Osprey Lake Aquatic Plant Management Plan

2010-11

Funded by the Osprey Lake Property Owners Association and a grant from the Wisconsin Department of Natural Resources.

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The Osprey Lake Property Owners Association approved the plan on February 11, 2011. The Wisconsin Department of Natural Resources approved the plan January 11, 2011.

Osprey Lake Aquatic Plant Management Objectives

Goal Statement: The goal of the Osprey Lake Aquatic Plant Management Plan is to protect the native lake ecosystem and native plant populations while guiding efforts to control Eurasian watermilfoil.

The goal of the Osprey Lake Aquatic Plant Management (APM) Plan will be accomplished through multiple objectives.

Objectives:

1. Control Eurasian watermilfoil in a sound, ecological manner to minimize the effect on native plants while controlling Eurasian watermilfoil at acceptable levels.

2. Educate property owners and lake users about aquatic invasive species to lessen the impact of Eurasian watermilfoil present in the lake and to prevent the introduction of new aquatic invasive species.

3. Educate property owners of the benefits of natural shorelines as it pertains to Eurasian watermilfoil and the ecosystem as a whole.

4. Preserve native aquatic plant habitats to maintain high water quality, healthy fish populations, and prevent increased aquatic invasive plant establishment.

 Photo: B. Follett

Lake Information

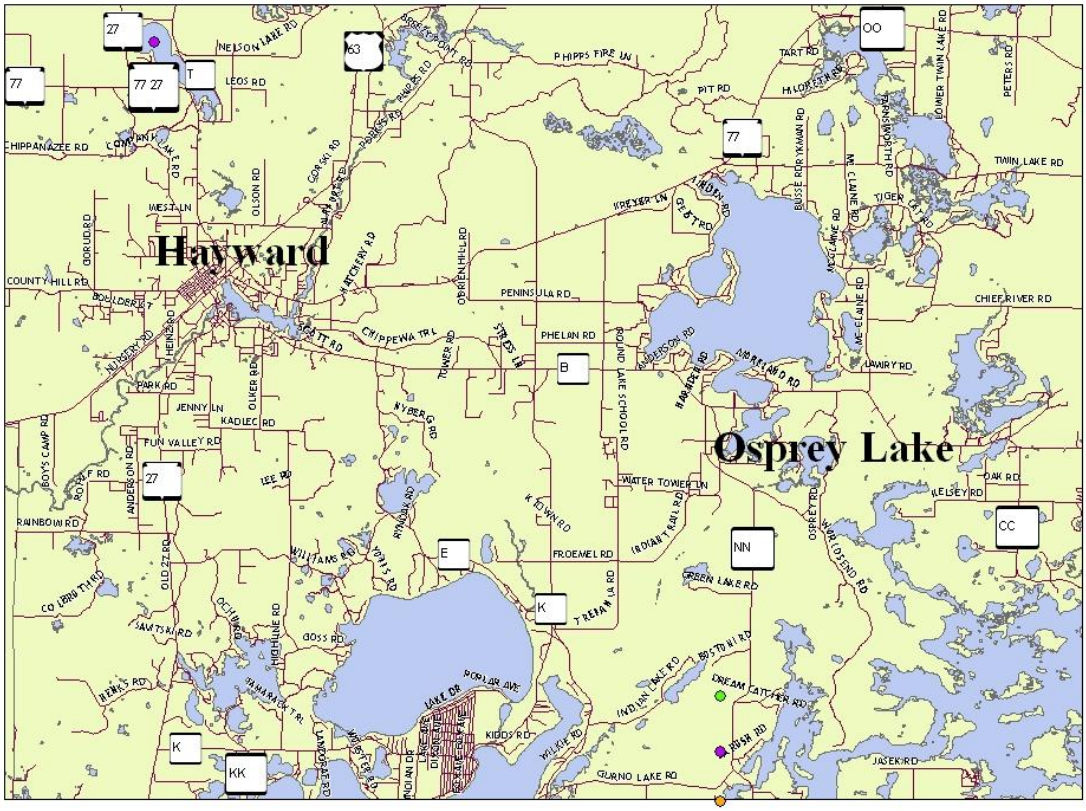
Osprey Lake Property Owners Association, Inc. (OLPOA) was formed in January 2004. Article I of the OLPOA bylaws state the mission of the organization:

"The purpose of the Association is to advocate, monitor and act for the protection, environmental and recreational preservation and enhancement of the quality of Osprey Lake, its shoreland and watershed areas located in Sawyer County, Wisconsin, and to respond to issues pertaining thereto as deemed relevant by the membership." (ospreylake.org)

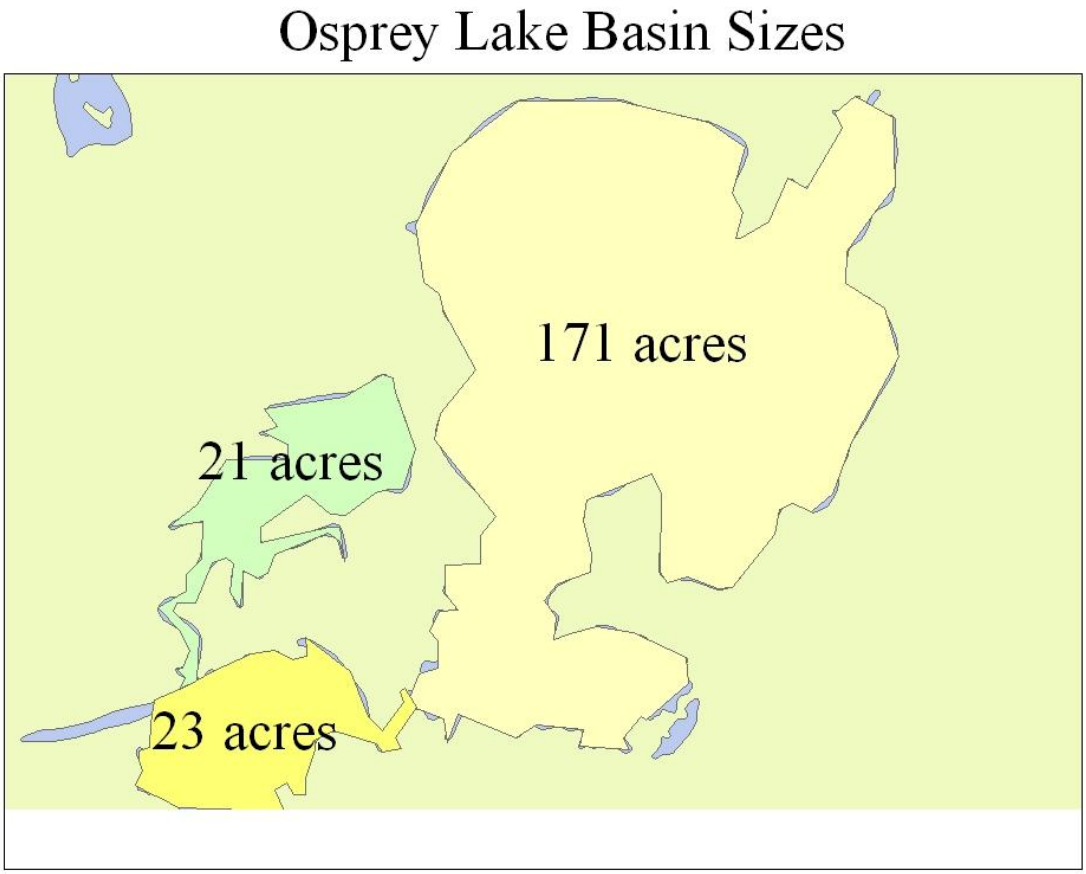
Osprey Lake is a 214 acre lake located in Northwestern Wisconsin near Hayward (Map 1). The lake consists of three connected waterbodies, two of which can only be accessed by non-motorized watercraft in periods of high water (Map 2). A large portion of the lake system may be considered wetlands as it is very shallow and contains many emergent, wetland plants. The southern portion of the lake is within the Lac Courte Oreilles Band of Lake Superior Chippewa Indians Reservation. Osprey Lake is considered a unique and significant water resource by the Lac Courte Oreille Band of Lake Superior Chippewa Indians (LCO) and the Wisconsin Department of Natural Resources (WI DNR). The LCO Tribe values the lake as a walleye spearing lake and maintains a boat landing at the southern end of the lake.

Osprey Lake is a soft-water drainage lake in the Couderay River watershed. The lake has an in-let stream from Little Round Lake and an outlet flowing into Lac Courte Oreilles Lake. Water quality data collected by the LCO Conservation Department classifies Osprey Lake as an oligotrophic lake (low productivity and no recreational use impairments), bordering on mesotrophic (D. Tyrolt, 2005).

Eurasian watermilfoil (EWM) was found in the lake in 2005. Since 2005, OLPOA has been responsible for controlling and mapping EWM with assistance from the WI DNR and the Sawyer County AIS Coordinator. The following Aquatic Plant Management Plan is a document to guide them in controlling EWM while protecting the lake ecosystem.



Map 1: Osprey Lake Location



Map 2: Osprey Lake Basin Sizes

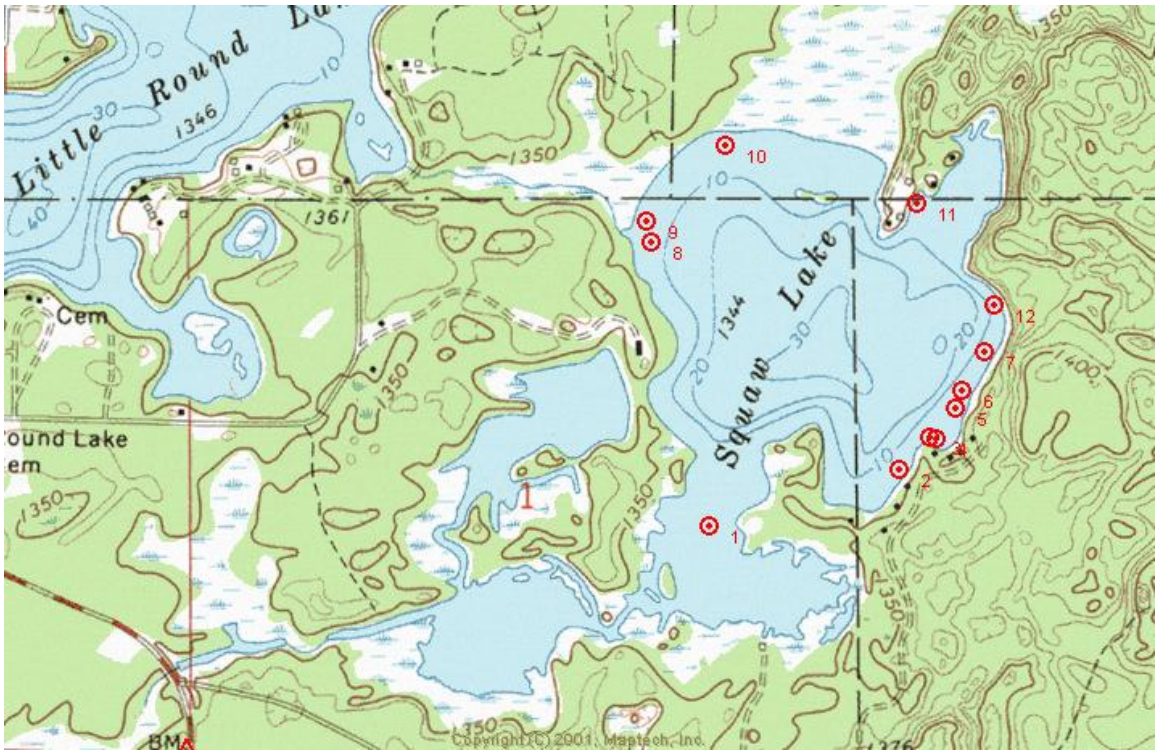
Management History

Eurasian watermilfoil (*Myriophyllum spicatum*) was found in Osprey Lake in 2005 by the LCO Conservation Department. The first location discovered was at the boat landing owned by the LCO Tribe. Subsequent surveys done by the Wisconsin Department of Natural Resources (DNR) found Eurasian watermilfoil in more locations around the lake (Map 3). It is unknown how long the EWM was in the lake, but given that less than 10 acres was found, it was suspected to be in the lake less than 5 years. The total area of EWM found was less than 5% of the littoral zone, meeting the requirements of the WI Department of Natural Resources Rapid Response Grant. The Osprey Lake Property Owners Association immediately applied for an AIS (Aquatic Invasive Species) rapid response grant from the DNR to control the Eurasian watermilfoil (EWM) while it was found in such low numbers. Control efforts were initiated quickly in order to prevent the EWM from spreading further in the lake. Three years of herbicide treatments were done on Osprey Lake under the DNR rapid response grant. Eight acres were treated on May 22, 2006 with Navigate (2,4-D) herbicide. A WI DNR point intercept survey done on August 2, 2006 found no EWM located at any points and visually saw the plant only between points 110-124 (near Round Lake inlet, see Map 4). In the spring of 2007, more EWM was discovered in the lake and 6 acres were treated on May 31, 2007 with Navigate herbicide. Again, EWM was difficult to find in the lake during the summer, but locations were discovered in the fall of 2007. In 2008, 4 acres were treated on June 10 (treatment delayed due to cold spring). Scattered plants were found around the lake in 2009 and less than 1 acre was treated with Navigate herbicide. In 2010, a larger treatment was again needed to control areas before they became dense beds. A treatment of 5.0 acres was done on June 25, 2010. Hand pulling was accomplished in small areas throughout the lake during these years. Areas targeted for hand pulling included locations near docks or swimming areas and other small, isolated areas not large enough for herbicide treatments. See treatment maps in the Appendix and Table 1 for more information.

Table 1:

EWM Control History			
Year	Acres Treated	Herbicide	Rate (lbs/acre)
2006	8	2,4-D	125
2007	6	2,4-D	100-125
2008	4	2,4-D	100-125
2009	1	2,4-D	150
2010	5	2,4-D	150

Map 3: Osprey Lake EWM Locations 2005 (WI DNR)



Plant Community

The plant community found in a lake is unique to each lake and can tell a lot about the condition of the lake. It is important to monitor the plant community, especially when chemical treatments are being done to control EWM. Changes in the plant community can indicate changes in recreational usage, development, water clarity, etc. Changes that may have an effect on the plant community should be closely monitored to limit disturbance. With changes in the plant community, changes in the fishery, water clarity, and levels of invasives can rapidly occur.

Plants are found in the littoral zone of a lake. The littoral zone is the area in a lake where sunlight can penetrate to the bottom allowing for rooted plants to accomplish photosynthesis. The littoral zone is different in each lake based on lake morphology and water clarity. This Aquatic Plant Management Plan focuses on the littoral zone and the plants located there.

In 2006, the WI DNR surveyed Osprey Lake using the point-intercept method. This method surveys the entire lake at pre-determined grid points on the lake (Map 4). Osprey Lake had 535 sampling points on 214 acres of the lake. Of the 535 pre-determined points, 319 points were sampled, 292 of the points were sites with water levels appropriate for plant growth. The maximum depth of plants in Osprey Lake is 24 feet (littoral zone is 0-24 feet). In the main basin of the lake (See Map 2), 117 acres of the 171 acres are littoral zone. The WI DNR survey showed that 71.23% of the littoral zone (the area shallower than the maximum depth of plants found growing) had plants present (see Maps 5 and 6). A total of 37 species of aquatic macrophytes and moss were found (Table 2). A Simpson Diversity Index of .93 was found in the lake. This number represents the diversity of plants found in the lake and is a value of 0 to 1. Simpson Diversity Index represents the likelihood of all plants being the same species (equal to 0) or all plants being different (equal to 1) at a given location. The closer the number is to 1, the higher the diversity of plants found in the lake.

The Floristic Quality Index (FQI) is another measure that is used to determine the quality of the aquatic plant community along with the other factors discussed. The FQI measures the impact of human development on the plant community. Each native plant species is assigned a Coefficient of Conservatism value of 1 to 10 indicating its sensitivity to human activities. A value of 1 means little to no sensitivity to human activities, while a value of 10 indicates the plant is highly sensitive and impacted easily by human activities. Nichols (1999) divided Wisconsin into four regions to determine the average FQI for each region. In the Northern lakes and forest region where Osprey Lake is located, the average species richness is 13 and the FQI is 24.3. The species richness for Osprey Lake is 36 (excluding moss) and the Floristic Quality Index is 37.6 (based on 30 species of plants, additional 5 species were not identified to species or were freshwater sponges or moss; Eurasian watermilfoil is not counted). The numbers for Osprey Lake indicate that it has higher diversity and is less impacted by human activities than other lakes in the region. (See Table 3 for additional statistics from the DNR 2005 survey).

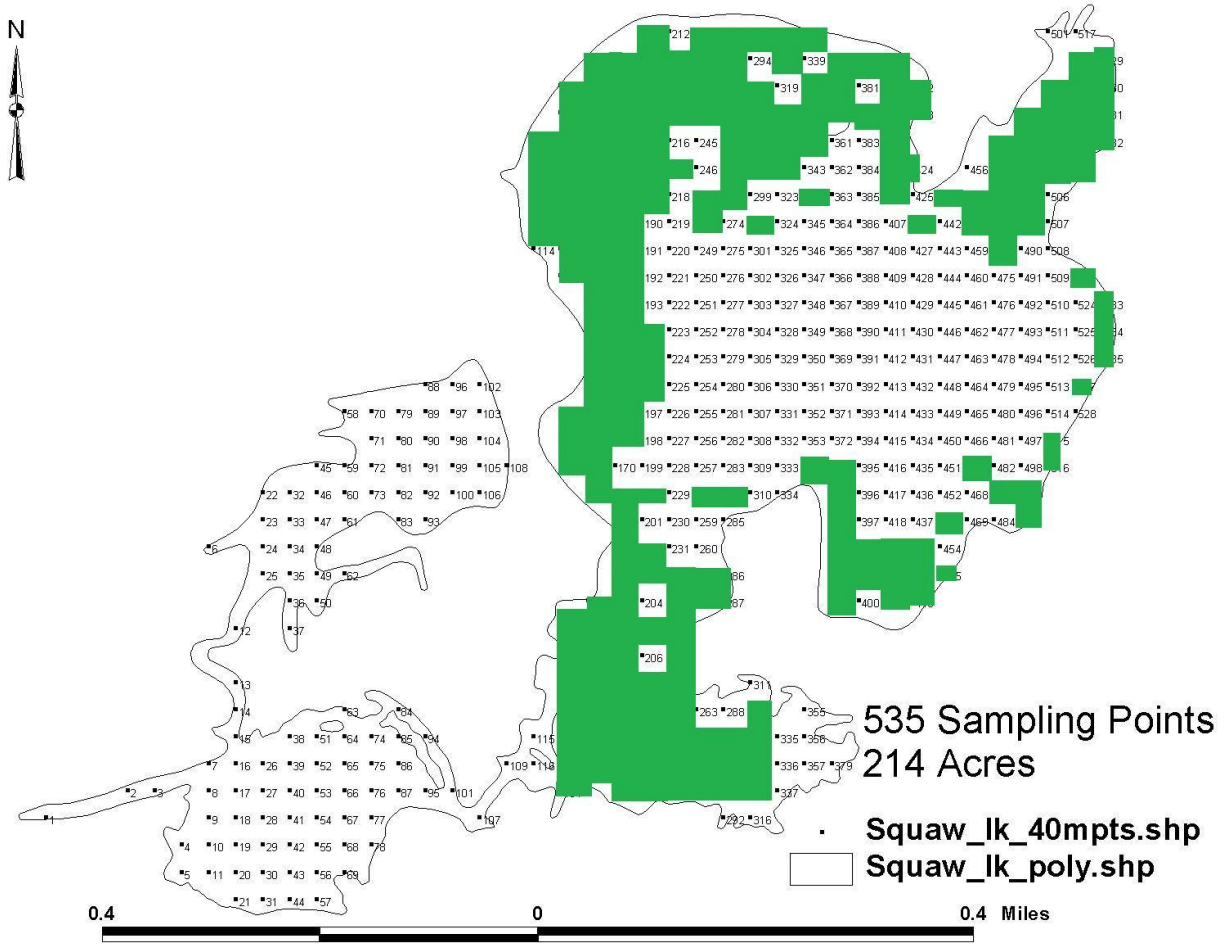
Table 3: Plant Community Summary Statistics	
Total number of points sampled	319
Total number of sites with vegetation	**208**
Total number of sites shallower than maximum depth of plants	**292**
Frequency of occurrence at sites shallower than maximum depth of plants	**71.23**
Simpson Diversity Index	**0.93**
Maximum depth of plants (ft)	**25.00**
Number of sites sampled using rake on Rope (R)	**88.00**
Number of sites sampled using rake on Pole (P)	**191**
Average number of all species per site (shallower than max depth)	**2**
Average number of all species per site (veg. sites only)	**1.48**
Average number of native species per site (shallower than max depth)	**1.80**
Average number of native species per site (veg. sites only)	**1.48**
Species Richness	**35.00**
Species Richness (including visuals)	**37**
MAX DEPTH REVISED (EXCLUDING FIL. ALGAE)	**24.00**

from WI DNR, 2006

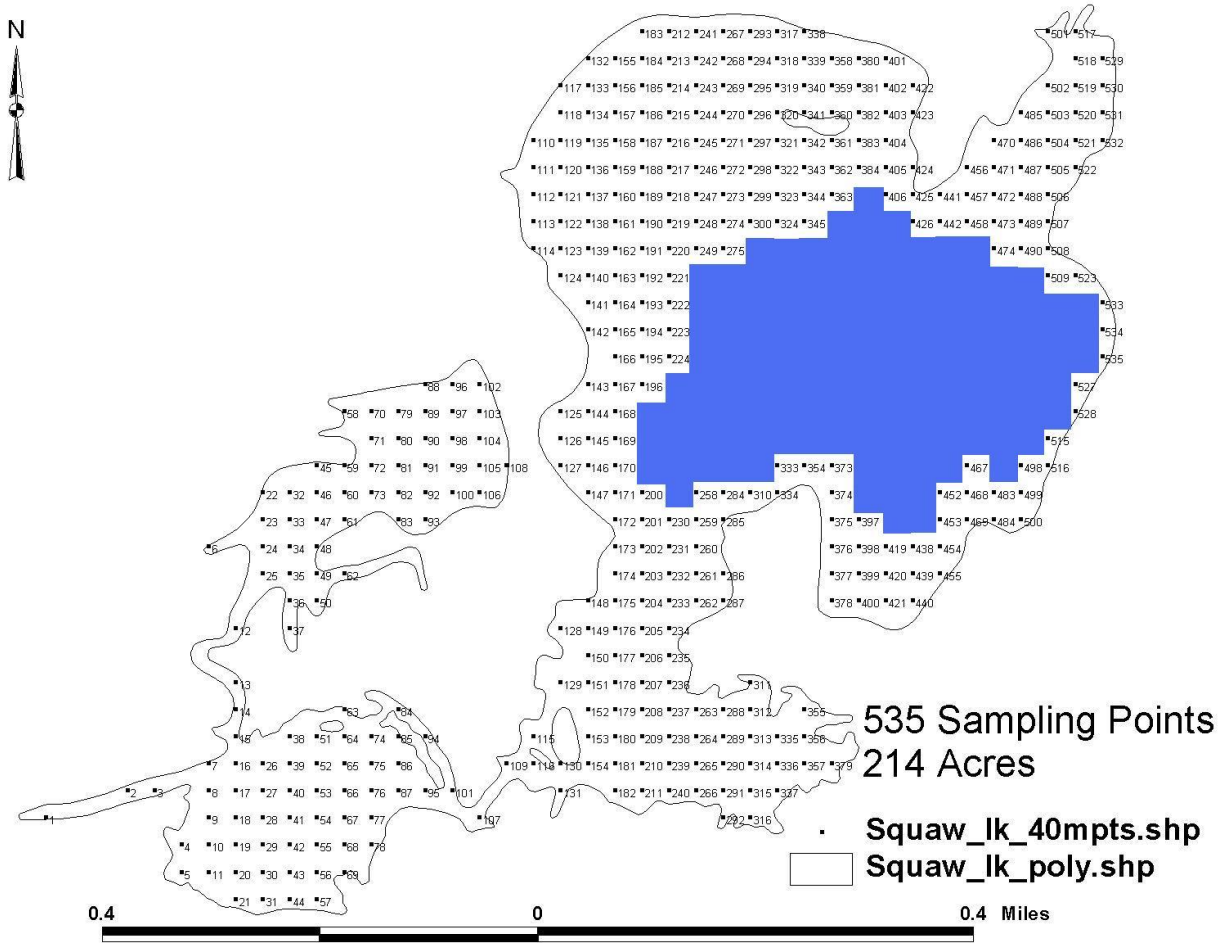
Osprey Lake has a very diverse community of plants. The species richness for the lake is over two times greater than what is seen on average in lakes in the Northern lakes and forest region. One species of Special Concern in Wisconsin was found in the lake, *Eleocharis robbinsii*. Robbins'Spikerush (*E. robbinsii*) is an emergent plant found in shallow water of soft-water lakes (See dnr.wi.gov for more information). Control activites for invasives should be avoided in areas where this plant is located.

The high Floristic Quality Index indicates that in 2006, the lake was not experiencing much disturbance due to human impacts. Unfortunately, there has not been another plant survey completed on the lake since 2006 and no pre-treatment survey was completed. Given the small chemical treatments that have been done on Eurasian watermilfoil it is not expected to have an effect on the number of species in the lake. Effects on northern milfoil, *Myriophyllum siburicum*, have been very limited with healthy populations existing in herbicide treated areas (personal observation). Herbicide treatments have been small in scale and scattered around the lake most likely having no effect on the littoral zone of the lake as a whole. Since 2006, increased development has been occurring around the lake which may have an effect and proposed developments should warrant monitoring. Another point intercept survey would be beneficial in determining the changes in the plant community due to herbicide treatments and development.

Map 4: Point Intercept Sampling Locations



Map 5: 2006 Plant Locations



Map 6: Areas too deep for plant growth (>24 feet)

Table 2:

Plant Species Found in Osprey Lake 2006		
Scientific Name	**Common Name**	**Frequency of Occurrence***
Myriophyllum spicatum	Eurasian watermilfoil	present
Brasenia schreberi	Watershield	4.33%
Ceratophyllum demersum	Coontail	1.44
Chara	Muskgrass	31.25
Eleocharis acicularis	Needle spikerush	4.81%
Eleocharis palustris	Creeping spikerush	present
Eleocharis robbinsii	Robbins spikerush	0.48%
Elodea canadensis	Common waterweed	28.37%
Eriocaulon aquaticum	Pipewort	0.48%
Heteranthera dubia	Water star-grass	1.92%
Megalodonta beckii	Water marigold	7.21%
moss		1.44%
Myriophyllum sibiricum	Northern watermilfoil	3.37%
Myriophyllum tenellum	Dwarf watermilfoil	4.33%
Najas flexilis	Bushy pondweed	24.52%
Nitella sp.	Nitella	19.23%
Nuphar variegata	Spatterdock	2.88%
Nymphaea odorata	White water lily	6.25%
Polygonum amphibium	Water smartweed	0.48%
Pontederia cordata	Pickerelweed	0.48%
Potamogeton amplifolius	Large-leaf pondweed	3.37%
Potamogeton epihydrus	Ribbon-leaf pondweed	1.44%
Potamogeton gramineus	Variable pondweed	13.46%
Potamogeton natans	Floating-leaf pondweed	4.81%
Potamogeton praelongus	White-stem pondweed	0.48%
Potamogeton pusillus	Small pondweed	18.75%
Potamogeton richardsonii	Clasping-leaf pondweed	8.17%
Potamogeton robbinsii	Robbins pondweed	27.88%
Potamogeton zosteriformis	Flat-stem pondweed	6.73%
Sagittaris sp.	Arrowhead	5.29%
Schoenoplectus subterminalis	Water bulrush	6.25%
Schoenoplectus tabernaemontani	Softstem bulrush	0.48%
Sparganium sp.	Burreed	1.92%
Utricularia intermedia	Flat-leaf bladderwort	0.96%
Vallisneria americana	Wild celery	8.65%
Freshwater sponge		0.96%
Typha sp.	cattail	present

*w/in vegetated areas

Fisheries and Wildlife Habitat

The fishery on Osprey Lake is managed by two organizations, the LCO Tribe and the Wisconsin Department of Natural Resources. The fishery supports large-mouth bass, northern pike, small-mouth bass, walleye, musky, and panfish. There is great spawning habitat for northern pike, musky, bass and some limited areas for walleye spawning. Currently, there is a large population of large-mouth bass and high numbers of northern pike. The growth rate of panfish in the lake is below average. A potential cause may be increased fishing pressure on predator fish reducing the number of smaller fish preyed upon each year (P. Christel, personal comm.).

Osprey Lake is being managed for walleyes. There is currently a walleye stocking program being implemented to determine if numbers can be raised enough to sustain a walleye fishery. On September 16, 2010 an electrofishing survey was done by the WI Department of Natural Resources to determine numbers of young walleye. Relatively low densities of walleye were found in the fall survey (3.2 young-of-year walleye/mile) (J. Krahn, personal comm.). The walleye found in the survey most likely represent fish that were stocked the previous year and not a naturally reproducing population (J. Krahn, personal comm.). Bluegills and largemouth bass were common during the survey and Northern pike were observed. Surveys will be done throughout 2011by the LCO Conservation Department and the WI Department of Natural Resources to determine the effectiveness of this program and the state of the fishery.

Osprey Lake is and is surrounded by exceptional wildlife habitat. The lake is considered an Area of Special Natural Resource Interest (ASNRI) by the WI DNR. The forested areas surrounding the lake provide habitat for many animals, along with the wetland areas on and near the lake. The relatively low density of homes and human disturbance on the lake make it attractive to wildlife and waterfowl. An eagle's nest is located on the island in the north part of the lake. Overall, with the predominantly natural shoreline that is found on the lake, the area is excellent wildlife and waterfowl habitat.

Photo: C. Dannehl

Water Quality

Water quality and plants are interconnected. Changes in water quality can affect the plant community in species composition and density of plants. Changes in the plant population can affect the water quality, increasing the water clarity or decreasing it.

Water quality on Osprey Lake is high, consistent with a north temperate, oligotrophic lake (Tyrolt, 2005). The LCO Conservation Department studied the water quality on Osprey Lake in 2004 to determine existing water quality, development, and management impacts.

Many of the water quality values for Osprey Lake are borderline between oligotrophic and mesotrophic categories. Oligotrophic lakes are lakes with low productivity and no recreational use impairments. Mesotrophic lakes have moderate productivity and may have minimal recreational use impairments. In 2004, Tyrolt found that total phosphorous and chlorophyll-a levels in Osprey Lake were within the oligotrophic range. Secchi disk readings of 14.9 ft on average are considered in the mesotrophic range. During the 2004 season, water quality averages bordered between oligotrophic and mesotrophic. The borderline averages indicate that a change in water quality due to development, recreation, or invasive species impacts could cause a change in the lake from oligotrophic status to mesotrophic status. (See Osprey Lake Water Quality Study for more information (Tyrolt, 2005)).

Water Use

Osprey Lake is a small, 214 acre lake with one public landing owned by the LCO Tribe. As of 2010, there are 18 private property units on the lake. In 2010, the Townships of Hayward, Hunter and Round Lake, at the request of OLPOA and with the support of WDNR and LCO, enacted a slow, no wake ordinance on Osprey Lake. No wake times are from 6:00 PM to 10:00 AM.

Recreational use of the lake typically consists of small fishing boats, pontoons, canoes, kayaks, and other small watercraft. Large boats are, in general, not attracted to the lake given its size and shallowness of the boat landing. Larger boats on the lake may pose a safety and environmental hazard on the lake given the presence of Eurasian watermilfoil and the small size of the lake. Water skiing and other recreational sports are limited to the times of 10 a.m. to 6 p.m., giving the lake a quiet feel for the majority of the time.

While a large part of the lake is considered littoral zone, aquatic plants do not typically interfere with recreational uses. Swimming is done mostly on the east side of the lake where plant levels are not as dense, or in deeper areas. In general, submersed plants are not problems near docks and usually do not present difficulty for boating because of dense growth.

Photo: C. Dannehl


Photo: B. Follett

Watershed Description

Osprey Lake has a large watershed of 10,149 acres (Tyrolt, 2005). Osprey Lake is a drainage lake, so the land draining into the inlet stream is considered part of the watershed. Only 1,449 acres of the 10,149 acres drains directly into the lake (Tyrolt, 2005). Round and Little Round Lakes watersheds make up the 8,700 acres remaining in the overall watershed which drain into Osprey Lake through the inlet into the lake. Tables 4 and 5 describe the land use types found in the direct watershed of the lake and the amount of phosphorous loading attributable to each type. Overall, the watershed is dominated by forest and the majority of phosphorous introduced to the lake is from the inflow from Round and Little Round Lakes. Events in the Round and Little Round Lakes watersheds will have a large impact on Osprey Lake.

Tyrolt (2005) modeled changes in the watershed to determine if residential development has had an effect on water quality and what effect additional development may have. The model D.

Tyrolt used is based upon the addition of phosphorous into the system given a different land use. He found that the residential development (as of 2004) has not caused a noticeable water quality change (a 1% decrease in water clarity). A large development, 200 acres, would result in a 9% overall reduction in water clarity (16.5 inches), but does not lead to a noticeable water quality change. However, a large development on the lake would affect the Secchi disk reading enough to change the lake from the oligotrophic to mesotrophic category. Overall, given the balance Osprey Lake has between oligotrophic and mesotrophic, changes in the watershed could have direct water quality impacts to the lake.

Table 4:

Osprey Lake Direct Watershed Land Uses and Acreages	
Land Use	**Acres**
Pasture/Grassland	36
Medium Density Residential	16
Rural Residential	36
Wetlands	204
Forest	1157
Lake Surface Area	208

from D. Tyrolt, 2005

Table 5:

Osprey Lake Phosphorous Source and Loading		
Source	**lbs.**	**%**
Internal Loading	15	4.06
Pasture/Grassland	11	3.10
Residential	12	3.30
Septic Systems	7	1.80
Wetlands	18	5.00
Forest	103	28.08
Atmospheric Deposition	52	14.19
Osprey Creek	149	40.48
Total	367	

From D. Tyrolt, 2005

Analysis and Alternative Treatment Options

This section will describe the available treatment options for aquatic invasive plants.

Permits are required from the WI DNR when chemical or mechanical control options are considered. Manual removal of an invasive aquatic plant is allowed without a permit (i.e. hand pulling or raking). Permit applications are available from the Wisconsin DNR.

Eurasian Watermilfoil

Many management techniques are available for Eurasian watermilfoil control. In this section we will explore the possibilities, discuss if they are appropriate, and determine adverse impacts of the techniques.


Photo: F. Koshere

Chemical Treatment

Many chemicals are available for aquatic plant control. All chemicals must be approved by the Environmental Protection Agency (EPA) and used according to label directions. In Wisconsin, herbicide applicators must be licensed by the Department of Agriculture, Trade and Consumer Protection and permits are required from the WI Department of Natural Resources. Two classes of aquatic herbicides are available:

1. Systemic: Systemic herbicides move through the entire plant. The herbicide is absorbed through leaves or stem and moves through the plant to affect the entire plant, usually resulting in kill. Effects of a systemic herbicide may take two weeks or more to be seen.
2. Contact: Contact herbicides kill the plant only at the point of contact. The entire plant system is not damaged, plants may still be able to regrow from root systems. Contact herbicides are used when an immediate removal of plant material is needed.

Available aquatic herbicides for use on Eurasian watermilfoil include:

2,4-D: 2,4-D is a systemic herbicide often used to treat Eurasian watermilfoil. It is sold under the trade names Navigate®, Aqua-Kleen®, Sculpin G, Renovate Max G (in combination with triclopyr), and others. 2,4-D is a selective herbicide that targets dicot plants. Dicots are broadleaved plants, such as Eurasian watermilfoil. Monocots, or grass-like plants, are typically not affected by 2,4-D and include many of the aquatic plants typically seen (pondweeds, water celery, etc.). The 2,4-D label has no fishing or swimming restrictions, however WI DNR recommends waiting 24 hours before swimming in treated areas.

Endothall: Endothall is a non-selective, contact herbicide. It is sold under the trade names Aquathol® (liquid) and Aquathol® Super K (granular), and Hydrothall 191® (granular). Endothall can be used in situations where Eurasian watermilfoil growth needs to be suppressed in order for native plants to recover. Endothall is not used for eradication purposes. Studies are being done looking at low doses of endothall combined with 2,4-D in combating Eurasian watermilfoil and curly-leaf pondweed. See label for restrictions.

Fluridone: Fluridone is a non-selective, systemic herbicide. It is sold under the trade names Sonar® and Avast!®. Fluridone is a slow-acting herbicide that has been used to selectively target Eurasian watermilfoil at low concentrations. The resident time of the herbicide must be high for effectiveness, therefore it can only be used in whole lake treatments, or calm isolated bay areas. Fluridone is not appropriate for small spot treatments.

Diquat: Diquat is a non-selective herbicide typically used to control emergent and submersed weeds. It is sold under the trade names Reward®, Aqua-Clear®, and Weedtrine®. It is very fast acting and has no restrictions for swimming, fish, or wildlife. There may be drinking water and irrigation restrictions of up to 5 days.

Triclopyr: Triclopyr is a selective herbicide that mimics plant hormones. It is a systemic herbicide used to control broadleaf plants. Triclopyr is sold under the trade name Renovate Max G (in combination with 2,4 D) and other Renovate names.

Advantages

- Herbicides for aquatic plant control are easily applied, even around obstacles such as docks and rafts.
- If applied at the correct dosage at the right time of year, herbicides can be very effective.
- Costs of herbicides are relatively low.

Disadvantages

- Some use restrictions may exist with certain herbicides (swimming, fish, irrigation, etc.).
- Non-target plants may be injured or killed.
- Multiple treatments may be necessary before adequate results.
- Low oxygen levels may be a concern if rapid die-off of plants occurs.
- Some people are adverse to any chemicals in public waters.

Cost

Most aquatic herbicide treatments will cost between $650-$1000/acre, depending on herbicide used, rate applied, cost of permit, and applicator charges.

Manual Removal

Manual removal of submersed aquatic plants is the least invasive, most selective form of control. It may involve hand pulling plants, raking, and SCUBA diving to remove plants.

Advantages

- Least invasive form of control.

- Volunteers can perform work.
- Very cost effective.
- Plant is removed from waterbody.
- Very selective.
- Results seen immediately.

Disadvantages

- Must remove entire plant from waterbody.
- May be labor intensive.
- Not feasible on large areas.
- Sediment is easily suspended making it difficult to see additional plants.

Mechanical Removal

Mechanical removal of submersed aquatic plants includes many different forms from rototillers to large plant harvesters. Plant harvesters are used to remove plant biomass from the water column in order to clear navigation channels. Rototillers, weed rollers, and weed cutters are used on a smaller scale to mechanically remove plants. Rototillers disturb the top few inches of sediment making it impossible for plants to establish. Weed rollers constantly roll across the sediment compacting the soil and eventually removing plants and impeding their growth. Weed cutters cut plant material a few feet below the water surface to remove surface biomass. Mechanical removal of aquatic plants requires a permit from the Wisconsin Department of Natural Resources and some types may not be allowed.

Advantages

- Immediate removal of plant material.
- Plant material removed from water body, so no low oxygen concern.
- No water use restrictions.

Disadvantages

- Not selective control, all plants removed.
- Disruptive to bottom sediment and organisms that may live there.
- May increase water turbidity.
- Many plant fragments produced.
- High cost.

Cost

Varies depending on machine used, from $1000 to over $100,000.

Bottom Barriers

Bottom barriers, or benthic barriers, use growth-inhibiting materials such as sand, gravel, nylon, plastic screens, etc. to prevent plants from growing on the substrate and killing plants that are already present. They are used in small areas around swimming beaches, docks, and ornamental

ponds. Upkeep may be problematic due to gases accumulating underneath the barrier and lifting it, materials breaking down, and barrier anchors releasing. Eventually sediment can accumulate over the top allowing plants to grow again.

Advantages

- Long-term costs may be low.
- Can be used around areas of high-traffic.

Disadvantages

- Costly at beginning of project.
- Harm habitat used by fish and other invertebrates.
- Effects all species covered.
- May have to be in place for years.
- Installation is difficult and time consuming.
- Not practical in large areas.

Cost

Varies depending on material used, size of area, and installation and upkeep charges, but generally $0.22 to $1.25 per foot plus installation charges.

Biocontrol

Biocontrol agents are organisms used to control invasive plants. Many different organisms have been attempted in the management of Eurasian watermilfoil. Grass carp were introduced in the United States many years ago for aquatic plant control and have been used to control Eurasian watermilfoil in many states. Results using grass carp are very mixed, with most areas not being affected in the correct manner. Grass carp are not selective, can harm native plants, and can have an impact on fisheries. Grass carp are not legal to use or possess in Wisconsin because of the harmful problems they can cause. The most hopeful biocontrol agent is the native weevil *Euhrychiopsis lecontei*. The milfoil weevil is a native weevil, found in some Wisconsin lakes, that may prefer Eurasian watermilfoil over native milfoils. In large numbers, the milfoil weevil can cause extensive damage to Eurasian watermilfoil populations, effectively controlling it. However, much research has been done on the milfoil weevil and its results are often disappointing. While the milfoil weevil may perform well in one lake, results in another may not be seen at all. The milfoil weevil appears to prefer lakes with little boat traffic, a small population of panfish, and native shorelines for overwintering.

Advantage

- The milfoil weevil is native.
- May achieve control without the use of chemicals or machines.
- Little labor is involved.

Disadvantage

- High cost.
- Unclear results, may or may not see change in Eurasian watermilfoil density and abundance.

Cost
Costs are high for the milfoil weevil. Each milfoil weevil costs around $1.25-1.50 and they are usually sold in lots of 1000. Effective results are only seen when 2 weevils per milfoil stem are found.

Overall recommendation
Eurasian watermilfoil in Northwestern Wisconsin is typically treated successfully using a combination of 2,4-D and manual removal.

Curly-leaf Pondweed

Chemical Control
Available aquatic herbicides available for use on curly-leaf pondweed include:

Endothall: Endothall is a non-selective, contact herbicide. It is sold under the trade names Aquathol® (liquid) and Aquathol® Super K (granular), and Hydrothall 191® (granular). These herbicides have been found to work well and results are usually seen within 2 weeks.

Diquat: Diquat is a non-selective, contact herbicide. It is sold as a liquid formation under the trade name Reward®.

Fluridone: Fluridone is a broad-spectrum, systemic herbicide. It is sold under the trade name Sonar® and Avast!®. Fluridone is only appropriate for whole lake treatments and may take 30 days to achieve results.

Advantages
- Herbicides for aquatic plant control are easily applied, even around obstacles such as docks and rafts.
- If applied at the correct dosage at the right time of year, herbicides can be very effective.
- Costs of herbicides are relatively low.

Disadvantages
- Some use restrictions may exist with certain herbicides (swimming, fish, irrigation, etc.).
- Non-target plants may be injured or killed.
- Multiple treatments may be necessary before adequate results. Turions may survive in sediment for 5 years, requiring a long-term effort.
- Low oxygen levels may be a concern if rapid die-off of plants occurs.
- Some people are adverse to any chemicals in public waters.

Manual Control

Manual removal of submersed aquatic plants is the least invasive, most selective form of control. It may involve hand pulling plants, raking, and SCUBA diving to remove plants.

Advantages

- Least invasive form of control.
- Volunteers can perform work.
- Very cost effective.
- Plant is removed from waterbody.
- Very selective.
- Results seen immediately.

Disadvantages

- Must remove entire plant from waterbody.
- May be labor intensive.
- Not feasible on large areas.
- Sediment is easily suspended making it difficult to see additional plants.
- Does not remove turions.

Mechanical Control

Mechanical control for curly-leaf pondweed includes using a mechanical harvester to remove plant biomass from the water column.

Advantages

- May inhibit turion formation.
- Immediate removal of plant material.
- Plant material removed from water body, so no low oxygen concern.
- No water use restrictions.

Disadvantages

- Not selective control, all plants removed.
- Disruptive to bottom sediment and organisms that may live there.
- May increase water turbidity.
- Many plant fragments produced.
- High cost.

Biocontrol

None is available at this time.

Overall recommendation

Curly-leaf pondweed responds well to endothall treatments.

Purple Loosestrife

Chemical Control

Available herbicides for purple loosestrife include:

Glyphosate: a non-specific herbicide that can be purchased in formulations for over water (Rodeo®) or away from water (Roundup®).

Triclopyr: a specific, broadleaf herbicide, sold as Garlon 3A®, Renovate, and other trade names.

Advantages

- Costs of herbicides are relatively low.

Disadvantages

- Some use restrictions may exist with certain herbicides (swimming, fish, irrigation, etc.).
- Non-target plants may be injured or killed.
- Multiple treatments may be necessary before adequate results. Seeds remain viable in the sediment.
- Very difficult to travel through wetland/shoreline areas where plants are typically found.
- Some people are adverse to any chemicals in public waters.

Manual Control

Manual removal of purple loosestrife includes digging of plants (making sure to include all of the roots) and clipping of flower tops before seed production.

Advantages

- Volunteers can perform work.
- Very cost effective.
- Very selective.
- Results seen immediately.
- Easily reduces number of seeds produced (each plant can produce up to 1 million seeds).

Disadvantages

- May be labor intensive.
- Not feasible on large areas.
- Digging of plants opens new locations for seed establishment of purple loosestrife from sediment or nearby plants.

Biocontrol

A very selective biocontrol program is established in Wisconsin. *Galerucella* sp. leaf eating beetles have been released around the state in purple loosestrife areas. The beetles successfully reduce the purple loosestrife population while not damaging native plants to a harmful extent.

Contact WI DNR in Hayward or Sawyer County AIS Coordinator for more information on beetle rearing and release program.

Advantages

- Volunteers can perform work.
- Very cost effective.
- Very selective.

Disadvantages

- Beetles may have difficulty overwintering if proper conditions are not available (i.e. appropriate natural habitat).
- May not be successful in very small areas.
- People often are worried/confused about beetles and bugs in general.

Overall recommendation

Flower tops should be cut immediately on newly found infestations if seeds have not been formed. Continual removal of flower tops is encouraged. Herbicides may be used on small, scattered infestations. A biocontrol program should be established for larger infestations.

Analysis of Management Options

As seen in the previous section, many options exist as to the management of aquatic plants in Osprey Lake. This section will outline the different options available and identify the objectives needed to maintain beneficial uses of the lake. Eurasian watermilfoil target levels will be identified and the degree of manipulation required to achieve target levels will be explored. Other common aquatic invasive plants will also be discussed.

Eurasian Watermilfoil (*Myriophyllum spicatum*)

Management options for Osprey Lake include a range of possibilities from no action to high/intensive management and control of invasives. Given the history of Eurasian watermilfoil in the lake and the actions of the Osprey Lake Property Owners Association, no action is not an option for management of this lake. The no action option for Osprey Lake could potentially result in Eurasian watermilfoil occupying 70% of the littoral zone. Over 70% of the littoral zone is currently populated with native plants, indicating it is appropriate for plant survival. While it is not known if EWM could infest such a large area on the lake and compete with the abundance and diversity of native plants found in the lake, levels of EWM much less than 70% would cause significant impacts to the lake.

The goal of the Aquatic Plant Management Plan in regards to Eurasian watermilfoil is to control EWM in a sound, ecological manner to minimize the effect on native plants while controlling

EWM at acceptable levels. In the history of EWM management on Osprey Lake, EWM has never been found at levels more than 4% of the lake (using 214 acres as total size). On average, 4.8 acres of EWM per year have been treated since the plant was first discovered in Osprey Lake. This results in less than 2.5% of the total lake area being treated with herbicides.

Concerns exist when herbicide treatments are done over multiple years. Susceptible plant species may be damaged and/or disappear from the lake (ex. water lilies), concerns over fish and other wildlife might occur, and recreational use in chemically treated water may be opposed over many years. Given the treatment history of Osprey Lake, the small spot treatments that are occurring are not likely to be causing environmental harm. The treatments are happening in small locations and are scattered throughout the lake. There should be little harm to the native plant population given the disjointed manner of treatment typically occurring. Native plants are found throughout 71% of the littoral zone of the lake, far exceeding the area impacted by herbicide treatments in any given year. With the scattered treatments that are typically occurring, if native plants were harmed in a treatment, plants would be available from other areas of the lake to re-colonize that location. There is also most likely an extensive seed bank of native plants throughout the lake which would restore the area back to a similar composition. An additional plant survey would be helpful to determine impact, if any, to the plant population.

For the following activities, the main basin of the lake, 171 acres, is only considered (see Map 2). Of the 171 acres, the littoral zone is considered to be 117 acres (depths less than 24 feet-maximum depth of plant growth). Given the goal of the Osprey Lake Property Owners Association to control EWM in a sound, ecological manner, the following control activities have been outlined:

At EWM levels **less than 3 acres** (2.5% of the littoral zone of the lake), **minor** control activities will take place. Minor activities are described as: 1. Hand pulling if plants are found in a new location; 2. Mapping Eurasian watermilfoil in June and September; 3. If money is available in the OLPOA fund, scuba divers will be hired to hand pull EWM.

At levels of EWM at **3 acres to 6 acres** (1.5% of the lake or 2.5-5.0 % of the littoral zone), **moderate** control activities will take place. Moderate control activities are described as: 1. Applying herbicide to EWM by a professional herbicide applicator when funded by a WI DNR grant; 2. Applying herbicide to EWM every other year when a WI DNR grant is not available; 3. Continuing to hand pull if plants are found in isolated, shallow areas, less than .25 acres; 4. Hiring divers to hand pull large areas of Eurasian watermilfoil; 4. Mapping Eurasian watermilfoil in June and September to monitor growth and determine effectiveness of treatment; 5. Monitor lake once/month for new outbreaks.

At levels **greater than 5%** of the littoral zone (6 acres), **intensive** control activities will take place. Intensive control activities are described as: all activities from above; and 6. Herbicide

treatment during late- summer/early fall to ensure successful die-off from spring herbicide treatment if WI DNR approval and grant funding available.

Areas for herbicide treatment will include spot treatments of areas larger than .25 acres. Smaller areas will be hand pulled, if feasible, and may be treated with herbicide if WI DNR funding available.

Map 7 shows areas that will be avoided during chemical treatments due to State Special Concern plant locations. Walleye spawning habitat will also be avoided by not completing chemical treatments during spawning seasons if upcoming fishery surveys show naturally reproducing walleye populations exist in the lake.

Map 7: Approximate Locations to be Avoided Due to State Special Concern Plant

Herbicide (Navigate, 2,4-D) guidelines will be as follows:

100-125 lbs/acre: Calm, sunny day in April or May; scattered milfoil; water depth of 5 feet or less.

150 lbs/acre: May or June treatment; windy day; moderate density of milfoil; water depth of 5-10 feet.

>150 lbs/acre: June treatment; high density of milfoil; water depth greater than 10 feet.

150-200 lbs/acre may be implemented on areas of persistent EWM, but only on a rotational basis and not in sensitive areas.

Many herbicide guidelines are now based on volumetric calculations (area x water depth) and will have to be re-calculated each year based on water depth. Herbicide concentrations will be based on label recommendations and advice from WI DNR, Sawyer County AIS Coordinator, herbicide applicator, or herbicide manufacturers.

Fall or summer treatments will need to be discussed with the WI DNR, an herbicide applicator or Sawyer County Aquatic Invasive Species Coordinator to determine herbicide rate and potential pros and cons.

Treatment priority will also be given to the boat landing area.

Other herbicides will be explored if desired results from Navigate (2,4-D) are not seen or if research suggests other herbicides may be more successful.

These guidelines are to be used only as a starting point. Actual lake conditions in a given year will require alteration of these guidelines with advice from the Sawyer County Aquatic Invasive Species Coordinator, herbicide applicator, or WI DNR.

Invasive plants not established in Osprey Lake, but found in Sawyer County:

Curly-leaf Pondweed (*Potamogeton crispus*)

Curly-leaf pondweed (*Potamogeton crispus*) has an interesting life history that is important in determining control options and needs. Curly-leaf pondweed begins growing in the fall from turions (small winter buds formed on the plant in the spring/summer) and possibly seeds. The plant continues growing slowly throughout the winter under the ice. At the time of ice-out, the plant is actively growing and has a head-start on natives and other invasives. Growth of curly-leaf continues until the end of June/beginning of July when the plants die-off. In some lakes, this die-off signals the end of a nuisance for the year, while in other lakes the release of nutrients from the decaying plants can trigger algal blooms. Plant die-off may also cause low oxygen level conditions in the lake. Turions are not susceptible to herbicide and may live in the sediment for up to 5 years.

Curly-leaf pondweed has been found in Northwest Wisconsin for many years. In some lakes near Osprey Lake (Sawyer County), curly-leaf has been found as a small part of the aquatic plant population and does not appear to become invasive. In other lakes, the curly-leaf pondweed has reached nuisance levels and the summer die-back may attribute to algal blooms. Close monitoring is warranted to determine the need and level of control curly-leaf may require in Osprey Lake.

If curly-leaf pondweed (*Potamogeton crispus*) is found in Osprey Lake the following options are possible: 1. No action. No activities will take place to monitor or control the curly-leaf pondweed. 2. Monitor and mapping only. Curly-leaf pondweed will be monitored and mapped in May of each year to determine extent of population and increase/decrease from previous year. No control will be implemented. 3. Monitor and control if population appears to be increasing. Curly-leaf will be monitored and mapped in May of each year to determine extent of population and increase/decrease from previous year. If population is found to be increasing, control treatments will be implemented in order to decrease population size. **The preferred option is:** 4. Control upon verification. The threat of curly-leaf pondweed will not be tolerated and control options will be initiated immediately upon verification.

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife (*Lythrum salicaria*) is a common plant found on shorelines and wetlands in Wisconsin. Plants can crowd out and displace native plants resulting in monotypic stands. Areas of purple loosestrife have less diversity than areas with native plants and are not as beneficial for wildlife.

Purple loosestrife is found in many areas near and occasionally at Osprey Lake. One plant was located on the southern part of the lake and was removed around 2006. In 2010, more plants were found near the boat landing on the southern end of the lake and were removed by members of the lake association (C. Dannehl, personal comm.). No other plants have been detected around the lake. An active biocontrol program is found throughout the state for this plant.

Control options for this plant include: 1. No action. No activities will be implemented to monitor or control purple loosestrife. 2. Monitor and map only. Monitor the purple loosestrife population to determine the extent of invasiveness on Osprey Lake. **The preferred option is:** 3. Monitor and control. Map and monitor the purple loosestrife population the end of July when plants are flowering. Control the plant through hand pulling and digging, herbicide, and biocontrol. 4. Monitor, control, and rear biocontrol beetles. Map and monitor the purple loosestrife population the end of July when plants are flowering. Control the plant through hand pulling and digging, herbicide, and biocontrol. The lake association will be responsible for rearing beetles to use on populations on Osprey Lake with assistance from Sawyer County or the WI DNR.

Other Aquatic Invasive Species

Other aquatic invasive species found in Sawyer County include flowering rush and yellow iris. There are not well defined control options for these plants and they will be handled on a case-by-case basis with help from the Sawyer County AIS Coordinator and the WI DNR.

Other aquatic plants that may be found in Wisconsin, such as Hydrilla and others found on the WI DNR's watch list will be controlled immediately upon verification. Because these plants are currently not found in Wisconsin, assistance from the WI DNR and Sawyer County AIS Coordinator will be essential in determining the correct mode of action. These cases will be handled and discussed on a case-by-case basis and the only option considered is immediate control.

Recommendations to Accomplish Objectives

Objective:

1. Control Eurasian watermilfoil in a sound, ecological manner to minimize the effect on native plants while controlling Eurasian watermilfoil at acceptable levels.

    - Initiate water quality testing in conjunction with the LCO Conservation Department and the WI DNR Citizen Lake Monitoring Network to ensure water quality is not changing on the lake due to EWM control.
    - Follow recommendations in the plan to control EWM.
    - Continue with scattered, spot treatments to reduce effect on native plants and allow for native plants from other areas to re-colonize if needed.
    - Monitor EWM monthly from May-September and report findings to Citizen Lake Monitoring Network (CLMN) AIS Monitoring program.
    - If intensive EWM control is required, discuss fall or mid-summer treatment plans with the WI DNR before implementation.
    - If EWM control is occurring with a WI DNR AIS Established Control grant, pre- and post- monitoring will be done.
    - Explore possibilities of different herbicides that may be more effective and show longer results.

2. Educate property owners and lake users about aquatic invasive species to lessen the impact of Eurasian watermilfoil present in the lake and to prevent the introduction of new aquatic invasive species.

    - Educational materials on invasive species will be mailed and/or hand delivered to new property owners on the lake each spring.
    - A Lake Excursion Field Trip will be held every 1-3 years to educate OLPOA members and others interested in EWM, proper removal techniques, locations in the lake, and what can be done to limit growth.
    - Boat landing signage will be monitored in order to ensure proper message is given to boaters entering the lake.
    - Develop a Clean Boats, Clean Waters Program on Osprey Lake. Develop a program individually or in conjunction with other lake associations in the area.
    - Boat cleaning tips will be sent out to OLPOA members in the spring to remind property owners and their visitors to clean their boats if visiting other lakes.

3. Educate property owners of the benefits of natural shorelines as it pertains to Eurasian watermilfoil and the ecosystem as a whole.

    - Lake shore ordinances and best management techniques will be shared with lake association members to encourage natural shorelines.
    - Articles will be written for newsletter or website.

- Share information about programs that may potentially help fund shoreline restoration.
- Remind lakeshore owners to remove the fewest amount of aquatic plants possible to reduce the likelihood of EWM establishing near their dock and to protect the diverse, native plant population.

4. Preserve native aquatic plant habitats to maintain high water quality, healthy fish populations, and prevent increased aquatic invasive plant establishment.

    - Maintain caution in using herbicides for EWM control.
    - Reduce disturbances from boat traffic by following no-wake rules.
    - Continue to work with the WI Department of Natural Resources Fish Management and the LCO Fisheries Biologist.
    - Encourage natural shorelines and limited in-lake plant removal.
    - Recognize the high diversity of the plant population present in Osprey Lake. Express the uniqueness of the lake to property owners and speak often about the importance of maintaining the current plant population.
    - Repeat point-intercept plant surveys every 5 years.

Implementation

Implementation of the objectives described in the document are recommended to be accomplished over the next five years. The small nature of the lake and the associated lake association may make execution of all of the goals financially unreachable. By working with the Sawyer County AIS Coordinator and the WI DNR, priority will be given to each of the recommended objectives based on funding issues and benefit to the lake ecosystem.

Eurasian Watermilfoil Control/Implementation Plan

Timeline	Activity	Responsible Party	Hours	Payment
January-March	Apply for control permit	OLPOA/ AIS Coord	2	Volunteer
February 1 or August 1	Apply for AIS Grant	OLPOA	8	Volunteer
May-September	Water quality testing	OLPOA, LCO	40	In-kind/volunteer
December	Write yearly summary	OLPOA	1	Volunteer
EWM General Activities				
March-April	Hire herbicide applicator	OLPOA	2	Volunteer
May	Survey for EWM	OLPOA/AIS Coord	4	In-kind/volunteer
May-June	Herbicide Treatment	Herbicide Applicator	5	Grant/OLPOA
July	Survey treatment area 3 weeks post treatment	OLPOA, AIS Coord, Consultant	2	Grant/in-kind/volunteer
July-August	Post-treatment monitoring	OLPOA, Consultant	20	Grant/in-kind/volunteer
August-September	Establish & carry out pre-treatment evaluation	OLPOA, Consultant	10	Grant/OLPOA
Minor Control Activities				
May-July	Hand pull EWM	OLPOA	20	In-kind/volunteer
May-July	Hire SCUBA divers	OLPOA	10	Grant/OLPOA
June and September	Survey and map entire lake	OLPOA	10	Grant/OLPOA/volunteer
Moderate Control Activities				
May-July	Hand pull EWM	OLPOA	10	In-kind/volunteer
May-July	Hire SCUBA divers	OLPOA	10	Grant/OLPOA
June and September	Map EWM	OLPOA	10	Grant/OLPOA/volunteer

May-September	Monitor lake once/month	OLPOA	10	In-kind/volunteer
Intensive Control Activities				
July-September	Discuss additional control options	OLPOA, AIS Coor., DNR	4	OLPOA

Curly-leaf pondweed Control Plan

Step #	Action	Responsible Party
1	Verify suspicious plant with the DNR or Sawyer County AIS Coordinator.	OLPOA
2	Survey lake to map all possible locations of CLP.	OLPOA/AIS Coordinator
3	Treat CLP aggressively with herbicide as soon as ice is out on the lake or water temperatures are around 50^{o}F.	Herbicide Applicator
4	Survey treatment area 2 weeks after herbicide treatment to determine effectiveness.	OLPOA
5	If CLP is a new infestation, survey again the following May/early June for presence. Immediately treat again with herbicide if CLP is found.	OLPOA/AIS Coordinator
6	If CLP is an established infestation, continue treatment again the following spring to control plants growing from turions.	OLPOA/Herbicide Applicator

Purple Loosestrife Control Plan

Step #	Action	Responsible Party
1	Verify suspicious plant with the DNR or Sawyer County AIS Coordinator.	OLPOA
2	Survey entire shoreline and wetland areas to map all possible locations.	OLPOA/AIS Coordinator
3	Cut off flower heads and/or remove plants.	OLPOA
4	If more found than OLPOA can reasonably handle, consult with DNR or Sawyer County AIS Coordinator to determine best method of removal given number of plants found.	OLPOA

Monitoring and Evaluation

Given the presence of EWM in Osprey Lake, monitoring and evaluation will be important to ensure proper control techniques are being utilized. The goal of monitoring and evaluation is to ensure that no harmful changes are occurring in Osprey Lake due to control techniques, development, or other human pressure. Monitoring and evaluation will also provide a method to determine if the objectives set forth in the Aquatic Plant Management Plan are being achieved or if the objectives need to be changed in order to be more effective. A strategy for changing objectives and for determining if they have been met will be outlined.

Monitoring in EWM areas:

- Collect water quality data including pH, dissolved oxygen, nitrogen and phosphorous concentrations, and secchi depth according to DNR and Citizen Lake Monitoring Network protocols or with assistance from the LCO Conservation Department.
- Survey treatment areas 1 week prior to treatment and 2-3 weeks post treatment. Collect 1 rake sample per acre to determine density.
- For treatments greater than 10% of the waterbody or treatments funded by a DNR Established Control Grant, follow pre and post treatment protocols by the WI DNR (protocols on UW-Ext. web site).
- Follow surveying and monitoring timelines found in implementation section.
- Maintain a short, yearly summary.

Evaluation in EWM areas:

- If surveying EWM areas 2-3 weeks after herbicide treatment shows greater than 60% live stems, alternative herbicide treatments should be investigated.
- If minor control activities are not successful in maintaining less than 3 acres of EWM in the lake on a consistent basis (i.e. 3 out of 5 years), the control activities should be revisited with the consultant, WI DNR, or the Sawyer County AIS Coordinator.
- If moderate control activities are not successful in maintaining less than 5 acres of EWM in the lake consistently, two herbicide treatments per year may be considered with advice from consultant and Sawyer County AIS Coordinator or WI DNR.
- If intensive control activities are not successful in reducing EWM to less than 5 acres of the lake, different herbicide options should be considered in consultations with DNR, Sawyer County AIS Coordinator, consultant, and/or Army Corp of Engineers researchers.
- If changes in water quality are seen that are concerning to DNR or Sawyer County AIS Coordinator that may be due to control techniques, activities may be changed or stopped based on observations.

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Nichols, SA. 1999. Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. Journal of Lake and Reservoir Management, 15(2):133-141.

Tyrolt, D. 2005. Osprey Lake Water Quality Study, 2004 Water Year. LCO Conservation Department.

University of Wisconsin-Madison, 2001. Wisconsin Floristic Quality Assessment (WFQA). Retrived October 27, 2009 from: http://www.botany.wisc.edu/WFQA.asp

Appendix

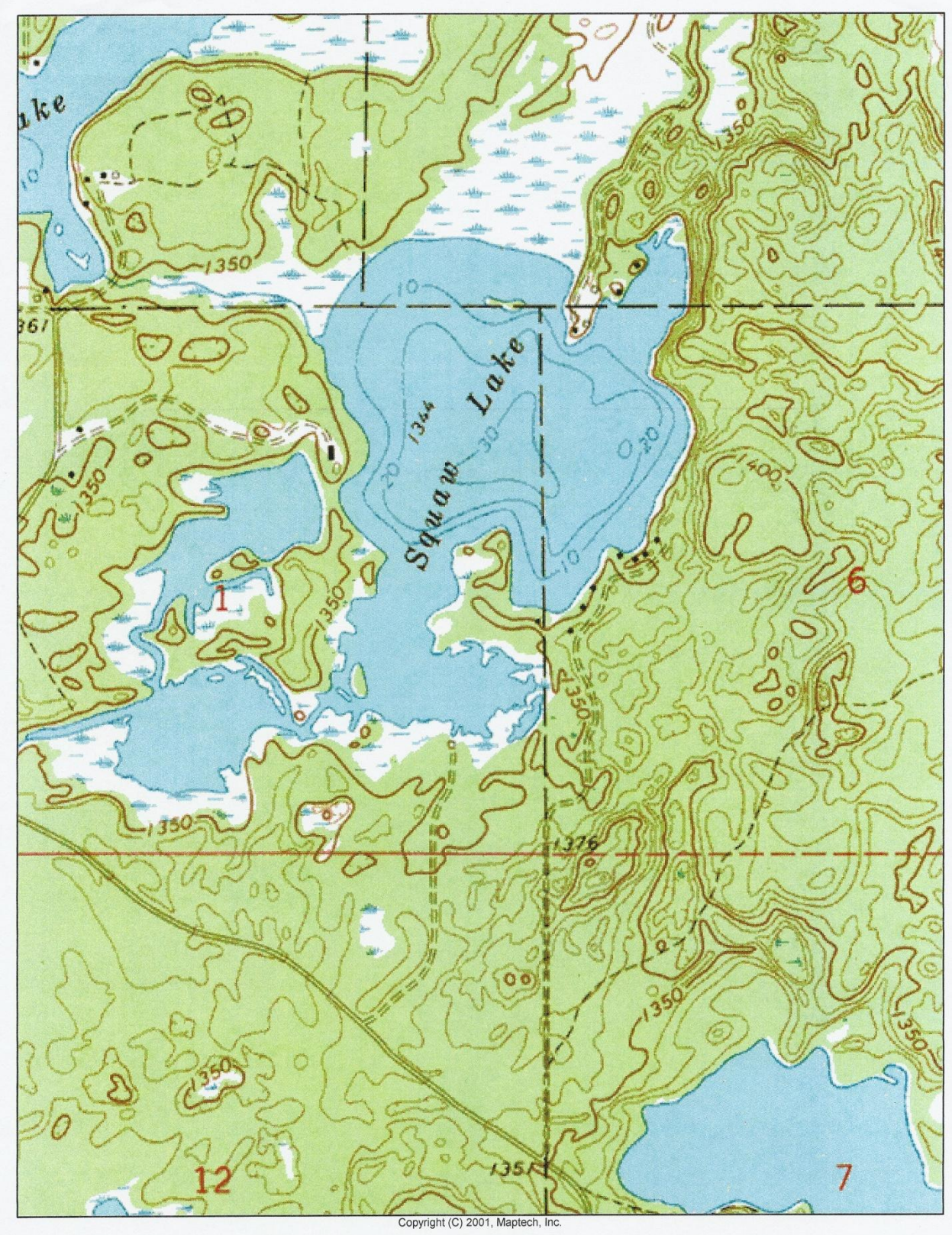
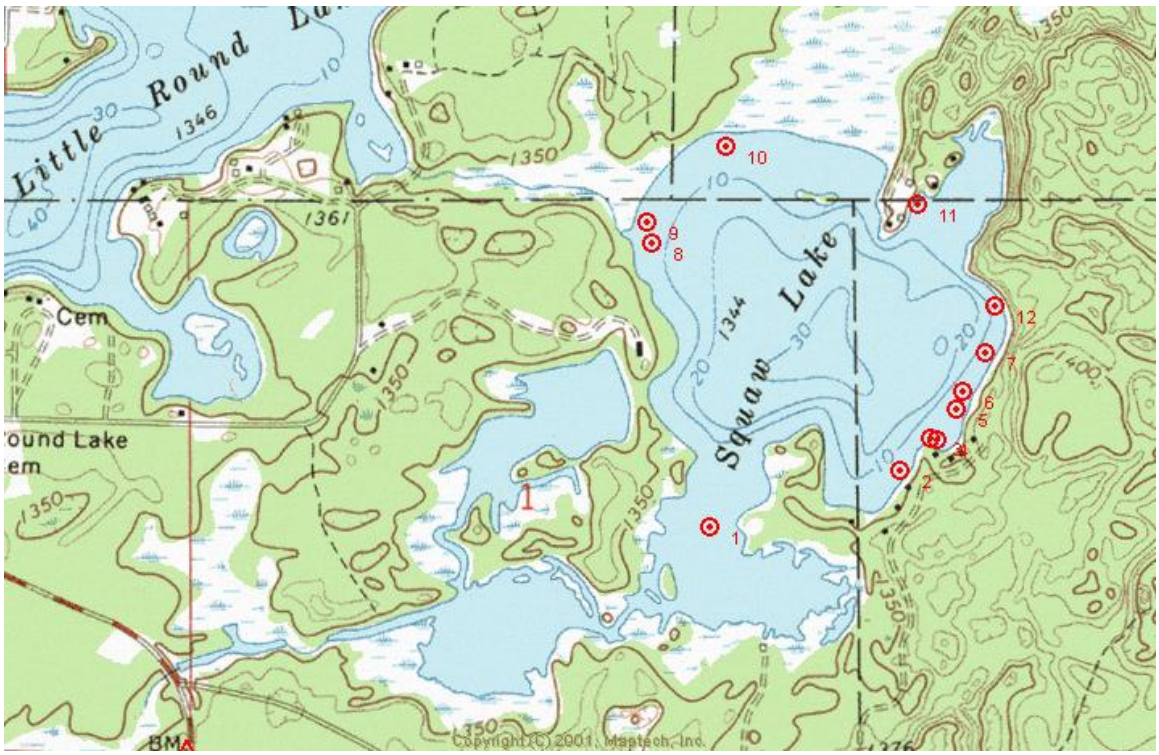


Figure 1: Location of Osprey Lake (formerly known as Squaw Lake)

Figure 2: EWM locations in 2005 (WI DNR)



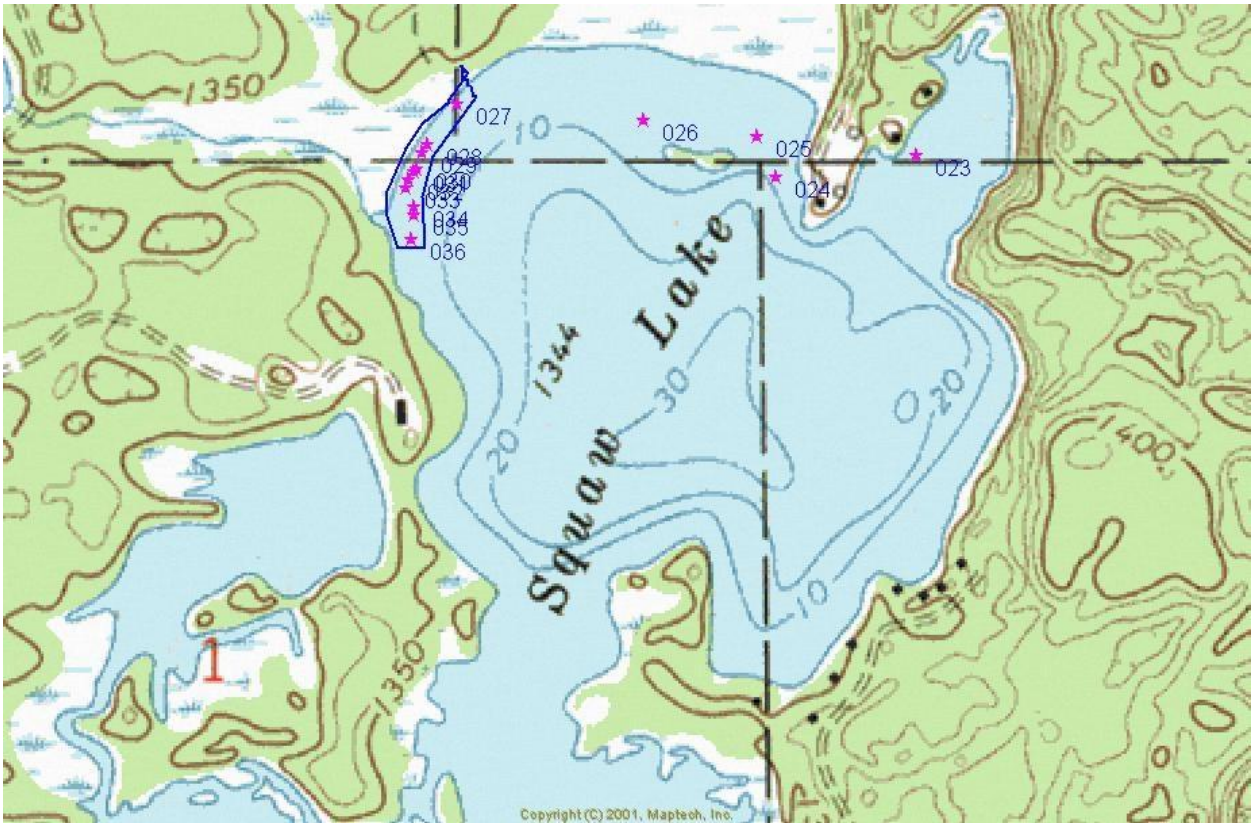
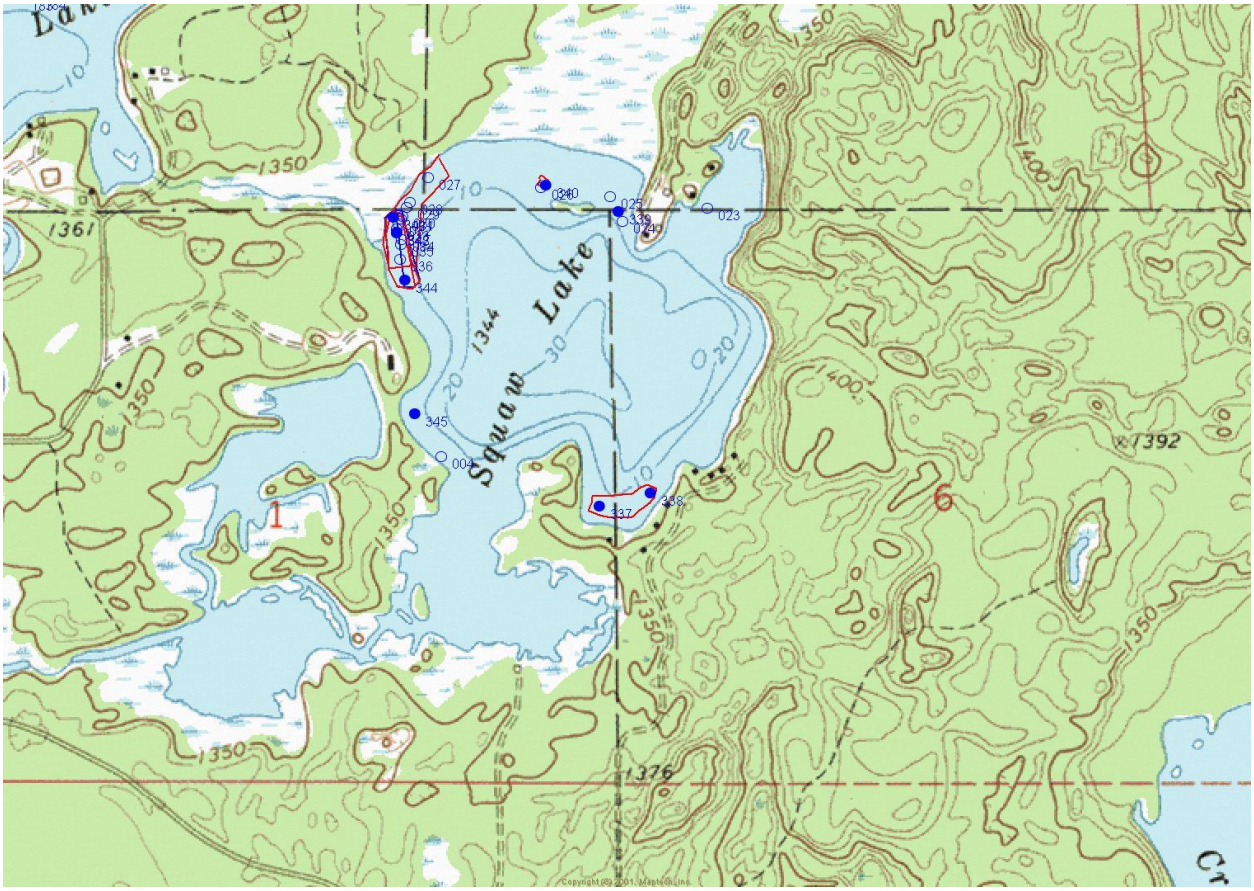
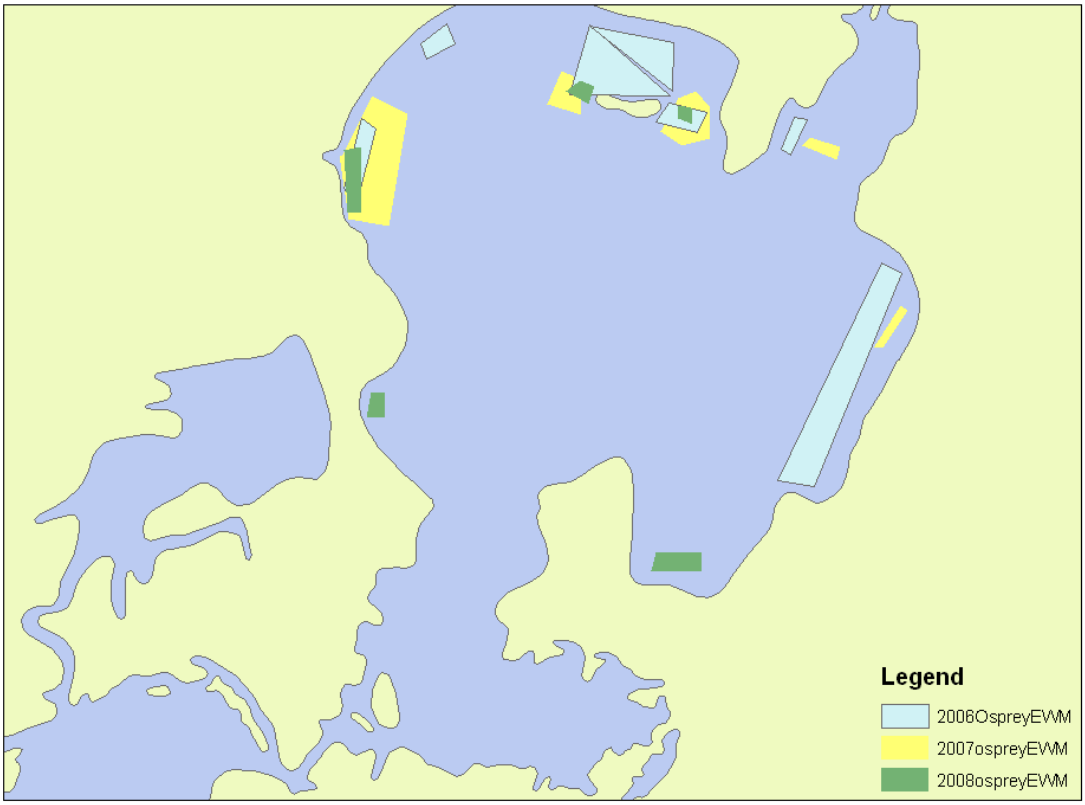


Figure 3: Eurasian watermilfoil locations October 2, 2006

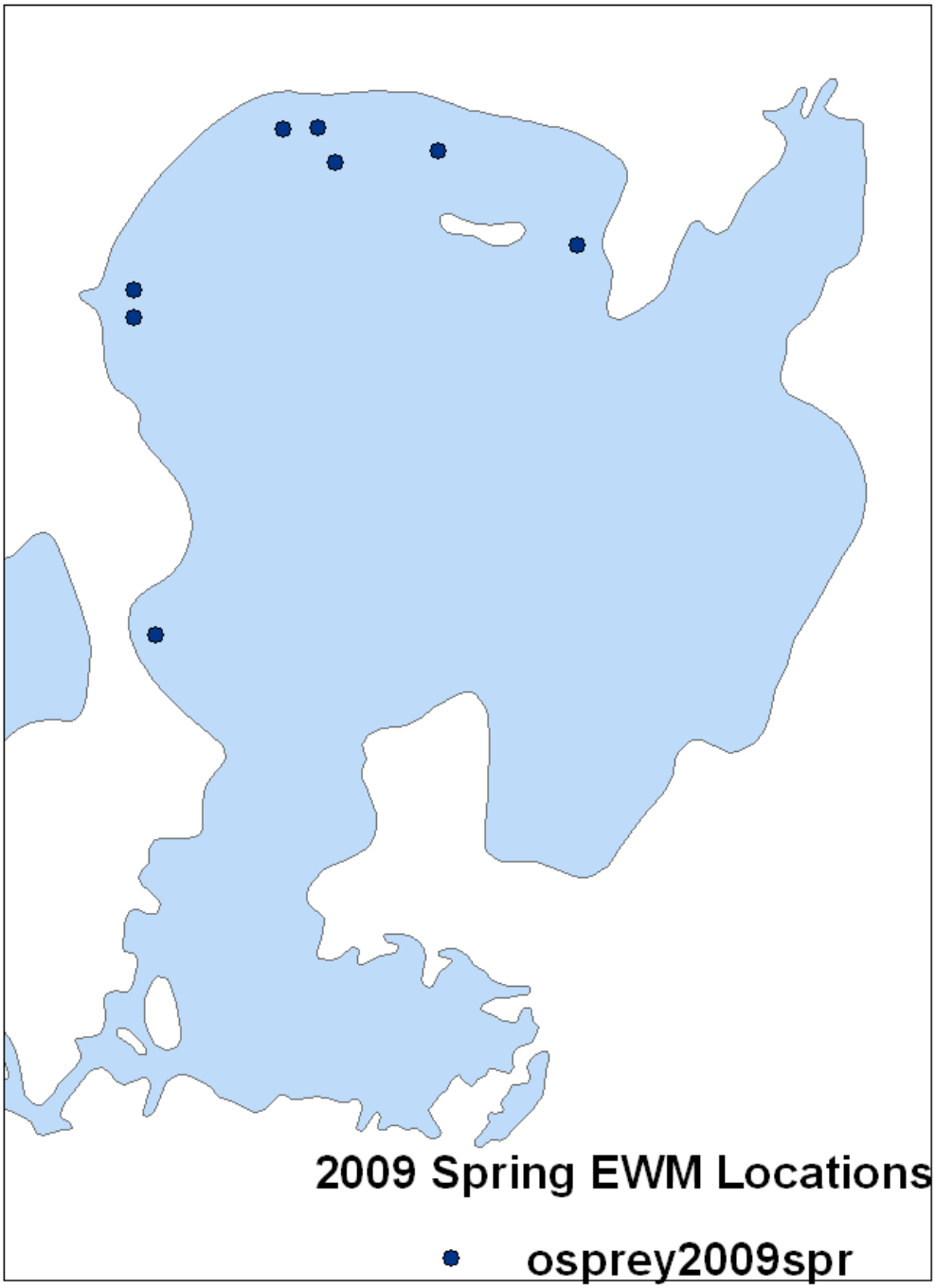


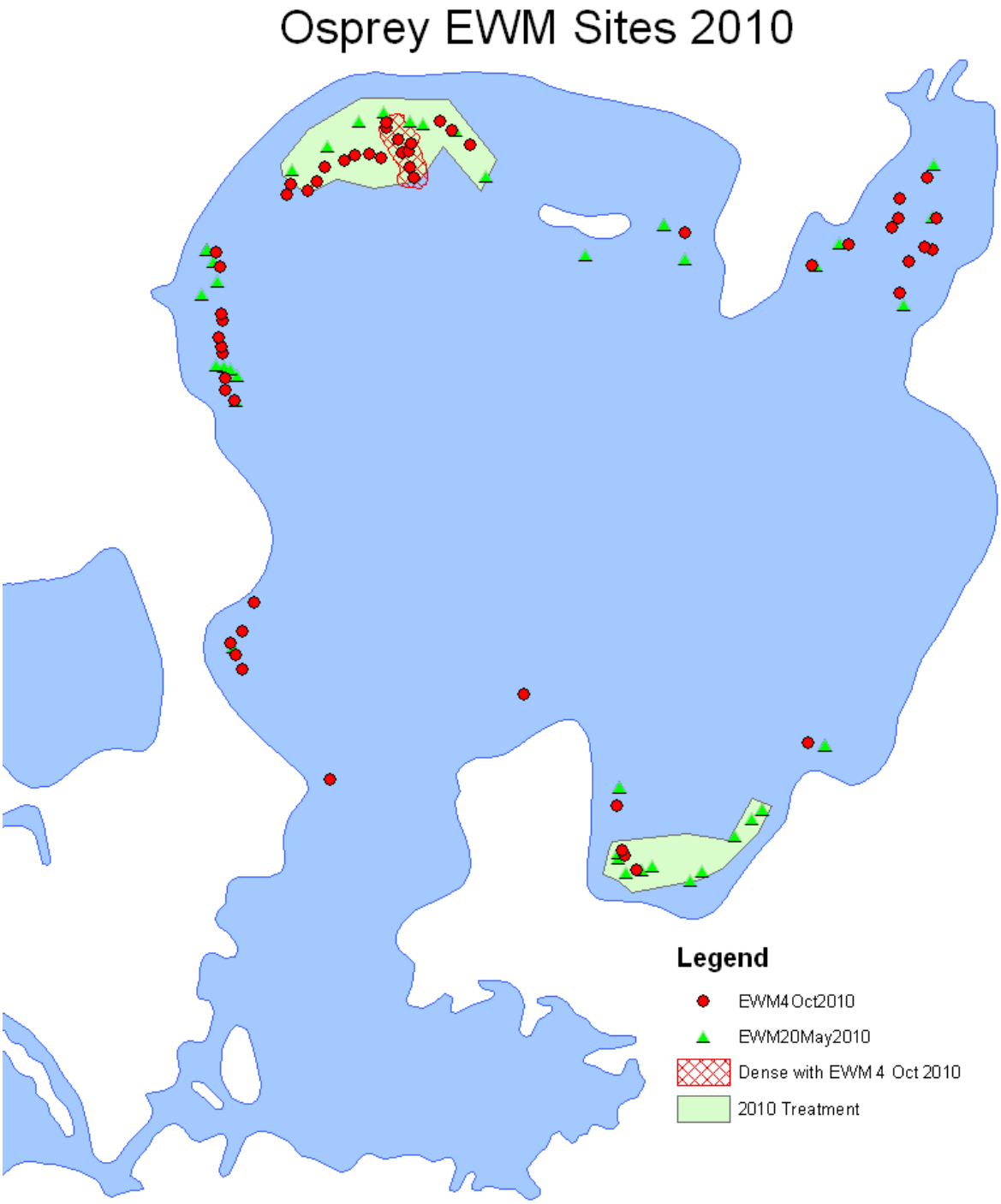
Eurasian watermilfoil, October 2007

Osprey Lake EWM 2006-2008



Osprey Lake




Osprey EWM Sites 2010
Legend
EWM4Oct2010
EWM20May2010
Dense with EWM 4 Oct 2010
2010 Treatment

Proposed 2011 Treatment Areas