed

Legend

- Curly-Leaf Pondweed Points
- Curly-Leaf Pondweed Lines
- Curly-Leaf Pondweed Areas

1: 576,344

N

18.2 0 9.10 18.2 Miles

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Notes

Wood County Curly leaf Pondweed

Legend

- Curly-Leaf Pondweed Points
- Curly-Leaf Pondweed Lines
- Curly-Leaf Pondweed Areas

1: 576,344

N

18.2 0 9.10 18.2 Miles

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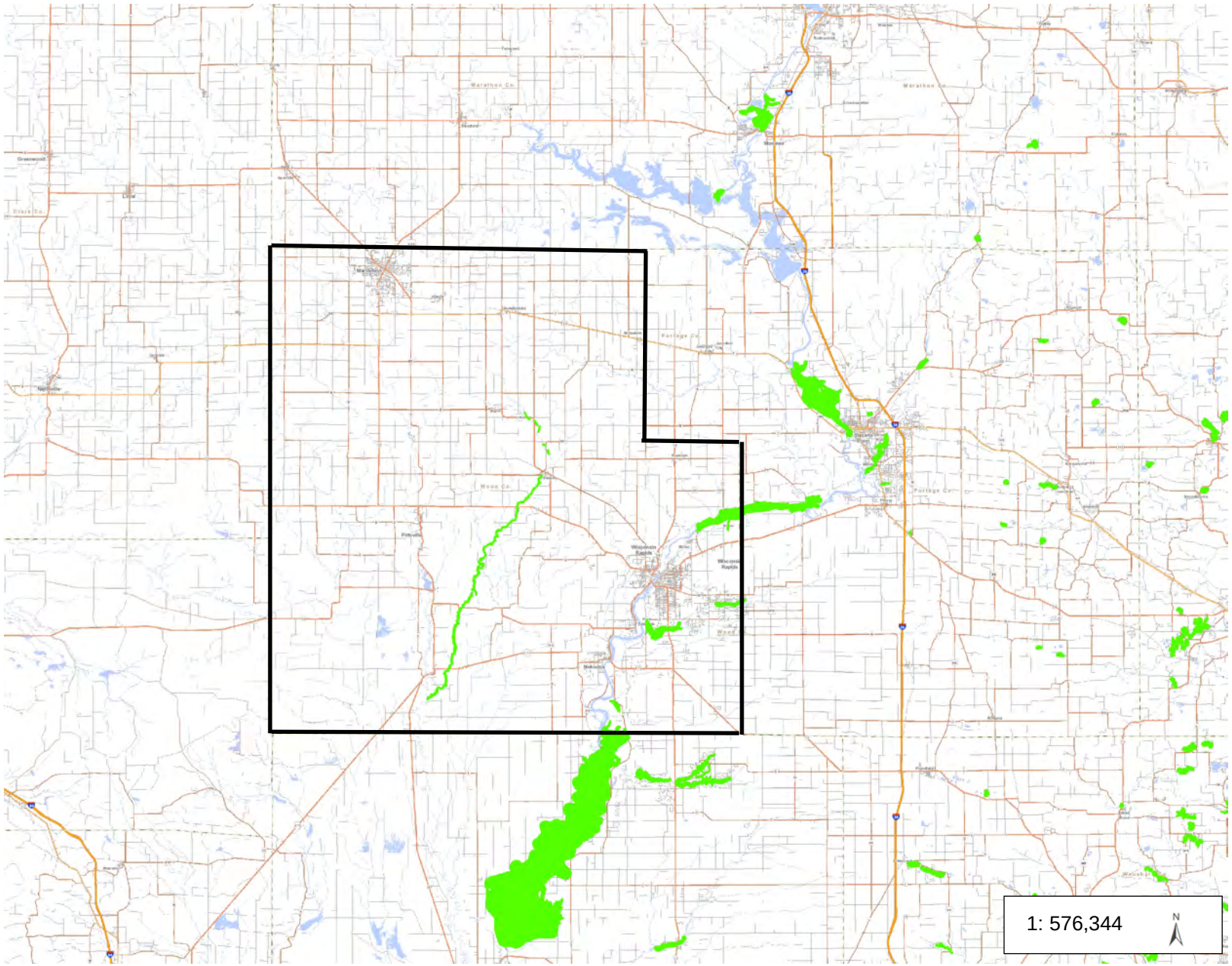
Notes

Wood County Eurasian Watermilfoil



Legend

- Eurasian Water-Milfoil (include Points
- Eurasian Water-Milfoil (include Lines
- Eurasian Water-Milfoil (include Areas

Notes

18.2 0 9.10 18.2 Miles

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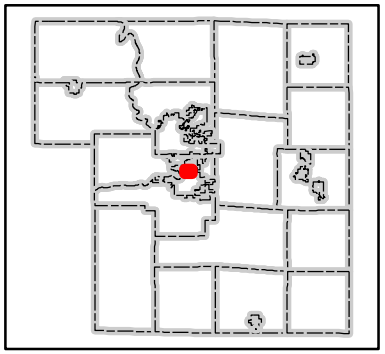
Appendix 3

Springville Pond Eurasian Water Milfoil and Weevils



Eurasian Water Milfoil

- Rake fullness ranking 1
- Rake fullness ranking 2

Collected August 8, 2013
with a Garmin GPSmap 62st
by Amy Thorstenson

Date of Photography: March 2010

Milfoil Weevil Whole Lake Average = 2.47 N/stem
(Individual bed averages indicated on map above)

Location:
Village of Plover
Town 23N Range 08E Section 15
Portage County, Wisconsin

Feet
0 100 200 300
Printed: July 29, 2014

Appendix 4

AIS Reported as of 2014

MARATHON COUNTY		
Waterbody Name	**WBIC**	**Invasive Species**
Big Bass Lake	1405200	Banded Mystery Snail
Big Rib River	1451800	Eurasian Water-Milfoil,Rusty Crayfish
Eau Claire Flowage	1437800	Chinese Mystery Snail,Eurasian Water-Milfoil
Flume Creek	286600	Rusty Crayfish
Johnson Creek	1424900	Rusty Crayfish
Lake Du Bay	1412200	Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Rusty Crayfish
Lake Wausau	1437500	Curly-Leaf Pondweed
Little Rib River	1451900	Rusty Crayfish
Little Trappe River	1470800	Rusty Crayfish
Lost Lake	1407000	Chinese Mystery Snail
Mayflower Lake	310500	Chinese Mystery Snail,Curly-Leaf Pondweed,Purple Loosestrife
Mission Lake	1005400	Banded Mystery Snail,Chinese Mystery Snail,Eurasian Water-Milfoil,Purple Loosestrife
Pike Lake	1406300	Banded Mystery Snail,Curly-Leaf Pondweed,Rusty Crayfish
Plover River	1402800	Rusty Crayfish
Rice Lake	1406500	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed
South Branch Embarrass River	305600	Rusty Crayfish
Spring Brook	1440800	Rusty Crayfish
Trappe River	1470700	Rusty Crayfish
Wadley Lake	1177600	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Rusty Crayfish
Wausau Dam Lake	1469700	Eurasian Water-Milfoil
Wisconsin River	1179900	Eurasian Water-Milfoil,Rusty Crayfish

AIS Reported as of 2014

PORTAGE COUNTY		
Waterbody Name	**WBIC**	**Invasive Species**
Adams Lake	267800	Banded Mystery Snail
Amherst Millpond	268200	Banded Mystery Snail,Curly-Leaf Pondweed,Rusty Crayfish
Bear Lake	181900	Chinese Mystery Snail,Eurasian Water-Milfoil
Biron Flowage	1396900	Eurasian Water-Milfoil
Collins Lake	270200	Chinese Mystery Snail,Eurasian Water-Milfoil
Ebert Lake	267700	Banded Mystery Snail
Flume Creek	286600	Rusty Crayfish
Fountain Lake	262200	Banded Mystery Snail
Jordan Pond	1403600	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil
Lake Du Bay	1412200	Chinese Mystery Snail,Curly-Leaf Pondweed,Rusty Crayfish
Lake Emily	189800	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Hybrid Eurasian / Northern Water-Milfoil,Rusty Crayfish
Lake Helen	287200	Eurasian Water-Milfoil
Lake Joanis	3000096	Chinese Mystery Snail,Eurasian Water-Milfoil,Freshwater Jellyfish
Lake Lime	190100	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil
McDill Pond	1403200	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Hybrid Eurasian / Northern Water-Milfoil,Japanese Knotweed,Rusty Crayfish
Mosquito Creek	1396600	Rusty Crayfish
Onland Lake	195100	Banded Mystery Snail
Pac-A-Wa Lake	1009300	Eurasian Water-Milfoil
Peterson Creek	275400	Viral Hemorrhagic Septicemia
Pickerel Lake	195900	Banded Mystery Snail,Eurasian Water-Milfoil,Phragmites (non-native)
Plover River	1402800	Curly-Leaf Pondweed,Rusty Crayfish
Plover River Flowage	1403000	Curly-Leaf Pondweed,Eurasian Water-Milfoil
Rinehart Lake	278600	Banded Mystery Snail
Sannes Creek	276000	Viral Hemorrhagic Septicemia
Spring Lake	267200	Banded Mystery Snail,Curly-Leaf Pondweed
Springville Pond	1402300	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Japanese Knotweed,Rusty Crayfish,Water Lettuce
Stoltenburg Lake	199400	Banded Mystery Snail
Sunset Lake	199700	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil

AIS Reported as of 2014

PORTAGE COUNTY		
Waterbody Name	**WBIC**	**Invasive Species**
Thomas Lake	200300	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil
Tomorrow River	270400	Purple Loosestrife
Tree Lake	289400	Banded Mystery Snail,Chinese Mystery Snail,Curly-Leaf Pondweed
Unnamed	267600	Banded Mystery Snail
Waupaca River	257400	Banded Mystery Snail,Purple Loosestrife,Rusty Crayfish
Wazeecha Lake	1391200	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Rusty Crayfish,Zebra Mussel
Wisconsin R Fl C3-Stevens Pt	1409400	Curly-Leaf Pondweed,Eurasian Water-Milfoil
Wisconsin River Flowage Number 1 51	1402700	Curly-Leaf Pondweed
Wolf Lake	241100	Banded Mystery Snail,Eurasian Water-Milfoil,Purple Loosestrife

AIS Reported as of 2014

WOOD COUNTY		
Waterbody Name	**WBIC**	**Invasive Species**
Biron Flowage	1396900	Eurasian Water-Milfoil
Cranberry Creek	1354800	Rusty Crayfish
Dexter Lake	1369900	Chinese Mystery Snail,Curly-Leaf Pondweed
Hemlock Creek	1366300	Eurasian Water-Milfoil
Lake Kaunewinne	1371900	Rusty Crayfish
Moccasin Creek	1388000	Rusty Crayfish
Mosquito Creek	1396600	Rusty Crayfish
Nepco Lake	1389800	Chinese Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Purple Loosestrife,Rusty Crayfish,Zebra Mussel
Petenwell Lake	1377100	Eurasian Water-Milfoil,Zebra Mussel
Puff Creek	1371500	Rusty Crayfish
Ross Lake	1382900	Eurasian Water-Milfoil
Unnamed	5585354	Curly-Leaf Pondweed
Unnamed T21n R06e S06-10cb	1388800	Curly-Leaf Pondweed
Wazeecha Lake	1391200	Banded Mystery Snail,Curly-Leaf Pondweed,Eurasian Water-Milfoil,Rusty Crayfish,Zebra Mussel
Wisconsin Rapids Flowage	1396200	Rusty Crayfish
Wisconsin River	1179900	Zebra Mussel
Yellow River	1352800	Rusty Crayfish

Appendix 5

Waupaca County - Year 2001

New London High School Site #1

Site Location

- **Take U.S. route 10 East of Stevens Point**
- **Turn left on county route W and go past Readfield**
- **You will pass New London High school**
- **Take a left onto Klatt Rd.**
- **The site is located just West of the school right in front of the woodlot.**

Site Survey Data

Table 1. Insect Release History

Date of Release:	August 2001
Weather:	Sunny
Number/Stage of Beetles:	Approx. 7,500 Pupae/Adults

Table 2. Survey Data from Year 2003

Date of Survey:	July 2003
Number of Purple Loosestrife Plants:	1-10
Density of Purple Loosestrife Plants:	Sparse
Amount of Feeding Damage:	None Visible
Weather:	80°

Table 3. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	26-50%
Wetland Location/Type:	Roadside
Beetle Damage:	N/A

Waupaca County - Year 2001

New London High School Site #2

Site Location

- **The site is located on state route 54 west of U.S. route 45.**
- **Look for the stake located on the north side of the road.**

Site Survey Data

Table 1. Insect Release History

Date of Release:	July 2001
Weather:	Dry
Number/Stage of Beetles:	Approx. 1,500 Pupae/Adults

Table 2. Survey Data from Year 2003

Date of Survey:	July 2003
Number of Purple Loosestrife Plants:	1-10
Density of Purple Loosestrife Plants:	Sparse
Amount of Feeding Damage:	Non Visible
Weather:	Sunny 80°

Table 3. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	Less than ½ acre
Number of Purple Loosestrife Plants:	11-49
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Roadside
Beetle Damage:	N/A

Adams County - Year 2002

Adams Friendship Middle School Release Site

Site Location

- **Take state route 13 south of Wisconsin Rapids.**
- **When you reach county route C go west.**
- **When driving on county route C turn left when you reach a blue sign stating "Petenwell County Park" which is at a 4 stop intersection (road turns to gravel).**
- **Where the road curves is where the beetles were released.**
- **The stake is across the street from the release site.**

Site Survey Data

Table 1. Insect Release History

Date of Release:	August 2002
Weather:	Unknown at Present Time
Number/Stage of Beetles:	Approx. 15,000 Pupae/Adults

Table 2. Survey Data from the Year 2003

Date of Survey:	August 2003
Number of Purple Loosestrife Plants:	11-49
Density of Purple Loosestrife Plants:	Dense
Amount of Leaf Damage:	None Visible
Weather	Sunny-85°

Table 3. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Ditch
Beetle Damage:	Plants no longer dense as previous survey suggested

Marquette County - Year 2002

Marquette County Land Conservation Department Site #1

Site Location

- **Take interstate 39 South of Stevens Point.**
- **Exit at state route 23 towards Montello.**
- **The site is located on 23 between 11th drive and Fern Avenue before the Montello city limits.**
- **The exact location is where the road curves on the North side of state route 23.**

Site Survey Data

Table 1. Insect Release History

Date of Release:	July 24th 2002
Weather:	Sunny, Hot
Number/Stage of Beetles:	Unknown at Present Time

Table 2. Survey Data from Year 2003

Date of Survey:	July 2003
Number of Purple Loosestrife Plants:	11-49
Density of Purple Loosestrife Plants:	Dense with few Sparse
Amount of Feeding Damage:	None Visible
Weather:	75° - Sunny

Table 3. Insect Release History

Date of Release:	July 2003
Weather:	80°-85°
Number/Stage of Beetles:	Unknown at Present Time

Table 4. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	1-10 acres
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Lake / Pond Edge / Ditch
Beetle Damage:	Present; Plants not flowering at time of survey

Portage County - Year 2003

Boston School Forest Site (old 10)

Site Location

- **Take 10 West of downtown Stevens Point**
- **Cross the Hwy 10 Bridge over the Wisconsin River.**
- **The site is located on the left side of the highway, right next to the train tracks across from W. Harding Ave.**

Table 1. Insect Release History

Date of Release:	August 15th 2003
Weather:	Sunny-80°+
Number/Stage of Beetles:	Approx. 15,000 Pupae/Adults

Table 2. Survey Data from Year 2013

North Side

Date of Survey:	August 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	26-50%
Wetland Location/Type:	Roadside
Beetle Damage:	Present

South Side

Date of Survey:	August 2013
Acreage of Infestation:	Less than ½ acre
Number of Purple Loosestrife Plants:	11-49
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Roadside
Beetle Damage:	Lots of damage visible

Waupaca County - Year 2003

Waupaca High School Site #2

Site Location

- **Take U.S. route 10 going east of Stevens Point.**
- **Exit at state route 22 South.**
- **Take route 22 south until you reach Rural Rd. and make a right.**
- **Now drive until you reach Fern Ave. and make another right.**
- **At the end of the road on the shore of Emmons Creek close to where the creek flows into Long Lake is the release site.**
- **The release site is located at N2294 Fern Avenue.**

Site Survey Data

Table 1. Insect Release History

Date of Release:	July 24th 2003
Weather:	85°-90°
Number/Stage of Beetles:	Approx. 4,500 Pupae/Adults

Table 2. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	26-50%
Wetland Location/Type:	Lake /Pond Edge
Beetle Damage:	N/A

Wood County 2011

Rudolph 3rd Avenue site

Site Location

- **Take Highway 66 west from Stevens Point towards Wisconsin Rapids**
- **Take 3rd avenue north past plum road on the left hand side**
- **Approximately 0.5-1 miles past plum road is release site on both sides of the road**

Site Survey Data

Table 1. Insect Release History

Date of Release:	June 30,2006
Weather:	Sunny
Number/Stage of Beetles:	Not recorded (estimated at 4000 in good condition)

Table 2. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	Less than ½ acre
Number of Purple Loosestrife Plants:	1-49
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Roadside
Beetle Damage:	Lots of beetle damage

Portage County

Highway 10 and M Stevens Point

Site Location

- **Take Highway HH(old 10) North from Stevens Point**
- **Where HH intersects highway M is site location on south and north sides of M**

Table 1. Survey Data from Year 2013

Date of Survey:	July 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	26-50%
Wetland Location/Type:	Roadside
Beetle Damage:	Little damage

Portage County

Highway HH (old 10) Intersect with 66 in Stevens Point

Site Location

- **Take Highway 66 West from Stevens Point to Highway HH**
- **At the Highway 66 and HH intersection the site is the South side of 66 and the south side of HH along with**
- **Another site in this location is on the North side of 66 about 50 yards south of the intersection**

Table 1. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Roadside
Beetle Damage:	Present

Portage County

Okray Property on HH (old 10)

Site Location

- **Take Highway 66 west from Stevens Point to Highway HH**
- **At the intersection of 66 and HH head Northwest and cross two smaller bridges over wetlands and on the third bridge the location is on the North and South sides of the Bridge**

Table 1. Survey Data from Year 2013

Date of Survey:	July 2013
Acreage of Infestation:	½ acre – 1 acre
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Roadside
Beetle Damage:	No damage visible

Wood County

Highway M on Paul J. Olson Wildlife Refuge

Site Location

- **Take Highway HH(old 10) North from Stevens Point**
- **Go West on Highway M**
- **Approximately 0.3 miles from highway 34 in Wood County is Site Location**

Table 1. Survey Data from Year 2013

Date of Survey:	August 2013
Acreage of Infestation:	1-10 acres
Number of Purple Loosestrife Plants:	50+
Density of Purple Loosestrife Plants:	0-25%
Wetland Location/Type:	Field
Beetle Damage:	None present; Has not had beetles previously

Appendix 6

Golden Sands
Resource Conservation
& Development Council, Inc.

Aquatic Invasive Species Quick Guide

Asian Clam (*Corbicula fluminea* O.F. Müller)

Description: The shell of the Asian clam is yellowish brown or black, with a polished white or light blue interior. The size of the shell averages about one inch across, but may be over two inches. Ridges on the shell are very pronounced and evenly spaced. Inside each half (valve) of the shell is a serrated lateral tooth and three large teeth at the hinge (see lower photo). Asian clams prefer sandy habitats of lakes and streams, and may be burrowed several inches into the sediment. They require well-oxygenated water with minimal pollution, and consume plankton through filter-feeding.

North American Distribution: Found in at least 43 U.S. states and the District of Columbia. Occurs in Lake Superior and Lake Michigan.

Asian clams are usually less than 1 inch across, but can be up to 2.5 inches.

Asian clams have a yellowish-brown to black shell, with well-defined ridges.

Dispersal Vectors: Native to China, Korea, and southeastern Russia, Asian clams probably arrived in the United States as juveniles in ballast water discharge, or as adults through importation as a food item. They could potentially be spread by anything that has sediment attached, such as boat anchors. Asian clams have also been sold through the aquarium trade. Densities of up to 20,000 per square meter have been observed. Asian clams can self-fertilize, and each individual can release up to 70,000 juveniles in one year.

Ecological Impacts: Asian clams are very successful at outcompeting native mollusks. In areas with very dense populations of Asian clams, fish spawning habitat and aquatic insect populations can also decrease. Costs of repairing Asian clam damage to water intake systems in the United States is estimated at nearly $1 billion per year.

Control Options: In small systems like power plant water intake systems, Asian clams can be controlled by chlorine injection, screening, or a temporary increase in temperature beyond 37 degrees Celsius.

In natural systems, an effective method of control is not yet known. Manual removal of Asian clams is possible, but labor-intensive. Prevention of spread is crucial to minimizing the impact of Asian clams on our native ecosystems. Asian clams and other aquarium pets should never be released into natural waters.

Note: Native fingernail clams look similar, but they are smaller, and lack the well-defined shell ridges and serrated lateral teeth.

Each side of the shell has a serrated lateral tooth (upper arrow), and three large hinge teeth (lower arrow).

Additional Information:

Global Invasive Species Database. *Corbicula fluminea*. http://www.issg.org/database/species/ecology.asp?si=537&fr=1&sts=sss&lang=EN

Foster, A.M., P. Fuller, A. Benson, S. Constant, D. Raikow, J. Larson, and A. Fusaro. 2013. *Corbicula fluminea*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=92

Photo credit: Paul Skawinski

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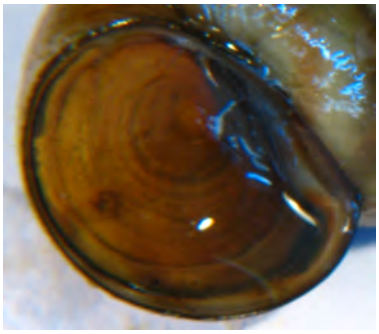
Aquatic Invasive Species Quick Guide

Banded Mystery Snail (*Viviparus georgianus* Lea)

Description: The banded mystery snail is a member of the family Viviparidae. Snails in this family give birth to live young, complete with shells. The shell is up to 1.5 inches tall, and 1-1.5 inches wide. Horizontal brown bands on the shell are visible from outside or inside the shell. A sturdy operculum is able to seal off the shell when the snail feels threatened. A typical life span is 3 years for males and 4 years for females. Mass die-offs of mature banded mystery snails are common in early spring after reproduction. Banded mystery snails occupy silt, marl, muck, and sand substrates.

The banded mystery snail is usually about an inch tall and has distinct horizontal bands.

North American Distribution: Southeastern U.S., lower Mississippi River, the Great Lakes states, northeastern U.S., and Quebec.



Banded mystery snails have a tough plate called an operculum covering the shell opening.

Dispersal Vectors: Banded mystery snails are native to the southeastern U.S. They were first documented in the Great Lakes basin in 1867 when 200 banded mystery snails were intentionally released by a civilian into the Hudson River drainage. Introductions have probably also occurred via the aquarium trade.

Ecological Impacts: Primarily grazes on diatoms, green algae, and fish eggs, but it is also capable of filter-feeding. First- and second-year individuals may be consumed by turtles, fish, and crayfish. Banded mystery snails have been documented at densities as high as 864 individuals per square meter. This species probably competes for food and resources with native snail species, but no serious negative impacts have been documented in its introduced range. It has been identified as an intermediate host to multiple trematode parasites, which have been involved in waterfowl die-offs in the Upper Mississippi River area.

Control Options: Manual removal of banded mystery snails is possible, but probably impractical in most situations.

Several chemical pesticides have been used to control snails in aquaculture ponds, but the banded mystery snail's thick operculum makes it less susceptible to these chemicals. Since most native snails do not have an operculum to seal off their shell, these native species are much more susceptible to pesticides.

An effective biological control agent is not known at this time.

A mass die-off of mature banded mystery snails.

Additional Information:

Eckblad, J.W. and M.H. Shealy, Jr. 1972. Predation on largemouth bass embryos by the pond snail *Viviparus georgianus*. Transactions of the American Fisheries Society. 101 (4): 734-738.

Kipp, R.M., A.J. Benson, J. Larson, and A. Fusaro. 2013. *Viviparus georgianus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1047 Revision Date: 3/12/2013

Photo credit: Paul Skawinski

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BMS-1-14

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Aquatic Invasive Species Quick Guide

Big-eared Radix (*Radix auricularia* L.)

Description: The big-eared Radix (also called European ear snail) has a yellow-tan, conical shell with 4-5 whorls and deep grooves between them. The lowest whorl is several times wider than the other whorls—it holds about 90% of the shell's total volume. The large, ear-shaped shell opening (aperture) is on the right side. The big-eared Radix does not have an operculum. This species can tolerate large fluctuations in water temperature and water level, and can also tolerate periods without oxygen. It prefers shallow, silty habitats, but has been observed in deep, rocky areas. In Great Britain, the species appears to be restricted to hard-water systems.

North American Distribution: Widely scattered in at least 15 U.S. states, and all of the Great Lakes.

The big-eared Radix averages between 1/2 and 1 inch long, and the shell opening is greater than 50% of the shell's height.

Young big-eared Radix are harder to discern from natives, but as they age, their lowest whorl becomes disproportionately larger than the upper whorls.

Dispersal Vectors: This European species is capable of self-fertilization (hermaphroditic) and breeds twice per year. Each snail can produce about 1300 eggs per year, laid in clumps of 50-150 eggs each. Eggs of the big-eared Radix can be transported along with plants, so it may have been introduced to new locations throughout the United States via the aquarium trade. Boats and other equipment moving plant material or mud between water bodies could also transport attached snails.

Ecological Impacts: The big-eared Radix feeds mostly on decaying organic material and algae of the genus *Cladophora*. It is an important host of many trematode parasites, especially the liver flukes *Fasciola gigantica* and *F. hepatica*. Some fishes and turtles feed on the big-eared Radix. Its impacts to native aquatic organism communities are largely unknown.

Control Options: Prevention of spread is crucial. Aquarium plants and animals should never be released into natural waterways.

Manual removal of snails is possible, but probably impractical in most cases. This snail's preference for soft substrates makes it difficult to access them by wading, and snails burrowed into the substrate may be difficult to find.

Niclosamide pesticides are used to control snails, but are not species-selective. They may be effective on the big-eared Radix, but other snails would also likely be harmed by the pesticide.

No effective biological control agent is known at this time.

Additional Information:

Mills, E. L., J. H. Leach, J. T. Carlton and C. L. Secor. 1993. *Exotic species in the Great Lakes: a history of biotic crises and anthropogenic Introductions*. Journal of Great Lakes Research 19(1):1-54.

Kipp, R.M., A.J. Benson, J. Larson, and A. Fusaro. 2013. *Radix auricularia*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1012 Revision Date: 6/11/2012

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RAD-1-14

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Aquatic Invasive Species Quick Guide

Brittle Naiad (*Najas minor* All.)

Description: Brittle naiad is a small, highly branched, submersed annual in the Najadaceae family. It has opposite leaves with tiny teeth on the edges, and are usually curved (especially later in the year). Brittle naiad gets its name from its weak, brittle stems, which fragment easily and serve to disperse fruits that are located in the leaf axils. Under magnification, these fruits have many rows of tiny, rectangular pits in a ladder-like arrangement.

Brittle naiad has been observed growing as deep as 5 meters, and prefers calm, alkaline environments.

North American Distribution: Ontario and the eastern and southeastern United States. One population has been reported from California.

Brittle naiad is highly branched, and leaves are often curved.

Long, elliptical fruits form in the leaf axils.

Dispersal Vectors: Brittle naiad is native to Europe and Asia, and was intentionally introduced to many lakes to increase food for waterfowl, which readily consume its seeds. It may have also been introduced by aquarium dumping into local waterways. Waterfowl can excrete the viable seeds in new areas. Fragments of brittle naiad can cling to boat trailers or equipment such as waders, duck hunting decoys, or even dogs.

Ecological Impacts: Brittle naiad can grow in very dense patches, and can outcompete native vegetation. This species is so aggressive that it has even been known to outcompete two very invasive aquatic plants—Eurasian watermilfoil and Hydrilla. Brittle naiad fruits are a food source for waterfowl.

Control Options: Brittle naiad is difficult to control once it is established. Manual removal of this plant can be difficult, because it easily fragments. Any leftover fragments could potentially produce new plants, especially if they contain fruits.

Mechanical harvesters have been used to remove brittle naiad biomass, but will likely spread the plant further via fragmentation.

Successful chemical control has been achieved with diquat, endothall, and fluridone herbicides. These herbicides can have negative impacts on many native aquatic plant species, so proper timing and dosage is crucial. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

A successful biological control agent is not known at this time.

Brittle naiad readily breaks into small pieces, which help disperse its seeds.

Additional Information:
Global Invasive Species Database. *Najas minor.* http://www.issg.org/database/species/ecology.asp?si=1560&fr=1&sts=tss&lang=EN

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BN-1-14

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Aquatic Invasive Species Quick Guide

Chinese Mystery Snail (*Cipangopaludina chinensis* Reeve)

Description: Chinese mystery snails are often large, up to nearly 3 inches tall. Shells are typically dark brown, and may have some dark vertical ridges near the opening. The lowermost whorl of the shell is usually much wider than the rest of the shell. At the opening of the shell, a thick, hardened plate called an operculum is able to seal the shell against predators or harmful chemicals in the water. Chinese mystery snails are capable of grazing algae from surfaces and filter-feeding on suspended algae particles.

North American Distribution: Scattered across North America, but they are most abundant in the eastern and central United States.

The Chinese mystery snail can be nearly 3 inches tall.

Chinese mystery snails have a tough plate called an operculum covering the shell opening.

Dispersal Vectors: Native to eastern Asia, Chinese mystery snails were first imported to the U.S. in the late 1800s as a food item in oriental markets. It is believed that some people may have "seeded" these snails into local waterways for later harvest. Chinese mystery snails are also introduced to water gardens for the purpose of clarifying the water and grazing algae from hard surfaces. At any time during summer and fall, each female may contain dozens of small snails at different stages of development. She occasionally gives birth to small batches of live young, complete with shells.

Ecological Impacts: Chinese mystery snails likely compete for food and resources with native snails and other grazers or filter-feeders. Some research studies suggest that impacts to native species may be insignificant. Chinese mystery snails serve as a secondary host for a trematode parasite that has been killing large numbers of waterfowl in the Midwestern U.S. Some larger animals like turtles or muskrats may occasionally feed on Chinese mystery snails.

Control Options: Manual removal of Chinese mystery snails remains the only effective method of control. Of course, the effect on the population depends on the number removed and the total population size. These snails prefer mucky, organic sediments, so manual removal is likely to be a difficult option in many areas.

Chemical control efforts tend to be unsuccessful and have unintended consequences to native snails and/or other animals. Chinese mystery snails can seal up their shells with their operculum, protecting them from unfavorable conditions like chemical pesticides. Most North American snails do not have this ability and would be harmed.

Juvenile Chinese mystery snails, just minutes old.

Additional Information:

Dillon, R. T. Jr., M. Ashton, M. Kohl, W. Reeves, T. Smith, T. Stewart & B. Watson 2013. *The freshwater gastropods of North America*. http://www.fwgna.org.

Global Invasive Species Database. *Bellamya chinensis*. http://www.issg.org/database/species/ecology.asp?si=1812&fr=1&sts=sss&lang=EN

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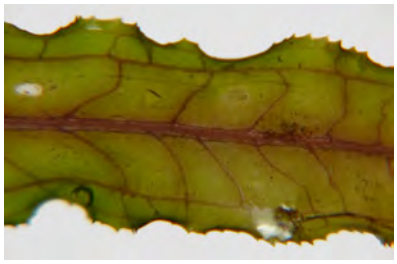
Aquatic Invasive Species Quick Guide

Curly-leaf Pondweed (*Potamogeton crispus* L.)

Description: Curly-leaf pondweed is a non-native, perennial aquatic plant in the Potamogetonaceae family, can grow in very shallow water or down to at least 15 feet deep. Its leaves are alternate with serrated margins, a blunt tip, and 3-5 veins running from the base to the tip. Late in its seasonal life cycle, the leaves become very wavy, but young plants have flat leaves. Curly-leaf pondweed typically dies back in June/July, but may grow year-round if a source of cool water exists nearby. Small, cloning buds (turions) are produced at the tip of the plant and in the leaf axils, which lie dormant through the summer and sprout by the following spring.

Curly-leaf pondweed has alternate, wavy leaves with blunt tips.

North American Distribution: Curly-leaf pondweed has been found across at least 47 U.S. states and most of southern Canada.



Leaves have small teeth on the edges and 3-5 veins running the length of the leaf.

Dispersal Vectors: Curly-leaf pondweed was introduced to North America from Europe in the late 1800s as an aquarium plant. It may also have been introduced during common carp stocking programs. Local spread is by rhizomes and turions. Seed viability in natural systems is typically very low (~0.001%) (Catling and Dobson, 1985). Boats have the potential to move curly-leaf pondweed between water bodies by transporting plants fragments with developed turions attached.

Ecological Impacts: Curly-leaf pondweed can form large, dense beds that sprawl across the surface, often seen in shallow lakes with soft sediments. These beds inhibit recreational activities and can reduce water flow. Die-off of curly-leaf pondweed in summer often leads to algae blooms. Seeds of curly-leaf pondweed are readily consumed by many species of ducks.

Control Options: Manual removal of curly-leaf pondweed is difficult; it involves pulling the plant and rhizome in as few pieces as possible. Rhizome fragments will sprout new plants. Turions also must be removed, so removal before turions are produced is recommended.

Mechanical removal can be done with aquatic plant harvesters, and should be done just before turion development. Removal of the top several feet of the plant at this time will reduce the number of seeds and turions produced that year. This type of removal could possibly stimulate rhizome development.

Chemical control typically uses contact herbicides like endothall. It can be effective on curly-leaf pondweed when applied at the proper dose and time of year, but multiple years of treatments are necessary to deplete the reserve of turions in the sediment. Unintended damage to the native aquatic plant community is likely with these herbicides. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

Turion of curly-leaf pondweed.

No effective biological control agents are currently known.

Additional Information:

Catling, P. M. and Dobson, I. 1985. The biology of Canadian weeds. 69. *Potamogeton crispus* L. Can. J. Plant Sci. 65: 655-668.

Photo Credit: Paul Skawinski

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Aquatic Invasive Species Quick Guide

Eurasian Watermilfoil (*Myriophyllum spicatum* L.)

Description: Eurasian watermilfoil is a non-native, perennial, submersed aquatic plant in the family Haloragaceae. Feather-shaped leaves are divided into 12 or more pairs of slender leaflets. Leaves are arranged in whorls of 4-6 around the stem. Stems and leaves tend to be limp, often with some pinkish color. 2-4" flower spikes are pink and yellow, held above the water, with many whorls of pink flowers (female) on the lower half, and whorls of yellow flowers (male) on the upper half. Eurasian watermilfoil can survive on wet shorelines during the growing season if water levels recede.

Eurasian watermilfoil has whorls of feather-shaped leaves with 12 or more pairs of leaflets.

North American Distribution: Eurasian watermilfoil occurs in British Columbia, Ontario, Quebec, and at least 47 U.S. states.

Fragments of Eurasian watermilfoil can produce roots and continue growing.

Dispersal Vectors: Eurasian watermilfoil was introduced from Europe and Asia in ballast water of trans-oceanic ships, and probably also as a result of aquarium dumping. Stem fragments disperse the plant short distances, but they can easily catch on boat trailers and other equipment and be moved between water bodies. Seeds are thought to have very low viability.

Ecological Impacts: Populations can spread quickly by fragmentation, and can create dense stands that exclude native vegetation. These stands also create floating mats of tangled vegetation, which increase water temperatures, reduce water movement, and impede recreational activities.

Control Options: Small patches of Eurasian watermilfoil can be removed manually. The base of the plant and roots must be removed, and all parts of the plant should be disposed of away from any water body. Use of large rakes is not recommended because of the risk of fragmentation. A free, helpful tutorial on manual removal of Eurasian watermilfoil is available on YouTube at http://www.youtube.com/watch?v=CfsEDyAwQP4

Chemical herbicides can be used to control large stands of Eurasian watermilfoil. These herbicides must be applied by a licensed applicator, and when water temperatures are 50-60°F. These herbicides may have negative impacts on native aquatic plant species, so proper timing and dosage is crucial. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

An aquatic insect native to much of North America, *Euhrychiopsis lecontei*, has been associated with declines of Eurasian watermilfoil. The weevil damages Eurasian watermilfoil through its feeding activity. In order to be effective, these weevils require abundant natural shoreline vegetation for overwintering.

Eurasian watermilfoil (left) has 12+ pairs of leaflets per leaf, while native watermilfoils (right) tend to have <12 pairs.

Additional Information:

Aiken, S. G., Newroth, P. R. and I. Wile. 1979. The biology of Canadian weeds. 34. *Myriophyllum spicatum* L. Can. J. Plant Sci. 59: 201-215.

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Aquatic Invasive Species Quick Guide

Faucet Snail (*Bithynia tentaculata* L.)

Description: A member of the Bithyniidae family, faucet snails grow up to 12-15mm tall (about 1/2"), and have a light brown to black shell with 5-6 whorls. The shell opening (aperture) is on the right side, and is less than half the height of the shell. A tough plate called an operculum tightly covers the aperture. It is teardrop-shaped, and displays several concentric rings on adults. Faucet snails can filter-feed on suspended algae, or graze algae off of rocks and other surfaces, whichever is more favorable at the time.

North American Distribution: Great Lakes region from New York and Quebec east to Minnesota. Also known from Montana and Chesapeake Bay.

Faucet snails have light brown to black shells, with the opening on the right side.


Faucet snail shells have 5-6 whorls, and a teardrop-shaped opening.

Dispersal Vectors: Faucet snails are native to Europe, and arrived in the Great Lakes through ballast water transport in the 1870s. They can be transported locally by boats, trailers, anchors, duck decoys, and other equipment that is moved between water bodies. Faucet snails can live for up to a month in dry mud, so proper cleaning of equipment is essential before moving to a new water body. Eggs are deposited on firm substrates in masses of up to 77.

Ecological Impacts: Faucet snails are intermediate hosts for three trematode parasites that can kill waterfowl. Several massive waterfowl die-offs have occurred in the Upper Midwestern U.S., and have been attributed to the birds' consumption of faucet snails. These parasites do not pose a risk to humans consuming cooked fish or waterfowl. Faucet snails also compete with native snails for food and other resources, and can clog water intake screens and pipes in municipal water systems.

Control Options: The best control measure for faucet snails is preventing their spread to new water bodies. Boats, trailers, decoys, and other recreational equipment should always be thoroughly checked before leaving a water body, to prevent faucet snails and other aquatic invasive species from being transported.

No effective chemical or biological control measures are known for faucet snails.


The adult faucet snail's operculum has many concentric rings.

Additional Information:

Brendelberger, H. and Jürgens, S. 1994. Suspension feeding in *Bithynia tentaculata* (Prosobranchia, Bithyniidae), as affected by body size, food, and temperature. Oecologia. 94:1 36-42.

Kipp, R.M., A.J. Benson, J. Larson, and A. Fusaro. 2013. *Bithynia tentaculata*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=987 Revision Date: 6/4/2012

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FS-1-14

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Aquatic Invasive Species Quick Guide

Flowering Rush (*Butomus umbellatus* L.)

Description: Flowering rush is a non-native, perennial aquatic plant in the family Butomaceae which grows from dark rhizomes that may be lumpy or hairy. Large, narrow leaves are dark green, usually twisted, triangular in cross-section, and originate from a basal cluster. Leaves are often slightly cupped at the base where they partially sheath each other. Plants are typically emergent and 3-5 feet tall, but can grow submerged to over 10 feet deep. A large umbel inflorescence is held on a round stalk and contains many pink flowers with 3 sepals, 3 petals, and red anthers.

Flowering rush has a large, showy inflorescence on a round stalk.

North American Distribution: Flowering rush has been reported across most of the northern United States and Canada.

Creamy white bulbils are produced on the rhizomes and resemble small onions.

Dispersal Vectors: Flowering rush was introduced from Eurasia as an ornamental plant for water gardens and other wet sites. It spreads locally by rhizomes, and produces asexual reproductive structures called bulbils (also called bulblets), which can dislodge from the parent plant and sprout new plants elsewhere. Fragments of the rhizome can also produce new plants. Muskrats may transport flowering rush short distances when building their huts, and waterfowl hunters may contribute to spread by using it in construction of hunting blinds.

Ecological Impacts: Populations can spread quickly by rhizomes and bulbils, crowding out valuable native species and decreasing plant and animal diversity. Its ability to grow on wet shores, as an emergent, or as a submergent allow it to create large, dense colonies. Colonies can be dense enough to prevent passage of boats.

Control Options: Small patches of flowering rush can be manually removed by gently digging up the rhizomes and removing all plant material from the site. Care should be taken to remove all bulbils and rhizome fragments. This is more easily done by reaching under the rhizome with bare hands rather than using a shovel. Removing the plants in as few pieces as possible will result in less risk of rhizome fragmentation and dislodged bulbils.

Chemical control of flowering rush is difficult due to the narrow, waxy leaves. Research is ongoing to find an herbicide that effectively controls flowering rush without serious negative effects on beneficial native vegetation. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

This emergent stand of flowering rush in 2 feet of water is preventing passage of a kayak.

No effective biological control agent is known at this time.

Additional Information:

Madsen, J.D., B. Sartain, G. Turnage, and M. Marko. 2013. Herbicide trails for management of flowering rush in Detroit Lakes, Minnesota for 2012. Geosystems Research Institute Report 5059, Geosystems Research Institute, Mississippi State University, Mississippi State, MS. April 2013.

Minnesota Sea Grant. Flowering Rush. www.seagrant.umn.edu/ais/flowering rush

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Aquatic Invasive Species Quick Guide

Hydrilla (*Hydrilla verticillata* (L. f.) Royle)

Description: Hydrilla, sometimes called water thyme, is a submersed, non-native, perennial aquatic plant in the Hydrocharitaceae family. Long stems contain many whorls of 4-8 short leaves, and tend to be bushy near the top. Leaves are serrated on both sides, and contain several spines on the underside of the midvein. Scaly tubers are produced in the sediments. Dense, overwintering turions can also form in the leaf axils. Small, white, female flowers are produced on long, slender stalks that rise to the surface. Green, male flowers release from the plant and float freely on the surface. Hydrilla prefers soft sediments in nutrient-rich waters.

Hydrilla has long, branching stems with whorls of 4-8 leaves.

North American Distribution: Along the west, south, and east coasts of the U.S.. Also documented in TN, IN, IA, and WI.

Leaves have whorls of 4-8 leaves that are serrated on the margins and have teeth under the midvein.

Dispersal Vectors: Native to Asia and Africa, Hydrilla was introduced to North America through the aquarium trade. Fragments of the plant are readily dispersed by water currents, boat trailers, anchors, motors, and other recreational equipment. Tubers are eaten by waterfowl and remain viable. Hydrilla has been sold through the aquarium trade, and was likely spread to local waters via illegal aquarium dumping. Hydrilla has been found attached to water lilies ordered over the Internet.

Ecological Impacts: Hydrilla forms dense monocultures and can shade out native vegetation. These dense colonies also restrict fish passage, and can cause stunting of fish populations as predator fish have trouble hunting for food. Dense mats can create areas of stagnant water, perfect for mosquito breeding habitat. Hydrilla mats can prevent boat passage, fishing, and swimming.

Control Options: Manual removal of Hydrilla is possible, but usually impractical if large mats are present. Plants must be removed carefully so that turions, tubers, or fragments are not left behind. Mechanical harvesting is widely used and effective at removing vegetation near the surface. Harvesting is not species-selective and can cause further spread through fragmentation.

Fluridone was the most heavily used herbicide for many years, but Hydrilla developed a resistance to this chemical. Endothall-based herbicides are now more common in many areas where fluridone-resistant Hydrilla is prevalent, but plants appear to be developing a resistance to this chemical as well. Use of these herbicides can destroy the stems and leaves, but tubers, turions, and seeds are not destroyed and may re-sprout. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

Several biological control agents have been used to control Hydrilla. Grass carp (*Ctenopharyngodon idella*) effectively suppress Hydrilla by feeding on stems and leaves, but they are not species-selective and often destroy much of the aquatic plant community. Grass carp are illegal to possess or transfer in many states. An aquatic weevil (*Bagous affinis*) feeds on the tubers, but only when they are exposed to the atmosphere. Larvae of a fly (*Hydrellia pakistanae*) feed on the leaves, but causes insignificant damage to the plant.

Hydrilla produces small, scaly tubers in the sediments.

Additional Information:
Hetrick, S.A. and K.A. Langeland. 2012. Hydrilla management in Florida lakes. University of Florida IFAS Extension Publication #SS-AGR-361. http://edis.ifas.ufl.edu/ag370
Global Invasive Species Database. 2006. *Hydrilla verticillata*. http://www.issg.org/database/species/ecology.asp?si=272&fr=1&sts=sss&lang=EN
Photo Credit: Paul Skawinski

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Aquatic Invasive Species Quick Guide

Japanese Knotweed (*Fallopia japonica* Houtt. Ronse Decr.)

Description: Japanese knotweed is a large, non-native shrub that grows up to 12 feet tall. It has hollow, woody stems (canes). Leaves are alternate, and widely lance-shaped to heart-shaped. Tiny, white flowers are produced in short, erect spikes that originate from the leaf axils. This species prefers full sun exposure, and grows aggressively in riparian areas, but can also grow in upland habitats. Rhizomes are dark brown and knotty, with an orange core. This plant has been nominated to be included in the list of 100 "World's Worst" invasive species. It has been known to damage foundations and sprout through asphalt.

North American Distribution: Documented in at least 41 U.S. states and 5 Canadian provinces.

Japanese knotweed has large, heart-shaped leaves and spikes of white flowers that originate from the leaf axils.

Stems are hollow, but solid at the nodes.

Dispersal Vectors: Japanese knotweed is native to Japan, and was introduced to North America as an ornamental plant, usually planted as "living fences" to generate privacy. It has occasionally been planted by beekeepers for its abundant flowers. Japanese knotweed primarily spreads by rhizomes. Fragments of rhizomes or stems can sprout new plants. Many populations along streams are started by fragments drifting in from upstream. Seeds have fairly high viability, but seedlings often die soon after germinating.

Ecological Impacts: This species forms dense stands that exclude native vegetation. This loss of diversity results in a loss of usable habitat for wildlife. A study found up to ten times as many plant species outside of Japanese knotweed patches, compared to within the patches. It also noted a 50% decrease in invertebrate diversity within a Japanese knotweed patch. Patches on streambanks can increase erosion as the plant dies back in fall and exposes large amounts of soil.

Control Options: Manual removal of Japanese knotweed is very difficult, due to its large network of rhizomes. These rhizomes can be several meters deep, making removal by digging nearly impossible. Repeated mowing or pulling of shoots can eventually exhaust the plant's underground energy supply, but this may take two years or more.

Systemic herbicides like glyphosate can control this species. It can be sprayed on the foliage, but take care to minimize chemical overspray, which will kill native vegetation. Cut stems once in early summer so plants re-grow shorter for fall treatment with less overspray. Stems can also be cut near the ground in fall, and a small volume of herbicide can be poured into the cut stem. A combination of manual removal and herbicide application tends to be the most effective control strategy. Always follow label directions. A WDNR permit is required when near water.

An effective biological control agent is not known at this time.

Dense patches of Japanese knotweed can exclude all other vegetation.

Additional Information:

Wisconsin Department of Natural Resources and University of Wisconsin Extension. Japanese knotweed. Informational brochure.
http://clean-water.uwex.edu/pubs/pdf/knotweed.pdf

Global Invasive Species Database. *Polygonum cuspidatum*.
http://www.issg.org/database/species/ecology.asp?si=91&fr=1&sts=sss&lang=EN

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Aquatic Invasive Species Quick Guide

New Zealand Mudsnail (*Potamopyrgus antipodarum* Gray)

Description: Mature New Zealand mudsnails have a cone-shaped, 4-6mm long, gray-brown shell with 7-8 whorls, separated by deep grooves. The opening (aperture) of the shell is on the right side, and can be sealed with a firm plate called an operculum. These snails can live out of water for up to 26 days; this adaptation combined with their small size make them very easily transferrable. Nearly all New Zealand mudsnails in North America appear to be female clones. Despite its name, these snails inhabit a variety of substrates, including silt, sand, cobble, and vegetation.

The tiny New Zealand mudsnail is only a few millimeters long.

North American Distribution: Widely scattered in the western U.S.; Lakes Ontario, Superior, and Michigan; St. Louis River; south-central WI; PA.


New Zealand mudsnail shells are brown, black, or gray, and may have tiny bumps.

Dispersal Vectors: New Zealand mudsnails are native to New Zealand and its nearby islands, and have been introduced to North America, Europe and Australia. In 1987, they were first discovered in the U.S. in Idaho's Snake River. These snails can reproduce asexually, so only one snail is needed to start a new population. Newly born, asexual females already contain developing embryos. Once established, they can be spread quickly by boots, waders, and other equipment. They may also be spread by fish that consume them—New Zealand mudsnails can pass through a fish's digestive system unharmed.

Ecological Impacts: New Zealand mudsnails have been observed at incredible densities of up to 800,000 per square meter. They consume large amounts of phytoplankton, which comprise the base of the aquatic food web. They also displace native snails and invertebrates that are more beneficial as food for wildlife—many birds and fish cannot digest New Zealand mudsnails. Industries drawing water from infested lakes or rivers often have problems with snails blocking their screens and clogging pipes.

Control Options: The most effective method of controlling New Zealand mudsnails is through prevention of their spread to new water bodies. Thorough cleaning/scrubbing or freezing of gear for 8 hours before moving to a new water body is crucial.

Long-term water level fluctuation can kill New Zealand mudsnails through dessication (drying out) or freezing, but these snails can live out of water in a damp environment for at least 26 days.

Several chemicals have shown to be lethal to New Zealand mudsnails in laboratory studies, but their safety and effectiveness in natural systems may differ. Bayluscide (active ingredient: niclosamide) was successfully used in a small stream in Montana at a concentration of 1ppm for 1 hour and achieved 100% mortality of New Zealand mudsnails. However, this chemical is also harmful to native snails and aquatic life, and is heavily regulated.

Some positive research exists regarding biological control using a trematode parasite from its native range, especially *Microphallus* sp., but this research is in early stages and has not been approved for use in North America.

Additional Information:

Benson, A.J., R.M. Kipp, J. Larson, and A. Fusaro. 2013. *Potamopyrgus antipodarum*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1008 Revision Date: 6/11/2012

Global Invasive Species Database. *Potamopyrgus antipodarum*. http://www.issg.org/database/species/management_info.asp si=449&fr=1&sts=sss&lang=EN

Photo Credit: Paul Skawinski

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Aquatic Invasive Species Quick Guide

Common Reed (*Phragmites australis* (Cav.) Trin. ex Steud.)

Description: Common reed, also called *Phragmites*, is a perennial, non-native grass that can grow up to 16 feet tall. Leaves are wide, dark green to blue-green, and up to 30 inches long. The base of the leaf narrows to a long sheath that tightly wraps around the stem. The leaf base has a short ligule (0.1 - 0.4mm). Leaves are dropped in winter but the sheaths remain attached to the stems. Stems are very strong, with distinct ridges. Large rhizomes quickly spread the plant locally, and may be seen creeping above ground as stolons. Seedheads are fluffy, often 8-12 inches tall, and are tan to purple.
A native subspecies also occurs in the U.S. and Canada. It has smooth, reddish stems, bright green leaves, and ligules 0.4—1.0mm long (see back side).


Common reed grows in dense patches and can tower over a person.

North American Distribution: Occurs throughout the continental United States and southern Canada.


Large, fluffy seedheads are present by late summer and persist into winter.

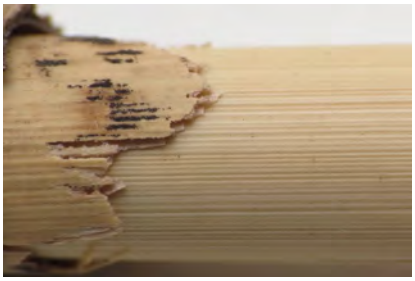
Dispersal Vectors: Stem and rhizome fragments can float to new locations and create new populations. Muskrats may transport stems for their shelters. Waterfowl hunters could move viable fragments for construction of hunting blinds. Seeds are dispersed by wind and water, but have low viability.

Ecological Impacts: Common reed can form very dense populations along streams and lakes, which often prevent access for humans and wildlife. They also shade out native vegetation, which leads to decreased diversity of plants and animals. *Phragmites* has displaced many large stands of coastal cordgrass (*Spartina*) populations, which are valuable for waterfowl. Abundant dead stems of *Phragmites* also increase the risk of marsh fires.

Control Options: Manual removal is difficult due to its extensive rhizome network. Combining bundling and cutting stems with painting herbicide on the cut stumps in fall can be effective on small sites. For large sites, cut stems in early summer and spray shorter re-growth stems in fall. Multiple applications will likely be needed. Herbicides must be labeled for aquatic use. Large stands of *Phragmites* along the Great Lakes shorelines and North American coastlines have been targeted with aerial herbicide applications.

Flooding can be used if the rhizomes are covered with several feet of water for at least four months. Draining can also be effective to reduce stand vigor.

No successful biological control agents are known at this time.


Phragmites has distinct ridges on its stems. The leaf sheath (shown at left) is tightly held.

Additional Information:
Global Invasive Species Database. *Phragmites australis*. http://www.issg.org/database/species/ecology.asp?fr=1&si=301
Great Lakes Phragmites Collaborative. http://www.GreatLakesPhragmites.net

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How can I tell the exotic *Phragmites* from the native *Phragmites*?

Exotic *Phragmites*

(*Phragmites australis* subsp. *australis*)

Leaf sheath tightly wrapped around stem

- Stem has distinct ridges and is tan-brown. Ridges can easily be felt with a fingernail.
- May have some irregular spots caused by mildew.
- Leaf sheaths stay attached to stems year-round.

Stems are often 12-15ft tall, with large, dense seedheads (early winter photo).

Native *Phragmites*

(*Phragmites australis* subsp. *americanus*)

- Stem is smooth (or with faint ridges), shiny, often reddish.
- Stem often has distinctly round, black spots.
- Leaf sheaths fall off stem during winter.

Stems usually less than 10ft tall, with sparse seedheads (early winter photo).

Photo credit: Paul Skawinski, Golden Sands RC&D

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Aquatic Invasive Species Quick Guide

Purple Loosestrife (*Lythrum salicaria* L.)

Description: Purple loosestrife is a perennial wetland plant in the Lythraceae family, growing to about 8 feet tall. Stems are woody, and 4-sided (rarely 6-sided in very large plants). Leaves are opposite or occasionally in whorls of 3, with smooth margins and no leaf stalk. Each flower has six petals, and many whorls of these flowers bloom at the same time. Large plants may have many pink-purple flower spikes. Fruit capsules contain thousands of seeds each.

North American Distribution: Nearly all U.S. states and the southern Canadian provinces. Reported as far north as 65°N latitude.

Purple loosestrife flowers have six wrinkled, pink-purple petals.

Purple loosestrife produces tall flower spikes and stands up to 8 feet tall.

Dispersal Vectors: Purple loosestrife seeds probably arrived in North America from Europe, in heaps of soil used for ship ballast. It also may have been intentionally imported for ornamental use, medicinal use, or use by beekeepers. Large purple loosestrife plants can produce over two million wind-dispersed seeds per year.

Ecological Impacts: Purple loosestrife can rapidly colonize new areas, displacing native vegetative communities. In many wetlands, purple loosestrife has become the dominant species. Nesting habitat quality can decrease as the result of purple loosestrife introduction, reducing the waterfowl and shorebird communities. Some cultivars of purple loosestrife can also hybridize with our native winged loosestrife (*Lythrum alatum*), reducing the native's genetic integrity.

Control Options: Manual removal of small stands of purple loosestrife can be very effective. Plants in moist, soft substrate can often be pulled out by hand, including the roots. Very large plants may require some digging to remove the entire plant. Cutting flowerheads or seedheads can prevent seed dispersal in the short term, but plants will re-sprout from the roots and may produce new flower spikes.

Glyphosate or 2,4-D-based herbicides can be used; they should be approved for aquatic use to avoid unnecessary harm to the ecosystem. For scattered plants, herbicide is best applied with a small bottle and a wicking tip that can be used to "paint" herbicide onto the plants.
Cutting the stem near the base and "painting" the cut stem is often effective. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

Purple loosestrife stems are woody and nearly square.

Biological control of purple loosestrife is a widely used, effective method of control. *Galerucella* beetles feed on purple loosestrife without negatively affecting native wetland plants. Many states and organizations offer free assistance to volunteers looking to raise *Galerucella* beetles for local release into infested wetlands.

Additional Information:

Mai, T.K., Lovett-Doust, J., Lovett-Doust, L., and Mulligan, G. A. 1992. The biology of Canadian weeds. 100. *Lythrum salicaria*. Can. J. Plant Sci. 72: 1305-1330

Wisconsin Department of Natural Resources. Purple loosestrife biocontrol. http://dnr.wi.gov/topic/invasives/loosestrife.html

Photo credit: Paul Skawinski

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PL-1-14

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Aquatic Invasive Species Quick Guide

Rusty Crayfish (*Orconectes rusticus* Girard)

Description: The rusty crayfish is a large crayfish of the family Cambaridae. Adults can reach six inches in length, including the claws. Most of the body is tan to light brown, but each side of the carapace has a rusty brown spot. Claws are large and typically have brightly colored tips above dark bands. Rusty crayfish are omnivores, feeding primarily on aquatic plants, snails, and other small invertebrates. They can commonly be found hiding under rocks, logs, and other debris. Rusty crayfish typically live 3-4 years.

North American Distribution: Rusty crayfish are most abundant in the western Great Lakes states, but have been documented from Minnesota and Iowa eastward to Maine, and in northern New Mexico.

Rusty crayfish are mostly light brown, with bright claw tips.

Each side of the carapace has a rusty brown spot.

Dispersal Vectors: Rusty crayfish are native to the Ohio River Basin, and were likely transported to the Midwest United States as bait by fishermen. Rusty crayfish quickly colonize lakes and streams by producing several hundred eggs per female each season. Eggs are protected under the female's tail until they hatch.

Ecological Impacts: Rusty crayfish are larger and more aggressive than most native crayfish, and are able to outcompete native species for food and habitat. Rusty crayfish consume large amounts of aquatic invertebrates, small fish, fish eggs, tadpoles, native crayfish, plants, and other aquatic life. They can hasten spread of Eurasian watermilfoil and other aggressive plants by cutting the stems, which then take root elsewhere.

Control Options: Manual trapping is effective for rusty crayfish. Always follow local trapping regulations. Modification of size limits of predator fish species can be effective. Walleye, smallmouth bass, largemouth bass, and yellow perch will consume young rusties. This strategy combined with trapping of large adults can reduce rusty crayfish populations.

An effective, safe pesticide for rusty crayfish has not been found. Although crayfish-selective pesticides exist, they are also harmful to native crayfish species.

An effective biological control agent has not been found. A parasite called *Microphallus* infects rusty crayfish (and other crayfish species), and is currently being researched. Lakes with abundant rusty crayfish are often found to have no *Microphallus* present.

Eggs and newly hatched young are held under the female's tail for protection.

Additional Information:

Hein, C.L., Roth, B.M., Ives, A.R., and M. Jake Vander Zanden. 2006. Fish predation and trapping for rusty crayfish (*Orconectes rusticus*) control: a whole-lake experiment. Can. J. Fish. Aquat. Sci. 63: 383-393.

Wisconsin Department of Natural Resources. Potential impacts to rusty crayfish (*Orconectes rusticus*) populations from a parasite, *Microphallus* sp.

Photo Credit: Paul Skawinski

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Aquatic Invasive Species Quick Guide

Starry Stonewort (*Nitellopsis obtusa* L.)

Description: Starry stonewort is a non-native species of large algae in the Characeae family. It has whorls of 4-6 long branchlets, with blunt tips. It is more robust than most members of its family, and can grow to over two meters tall. Colorless rhizoids anchor this alga, and contain up to several dozen 4-5mm, star-shaped bulbils. Starry stonewort typically grows in alkaline lakes with marl sediments, up to 9 meters deep. Orange reproductive structures called oogonia are located in the axils of the upper branchlets. Starry stonewort is typically an annual, but can behave as a perennial during mild winters. Interestingly, starry stonewort is listed as an endangered species in the United Kingdom.

Starry stonewort has whorls of long branchlets, each with a blunt tip.

North American Distribution: Michigan, northern Indiana, and the northeast United States. Recently discovered in southeastern Wisconsin.

Star-shaped bulbils give the starry stonewort its name.

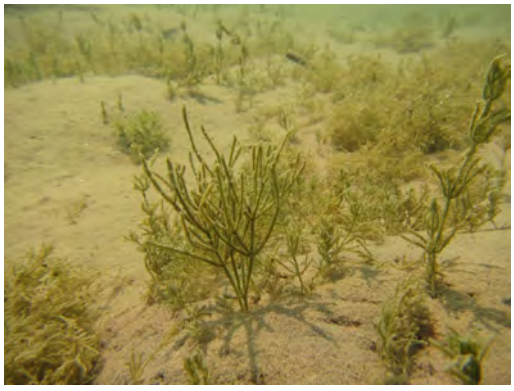
Dispersal Vectors: Starry stonewort is native to Europe and western Asia. It was probably introduced to the Great Lakes via ballast water carried in trans-oceanic ships. Fragments of starry stonewort can easily be spread by boats, trailers, and possibly waterfowl. Local dispersal occurs by oogonia and bulbils being transported by water currents or animals within the lake.

Ecological Impacts: By forming extremely dense mats of vegetation, starry stonewort can greatly reduce the diversity of aquatic plants in a lake. It can also impede movement of fish and other animals, and can decrease successful spawning activity. Mats growing to the surface can reduce water flow and prevent recreational activities.

Control Options: Manual removal of starry stonewort is difficult and probably impractical on a large scale. Abundant bulbils on the rhizoids can dislodge if disturbed, and will sprout new individuals. Manual removal efforts must emphasize careful removal of these bulbils.

Copper-based herbicides have been effective at suppressing starry stonewort. Endothall is sometimes added to copper herbicides to increase its effectiveness. Herbicide applications may be less effective on tall stands of starry stonewort, as the chemical is quickly absorbed into the upper parts of the algae, leaving the lower parts unharmed. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

An effective biological control agent is not known at this time.



Starry stonewort (front, center), much more robust than the surrounding native muskgrasses (*Chara* spp.).

Additional Information:

Pullman, G. Douglas and Gary Crawford. 2010. A decade of starry stonewort in Michigan. Lakeline. 36-42.

Photo credit: Paul Skawinski

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Aquatic Invasive Species Quick Guide

Water Chestnut (*Trapa natans* L.)

Description: Water chestnut is a non-native, annual aquatic plant in the Trapaceae family. It produces a floating rosette of very waxy, triangular leaves which are heavily serrated on the edges. The leaf stalk is swollen at the base to provide buoyancy. Submersed leaves are opposite and highly divided into delicate leaflets. Roots can form at any of the submersed nodes, and the plant may be found rooted to the bottom in shallow water. Flowers are 4-parted and occur at the base of the floating leaves. Fruits are hard, about one inch across, with four stiff spines. Water chestnut prefers slow, nutrient-rich waters.

North American Distribution: Along the east coast, from Virginia to Quebec.

Water chestnut forms large, floating rosettes with dozens of triangular leaves.

Submersed leaves are opposite and highly divided into many thin leaflets.

Dispersal Vectors: Native to Europe and Asia, it was introduced intentionally to several water bodies in Massachusetts. Fragments of water chestnut can be transported by boat trailers and equipment, and rosettes can float to new areas (especially in riverine systems). Water chestnut has been used in water gardens, and may escape through improper disposal of unwanted plants. Seeds remain viable for 12 years, and are probably too heavy to cling to animal fur or feathers.

Ecological Impacts: Water chestnut can rapidly cover entire bays of lakes and rivers, shading out native plants underneath, and reducing dissolved oxygen levels. The reduction in plant diversity and dissolved oxygen has serious consequences to the aquatic animal community. Large, barbed fruits are extremely sharp and can puncture feet and even shoe soles.

Control Options: Manual removal of water chestnut is highly effective. Plants are easily seen, and floating rosettes can be easily removed from the water. Care must be taken to remove all fragments of the plant, and rooted portions must be carefully removed to avoid breakage. Seeds may also fall off easily if removal is done late in the growing season. Mechanical harvesting has been effective at clearing large areas of water chestnut, but fragmentation is likely to spread water chestnut. Rooted plants will re-sprout if only the top portion is removed.

Chemical control can be successful at reducing water chestnut, and typically utilize 2,4-D or triclopyr herbicides. Several years of treatments are necessary to kill seedlings as they re-populate the area. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

Several possible biological control agents have been studied, but none has been considered a feasible strategy for large-scale control.

Note: The water chestnut common in Asian cooking is *Eleocharis dulcis*, not *Trapa natans*.

The stalks of floating leaves are swollen with large air cells.

Additional Information:

Naylor, Mike. 2003. Water chestnut (*Trapa natans*) in the Chesapeake Bay watershed: a regional management plan. Maryland Department of Natural Resources. http://www.dnr.state.md.us/irc/docs/00016247.pdf

Poovey, A.G. and Kurt D. Getsinger. 2007. Subsurface applications of triclopyr and 2,4-D amine for control of water chestnut (Trapa natans L.). J. Aquat. Plant Manage. 45: 63-66. http://www.apms.org/japm/vol45/v45p63.pdf

Photo Credit: Paul Skawinski

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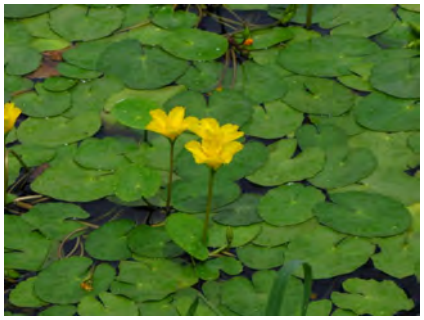
Aquatic Invasive Species Quick Guide

Yellow Floating Heart (*Nymphoides peltata* (S.G. Gmel.) Kuntze)

Description: Yellow floating heart is a perennial, rhizomatous aquatic plant in the Menyanthaceae family. It has small, heart-shaped, floating leaves. Each leaf usually has a wavy edge (margin). The flowers are held on stalks several inches above the water, with one flower per stalk. Each flower is yellow with 5 petals, and each petal has a very thin fringe surrounding it (see photo below). Fruits are green, flattened, and about 1 inch long. Seeds are flattened, gray-black, with dozens of tiny, transparent hairs.

North American Distribution: Eastern Canada, eastern U.S., Midwestern U.S., southern U.S. from Texas to California.



Yellow floating heart has small, floating leaves and yellow flowers held on long stalks.

Flowers are yellow with 5 fringed petals.

Fruits are flattened, pointed at one end, and about 1 inch long.

Dispersal Vectors: Native to Europe and Asia, yellow floating heart was introduced to North America as an ornamental plant for water gardens. Water gardeners probably released excess plants into local waterways, or the seeds may have been carried to local waters by animals. Yellow floating heart can spread by fragments of the rhizomes or stolons, and by seed. Seeds have a fringe of tiny hairs that allow the seeds to float and cling to animal fur. Nursery shipments of yellow floating heart have been found to contain seeds and fragments of additional invasive species, including Hydrilla.

Ecological Impacts: Yellow floating heart can completely cover the water's surface in shallow areas. It can choke out native vegetation and reduce a waterbody's value to wildlife. Dissolved oxygen concentrations are often reduced by thick cover of yellow floating heart, which reduces diversity of aquatic animals. Stagnant areas produced by the dense vegetation can provide ideal breeding conditions for mosquitoes.

Control Options: Many states have prohibited sale or possession of yellow floating heart due to its incredibly invasive nature. Plants or animals should never be released from aquaria or water gardens.

Manual removal is difficult, but effective. All fragments and roots of the plants must be removed. Rhizomes are incredibly strong, and lifting plants from underneath the rhizome is most effective. Manual removal of yellow floating needs to occur multiple times to remove seedlings or new sprouts. Continued monitoring of the site is essential.

Chemical control of yellow floating heart is also difficult. Even at maximum label rates, many aquatic herbicides are ineffective against this species. Its thick, waxy leaves are effective at repelling liquid herbicides. Most states require chemical use permits for any herbicide treatments in standing water or wetland situations.

A successful biological control agent is not known at this time.

Seeds are oblong, 3mm long, and surrounded by tiny, transparent hairs

Additional Information:
Global Invasive Species Database. *Nymphoides peltata*. http://plants.usda.gov/core/profile?symbol=NYPE

Photo credit: Paul Skawinski

This Quick Guide is part of a series on aquatic invasive species, and may be reproduced for educational purposes. Visit us at www.goldensandsrcd.org/our-work/water to download this series of handouts.
Developed by Golden Sands Resource Conservation & Development (RC&D) Council, Inc. as part of an aquatic invasive species (AIS) education program, supported by an AIS grant from the Wisconsin Department of Natural Resources.
YFH-1-14

Golden Sands
Resource Conservation
& Development Council, Inc.

Aquatic Invasive Species Quick Guide

Yellow Iris (*Iris pseudacorus* L.)

Description: Yellow Iris is a non-native, perennial aquatic plant in the family Iridaceae that grows from rhizomes. Large, sword-like leaves are light-dark green, and sheath each other at the base. Several large, yellow flowers are held on a round or slightly flattened stalk. Each flower has three large, drooping sepals and three shorter petals. Plants grow in wet soil or emerge from shallow water, and reach 2-6 feet tall.

North American Distribution: Yellow Iris has been reported across most of the northern United States and Canada.

Yellow Iris produces many large, yellow flowers on a rigid stalk.

Long fruit capsules produce dozens of tan-brown, circular seeds.

Dispersal Vectors: Yellow Iris was introduced from Eurasia as an ornamental plant for water gardens and other wet sites. It spreads locally by rhizomes and by large, round seeds. Dislodged fragments of the rhizome can also produce new plants. Muskrats may transport yellow Iris short distances to build their huts, and waterfowl hunters may contribute to spread by using it in construction of hunting blinds. Yellow Iris is still sold in some nurseries and internet stores.

Ecological Impacts: Populations can spread quickly by rhizomes and seeds, crowding out valuable native plant species and decreasing plant and animal diversity. A study by Raven and Thomas in 1990 noted a large population of yellow Iris that had excluded all other vegetation, even cattails. Yellow Iris is unpalatable to wildlife and livestock due to high levels of glycosides.

Control Options: Manual removal of yellow Iris is difficult, because of its strong rhizome network. Removal of small clumps is easier in areas of soft, water-logged substrates, and these clumps should be grasped as far down the stem as possible and pulled straight up to have the best chance of removing the entire rhizome. Digging is also an option—care should be taken to get underneath the entire rhizome without breaking it, and removal of native species must be minimized. All plant material must be removed from the site and disposed of away from water bodies. Yellow Iris can cause skin irritation, so gloves should be worn when working with this species.

Yellow Iris can be controlled by glyphosate-based herbicides. Plants growing near standing water should be treated with an herbicide approved for aquatic use to minimize harm to amphibians.

Large stands of yellow Iris in shallow water of a lake.

No effective biological control agent is known at this time.

Additional Information:

Jacobs, J. et al. 2010. Ecology and management of yellowflag Iris (*Iris pseudacorus* L.). Invasive Species Technical Note No. MT-28. United States Department of Agriculture, Natural Resources Conservation Service. 6pp.

Raven, P.H. and J.H. Thomas.. 1970. *Iris pseudacorus* in western North America. Madrono. 20:390-391

Photo credit: Paul Skawinski

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YI-1-14

Golden Sands
Resource Conservation
& Development Council, Inc.

Aquatic Invasive Species Quick Guide

Zebra Mussel (*Dreissena polymorpha* Pallas)

Description: The zebra mussel is a small mollusk in the family Dreissenidae. It grows up to about 1.25 inches long. The shells are flat on the hinged side (D-shaped). Zebra mussels have tiny threads that anchor themselves to various firm surfaces like rocks, logs, plants, trash—even other animals. Shells are typically light brown to white, with brown-black stripes. These colors may be faint if the shells have been exposed to prolonged direct sunlight.
The related quagga mussel looks similar, but their shells are not flat on the hinged side.

Zebra mussels have D-shaped shells with brown-black stripes. 4X typical size.

North American Distribution: Zebra mussels are abundant in the Great Lakes, and are scattered in inland waters in the eastern and central United States. They have recently been introduced to the western U.S.

Zebra mussels will colonize any firm surface, even this old tennis ball.

Dispersal Vectors: Zebra mussels were first documented in Michigan's Lake St. Clair in 1988, probably arriving from the Black or Caspian Sea via ballast water of ocean-going ships. Each female can produce up to a million eggs each year, which hatch into free-floating larvae. These microscopic larvae can be transported between water bodies in live wells, bait buckets, or motors. Adult zebra mussels can also attach to plants, and can be transported by boats that aren't cleaned properly after use. Female zebra mussels can reproduce at two years old.

Ecological Impacts: Zebra mussels are filter-feeders, consuming tiny food particles that are the base of the aquatic food web. This removal of food particles results in less food available for other animals like zooplankton, native mussels, and fishes. In many cases, the clearer water caused by the zebra mussels has resulted in severe blooms of filamentous algae. These blooms washing up on shore provide ideal conditions for Clostridium botulinum, the bacteria responsible for killing birds through avian botulism. The sharp shells can cut the feet of people enjoying beaches, and can result in various infections.

Control options: Manual removal of zebra mussels is easy, but impractical due to their sheer abundance. Zebra mussels are occasionally removed from inside water intake pipes with chisels or high-pressure water jets.

No chemical control agent is known to kill zebra mussels without seriously harming other aquatic life or water quality. A 2% chlorine bleach solution is effective at killing zebra mussels when cleaning boating equipment or other gear away from waterbodies.

A bacterial formulation is currently being researched, which uses a native soil bacterium to kill zebra mussels without causing other damage to the ecosystem. This formulation is not approved for widespread use at this time.

These zebra mussels are attached to a fragment of Eurasian watermilfoil.

Additional information:
United States Geological Survey. *Dreissena polymorpha*. http://nas.er.usgs.gov//queries/FactSheet.aspx?speciesID=5

Photo credit: Paul Skawinski

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ZM-1-14

Appendix 7

MARATHON					
Plover River Mercantile	Martindale	Russell	6392 Village Ln	Hatley	54440
Cyran's Du Bay Pit Stop	Cyran	Keith	1621 County Rd DB	Mosinee	54455
Gander Mountain	Keenan	Thomas	1560 County Trunk Hwy XX	Mosinee	54455
Lietz's Convenience Store	Lietz	Veronica	1121 Western Ave	Mosinee	54455
Mosinee Bait & Taxidermy	Schmidt	Gary	922 Western Ave	Mosinee	54455
The Sportsman's Repair Shop	Brod	Chuck	1007 Pasha Ave	Mosinee	54455
51 Sport Shop Inc	Seehafer	Mark	5704 Business Hwy 51 S	Schofield	54476
Balz Bait	Balz	Robert	1839 West Pardee St	Wausau	
Riverside Bait and Tackle	Syring	Keith	P.O. box 233	Schofield	
Morrill's Bait Shop	Morrill	Mary	115 South Hwy O	Mosinee	
PORTAGE					
Hoover's Live Bait	Parker	William	9970 County Rd KK	Amherst	54406
Magic Products Inc			3931 2nd Street	Amherst Junction	54407
Bobber Down Live Bait & Tackle			3411 Johnson Ave	Plover	54467
Cliff's Bait & Tackle	Gollon	Helen	1200 Post Rd	Plover	54467
Plover Bait	Orlowski	Kevin	4620 Coolidge Ave	Plover	54467
Rosholt Hardware Hank			177 North Main St	Rosholt	54473
White Pine Baits			10226 East White Pine Rd	Rosholt	54473
Central Wisconsin Fish Farms, LLC	Gollon	Fritz	1121 Old Wausau Rd	Stevens Point	54481
Gollon Bros Wholesale Live Bait Inc	Gollon	William	2450 Torun Rd	Stevens Point	54481
Northern Bait & Tackle	Vollert	Gary	1500 Maria Dr	Stevens Point	54481
Worth CO			214 Sherman Ave	Stevens Point	54481
	Disher	Ronald		Almond	
Northern Crab Company	Readel	Samuel		Amherst	
WOOD					
Wal-Mart Super Center #2813	Marquardt	Ginny	2001 North Central Ave	Marshfield	54449
Dragging a Line Bait & Tackle	Witt	Katherine	708 Point Basse Ave	Nekoosa	54457
Pritzl's Trading Post			251 State Hwy 13 S	Nekoosa	54457
Sunrise Bait & Tackle	Stoiber	Robert	344 Wood Ave	Nekoosa	54457
The Bait Tender			108 County Rd Z	Nekoosa	54457
Lakeside Oasis LLC	Bloyd	Scott	3738 State Hwy 80	Pittsville	54466
Ace Hardware	Flammini	Domonic	2350 8th St South	WI Rapids	54494
Jerry's Bait & Tackle			3940 8th St South	WI Rapids	54494
Musky Business		Ted	1050 Baker St	WI Rapids	54494
Timberline Archery Bait & Tackle			8131 State Hwy 13 S	WI Rapids	54494
Zalt North American Distribution			8031 Pine Haven Ct	WI Rapids	54494

Yellow highlighted locations are priority bait shops.

Appendix 8

Amherst Millpond, Portage County AIS survey results
July 18th, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Small duckweed
Large duckweed
Common waterweed
Coontail
White water crowfoot
Bullhead lily
Sago pondweed
Flat-stemmed pondweed
Watermeal
Water celery
Striped White water lily
***Banded mystery snail**
***Curly leaf pondweed**
***Rusty Crayfish**
***Purple loosestrife**

Notes:

Curly leaf pondweed was prevalent throughout the lake, but concentrated along the upper and middle section of the mill pond. It was also sparse throughout the channel. Much of the curly leaf pondweed was dying or had died recently. Common waterweed and coontail were both abundant throughout the system. There was a very high amount of banded mystery snails throughout the lake as well. One purple loosestrife plant was found flowering, and the stalks all were broken to prevent it from going to seed.

The water was also murky, and there was a large population of kingfishers throughout the mill pond.

Bear Lake, Portage County AIS survey results
June 15th, 2012
Conducted by Paul Skawinski and Kate Carson, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List in order of observance (AIS highlighted in red and marked with an asterisk*)

***Chinese mystery snail**
Common waterweed
Coontail
Purple-fringed Riccia
Striped white water lily
Watershield
Large-leaf pondweed
Small duckweed
Flat-leaf bladderwort
***Eurasian watermilfoil**
Variable pondweed
Illinois pondweed
Bullhead pond lily
Creeping bladderwort
Northern manna grass
Water smartweed
White-stem pondweed
Floating-leaf pondweed
Stiff pondweed
Creeping spikerush
Leafy pondweed
Softstem bulrush
*Reed canary grass
Water bulrush
Aquatic moss (*Drepanocladus* sp.)
Flat-stem pondweed
Common bladderwort
Small pondweed
Small bladderwort
Oakes' pondweed

Notes:
Water level at Bear Lake was up several feet from past years. Clumps of Eurasian watermilfoil (EWM) were primarily singular, without any true "beds" observed. Only a few fragments of EWM were found among the watershield leaves, which were all removed. In past years, fragments were abundant throughout the watershield leaves around much of the lake. A few Chinese mystery snail shells were observed near the boat landing, but no live individuals were detected.
An herbicide treatment was performed in May 2012. The treatment appears to have been very successful, with only a couple dozen individual EWM clumps observed in the lake. A hand-pulling effort could remove most of these, while a SCUBA diver would be required for a few deeper clumps. Each location of EWM was recorded with a GPS unit, and a map will be created and sent out next week.

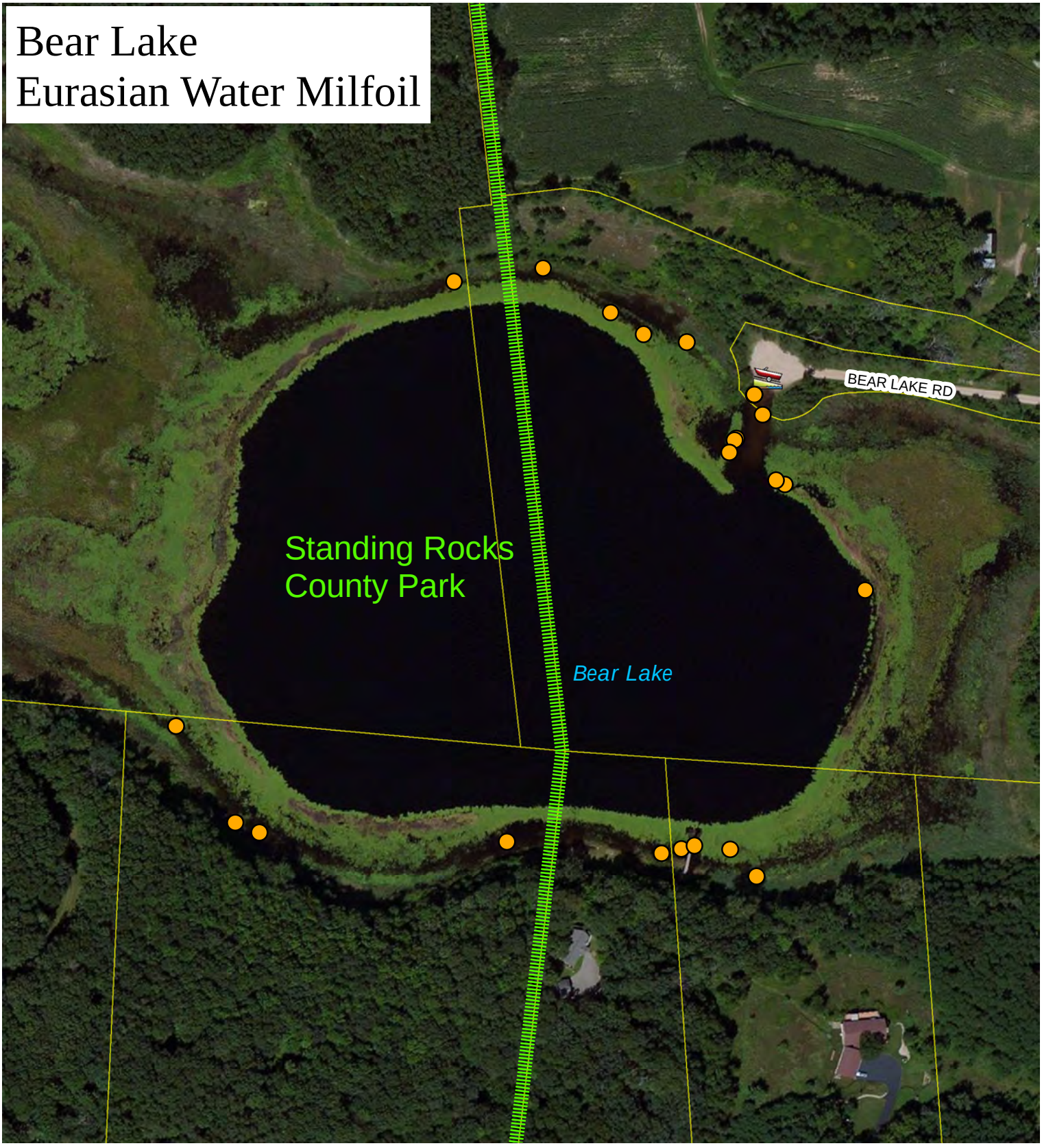
Some newly flooded areas were dominated by species that are very uncommon in central Wisconsin, including water bulrush, small bladderwort, aquatic moss, and flat-leaf bladderwort. Oakes' pondweed was also found on the east end of the lake. A few large stands of softstem bulrush occur along the north side of the lake.

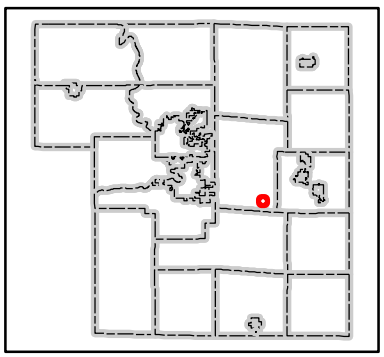
A rake was dropped and pulled for a short distance (4-5ft) through the herbicide treatment area to the east of the boat landing. In this area, the water is too deep to detect EWM by a visual survey alone. Rake drops occurred 16 times in 7 to 18 feet of water. EWM was found on 1 of the 16 rake drops. This point was recorded with a GPS unit to be added to the map. The treatment area appears to have been well colonized by several native species, which will be crucial to prevent EWM from re-colonizing the area. Large-leaf pondweed and coontail were abundant throughout this area. The coontail showed some symptoms of exposure to 2,4-D, but appears to be doing fine. All EWM plants observed during the survey also showed symptoms of 2,4-D exposure, but were surviving. None of the bladderwort species or other dicots showed any symptoms of 2,4-D exposure.

The species found on each rake drop are listed below:

1) Large-leaf pondweed, coontail
2) Large-leaf pondweed, coontail
3) Watershield
4) Large-leaf pondweed
5) Coontail
6) Large-leaf pondweed, coontail
7) EWM, coontail
8) Large-leaf pondweed, coontail, common waterweed
9) Large-leaf pondweed, coontail
10) Large-leaf pondweed, coontail, watershield
11) Large-leaf pondweed, coontail
12) Large-leaf pondweed, coontail
13) Coontail, watershield
14) Coontail
15) Large-leaf pondweed, coontail, white-stem pondweed
16) Aquatic moss (*Drepanocladus* sp.)

Bear Lake
Eurasian Water Milfoil





● Eurasian Water Milfoil

Location:
Town of Stockton
Town 23N Range 09
Sections 27 and 34
Portage County, Wisconsin

Collected June 15, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

N

Feet

0 100 200 300 400

Printed: June 27, 2012

Collins Lake, Portage County AIS survey results
June 5th, 2012
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

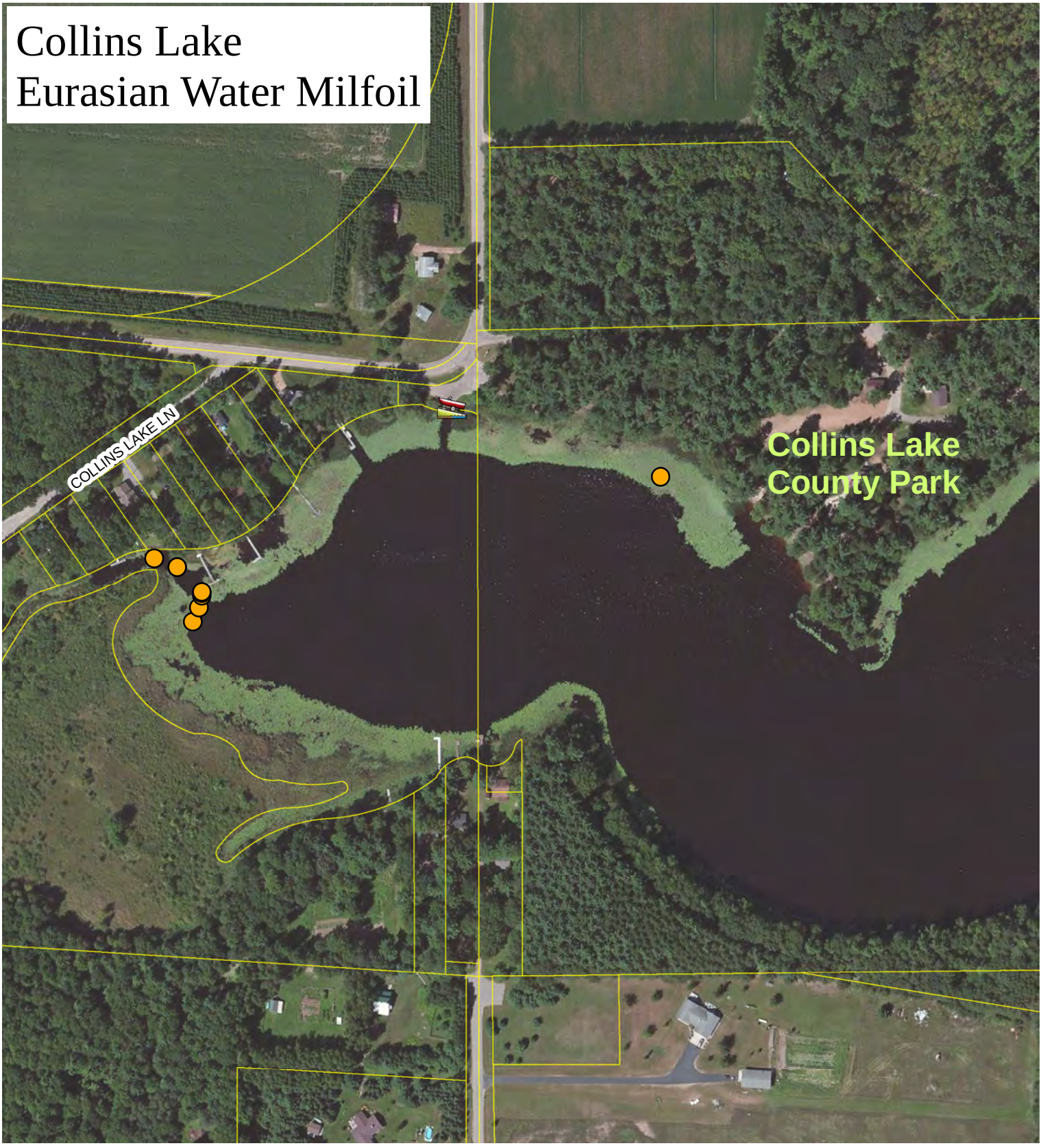
Large-leaf pondweed
Common bladderwort
Coontail
Common waterweed
Small duckweed (*Lemna minor*)
Striped white water lily (*Nymphaea odorata* subsp. *tuberosa*)
Aquatic moss (*Drepanocladus* sp.)
Fries' pondweed
Eurasian watermilfoil*
Fern pondweed
Variable pondweed
Water smartweed
Flat-stem pondweed
Water marigold
Small pondweed
Bullhead pond lily
Watershield
White water crowfoot
Narrow-leaf bur-reed
Northern watermilfoil
Creeping spikerush
Leafy pondweed

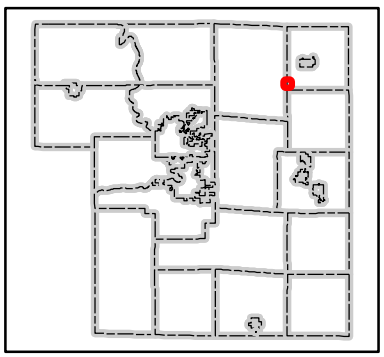
Notes:

Eurasian watermilfoil was hand-pulled several times throughout 2009 and 2010. It was not detected in 2011, but was once again found during this survey. About 10 plants were discovered in the same area as they have been in the past. All were hand-pulled. A few northern watermilfoil plants closely resembled Eurasian watermilfoil; they were treated as hybrid EWM/NWM and were pulled. Monitoring will continue.

Filamentous algae was abundant throughout the lake. Collins Lake's aquatic plant community is still above average, but rare species detected in the past (flat-leaf bladderwort, large purple bladderwort, golden pert) were not detected during this survey. Inlets on both sides of the farm on the NE side of the lake were surrounded by extensive mats of coontail and duckweed, suggesting high-nutrient conditions.

Collins Lake
Eurasian Water Milfoil





● Eurasian Water Milfoil

Location:
Towns of Sharon and Alban
Town 25N Range 09E Section 36
Town 25N Range 10E Section 31
Portage County, Wisconsin

Collected June 12, 2012
with a Garmin GPSmap 62st

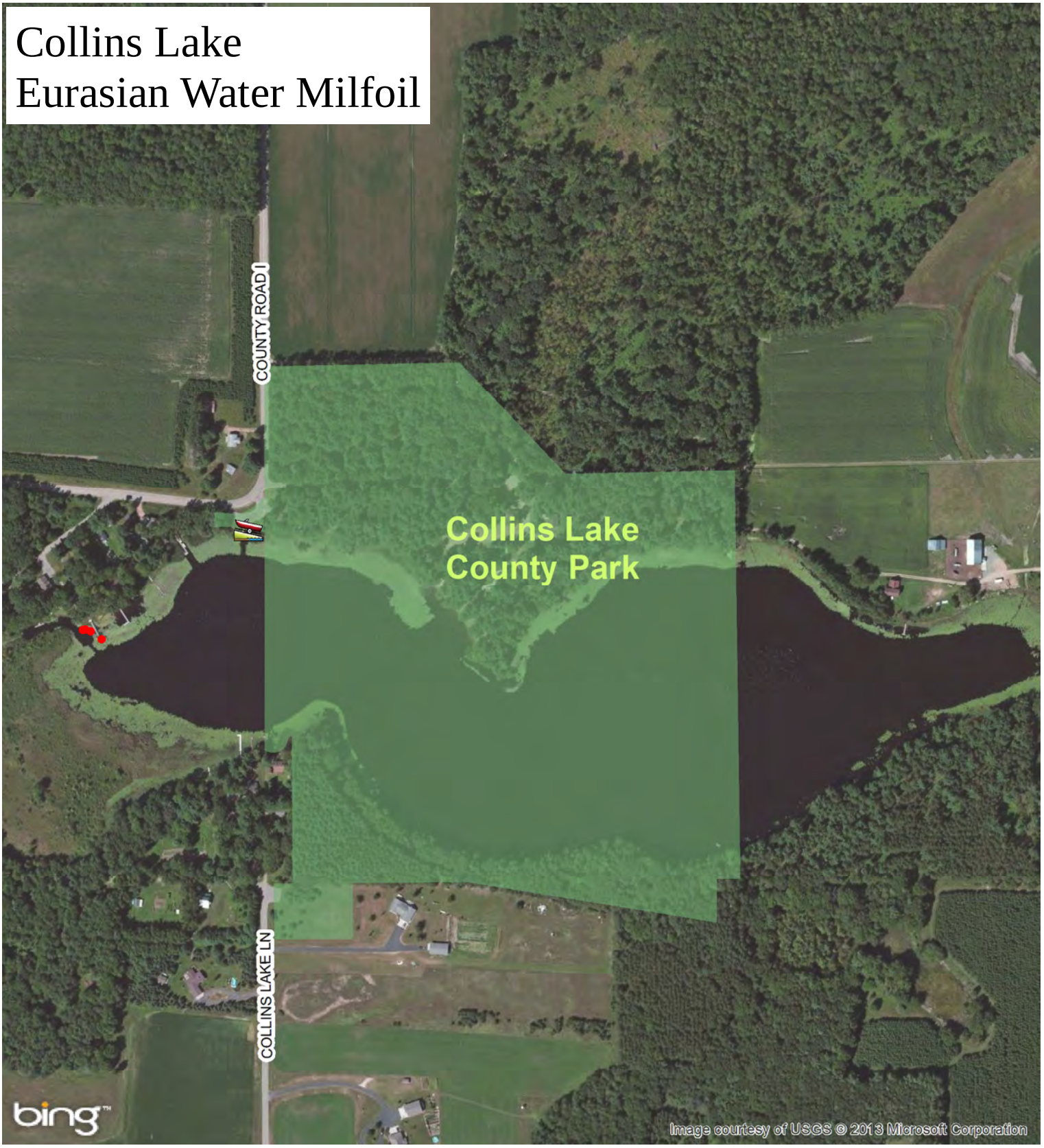
Date of Photography: Summer 2011

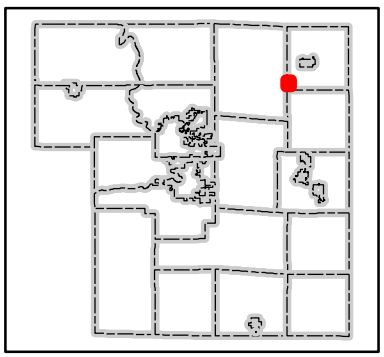
N

Feet
0 100 200 300 400

Printed: June 27, 2012

Collins Lake
Eurasian Water Milfoil





Eurasian Water Milfoil

Collected June 12, 2013
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Towns of Sharon and Alban
Town 25N Range 9E Section 36 and
Town 25N Range 10E Section 31
Portage County, Wisconsin

Feet
0 100 200 300

Printed: July 16, 2013

Lake Emily, Portage County AIS survey results
June 21, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

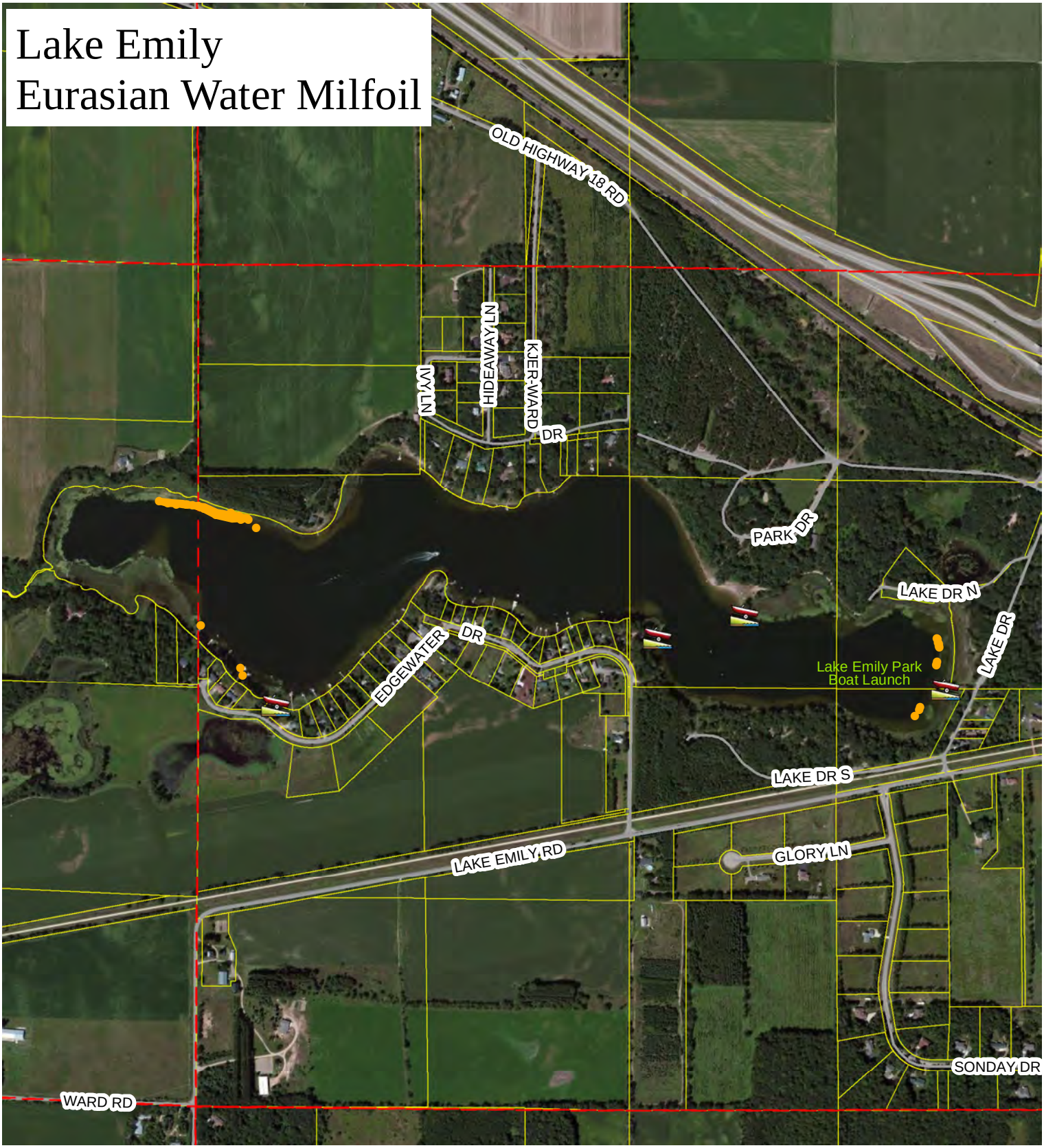
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

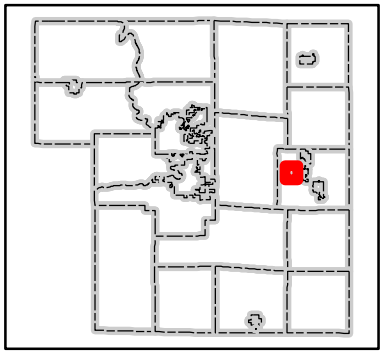
Watershield
Coontail
Chara
Common waterweed
Water marigold
Slender naiad
Northern Watermilfoil
***Eurasian Watermilfoil**
***Eurasian watermilfoil/Northern watermilfoil Hybrid**
Bullhead pond lily
White water lily
Large leaved pondweed
Fries Pondweed
Variable pondweed
Illinois pondweed
Water smartweed
Floating-leaf pondweed
Flat-stemmed pondweed
Water celery

Notes:

Eurasian Watermilfoil EWM Hybrid has been present in the lake for years. The northwestern end, along with the boat landing on the east side has historically contained the EWM Hybrid. A chemical treatment in 2012 revealed success in ridding the east side of EWM. The northwestern research bay has EWM that does not get treated with herbicides. The northwestern population is partially fed by the EWM in the bay. The northwestern population was greatly reduced as a result of the chemical treatment in 2012. There are some spots with a few EWM plants on the southwestern side that can be hand pulled. Also on the south side of the lake, on the western side, there are a few EWM plants that were newly discovered in 2012 that can be hand pulled in 2013.

Lake Emily
Eurasian Water Milfoil





● Eurasian Water Milfoil

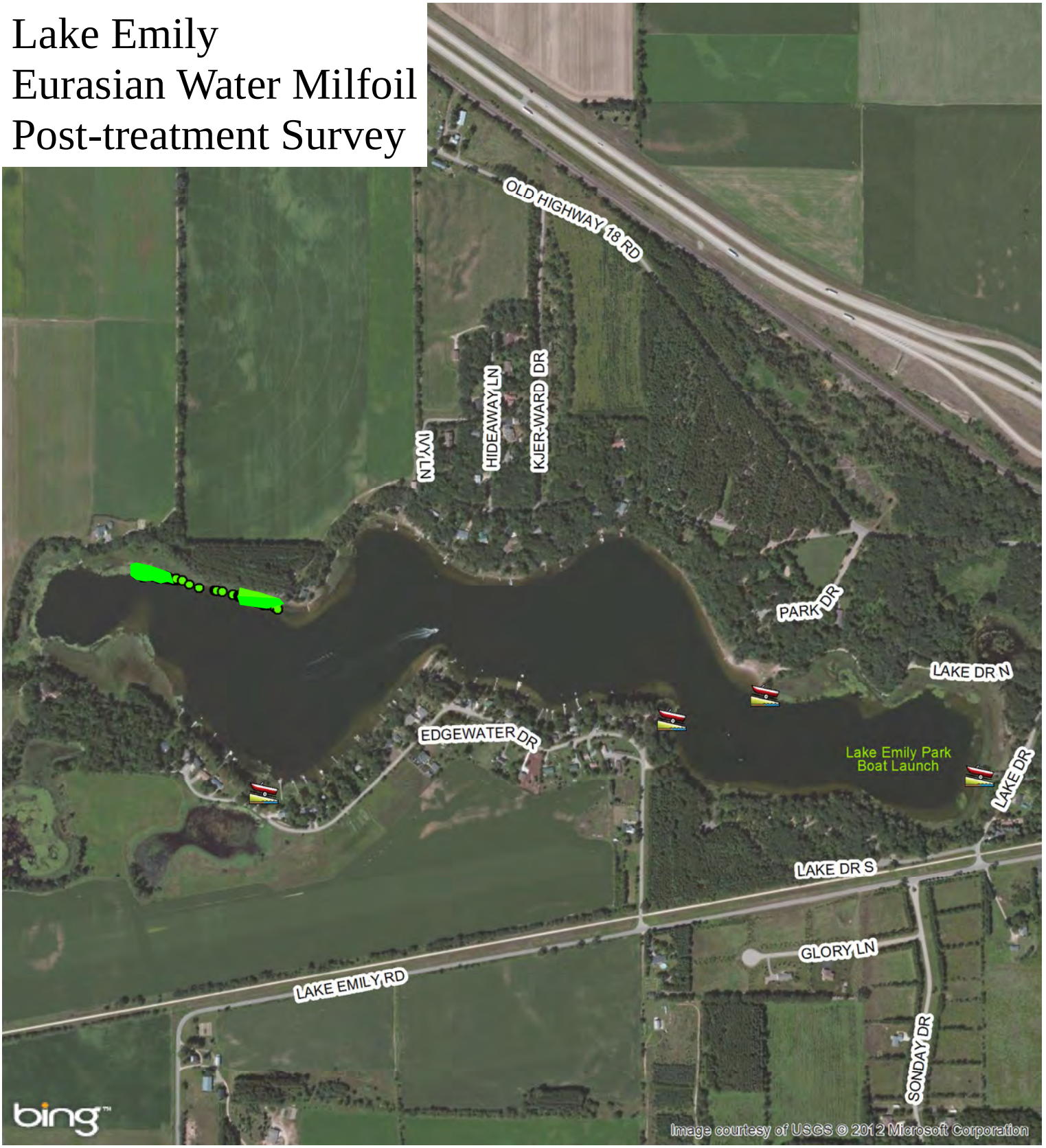
Location:
Town of Amherst
Town 23N Range 9E Section 13
and Range 10E Section 18
Portage County, Wisconsin

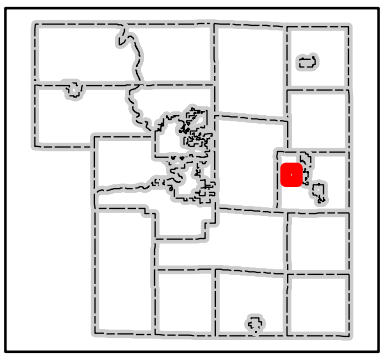
Collected May 16, 2012
with a Garmin GPSmap 76

Feet
0 200 400 600 800

Printed: May 24, 2012
Date of Photography: Summer 2011

Lake Emily
Eurasian Water Milfoil
Post-treatment Survey





● Eurasian Water Milfoil

Collected June 21, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Amherst
Town 23N Range 09E Section 13
Town 23N Range 10E Section 18
Portage County, Wisconsin

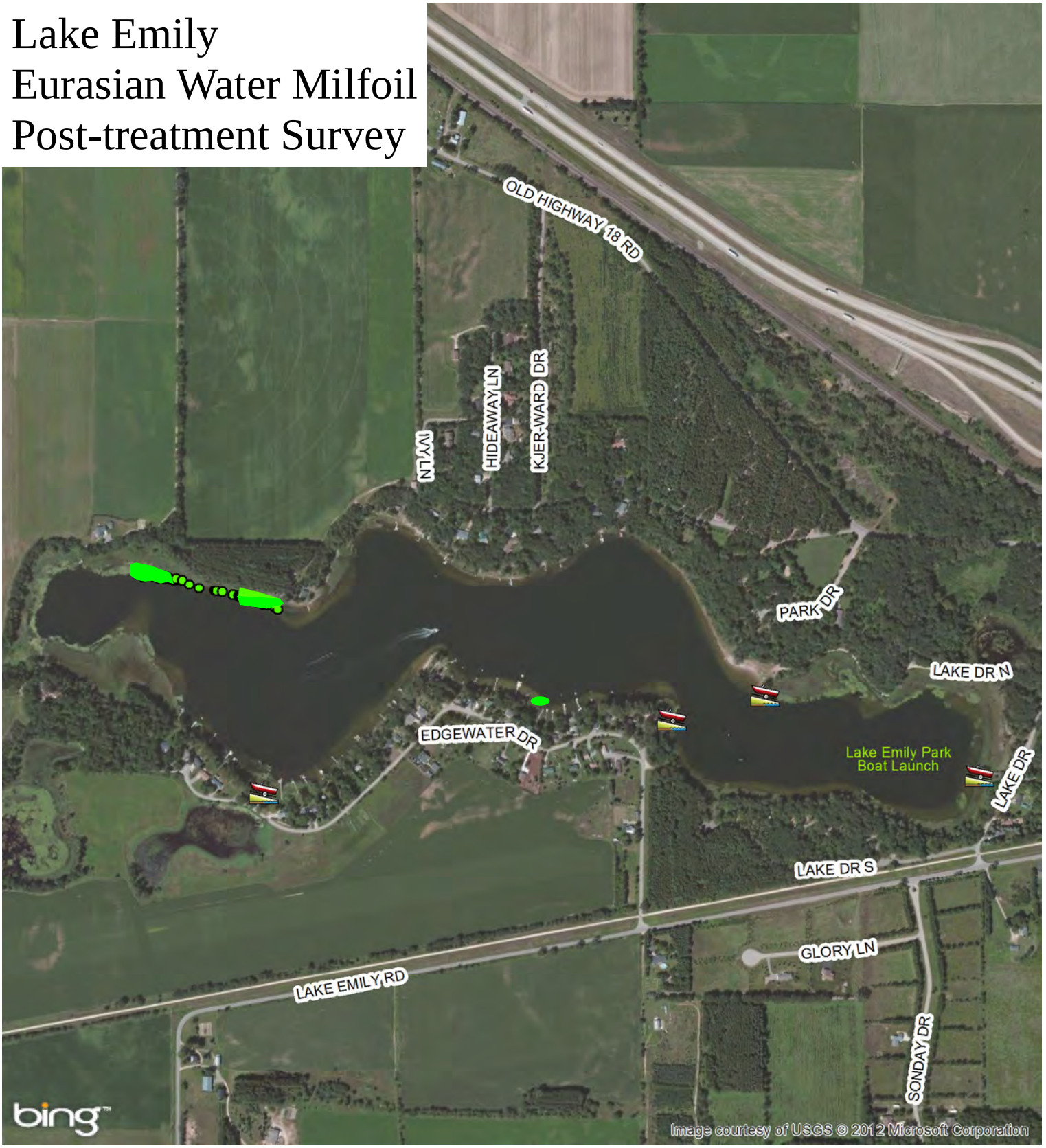
N

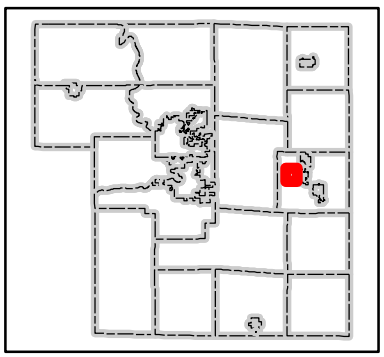
Feet

0 300 600 900

Printed: July 23, 2012

Lake Emily
Eurasian Water Milfoil
Post-treatment Survey





● Eurasian Water Milfoil

0.25 acres total

Collected June 21, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Amherst
Town 23N Range 09E Section 13
Town 23N Range 10E Section 18
Portage County, Wisconsin

N

Feet

0 300 600 900

Printed: July 23, 2012

Fountain Lake, Portage County AIS survey results
July 6th , 2012
Conducted by Savanna Dahl, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

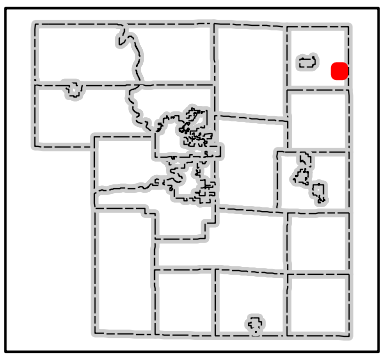
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Illinois pondweed
Chara
Sago pondweed
Fries' pondweed
Coontail
Northern watermilfoil
Variable pondweed
Whorled watermilfoil
Water smartweed
Bullhead pond lily
*Banded mystery snail

Notes:

No aquatic invasive species are present at this lake, except for banded mystery snails.

Lake Helen
Eurasian Water Milfoil



Eurasian Water Milfoil

Collected June 12, 2013
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Alban
Town 25N Range 10E
Sections 25 and 26
Portage County, Wisconsin

N

Feet
0 100 200 300

Printed: July 16, 2013

Jacqueline Lake, Portage County AIS survey results
June 22nd, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

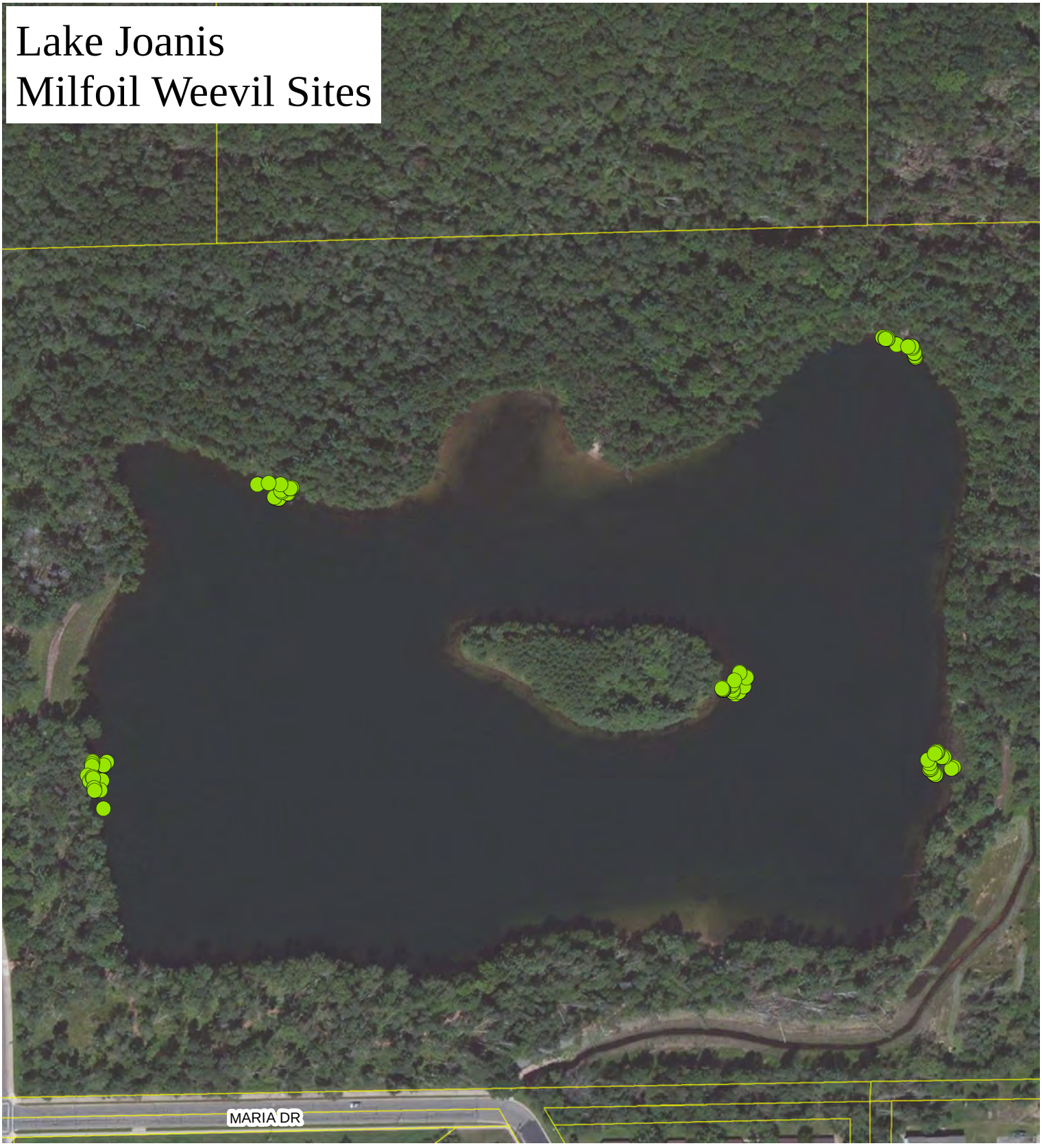
During the course of the survey, observed native aquatic plants were also recorded.

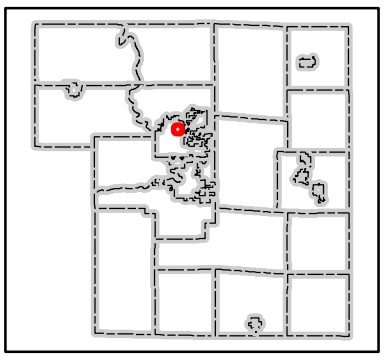
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Large purple bladderwort
Watershield
White water lily
Arrowhead
Floating leaf pondweed
Ribbon leaf pondweed
Water smartweed
Large leaf pondweed
Small purple bladderwort
Spike rush
Water bull rush
Common bladderwort
Bullhead pond lily

Notes:

Lake Joanis
Milfoil Weevil Sites





Weevil Sample Points

Location:
City of Stevens Point
Town 24N Range 08E
Section 28
Portage County, Wisconsin

Collected June 4, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

N

Feet

0 100 200 300 400

Printed: June 27, 2012

Jordan Pond, Portage County AIS survey results
July 23th, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Small duckweed
Large duckweed
Common waterweed
Coontail
Bullhead lily
Sago pondweed
Flat-stemmed pondweed
Watermeal
Striped White water lily
***Eurasian watermilfoil**
***Curly leaf pondweed**
***Rusty Crayfish**
***Purple loosestrife**

Notes:

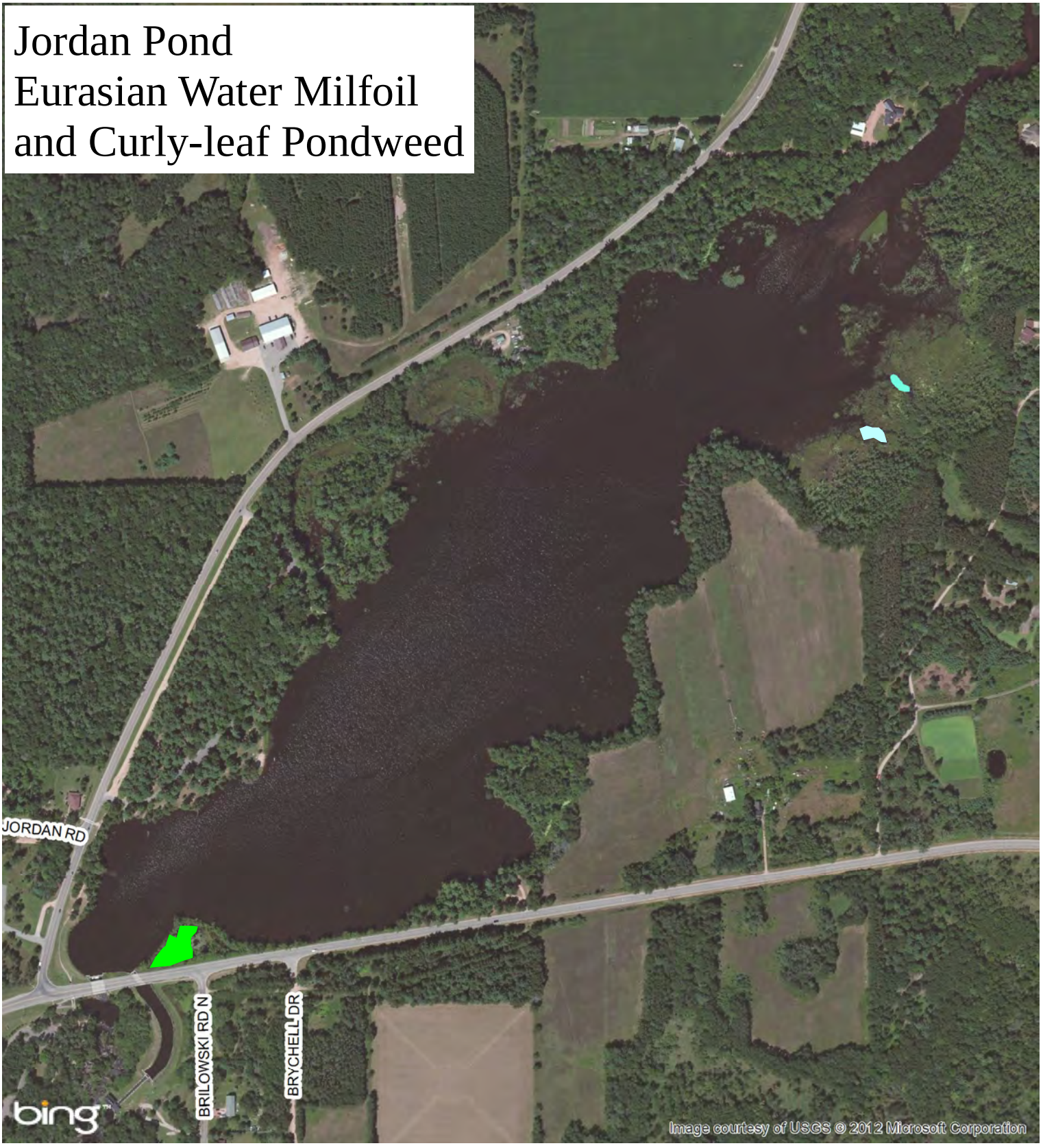
Eurasian Watermilfoil was found in a small bay just up from the dam. The bay was accessible only by kayak, and did not have carp in it, like the rest of the pond did. The pond had very little vegetation, with water lilies being the main aquatic plant. The small, very shallow bays had more vegetation.

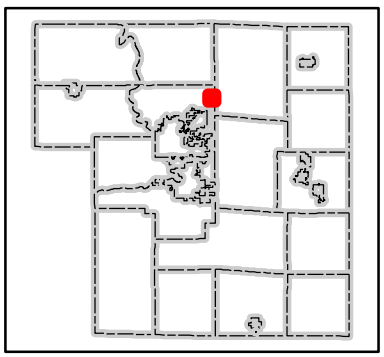
Curly leaf pondweed was found in two such bays on the east side of the lake. The plants were scattered, and are probably more numerous earlier in the year.

Rusty crayfish are common throughout the lake.

A few purple loosestrife plants were found on the sandbar island just south of the mouth of where the river comes into the lake.

Jordan Pond
Eurasian Water Milfoil
and Curly-leaf Pondweed





Eurasian Water Milfoil
Curly-leaf Pondweed

0.49 acres

Collected July 23, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Hull
Town 24N Range 08E Section 12
Portage County, Wisconsin

Feet
0 200 400 600

Printed: August 10, 2012

Lime Lake, Portage County AIS survey results
June 21st, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

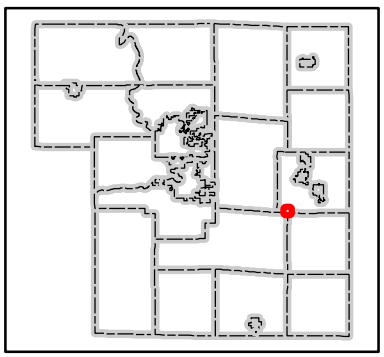
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Coontail
Illinois pondweed
Flat-stemmed pondweed
White Water lily
Northern water milfoil
***Banded mystery snail**
***Curly leaf pondweed**
Sago pondweed
Common Waterweed (Elodea)
Common Bladderwort
Large duckweed
Fries pondweed
Bullhead pond lily
White stemmed pondweed
Chara
***Narrow leaved cattail**

Notes:

This lake had been treated for Eurasian watermilfoil in 2011. No new plants were discovered during this survey. Curly leaf pondweed was discovered near the boat landing scattered out until the end of the cattails. About 48 plants were found. All plants were hand pulled, including turions. There is a very abundant native milfoil population and coontail population throughout the littoral zone.

Lime Lake
Curly-leaf Pondweed



● Curly-leaf Pondweed

Density of vegetation: Individual plants
near the boat launch

Collected June 21, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

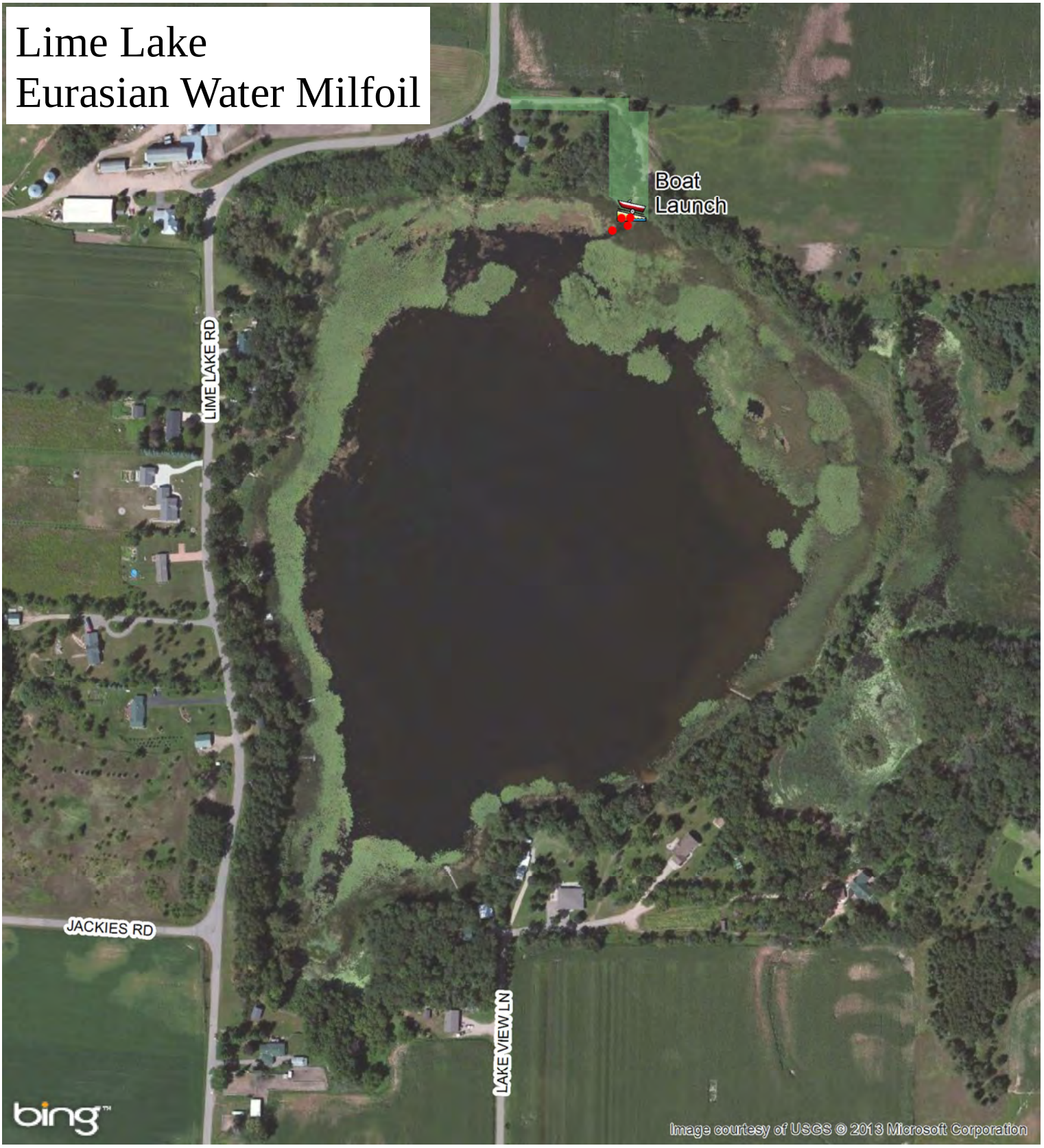
Location:
Town of Amherst
Town 23N Range 09E Section 36
Town 23N Range10E Section 31
Portage County, Wisconsin

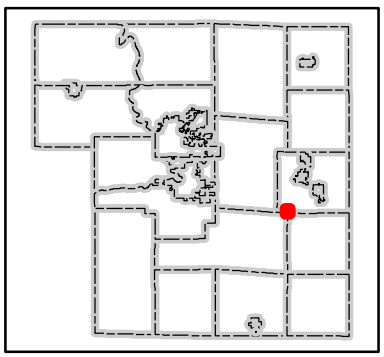
N

Feet
0 100 200 300

Printed: July 23, 2012

Lime Lake
Eurasian Water Milfoil





Eurasian Water Milfoil

Collected June 12, 2013
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Amherst
Town 23N Range 9E Section 36 and
Town 23N Range 10E Section 31
Portage County, Wisconsin

Feet
0 100 200 300

Printed: July 16, 2013

Meyers Lake, Portage County AIS survey results
July 8th , 2012
Conducted by Savanna Dahl, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Illinois pondweed
Northern watermilfoil
Variable pondweed
White stem pondweed
Common waterweed
Slender naiad
Floating leaf pondweed
Flat stem pondweed
Watershield
Water stargrass
Common bladderwort
White water lily
Southern naiad
Bullhead pond lily

Notes:

No Aquatic invasive species were found!

Minister Lake, Portage County AIS survey results
June 13th, 2012
Conducted by Paul Skawinski & Kate Carson, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Bullhead pond lily
Watershield
Water smartweed
Common bladderwort
Creeping bladderwort
Twin-stem bladderwort – Special Concern species
Ribbon-leaf pondweed
Small pondweed
Northern St. john's wort
Creeping spikerush
Large-leaf pondweed
Striped white water lily

Notes:

No AIS were found at Minister Lake. Minister Lake has only carry-in access, provided by a short trail from the road.

Onland Lake, Portage County AIS survey results
June 13th, 2012
Conducted by Paul Skawinski & Kate Carson, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Water celery
Turion duckweed (*Lemna turionifera*)
Water smartweed
Water marigold
***Purple loosestrife**
Large-leaf pondweed
Hybrid cattail (*Typha* X *glauca*)
Bullhead pond lily
Three-square bulrush
Native *phragmites australis* (giant reed)
Stiff pondweed
White-stem pondweed
White water crowfoot
Coontail
Flat-stem pondweed
Slender naiad
Common bladderwort
Watershield
Illinois pondweed
Chara
Sago pondweed
Fries' pondweed
Floating-leaf pondweed
Northern watermilfoil
Variable pondweed
Small pondweed
Striped white water lily
***Banded mystery snail**

Notes:
Scattered clumps of purple loosestrife were observed near the boat landing. No beetle damage was observed. Banded mystery snails were scattered around the lake at low density. The water clarity and aquatic plant diversity was excellent.

Lake Pacawa, Portage County AIS survey results
July 3th, 2012
Conducted by Kaycie Stushek & Savanna Dahl, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

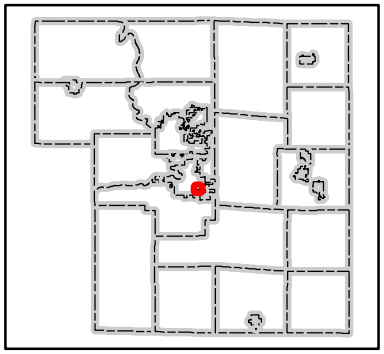
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Sago pondweed
Illinois Pondweed
Chara
Northern Watermilfoil
Flat-stemmed pondweed
***Eurasian watermilfoil/Northern watermilfoil hybrid**

Notes:

EWM/NWM hybrid was abundant throughout the lake. The plant diversity was low, but water clarity was high.

Lake Pacawa
Eurasian Water Milfoil



Eurasian Water Milfoil

Bed	Acreage	Bed	Acreage	Bed	Acreage	Bed	Acreage
1	0.425	5	0.158	9	0.004	13	0.036
2	0.267	6	0.004	10	0.369	14	1.181
3	0.080	7	0.031	11	0.739	15	0.173
4	0.186	8	0.064	12	0.024	16	0.176

Density for all beds: 1 plant per foot to 1 plant per 5 feet

Collected July 3, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Village and Town of Plover
Town 23N Range 08E Section 36
Portage County, Wisconsin

Feet
0 100 200 300

Printed: July 20, 2012

Pickerel Lake – Portage County AIS survey results
June 1st, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

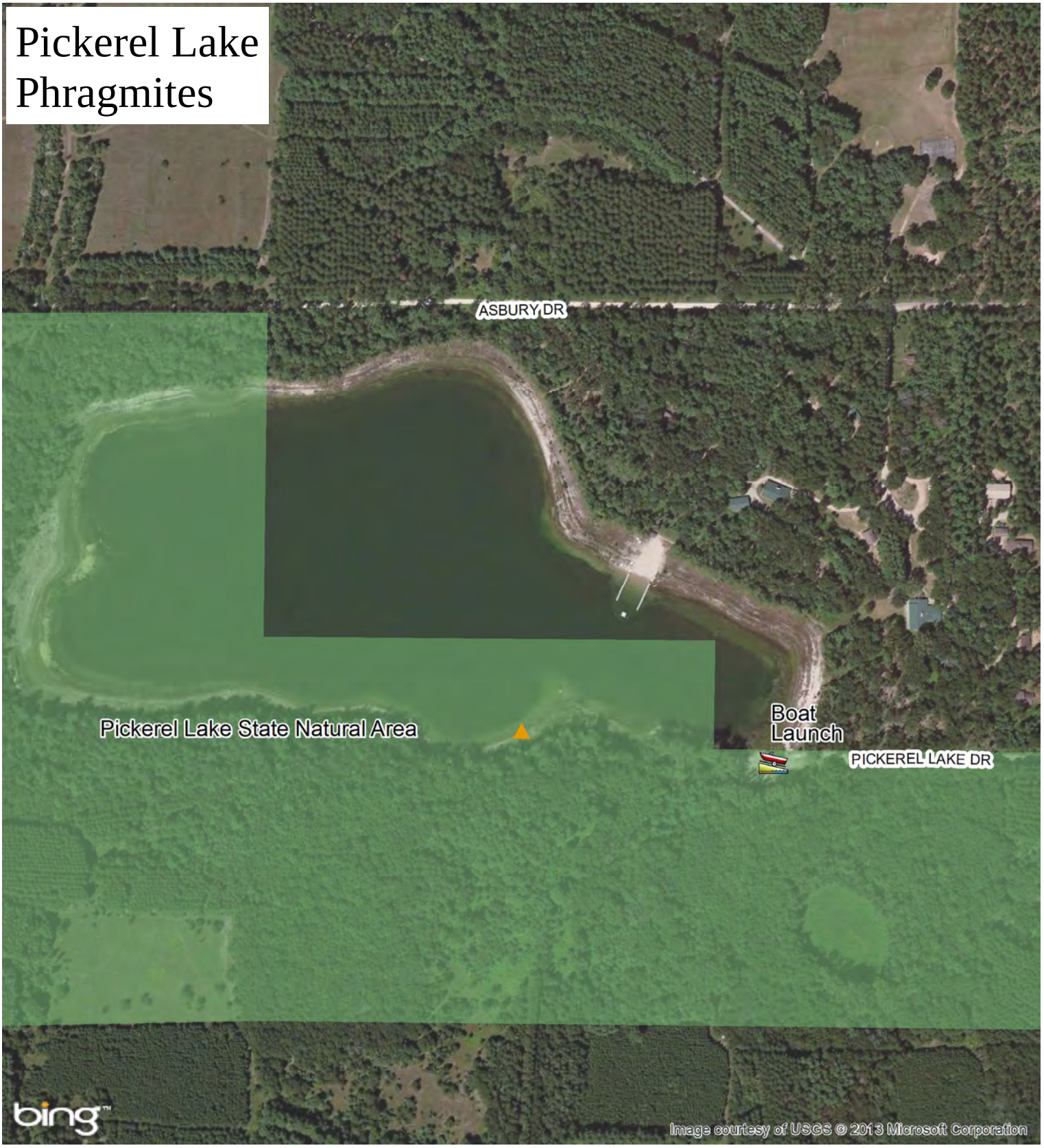
During the course of the survey, observed native aquatic plants were also recorded.

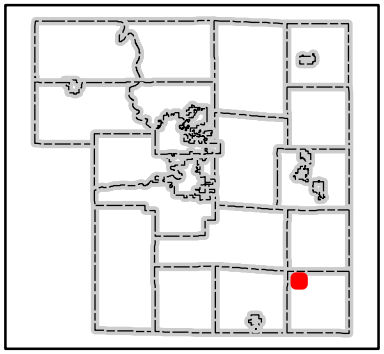
AIS & Aquatic Plant List (AIS highlighted with an asterisk)

*Banded mystery snail
Chara
Slender Naiad
Illinois pondweed
Sago Pondweed

Was conducting post herbicide treatment for Eurasian Watermilfoil (EWM) conducted one month prior. No living EWM was found, but some dead leaflets of both EWM and Northern Watermilfoil were found floating. The water was very murky with tiny bits of floating marl or detritus, so it made visibility very low. This was assumed to be from the herbicide treatment, which covered a large portion of the lake. I did not see any Fassett's locoweed flowering either. The water was up at least a foot from last year, which could be the contributing factor.

Pickerel Lake Phragmites





▲ Phragmites

Collected June 10, 2013
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Belmont
Town 21N Range 10E
Sections 5 and 6
Portage County, Wisconsin

N

Feet
0 100 200 300

Printed: July 16, 2013

Rinehart Lake, Portage County AIS survey results
June 13th, 2012
Conducted by Paul Skawinski & Kate Carson, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Bullhead pond lily
Variable pondweed
Slender naiad
Sago pondweed
Floating-leaf pondweed
Fries' pondweed
Northern watermilfoil
White-stem pondweed
Small pondweed
Broad-leaf arrowhead
White water crowfoot
Flat-stem pondweed
Common bladderwort
Illinois pondweed
Chara
Striped white water lily
***Banded mystery snail**

Notes:

Banded mystery snails scattered at low density. Substrate is dominated by muskgrasses (*Chara* spp.). Near-shore areas dominated by abundant hardstem bulrush (*Schoenoplectus tabernaemontani*).

Rocky Run Lake, Portage County AIS survey results
June 5th, 2012
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Large-leaf pondweed
Common bladderwort
Pickerelweed
Purple loosestrife (with beetle damage, eggs)
Bullhead pond lily
Chara/muskgrass
Water celery
Creeping spikerush
Ribbon-leaf pondweed
Needle spikerush
Creeping bladderwort
Slender waterweed
Vasey's pondweed – (*Potamogeton vaseyi* – SPECIAL CONCERN SPECIES)
Water purslane (*Ludwigia palustris*)
Northern St. Johns' wort (*Hypericum boreale*)
Brown-fruited rush
Common waterweed
Water-thread pondweed (*Potamogeton diversifolius* subsp. *diversifolius* – SPECIAL CONCERN SPECIES)

Notes:

Eurasian watermilfoil was hand-pulled several times throughout 2009 and early 2010. EWM has not been detected since then, using visual survey methods and an underwater camera.

The aquatic plant community is fantastic for a natural lake, let alone a constructed wetland. Water-thread pondweed was observed in a healthy bed of several hundred plants or more. Both subspecies of *P. diversifolius* are rare across the state, but subsp. *diversifolius* is very rarely seen. Vasey's pondweed (*Potamogeton vaseyi*) and slender waterweed (*Elodea nuttallii*) also quite rare, especially in Central Wisconsin.

A specimen of water-thread pondweed was collected for the Natural Heritage Inventory records, and will be submitted to the UWSP Freckmann Herbarium.

Purple loosestrife was the only exotic species found. Rocky Run Lake is used primarily by canoe/kayak/rowboat fishermen, and for training hunting dogs.

Spring Lake, Portage County AIS survey results
August 7th, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

White water crowfoot
Northern Watermilfoil
Chara
Coontail
Flat-stemmed pondweed
Clasping leaf pondweed
Floating leaf pondweed
Watercress (introduced)
Small duckweed
Blunt tipped pondweed
Forked duckweed
Water stargrass
Bullhead pond lily
Common Bladderwort
***Banded mystery snail**
***Curly leaf pondweed**
***Purple loosestrife**

Notes:

Curly leaf pondweed was present in a few patches, or as single plants in the lake. One patch near the south west side contained very small plants, and was in shallow water. It was hand pulled, and consisted of about 60 plants.

Northern watermilfoil was abundant, as was clasping leaf pondweed. The clasping leaf pondweed seemed to be in very dense patches, and it is important it is not mistaken for Curly leaf pondweed in the future.

The lake is spring fed, and is very cold. The curly leaf pondweed was healthy, varied greatly in size and was not forming turions.

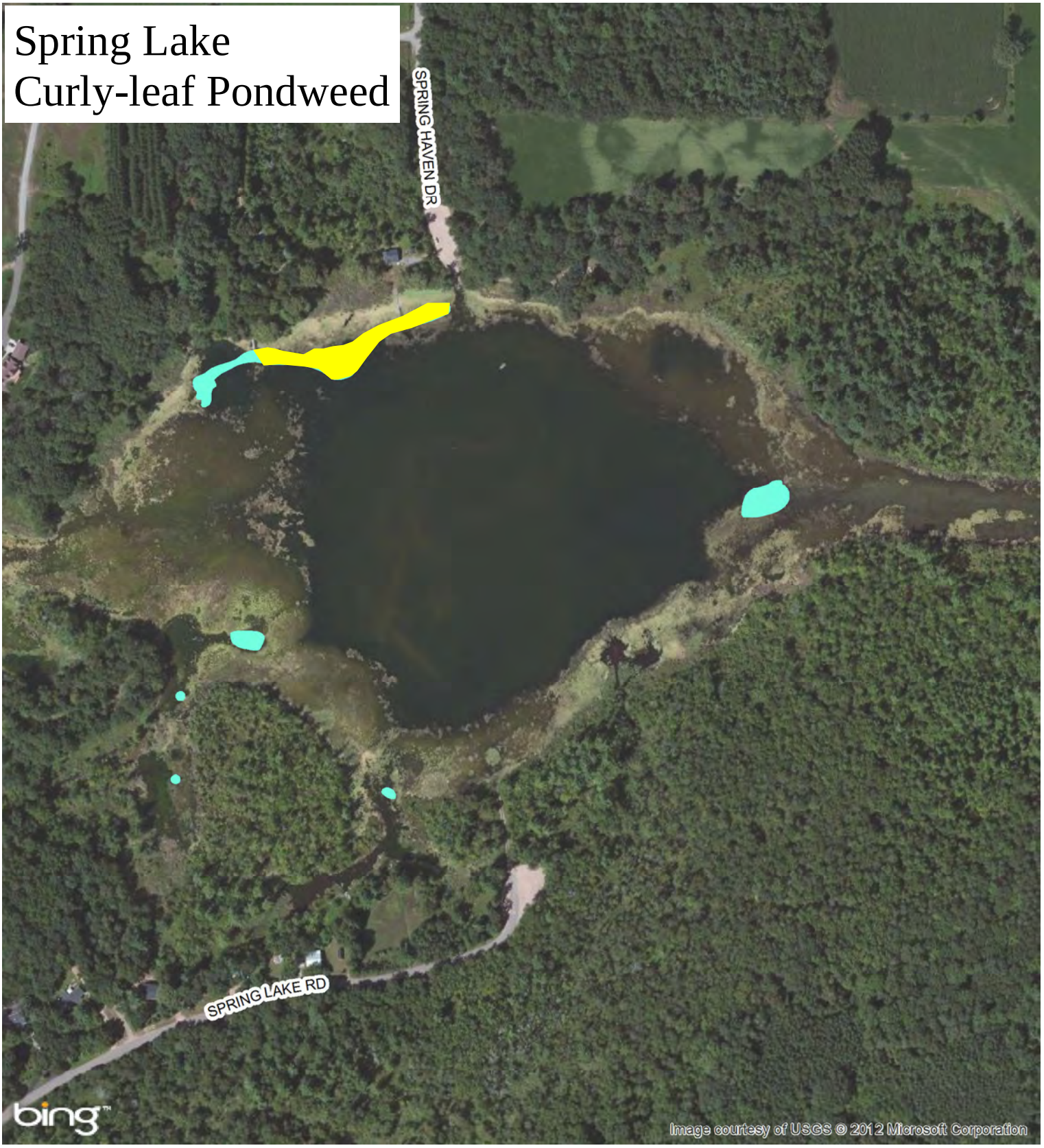
Banded mystery snails were present, but not abundant, near the boat landing.

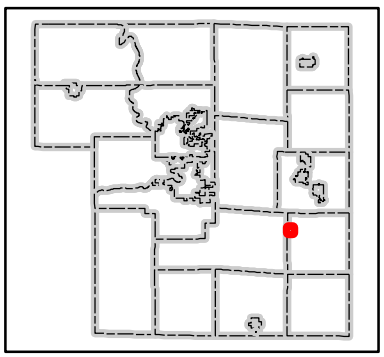
Purple loosestrife was located in the cattail area to the east of the boat landing.

One tiny watercress plant was found in the back of a bay on the southeast side of the lake. Algae is abundant in some small bays of the lake. A pink-color was present in some locations where algae was abundant, and a spring entered the lake.

Chara was close to the surface in many areas on the western end of the lake, prohibiting passage to the very west end of the lake.

Spring Lake
Curly-leaf Pondweed





Curly-leaf Pondweed Rake Density 2

Curly-leaf Pondweed Rake Density 1

Collected August 7, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Lanark
Town 23N Range 10E Section 7
Portage County, Wisconsin

Feet
0 100 200 300

Printed: August 10, 2012

Springville Pond, Portage County AIS survey results
June 11th, 2012
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

***Eurasian watermilfoil**
***Curly-leaf pondweed**
Sago pondweed
***Banded mystery snail**
Horned pondweed
Filamentous algae
Variable pondweed
Illinois pondweed
Clasping leaf pondweed
Fries' pondweed
Common waterweed
***Exotic *Nymphaea* species (water lily)**
White water crowfoot
Leafy pondweed
Watercress
Water stargrass
***Aquatic forget-me-not**
Small duckweed
***Yellow Iris**
*** Japanese knotweed**

Notes:

Eurasian Watermilfoil was found scattered throughout the lake, with a few dense patches. A very dense patch of Eurasian watermilfoil was located on the east side of the lake. EWM, common waterweed, sago pondweed, duckweed, curly leaf pondweed and algae make the east side of the lake almost impassable by kayak. Weevils were found in high densities on the mid and eastern sides of the lake.

CLP also widespread, but sparse throughout the lake, and mostly restricted to the upper half of the pond. CLP is abundant in the upper 10% of the pond, near the inlet.

Also at the upper end surrounding the inlet, aquatic forget-me-not (*Myosotis scorpioides*) is common along the shorelines, mixed with two abundant exotics - bittersweet nightshade (*Solanum dulcamara*) and reed canary grass (*Phalaris arundinacea*).

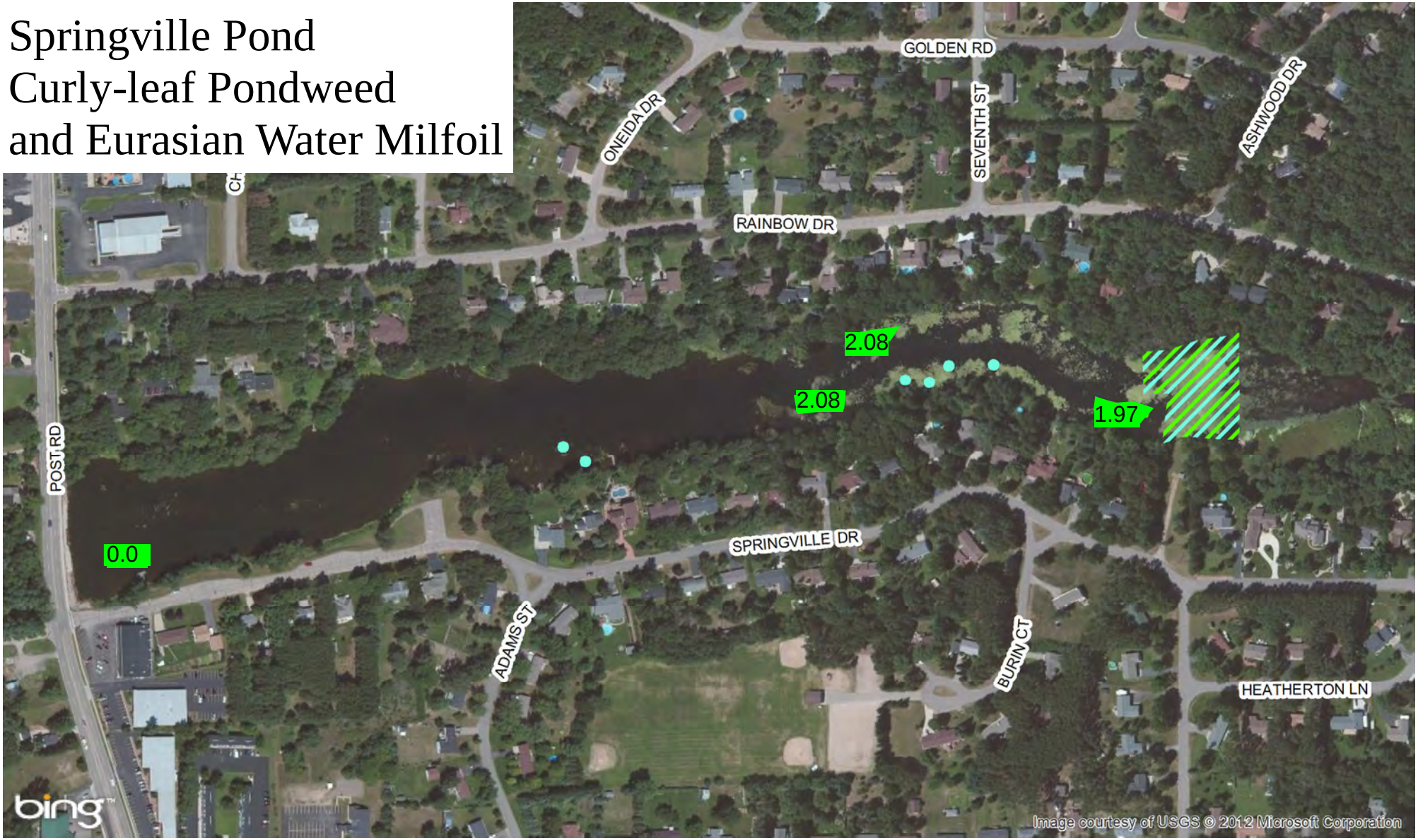
Exotic water lilies (*Nymphaea* sp.) were found near the east end of the pond, planted next to a dock. These lilies covered an area of approximately 80 sq ft. Both cream-colored and white lilies existed. Since no native Nymphaea species were found in Springville, the white lilies in this location are probably also exotic cultivars planted alongside the cream-colored ones.
Yellow Iris (*Iris pseudacorus*) was also found at this location, adjacent to the lilies.

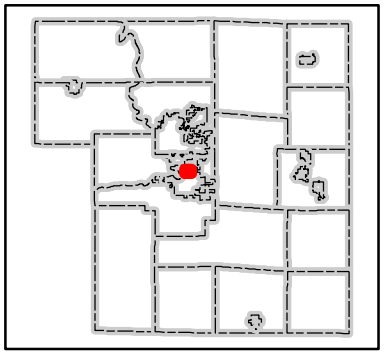
Banded mystery snails were very abundant in some locations.

Japanese knotweed (*Polygonum cuspidatum*) was found on the northwest side. It appears to be on the boundary between a house and the dental clinic.


Rainbow Dr
Chippewa Dr
Ojibwa Ln
Oneida Dr
Seventh St
Ashwood Dr
B51
51
Springville Pond
Little Plover River
Plover
PORTAGE
Springville Dr
Adams St
Burtin Ct
Heatherton L
Heatherton L

Springville Pond
Curly-leaf Pondweed
and Eurasian Water Milfoil





Eurasian Water Milfoil

Curly-leaf Pondweed

*Rest of the Lake has Eurasian water milfoil lightly scattered throughout. Map shows dense beds and average weevils/stem.

Collected July 23, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Village of Plover
Town 23N Range 08E Section 15
Portage County, Wisconsin

Feet
0 100 200 300

Printed: August 10, 2012

Stoltenburg Lake (Lake Elaine), Portage County AIS survey results
June 13th, 2012
Conducted by Paul Skawinski & Kate Carson, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Bullhead pond lily
Water stargrass
Stiff pondweed
White water crowfoot
Coontail
Flat-stem pondweed
Slender naiad
Water horsetail (*Equisetum fluviatile*)
Common bladderwort
Broad-leaf cattail
Hybrid cattail
Watershield
Broad-leaf arrowhead
Illinois pondweed
Chara
Sago pondweed
Fries' pondweed
Floating-leaf pondweed
Northern watermilfoil
Variable pondweed
Small pondweed
Striped white water lily
***Banded mystery snail**
Small duckweed

Notes:

Banded mystery snails were scattered around the lake at low density. Most of the cattails were broad-leaf (*Typha latifolia*), though some hybrid cattails (*Typha* X *glauca*) were observed. Most of the cattail clones were in flower.

Sunset Lake, Portage County AIS survey results
June 11th, 2012
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

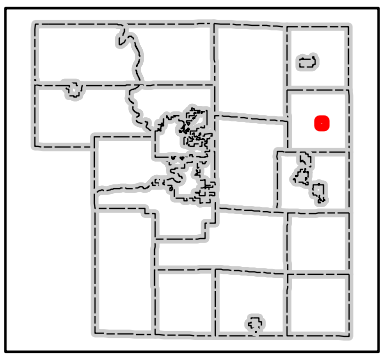
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

Variable pondweed
Illinois pondweed
Chara
Floating-leaf pondweed
***Banded mystery snail**
Common bladderwort
Slender naiad
***Eurasian watermilfoil**
Aquatic moss (*Drepanocladus* sp.)
Sago pondweed
Brown-fruited rush

Notes:

Eurasian watermilfoil was not detected near the boat landing/beach, where it has been present for the last several years. Hand-pulling and herbicides have both been used on the boat landing/beach population. EWM was found this year on the west side of the lake. Two small clumps were in shallow water and were hand-pulled after being recorded with a GPS unit. The third clump was larger and deeper (5-6ft), and could not be hand-pulled from the surface. All of the plants in the third clump were less than 2ft tall, with the majority only ~1ft tall. Snorkeling for these is recommended.
Banded mystery snails were common throughout the lake.

Sunset Lake
Eurasian Water Milfoil



● Eurasian Water Milfoil

Collected July 9, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of New Hope
Town 24N Range 10E Section 22
Portage County, Wisconsin

Feet
0 100 200 300

Printed: July 24, 2012

Thomas Lake, Portage County AIS survey results
June 21st, 2012
Conducted by Kaycie Stushek, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

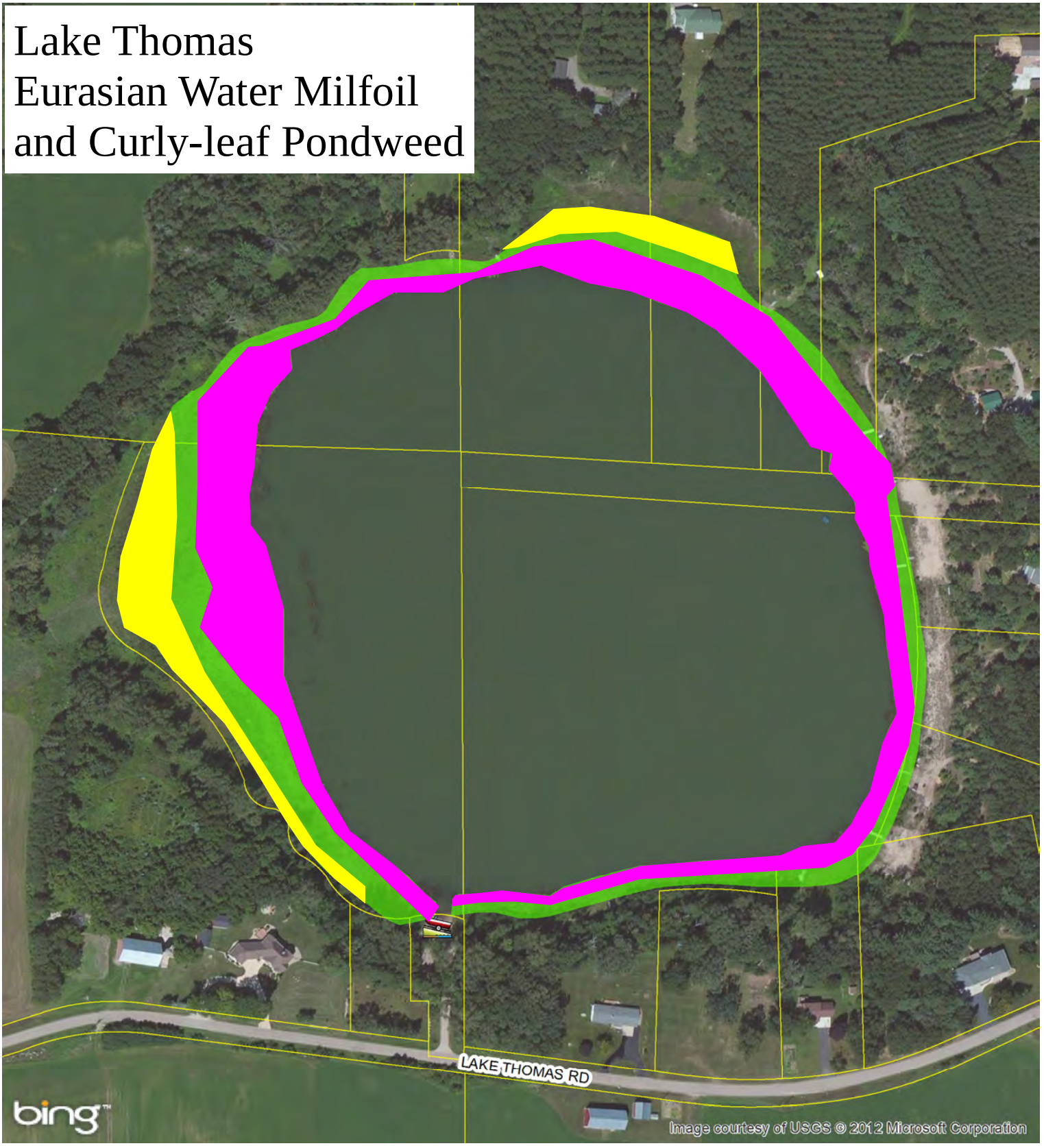
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

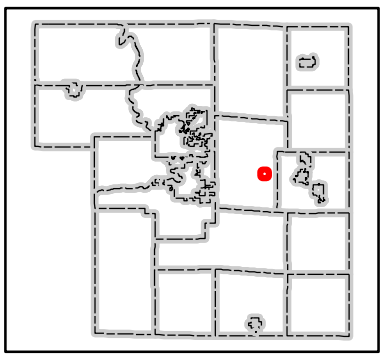
Coontail
Illinois pondweed
Fern pondweed
Hard stemmed Bulrush
Flat-stemmed pondweed
White Water lily
Northern water milfoil
Water smartweed
***Banded mystery snail**
***Eurasian watermilfoil**
***Curly leaf pondweed**
***Giant Reed Grass**
Sago pondweed

Notes:

Eurasian watermilfoil was detected near the boat landing/beach, where it has been present for the last several years. Hand-pulling has been used on the population near the boat landing in the past. The Eurasian watermilfoil grows throughout the entire littoral zone in varying densities, forming a ring around the whole lake. Curly leaf pondweed is also present in less dense patches, but is throughout the littoral zone as well. Giant Reed Grass was present on the east side of the lake inland from the cattails.

Lake Thomas
Eurasian Water Milfoil and Curly-leaf Pondweed





Eurasian Water Milfoil and Curly-leaf Pondweed

Rake density of 3
Rake density of 2
Rake density of 1

Density of vegetation: 1 plant per 6 inches to 1 plant per 7 feet

Total Acres: 8.8

Collected June 21, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

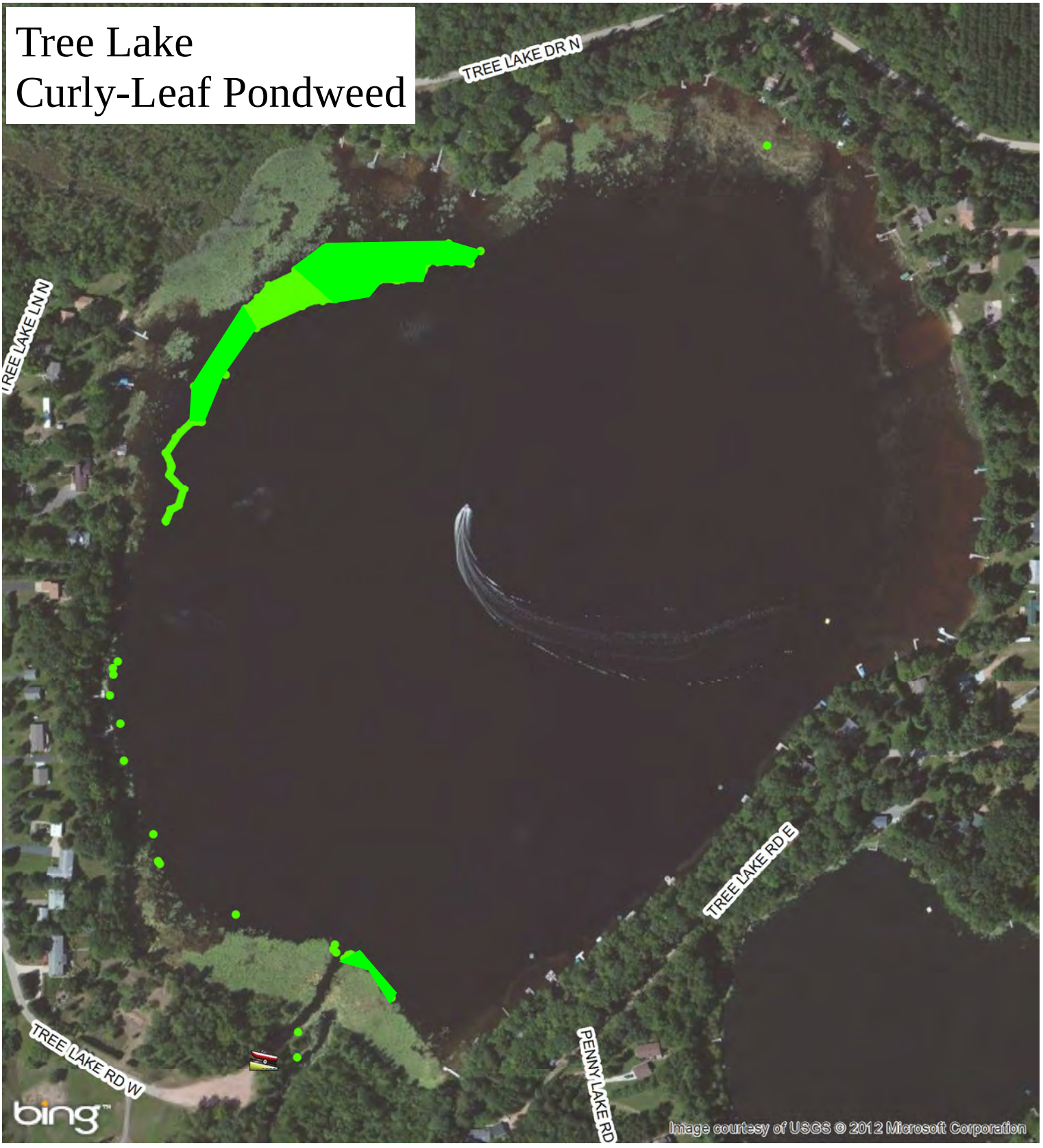
Location:
Town of Stockton
Town 23N Range 09E Section 15
Portage County, Wisconsin

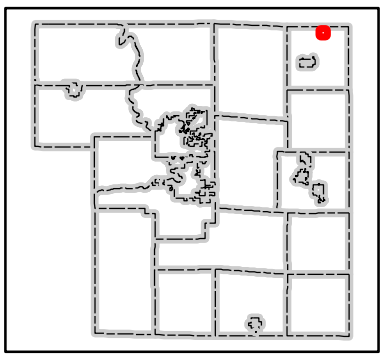
N

Feet
0 100 200 300

Printed: July 23, 2012

Tree Lake
Curly-Leaf Pondweed





Curly-Leaf Pondweed

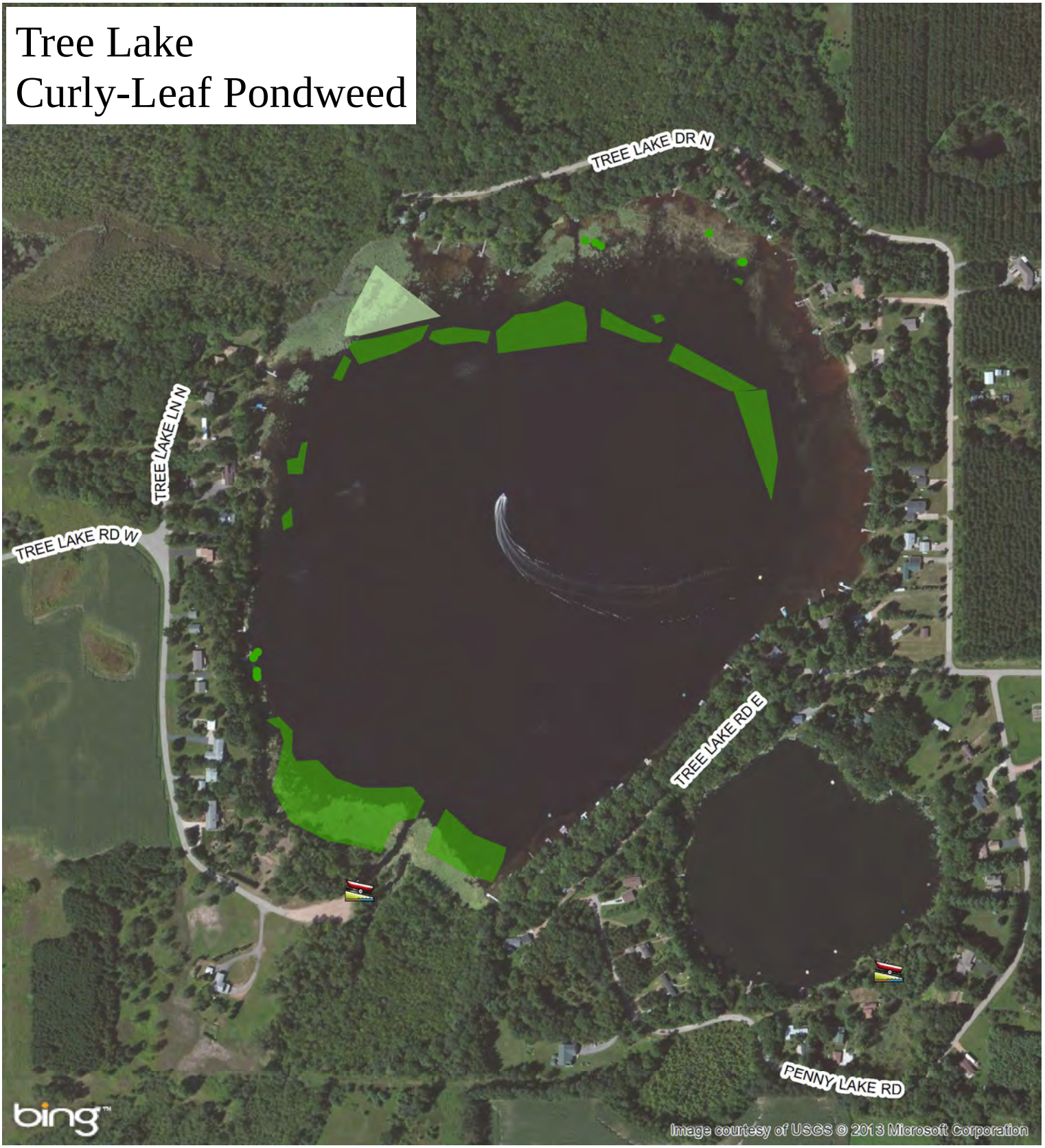
Collected July 11, 2012
with a Garmin GPSmap 62st

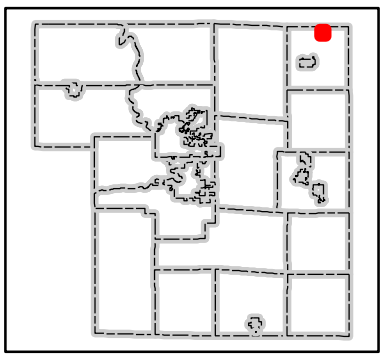
Date of Photography: Summer 2011

Location:
Town of Alban
Town 25N Range 10E Section 3
Portage County, Wisconsin

N
Feet
0 100 200 300
Printed: July 24, 2012

Tree Lake
Curly-Leaf Pondweed





Curly-Leaf Pondweed

- Rake-full density 1
- Rake-full density 3

Collected June 12, 2013
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

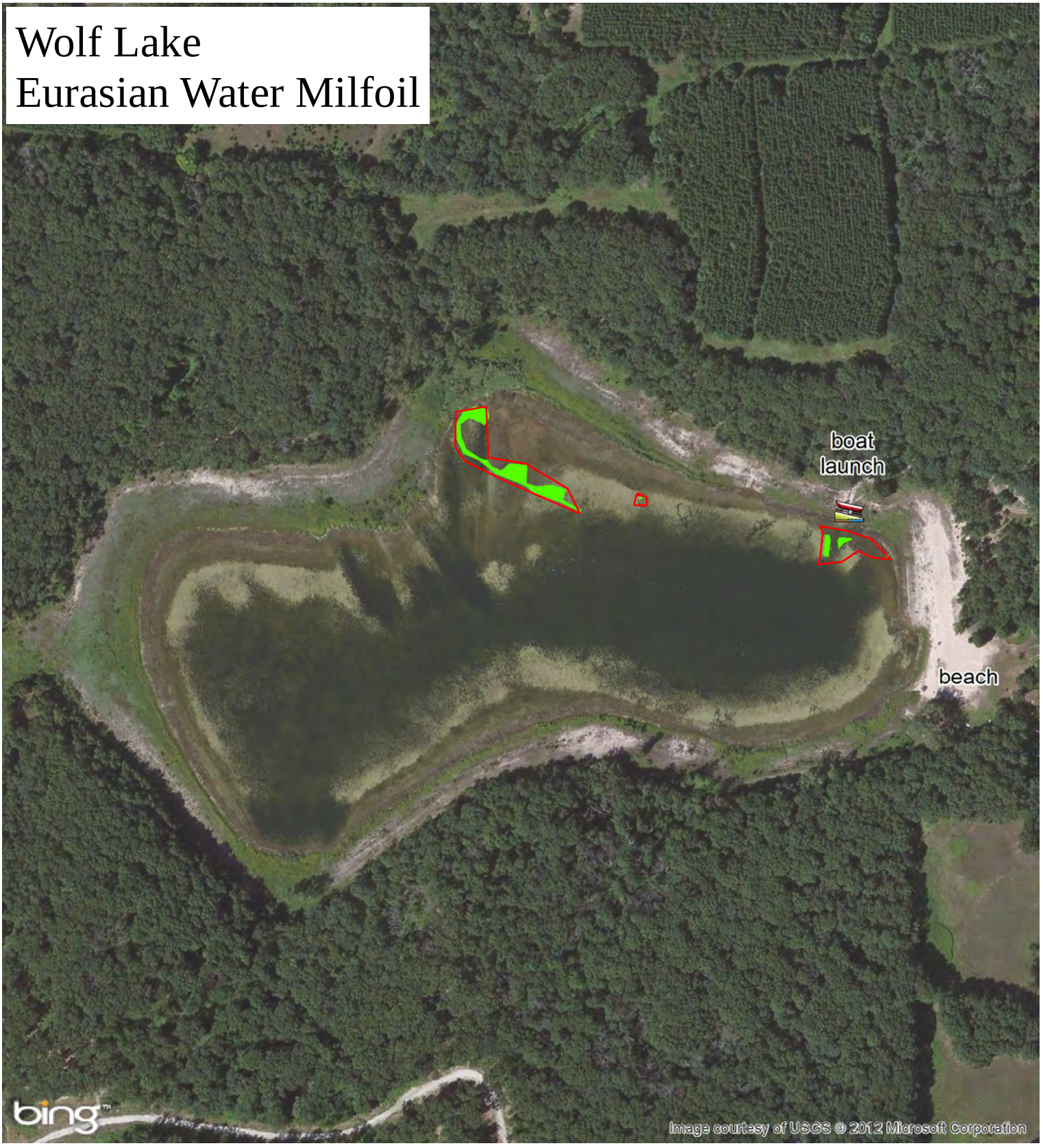
Location:
Town of Alban
Town 25N Range 10E Section 3
Portage County, Wisconsin

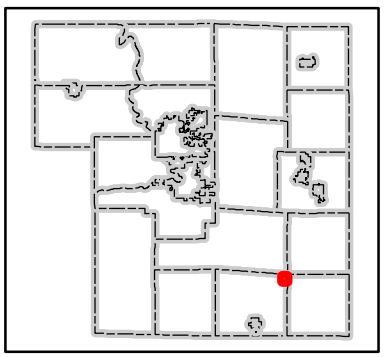
N

Feet
0 100 200 300

Printed: July 16, 2013

Wolf Lake
Eurasian Water Milfoil





Eurasian Water Milfoil

0.188 acres

Collected July 8, 2012
with a Garmin GPSmap 62st

Date of Photography: Summer 2011

Location:
Town of Almond
Town 21N Range 09E Section 1
Portage County, Wisconsin

N

Feet
0 100 200 300

Printed: September 18, 2012

Appendix 9

Lake Dexter – Wood County AIS survey results
August 5th, 2013
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)

***Curly-leaf pondweed**
Sago pondweed
Coontail
Broad-leaf arrowhead
Water celery
Filamentous algae
Longleaf pondweed
Purple loosestrife
Floating-leaf pondweed
Small duckweed
Mud-midget (*Wolffiella gladiata*)
Blue-green algae (occurring in several near-shore areas)
Common waterweed
Leafy pondweed
Slender Nitella (*Nitella flexilis*)
Slender waterweed
Water smartweed

Notes:
Visibility was about 1 foot. Maximum observed depth of rooted aquatic plants was also about 1 foot (sago pondweed). Blue-green algae bloom was observed in a few stagnant locations near shore. Mud-midget (*Wolfiella gladiata*) was observed scattered in very low density throughout the lake, which is the first record of this very small species in Wisconsin.

Lake Nepco – Wood County AIS survey results
August 12th, 2013
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

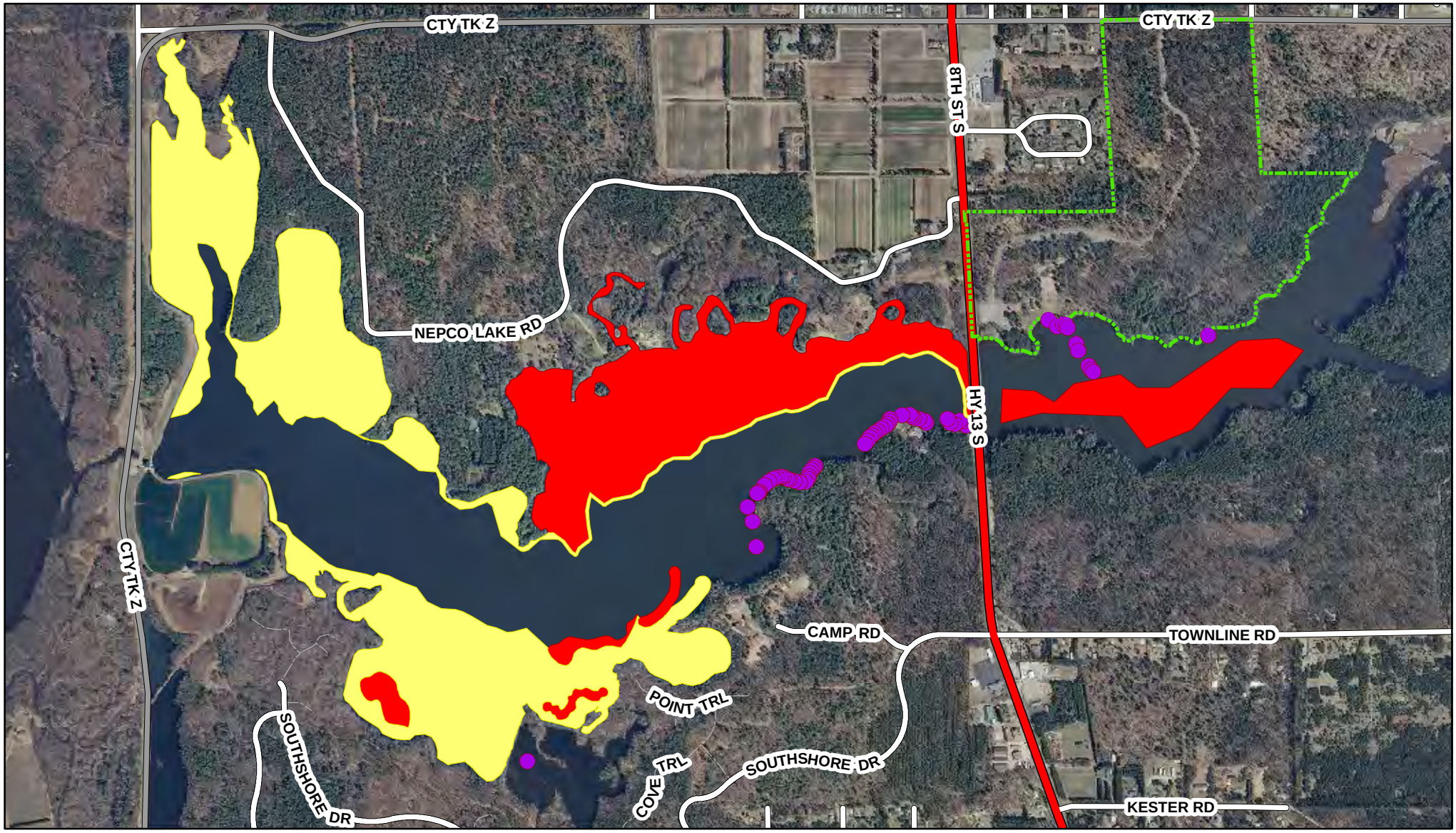
AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)
Low-priority "watch" species are highlighted in orange

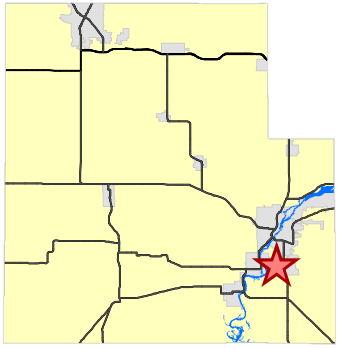
***Curly-leaf pondweed**
Common waterweed
Clasping-leaf pondweed
White-stem pondweed
Water stargrass
Coontail
Water celery
***Eurasian watermilfoil**
Large-leaf pondweed
***Zebra mussels**
Flat-stem pondweed
Sago pondweed
***Banded mystery snail**
***Rusty crayfish**
***Chinese mystery snail**
Fries' pondweed
White water lily
Northern watermilfoil
Floating-leaf pondweed
Needle spikerush
Slender naiad
Watermeal (2 species found – *Wolffia borealis, Wolffia columbiana*)
Bullhead pond lily
White water crowfoot
Long-leaf pondweed
Flat-stem pondweed
Variable pondweed
Small pondweed
Alpine pondweed
Common bladderwort
Illinois pondweed
Small duckweed
Large duckweed
Leafy pondweed
Broad-leaf arrowhead
Hardstem bulrush
Softstem bulrush
Horned pondweed
Narrow-leaf cattail

Hybrid cattail (*Typha latifolia* x *T. angustifolia*)
Aquatic forget-me-not
Yellow Iris
Broad-leaf cattail
Muskgrass (three species found – *Chara contraria, Chara globularis, Chara braunii*)

Notes:
Eurasian watermilfoil is common throughout much of the lake, forming dense beds in many areas. EWM is most dense in the north central and eastern areas of the lake. Curly-leaf pondweed was observed, but was probably at lower-than-normal abundance because of the time of year. Zebra mussels were common throughout the lake. Banded and Chinese mystery snails were observed at low density near the county park. Yellow Iris was observed on the SW side of the Hwy 13 bridge.

Alpine pondweed, a rare native species, was found in a quiet bay across from the county park.





Eurasian Water Milfoil

NEPCO Lake, Wood County, Wisconsin

- Rake Density 1
- Rake Density 2
- Individual EWM Plants or Clumps

Collected: July 23, 2013
Equipment: Garmin GPSMap 62st
Date of Photography: Spring 2010

N

Miles
0 0.1 0.2 0.3 0.4 0.5

Printed Date: 10/29/2013

Lake Wazeecha – Wood County AIS survey results
July 23rd, 2013
Conducted by Paul Skawinski and Trevor Skerven, Golden Sands RC&D

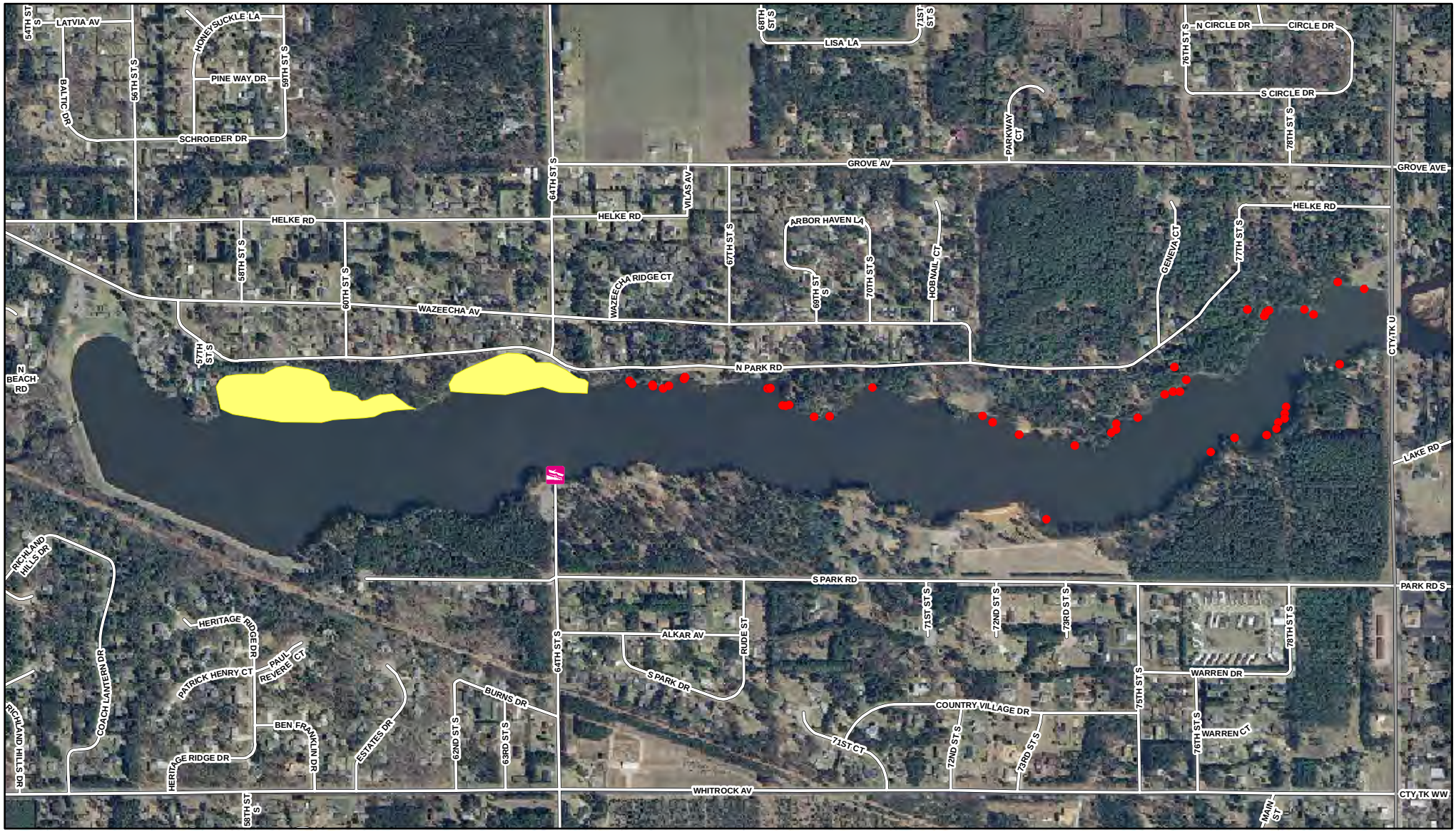
During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)
Low-priority "watch" species are highlighted in orange

***Curly-leaf pondweed**
Common waterweed
Water celery
***Eurasian watermilfoil**
Large-leaf pondweed
Floating-leaf bur-reed
***Zebra mussels**
Flat-stem pondweed
Sago pondweed
***Banded mystery snail**
***Rusty crayfish**
Fries' pondweed
White water lily
Water stargrass
Coontail
Floating-leaf pondweed
Needle spikerush
Long-leaf pondweed
Ribbon-leaf pondweed
Alpine pondweed
Water starwort (*Callitriche palustris*)
Common bladderwort
Small duckweed
Leafy pondweed
Broad-leaf arrowhead
Hardstem bulrush
Water plantain
Softstem bulrush
Narrow-leaf cattail
Aquatic forget-me-not
Broad-leaf cattail
Muskgrass (one species found – *Chara contraria*)
Water horsetail

Notes:
Eurasian watermilfoil was scattered throughout most of the littoral zone. Two bays on the north side contained extensive beds of EWM at moderate density. CLP was widely scattered, but may be more

abundant in late spring or early summer. Zebra mussels are common throughout the lake, wherever a hard substrate is found. Banded mystery snails were widely scattered.
Alpine pondweed is a very unusual native species in Central Wisconsin, and was located in a small channel near the campground on the NE side of the lake.



Eurasian Water Milfoil

Lake Wazeecha, Wood County, Wisconsin

Rake Density 1

Individual EWM Plants or Clumps

Collected: July 23, 2013
Equipment: Garmin GPSMap 62st
Date of Photography: Spring 2010

N

Miles

0 0.1 0.2 0.3 0.4 0.5

Printed Date: 10/29/2013

North Wood County Park AIS survey results
August 5th, 2013
Conducted by Paul Skawinski, Golden Sands RC&D

During the course of the survey, observed native aquatic plants were also recorded.

AIS & Aquatic Plant List (AIS highlighted in red and marked with an asterisk*)
Low-priority "watch" species are highlighted in orange

Lake Kaunewinne
***Banded mystery snail**
***Rusty crayfish**
Small duckweed
Large duckweed

Notes:
Gravelly substrate and an abundant rusty crayfish population prevent a healthy aquatic plant community from establishing. Most of shoreline is mowed to the edge, except north of the footbridge. Preservation of native vegetation buffers in at least some select areas would protect water quality, reduce erosion, and provide wildlife habitat.

Lake Manakiki
***Banded mystery snail**
***Rusty crayfish**
Large duckweed
Small duckweed
***Purple loosestrife**

Notes:
A few small purple loosestrife plants found at edge of lake. Most of shoreline is mowed to the edge, except in the campground area. Preservation of native vegetation buffers in at least some select areas would protect water quality, reduce erosion, and provide wildlife habitat.