Lake Hayward Aquatic Plant Management Plan

Lake Hayward Property Owners Association and Sawyer County Zoning and Conservation Department

5/14/2015

Developed in cooperation with the Sawyer County Zoning and Conservation Department and the Lake Hayward Property Owners Association.

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Lake Hayward POA Board Members

Matthew Miller, Xcel Energy

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John McCue, City of Hayward

Jim Montag, Hayward Outfitters

Lake Hayward Property Owners Association Mission

Lake Hayward Property Owners Association was founded for the sole purpose to preserve and protect Lake Hayward and its surroundings relating to the control of nuisance plants, protection of desirable vegetation, and to enhance the water quality; from the State Highway 77 Bridge to the Xcel Energy Dam.

This plan was approved by the Lake Hayward Property Owners Association in December 2014.

This Plan was shared with the public through letters to property owners on Lake Hayward, availability on the Lake Hayward Property Owners website, inclusion of public and private entities that have a stake in the Lake on the committee, and a public meeting held at the Hayward Middle School. All comments received were taken into consideration in the plan.

Lake Hayward Aquatic Plant Management Plan

May 2015

Lake Hayward Aquatic Plant Management Goals

Primary Goal:

To guide efforts of aquatic invasive species control and nuisance plant control to benefit native plants and water quality.

Objectives:

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

2. Establish acceptable levels of invasives to maintain or enhance native fish and other lake dependent animals.

3. Monitor curlyleaf pondweed (CLP), purple loosestrife, and other aquatic invasive species.

4. Reduce nuisance plant growth in recreation areas.

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

6. 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.

7. Protect and enhance water quality.

Lake Information

Lake Hayward is a 191 acre flowage located in the City of Hayward, Wisconsin. The lake has a long and important history to the city of Hayward and the surrounding area. Once used as a holding pond for logs being sent down the Namekagon River, today Lake Hayward provides recreation and fishing opportunities for many residents and visitors.

Lake Hayward is formed by a dam on the Namekagon River. The dam was originally built in 1882 to serve the needs of holding and sending white pine logs down the Namekagon River and as a millpond. The current Hayward dam was built in 1910. Northern Wisconsin Lumber Company ran a sawmill on the power generated by the dam on the Namekagon and also provided electricity to the neighboring village of Hayward. Today, the Hayward Hydroelectric Project (Project) is owned and operated by Xcel Energy and consists of a powerhouse with one generator along with an overflow spillway. The Project is operated under the regulatory authority of the Federal Energy Regulatory Commission (FERC) in a run-of-river mode with a pond elevation range of 6" (1187.0'-1187.5' NGVD). Pond elevation is controlled using both the powerhouse generator and spillway. There is a minimum flow requirement of 8 cfs below the spillway which was recently refurbished to allow flows to be passed by slide gate or manually by adding or removing boards (Xcel Energy, 2014). It takes 4-6 days for complete turnover of the lake to occur (A. Smith, WI DNR, personal communication).

Today, Lake Hayward is 191 (247) acres with a maximum depth of 17 feet and a mean depth of 5 feet. In 2011, the WI DNR classified the lake as an outstanding/exceptional resource water under NR 102 under the Fisheries Program (dnr.wi.gov/water/waterDetail.aspx?key=17408). The lake is managed for fishing and swimming and is not considered impaired. In 1992, the WI DNR found the lake to have "generally good water quality, but as is common to impoundments, some bay and shallow areas are becoming sediment filled and aquatic vegetation is causing some use problems."

Endangered Resources, LLC (2013) found that 77.8% of the lake bottom was organic and sandy muck, 20.1% pure sand, and 2.1% was rock. Organic muck areas were found in bays on the eastern half of the lake and in the northwest bay. Sand and rock areas were found in the river channel and along the shoreline on the western half of the lake.

The proximity of Lake Hayward to the City of Hayward has translated into development around the lake, both residential and commercial.

Lake Hayward is part of the Saint Croix National Scenic Riverway, a unit of the National Park Service (NPS). The Hayward Flowage (as referenced in the NPS General Management Plan) is designated as an urban recreation area (General Management Plan, Upper St. Croix and Namekagon Rivers, 1998). Urban recreation areas allow for human development to dominate the landscape, although natural elements will be present. Local government zoning is the primary regulatory method and local authorities are responsible for managing people and resources.

Plant Community

Eurasian watermilfoil (hybrid, Myriophyllum spicatum x Myriophyllum sibiricum) was confirmed in Lake Hayward in 2012. The rapid expansion of the plant throughout the lake triggered the formation of the Lake Hayward Property Owners Association, a rapid response grant from the WI DNR, and a partnership with Sawyer County that resulted in the development of this document. The threat of unmanaged EWM in the lake is great enough to cause a foreseeable loss in recreation activities such as boating, kayaking, and fishing throughout the littoral zone of the lake.

A lake's plant community is unique and can tell a lot about the condition of the waterbody. It is important to monitor the plant community, especially when chemical treatments are being conducted 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 as they can lead to rapid changes in the fishery, water clarity, and levels of invasive species.

The area of a lake where plants are found is called the littoral zone. This 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 within it.

The plant community on Lake Hayward was surveyed by Matt Berg of Endangered Resources Services, LLC using the Point-Intercept method in 2013. The report is summarized below; however, a complete copy is available upon request from the Lake Hayward Property Owners Association (lakehayward.org).

Lake Hayward (WBIC 2725500) is a 191 acre impoundment with a mean depth of 5' and a maximum depth of 13'. To survey the plants in the lake, the WI DNR generated a point sampling grid of 482 points based on shoreline shape and distance, water clarity, depth, islands, and total lake acreage. The point-intercept survey method surveys the entire lake at the pre-determined grid points on the lake. This method also incorporates the use of a rake to sample the plants on the bottom of the lake in approximately 2.5' sections. All plants on the rake are identified and assigned a rake fullness value of 1-3 as an estimation of abundance (1=low, 3=high).

A point-intercept survey was conducted on June 17-18, 2013 (pre-treatment) and again on July 26-28, 2013 (post-treatment) by Endangered Resources Services, LLC. The goals of the survey included evaluating the effectiveness of the EWM herbicide treatment, quantifying the lake's curlyleaf pondweed population, and documenting the native plant diversity, richness, density, and distribution.

In June 2013, macrophytes were found growing at 349 sites or 73.0% of the lake; during the post-treatment, this decreased slightly to 71.3% (341 points). Overall diversity was extremely high and nearly unchanged with a Simpson Diversity Index value of 0.92 pre and 0.93 post. The Simpson Diversity Index represents the diversity of plants found in the lake and has a value range 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 method used to determine the quality of the aquatic plant community in a lake. 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 easily impacted by human activities. The more changes to a lake caused by human activities, the higher the number of plants with low values, i.e. plants that are tolerant to habitat modifications, will be found. The 40 native

index species found in the lake during the pretreatment survey produced an average mean Coefficient of Conservatism of 6.3 and a FQI of 39.5. This increased slightly to 44 species with a mean C of 6.4 and an FQI of 42.5 post-treatment. Nichols (1999) divided Wisconsin into four regions to determine the average FQI for each region. In the Northern lakes and forest region where Lake Hayward is located, the average FQI is 24.3. Both mean C values were slightly below average while the FQI's were well above the median for this part of the state.

Species richness indicates the number of different plant species found in and adjacent (on the waterline) to the lake. Species richness was 46 pre/50 post with an additional 15 visual and boat survey species bringing this total to 65species in July. Mean native species at sites with vegetation jumped from 2.84 species/site pretreatment to 4.08/site post-treatment. Coontail (*Ceratophyllum demersum*), Forked duckweed (*Lemna trisulca*), Common waterweed (*Elodea canadensis*), and Fern pondweed (*Potamogeton robbinsii*) were the most common native species in both the pre and post-treatment surveys (43.71%, 31.71%, 31.43%, and 29.71% of survey points with vegetation respectively pretreatment/58.36%, 43.99%, 43.99%, and 36.07% post-treatment). No species showed a significant decline post-treatment other than CLP (naturally occurring) and filamentous algae, although 11 species showed moderately or highly significant increases. A small bed of Northern wild rice (<0.2 acres) was located just south of the HWY 77 Bridge. Vasey's pondweed (*Potamogeton vaseyi*) was the only Species of Special Concern found. Other exotic species found included Reed canary grass (*Phalaris arundinacea*), Purple loosestrife (*Lythrum salicaria*), Common forget-me-not (*Myosotis scorpioides*), and Yellow Iris (*Iris pseudacorus*).

Eurasian watermilfoil (EWM) was present at 54 points or 11.3% of the lake during the pretreatment survey with 13 points rating a 3 and 11 points a 2. This indicates that 4.8% of the lake had a significant infestation. Post-treatment, EWM was still present at 53 points (11.09%) with an identical 4.8% of the lake having a significant infestation. Although EWM plants showed evidence of chemical burn, many were not killed and neither changes in plants or rake fullness were significant. CLP was present at 143 pretreatment points or 29.9 % of the lake. Of these, 83 (17.4%) had a rake fullness of 2 or 3 indicating a significant infestation. By the post treatment, most CLP had senesced and it was only present at 9 points, all of which rated a 1.

No quantitative survey was done on Lake Hayward in 2014, but changes in the plant community were noted. Eurasian watermilfoil was still found throughout the lake, but it was not as robust or dense as in the previous year. Curlyleaf pondweed was also reduced in the spring of 2014, most likely due to low light conditions under the ice causing limited overwinter growth.

Management History

Aquatic plant management began on Lake Hayward in 2011, even though there have been nuisance levels of plants in years prior to 2011. In 2011, a few Eurasian watermilfoil plants were identified in the lake by the Sawyer County Aquatic Invasive Species Coordinator. A permit to treat .05 acres was granted to the County by the WI Department of Natural Resources to chemically treat the few plants that were found. The treatment took place on July 13, 2011 (see Map 1 for location).

In 2012, no management actions were taken. The population of Eurasian watermilfoil that was found in 2011 was not present in 2012. However, there were other plants in the lake that had the appearance of EWM in the water, but upon closer inspection were identified as a robust, native milfoil by the WI DNR. These plants were sent in for DNA confirmation by the WI DNR and during the winter of 2012-2013 a hybrid milfoil determination was made (*Myriophyllum spicatum* X *Myriophyllum sibircium*). Plans were made in the spring of 2013 to treat the suspected 0.5-1.0 acre of hybrid milfoil in the lake. At the same time, the residents of Lake Hayward were in the process of forming a lake association.

Pre-treatment surveys in May of 2013 found over 20 acres of hybrid Milfoil, instead of the expected 1.0 acre. An Aquatic Invasive Species (AIS) Rapid Response grant was awarded to Sawyer County to help with the funding of the larger treatment. The original 1.0 acre permit was amended to treat 23 acres of hybrid Milfoil (hereafter referred to as Eurasian watermilfoil or EWM). NEC, Inc. was hired to complete the herbicide treatment using a liquid 2,4-D product. Pre-treatment and post-treatment Point Intercept surveys were done in conjunction with the treatment and funded by the rapid response grant. Endangered Resource Services, LLC completed the surveys and report.

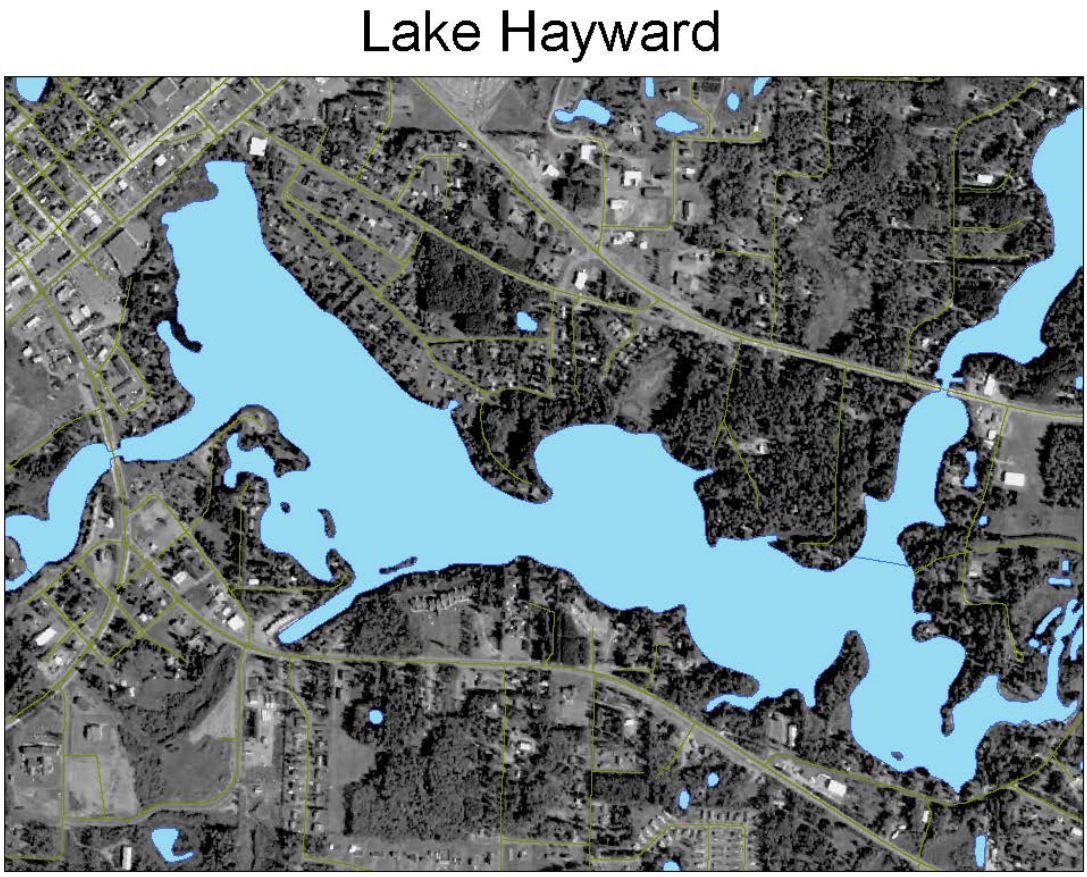
During the winter of 2014, the Eurasian watermilfoil Pre/Post Herbicide Treatment Survey report was received and studied. Based on the results of the 2013 herbicide treatment, it was decided to treat 15 acres of EWM in the summer of 2014. Pre-treatment surveys in May of 2014 showed once again that the EWM did not overwinter as expected. The winter of 2013-14 was colder and snowier than typical winters on Lake Hayward. The extreme weather conditions seem to have had an impact on invasive species and populations were reduced. Eurasian watermilfoil and curlyleaf pondweed were both found in numbers less than expected in the spring of 2014. Pre-treatment plans were changed to reduce the number of acres treated and to wait until more plants were visible. An herbicide treatment was competed on June 26, 2014. Three different areas were treated for a total of 9.5 acres. Tribune herbicide (diquat) was used in the Northwest Bay of the lake to treat 3 acres of EWM. Given the flow and wind through this area of the lake, Tribune was used in order to reduce the amount of time the herbicide had to be in contact with the plant to achieve control. Diquat acts as a contact herbicide and will just kill the above ground portion of the plant, not the root structure. A liquid 2,4-D product (DMA 4 IVM), was used in the other 2 locations on the lake (6.5 acres total) because of less water movement and therefore greater contact time of the herbicide. DMA 4 is a systemic herbicide that is taken up by the plant and translocated throughout the plant to the roots. If effective, the plant is killed at the roots and is unable to continue growth.

Curlyleaf pondweed growth was also greatly reduced in 2014, even though no control work was done to specifically target it. Plants were very small, easily uprooted, and rarely topped out on the surface of the water. A possible cause of the reduction is the cold temperatures and high snow amount during the winter of 2013-14 that blocked light from entering through the ice to enable early growth of CLP.

Table 1: Herbicide Usage on Lake Hayward

Year	Acreage Treated	Herbicide
2011	<0.5	Navigate (2,4-D)
2012	0	N/A
2013	23	DMA4 (2,4-D)
2014	9.5	Tribune (diquat), DMA 4 (2,4-D)

Lake Map



Fisheries

Fisheries information is provided by Max Wolter, WDNR Fisheries Biologist.

Overview of the fishery- Lake Hayward contains muskellunge (stocked), northern pike, largemouth bass, smallmouth bass, walleye (stocked), bluegill, pumpkinseed sunfish,

yellow perch, black crappie, yellow and black bullhead, white sucker, and several species of redhorse that primarily inhabit the area surrounding the inlet of the Namekagon River. Brook and chestnut lamprey are also present (chestnut lamprey are parasitic on fish and can be seen on bass, pike, and muskellunge in Lake Hayward on occasion).

There is very little successful muskellunge reproduction in Lake Hayward but stocked fish appear to have high survival and reach trophy length (see accompanying report and photograph). Muskellunge in Lake Hayward benefit from the influx of forage fish from the Namekagon River (redhorse, sucker, and likely the occasional trout). Muskellunge will use aquatic vegetation as a refuge when young, and as foraging habitat as they grow.

Northern pike are entirely self-sustaining and size of pike is very good compared to many lakes in the area. Pike likely benefit from the same forage base as muskellunge. Northern pike are very reliant on aquatic vegetation for reproduction (eggs stick to aquatic plants) and foraging.

Largemouth bass are common in Lake Hayward and size structure is better than many other lakes in the area with many legal sized (>14 inches) fish present. Largemouth bass use aquatic vegetation as their primary habitat. Smallmouth bass are considerably rarer and are focused in the area around the inlet of the Namekagon River. Smallmouth bass are more keyed on rocky habitat in comparison to aquatic plants.

Walleye are relatively rare in Lake Hayward indicating that stocking success is low and natural reproduction is non-existent. Walleye of several sizes were stocked aggressively for many years with little result. Stocked walleye that do survive grow well and are a nice "bonus" species in the lake for anglers. Both walleye and muskellunge are susceptible to "dam escapement", which is movement through or over a dam in a manner that prevents their return to the lake. We suspect that many stocked walleye and muskellunge wind up in the Namekagon River below Lake Hayward. From 2005 to 2010 there was a barrier net installed seasonally (purchased by Xcel and installed/maintained by DNR) to address this issue, but over time this project was deemed infeasible because the net had to be cleaned ~3 times a week as a result of entrainment of dead aquatic plants (primarily CLP).

Bluegill and pumpkinseed sunfish are abundant in Lake Hayward but have above average size. These species use aquatic plants as refuge from predation but excessive plant growth can pose management problems for panfish. Healthy fish populations rely on a large percentage of the panfish born each year to be eaten by predators, otherwise stunting can occur. These high levels of predation are not possible when aquatic vegetation becomes overly dense. Despite dense vegetation in some areas of Lake Hayward stunting of panfish has not been observed in Lake Hayward up to this point.

Yellow perch and black crappie are more rare than bluegill and do not comprise a significant portion of the fishery. Both can reach large sizes.

General comments on aquatic plants and the fish community- The fish community of Lake Hayward benefits from the diversity of the plant community and the inflowing water

of the Namekagon River. Without either of these factors it is reasonable to presume that the fishery would decrease in quality. While sections of the lake certainly have aquatic plant densities that are too high for optimum fish habitat (these areas are impacted by invasive species) there has not been a noticeable impact on the overall fish community to date. Manual removal of aquatic plants if undertaken should be done after fish spawning if possible. Disturbance of the sediments and plants themselves could have negative effects on spawning success of essentially all species of fish in Lake Hayward if timed incorrectly. Chemical treatment of aquatic invasive plants should be undertaken with great caution and with intense scrutiny of any potential chemical product. Any chemical selected should ideally lead to no further restrictions on fish consumption since this is a popular lake for families to fish.

Schedule of upcoming surveys- Lake Hayward was surveyed in 2013 for early spawning species (muskellunge, northern pike, and walleye, see attached report). The next survey is scheduled for 2015 and will include a comprehensive study of the fish population including estimations of the total number of muskellunge and walleye. Lake Hayward is officially on a 7 year survey rotation based on its size, but because of its proximity to town it is typically surveyed more often.

Stocking plan- At this point in time the DNR plans to continue to stock Lake Hayward with both muskellunge and walleye when they are available. However, Lake Hayward is a lower priority stocking location than many other lakes in the area due to the low success of previous walleye stocking and lack of necessity to stock muskellunge more frequently than every few years. Private stocking of both muskellunge and walleye will be permitted if the stocking specifications match DNR protocol.

Wildlife Habitat

For Sawyer County, Lake Hayward is an urban lake. Despite its proximity to the City of Hayward, wildlife is abundant. Herons, loons, eagles, ducks, otter, beavers, and deer are common wildlife that are viewed frequently. Eagles have been known to nest on the lake and there appears to be appropriate wildlife habitat for many species.

Water Quality

Water quality is an important indicator of the health of a lake. Water quality can be measured in many ways and includes the chemical and biological characteristics of the water.

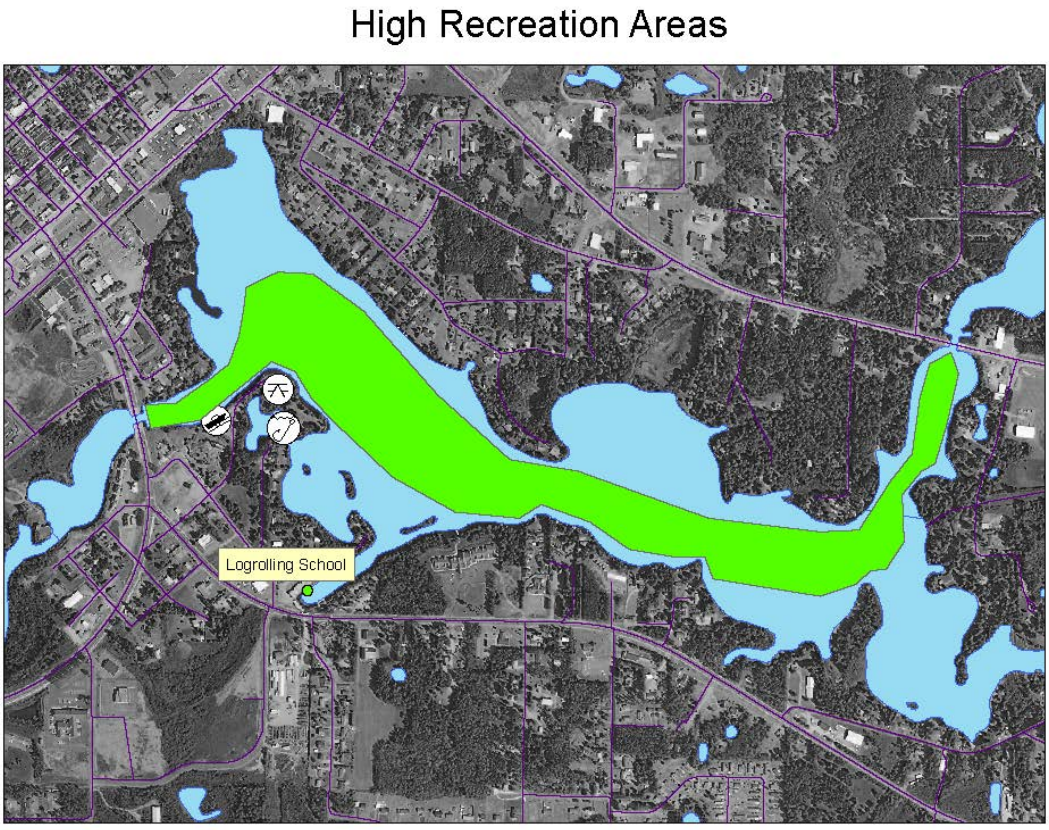
The Trophic State Index (TSI) of a lake reflects a lake's nutrient and clarity levels. The trophic status relates to the amount of algae in a lake and how that affects the depth sunlight can infiltrate into the water. Lakes are divided into three categories based on their Trophic State Index: oligotrophic, mesotrophic, or eutrophic. Oligotrophic lakes are deep, clear lakes with little nutrients and are oxygen rich. Eutrophic lakes are high in nutrients and typically have large plant

populations. Eutrophic lakes may experience algae blooms and are often thought of as “weedy”. Mesotrophic lakes are in between oligotrophic and eutrophic lakes. They have medium amounts of nutrients and usually have beds of submersed vegetation.

Lake Hayward is in the mesotrophic category. Water quality data collection was begun by the Lake Hayward Property Owners Association in 2014 through the WI DNR Citizen Lake Monitoring Network. Water quality data was collected sporadically over the years until this time. The Wisconsin DNR monitored the trophic status of the lake using satellite water clarity observations over the last 5 years (approximately 2009-2014). The average summer trophic state of the last five years, according to the WI DNR was 47 (dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2725500&page=waterquality; accessed 9/9/2014), placing Lake Hayward in the mesotrophic category.

Water quality on Lake Hayward is most likely impacted by run-off off from streets in the City of Hayward, lack of buffer zones, and the mostly urban environment it is located in.

Water Use



Lake Hayward is frequently used for recreational activities such as fishing, boating, waterskiing, canoeing, kayaking, and swimming. The amount of nuisance plants in the lake prior to 2014 restricted these activities in some of the bays in the lake.

The Namekagon River that flows into Lake Hayward is a popular destination for canoes and kayaks. Many of these recreational boaters travel through Lake Hayward before continuing their journey down river or ending their trip at the Lake Hayward public boat launch.

The Namekagon River Rollers log rolling school is located on Lake Hayward, along with the site of Fred Scheer's Lumberjack Show. Both of these businesses use a bay on Lake Hayward for log rolling and other historic lumberjack related activities. The Lumberjack World Championship uses the same bay the last full weekend of July each year for lumberjack competitions.

The City of Hayward maintains a swimming beach, park, and fishing pier on Lake Hayward. A public boat landing is also located at the park.

During the winter the lake is used for ice fishing, snowmobiling, and the American Birkebiener ski trail crosses the lake in February.

Watershed Description

Lake Hayward is located in the Trego Lake-Middle Namekagon River watershed. The watershed is 268.89 mi^2 (dnr.wi.gov, accessed 9/9/2014). The watershed is primarily comprised of forested land (67.45%), wetland (14.7%), agriculture (9.5%), and other uses (8.35%). The large watershed that Lake Hayward is part of includes 217.96 miles of stream, 4,463.49 lake acres and 28,205.13 acres of wetland (dnr.wi.gov, accessed 9/9/2014). However, given Lake Hayward's urban location, much of its immediate watershed is residential and commercial areas. There is most likely a large amount of run-off, sedimentation, and nutrient input from roads, parking lots, and large amounts of impervious surfaces that run into Lake Hayward. Smith Lake Creek runs through the City of Hayward and into Lake Hayward through a culvert on the Northwest side of the lake. Improvements in buffer zones around the creek and at the outlet would assist in filtering out pollutants that are now running directly into Lake Hayward.

Shoreline Habitat

Lake Hayward is located in the City of Hayward and the Town of Hayward, within Sawyer County. Shoreline ordinances are similar in both areas with a 35 foot deep buffer required for all properties except for a 30 foot use corridor. See http://cityofhaywardwi.gov/wp-content/uploads/Zoning-Ordinances.pdf for the City of Hayward shoreland regulation ordinance. Sawyer County ordinances may be found at http://www.sawyercountygov.org/Portals/0/CountyDepartments/ZoningAndSanitation/FINAL%202%20Shoreland-Wetland%20Protection%20Ordinance.pdf. Most lake properties were developed

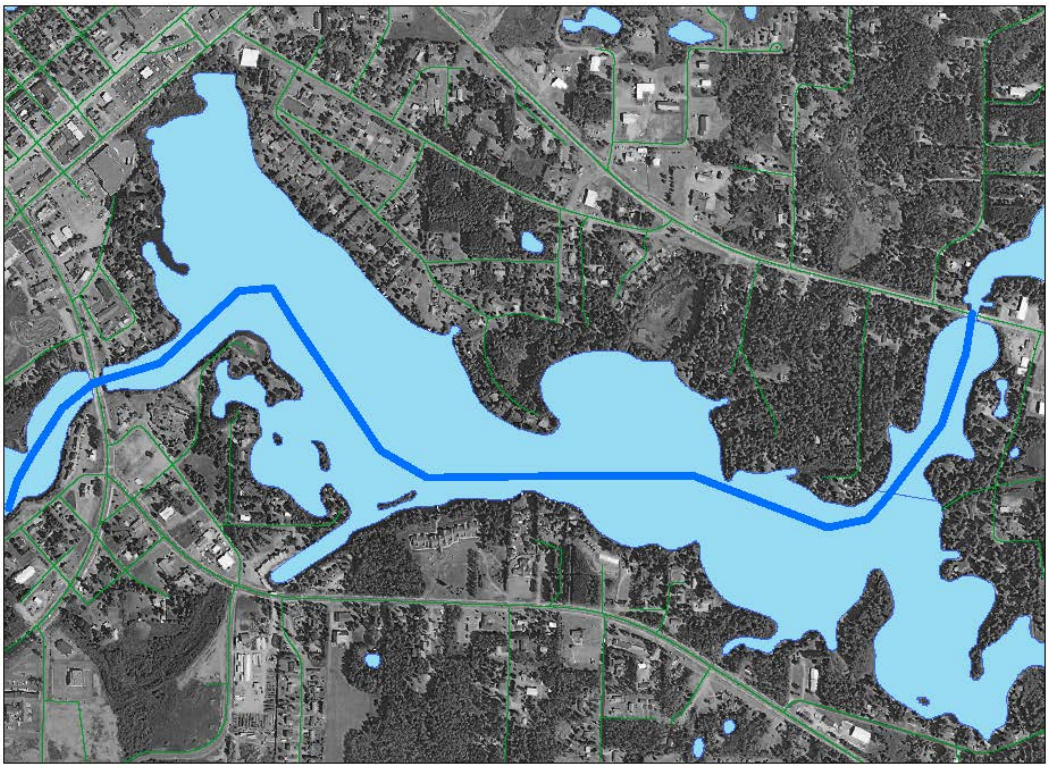
before zoning ordinances were in place and current buffer zones reflect lack of zoning on the lake. Very few shoreline properties have developed 35 foot buffers. Lack of shoreline habitat is most likely reflected in increased run-off and nutrient inputs into the lake. Increased nutrients in the lake can cause increased plant growth of native and invasive plants.

Lawn care practices and fertilizer use is not known on properties on Lake Hayward. Education should be done to increase awareness of lawn care practices and effects on Lake Hayward. For instance, using non-phosphorous fertilizer will help alleviate algae blooms in the lake, but the nitrogen in the fertilizer can increase plant growth in the lawn and in the lake. An education program to share best management practices may help in reducing overall plant growth in the lake.

Analysis and Alternative Treatments

Lake Hayward is a shallow water impoundment prone to excessive plant growth given its bottom substrate composition, nutrient inputs, and mean water depth. Submersed, aquatic plants will always comprise a large percentage of the lake bottom, however the hope is that native plants dominant the plant population and not aquatic invasive species, such as Eurasian watermilfoil (EWM) and Curlyleaf pondweed (CLP).

Approximate River Channel- Area with Increased Water Movement



Levels of Control

For all plants found in the lake, varying levels of control may be appropriate at different times. Based on the amount of control deemed necessary at a given time, we will discuss no manipulation, small scale manipulation, large-scale manipulation, and whole-lake-scale manipulation. Consideration will also be given to the Aquatic Plant Management Strategy, Northern Region WDNR (Summer 2007) found in Appendix 1.

No manipulation. No manipulation or control work may be the best alternative on lakes where no aquatic invasive species have been found or in areas where protecting native plants is the goal.

Given the state of aquatic plants in Lake Hayward and the presence of Eurasian watermilfoil and curlyleaf pondweed, no manipulation may not be the choice for overall plant management. Years

or areas in the lake may be designated for no control or manipulation. No control means no plant control by chemical, mechanical, or manual means will take place.

***Small-scale manipulation*.** Low levels of control may be used if aquatic invasive plants are found in low abundance, or if concerns over plant populations are slight. Proposed treatments typically involve less than 10 acres or less than 10% of the littoral zone.

Large-scale manipulation. High levels of control effort will be done when severe plant concerns exist. Management decisions may substantially impact or change the state of the lake. Proposed treatments will impact more than 10 acres of 10% of the littoral zone. Established infestations of invasive species usually are present.

Whole-lake-scale manipulation. Large scale manipulation of greater than 50% of the littoral zone.

Whole lake treatments in Lake Hayward include drawdowns and large herbicide treatments that would include most of the littoral zone of the lake.

Control Options/Techniques

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. Systemic herbicides usually require many hours of contact with the plant for effective absorption to take place.
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 may be used when water flow inhibits long herbicide retention times as a few hours of contact is usually enough to affect the plant.

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 in area lakes (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. Check specific herbicide formulations for irrigation restrictions.

Liquid and granular forms of 2,4-D are available. Liquid formulations are much less expensive than granular forms. The benefit of granular form may be that it gradually releases its chemical into the water, resulting in longer herbicide contact to the plants. However, herbicide concentration data that has been recently collected does not always show slow-release tendencies, so the benefit of granular is debatable. Granular does appear to sometime perform better in small areas, or deep water areas. The type of substrate may also determine the efficacy of granular forms and the amount of herbicide released into the water column or trapped in sediment pore water. Before deciding on herbicide type and formulation it is best to discuss the control treatment with a consultant and agency representative (County AIS Coordinator or WI DNR).

Diquat: Diquat is a non-selective herbicide typically used to control emergent and submersed weeds. It is sold under the trade names Tribune, 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. Diquat is an appropriate choice in areas with low native plant abundance and moving water. Diquat requires only a few hours of contact time to affect plants negatively.

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 have been done combining low doses of endothall with 2,4-D in combating Eurasian watermilfoil and curly-leaf pondweed with success. Each formulation using endothall has different restrictions, check labels to determine use 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 or lakes with moving water, so may not be appropriate for Lake Hayward.

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. It should not be used in moving water and rapidly degrades in areas with organic material in the soils. There are no restrictions for swimming, fishing, or pet/livestock drinking water use, but there are restrictions for irrigation and human consumption (may be as long as 120 days). See WI DNR factsheet for most current restrictions.

Chemical Treatment 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, fishing, 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-$1300/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. SCUBA diving for plants may be difficult in Lake Hayward given soft sediments, dark waters, and relatively shallow depths. While it could be explored as a control option, it may be difficult and very time consuming to implement.

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.

Cost

Manual removal of plants is often done with volunteers. SCUBA divers may be hired for varying costs including reimbursement for tank air, hourly wage, etc.

Mechanical Removal

Mechanical removal of submersed aquatic plants includes many different forms from rototillers to large plant harvesters. Many types of mechanical harvest are not allowed in Wisconsin, so check with the WI DNR before proceeding with mechanical removal.

Plant harvesters are used to remove plant biomass from the water column in order to clear navigation channels. Plant harvesters do not control weeds, they simply remove part of the plant for temporary relief from nuisance levels. Harvesting does not work in shallow areas where the harvester may be too close to the bottom or areas with obstructions such as logs or stumps underwater, docks, or other obstacles.

Rototillers, weed rollers, and weed cutters are also used on a smaller scale to mechanically remove plants. Many of these mechanical options are not legal for use in Wisconsin because of the damage they can have to native plants and animals. Please contact the WI DNR to find out if practices are allowed and if mechanical removal of aquatic plants requires a permit from the Wisconsin Department of Natural Resources.

DASH Harvesting

Diver assisted suction harvesting (DASH) is a relatively new control option for NW Wisconsin. A DASH unit is placed on a boat and provides suction and/or air to divers in the water. Divers handpull plants and then transport them to the boat via suction hoses. DASH harvesting is faster than traditional SCUBA handpulling, but can be very time consuming and expensive.

Advantages

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

Disadvantages

- Disruptive to bottom sediment and organisms that may live there, even though sediment is not suctioned, just the plant.
- May increase water turbidity.
- High cost.

Cost

Varies depending on machine used, from $1000 to over $100,000. Consultants are available to handpull using DASH units. Prices are typically in the $1000 range for removing .25 acres of EWM.

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 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. 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.

Advantages

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

Disadvantages

- 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.

Drawdown

Because Lake Hayward is an impoundment, the dam and powerhouse could potentially be used to draw down the lake. A drawdown would lower the water elevation to a pre-determined level in the late summer/early fall, letting exposed sediments dry out and freeze. Freezing of the sediments will in turn freeze plant root structures, effectively killing the plants. A drawdown is a control tool to explore which may have little cost and a potentially big impact.

Drawdown dries out and freezes all exposed lake bed surfaces, typically harming invasive plants while native plants return to the area quickly. Thought must also be given to reptiles, amphibians, insects, crayfish, mussels, and other animals in the lake that overwinter in the lake bed sediments. A slow, late summer/early fall drawdown is recommended to reduce the impact of the drawdown on animals that utilize the lake.

Several factors must be considered prior to a winter drawdown and they include: the physical configuration of the dam, minimum elevation for EWM control, required minimum downstream flows and pond level elevation, and the impacts to the fishery must be explored in greater depth before any decisions on winter drawdowns can be determined. Xcel Energy would have to develop a drawdown management plan in consultation with the National Park Service, U.S. Fish and Wildlife Service, and the WI Department of Natural Resources. The plan would then have to be submitted to FERC for approval. The American Birkebeiner, City of Hayward, businesses, snowmobiling clubs, and property owners would have to be informed and alternate plans developed if low water levels impacted any activities.

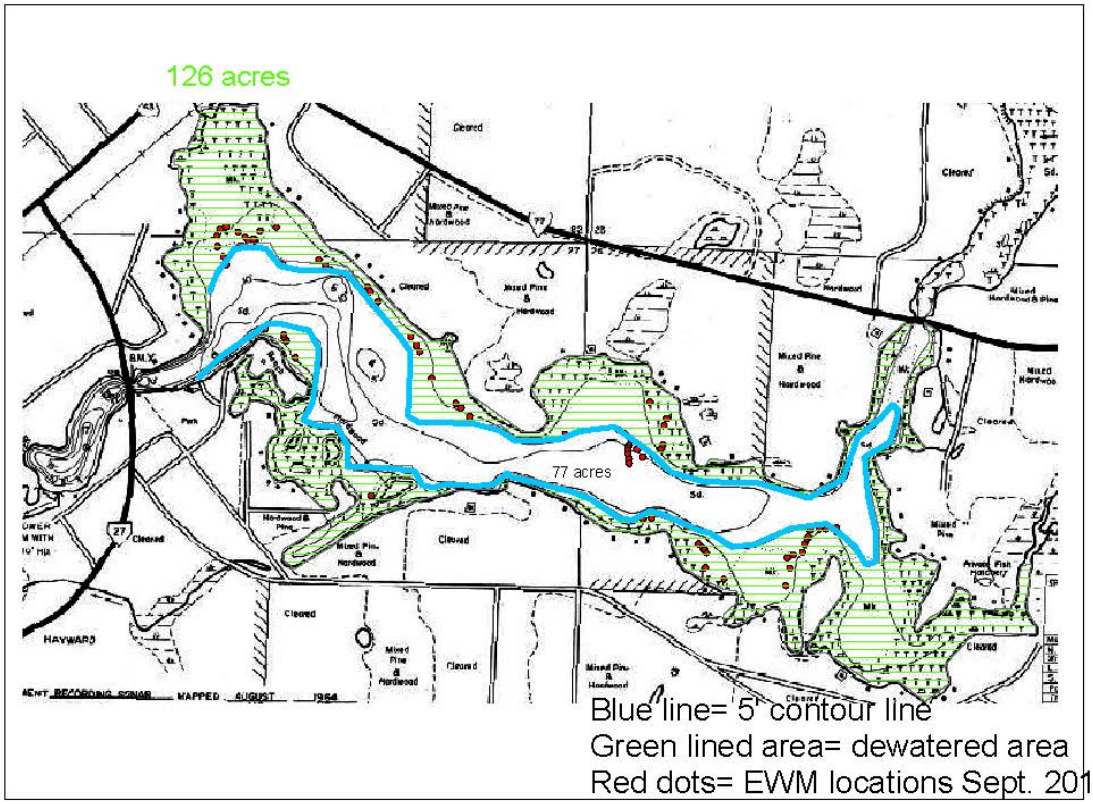
Preliminary consultation was done with Xcel Energy in 2014 (Matthew Miller, Hydro Licensing Specialist). During these discussions, a 3’ drawdown seems to be the only viable drawdown option for Lake Hayward. A 3’ drawdown was done in April of 2004 for maintenance purposes and might be a possibility to implement again in the future. A drawdown at this level would not impact the majority of the EWM areas, but would allow for adequate water to flow through the dam and downstream (8 cubic feet per second (cfs) required to go through the dam and downstream). A drawdown of 3’ will not cause any icing concerns to the dam structure or cause a shutdown of the power generating equipment. Overall, preliminary evaluation by Xcel shows that a drawdown greater than 3’ is feasible due to structure concerns, but more investigation is necessary.

At this time, it is still important to continue research as to whether a drawdown could take place to impact the majority of the EWM in the lake. Additional information on feasible drawdown levels,

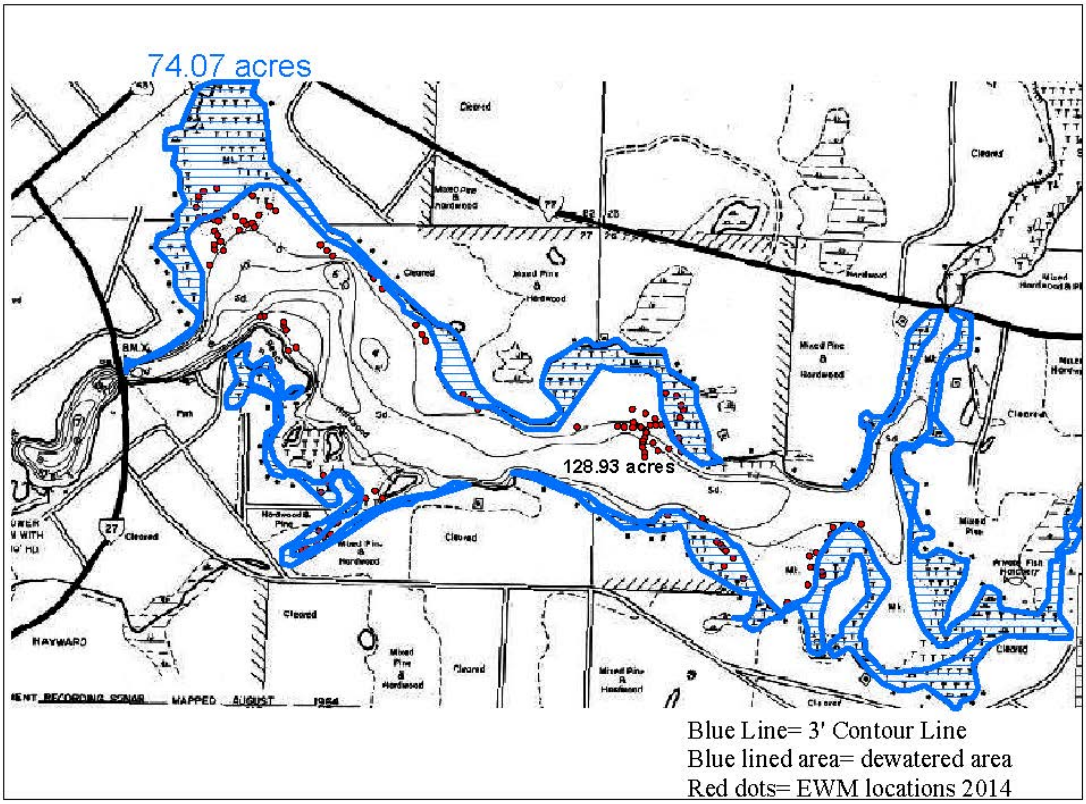
and the ability of Xcel to drawdown the lake given power production and regulations from Federal Energy Regulatory Commission, is needed before plans can be developed.

Given that current research on hybrid milfoil suggests that herbicide treatments may not be successful in the long term, a more in-depth inquiry should be made to Xcel Energy on options for a drawdown greater than 3'. The LHPOA will have to work closely with the WI DNR, National Park Service, and Xcel Energy to determine if a plan can be created to affect more of the EWM areas than a 3' drawdown. It should, however, be noted that the WI DNR fisheries program has very high concerns about the impacts to fisheries and the LHPOA would have to be prepared to work closely with the DNR during the drawdown. LHPOA should contact Sawyer County Zoning and Conservation and the WI DNR Regional Lakes Biologist to begin discussions with Xcel Energy.

Lake Hayward 5' Drawdown Potential



Lake Hayward 3' Drawdown Potential



Overall recommendation

Eurasian watermilfoil control in Lake Hayward will take a multi-technique approach. It is appropriate to use 2,4-D products and Diquat products depending on the lake area being treated and the associated amount of water flow. A combination of liquid and granular products may be needed. Thought should be given to timing and appropriate conditions for each option with the herbicide applicator. Chemical treatments should be done as early in the season as possible, as soon as plants are actively growing (before June if possible). The 2013 Lake Hayward Herbicide Concentration Monitoring Survey found at the end of this document should be used to guide herbicide treatments in regards to locations and amounts of herbicides used. Manual removal at the public beach area, boat landing, and private docks is encouraged. Drawdown possibilities should be explored. If feasible, a late summer/early fall drawdown could provide control of EWM with little cost and impact to native plants. Specific recommendations for treatment are found in the Recommendations section.

Curlyleaf Pondweed

Chemical Control

Available aquatic herbicides available for use on curlyleaf 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. Studies have been done combining low doses of endothall with 2,4-D in combating Eurasian watermilfoil and curly-leaf pondweed with success. Each formulation using endothall has different restrictions, check labels to determine use restrictions.

Diquat: Diquat is a non-selective, contact herbicide. It is sold as a liquid formation under the trade name Reward®. Diquat may be appropriate in areas where moving water is a concern and the main control goal is to reduce total biomass and turion production, not complete kill.

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. Fluridone may not be appropriate for use in Lake Hayward.

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, fishing, irrigation, etc.).
- Non-target plants may be injured or killed.
- Multiple treatments may be necessary before adequate results. Turions may survive in sediment for 7 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.

Cost

Costs range from $500-$1000 depending on herbicide used and depth of water.

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. Manual removal of

curlyleaf pondweed should be done before turions are formed on the plants (usually before mid-June). New plants may grow from turions which will not be removed with manual control.

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.

Cost

Manual removal of plants is often done with volunteers. SCUBA divers may be hired for varying costs including reimbursement for tank air, hourly wage, etc.

Mechanical Control

Mechanical control for curly-leaf pondweed includes using a mechanical harvester to remove plant biomass from the water column. Early season removal of plant near the sediment can reduce the number of turions formed over the season. Typical mechanical harvester depth levels may not impact turion production, but will remove some turions with the plant material.

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.

Drawdown
Drawdown may be effective for Curlyleaf pondweed if turions freeze. See the Eurasian watermilfoil for more information on lake drawdown.

Overall recommendation
Curlyleaf pondweed responds well to endothall treatments. Drawdown of the lake could also be looked at as a tool for control. See Recommendations section for specific control information.

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 are seen.
- 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 are seen immediately.
- Easily reduces number of seeds produced (each plant can produce up to 1-2 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. A well-established population of Galerucella beetles can be found on Lake Hayward in the Northwest Bay near Bonnie's Floral and Railroad Street. The beetle population has been there for many years and is often a collection site for distributing beetles to other sites around the county. Contact WI DNR 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. Continual removal of flower tops is encouraged. Herbicides may be used on small, scattered infestations. The already established Galerucella beetle population should be monitored to ensure it is still thriving and keeping the majority of the purple loosestrife around the lake under control.

Analysis of Management Options

As seen in the previous section, many options exist for the management of aquatic plants in Lake Hayward. This section will outline the different options available and identify the objectives needed to maintain beneficial uses of the lake. Eurasian watermilfoil and curlyleaf pondweed levels of control 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.

Treatment Options to Consider

1. No treatment. Do not do any chemical herbicide, hand pulling, or harvesting of invasive species in Lake Hayward.
    (1) Pros: No cash output for the lake association or property owners.
    (2) Cons: Invasive species are left unchecked. Eurasian watermilfoil and Curlyleaf pondweed could potentially be found throughout the lake and cause problems for fishing, boating, swimming, and have other recreational and ecological impacts.
    Cost: $0

2. Whole Lake Eurasian Watermilfoil Treatment. Treat the entire lake for Eurasian watermilfoil. Whole lake treatments are done by treating the entire water body with a low dose of liquid chemical.
    (1) Pros: All areas of the lake with Eurasian watermilfoil will be treated.
    (2) Cons: Costly approach. May not be feasible if herbicide is flushed downstream too quickly (new water cycles through the lake every 4-6 days).
    (3) Other considerations: Would it be possible to close the dam enough to reduce flow, keeping the herbicide in the lake longer? How long will recreation and fishing be impacted with a whole lake treatment?
    Cost: approximately $17,784.00 using DMA 4.

3. Whole Lake Curlyleaf Pondweed Treatment. Treat the entire lake for Curlyleaf pondweed. Similar issues to whole lake Eurasian watermilfoil treatment.
    (1) Pros: Control Curlyleaf pondweed.
    (2) Cons: Very expensive. Does cost outweigh the limited time (around 2 months) that CLP proves to be a nuisance? Herbicide control will not affect the turions in the substrate, so overall reduction in CLP numbers and density will take a multi-year effort (5-7 years).
    Cost: approximately $70,000 using Aquathol K.

4. Eurasian watermilfoil spot treatments. Treat select areas of Eurasian watermilfoil only. Treatment areas chosen could be based upon: 1. Areas that are causing recreational impacts; 2. Newly discovered areas that do not have large, established beds (trying to slow down spread throughout the lake); 3. Areas that are boated through often causing fragmentation and spread throughout the lake; 4. Dense areas that are limiting growth of native plants; 5. Other areas based upon concerns of the lake association.

(1) Pros: Some level of EWM control may be achieved without the expense of a whole lake treatment.
(2) Cons: EWM will still be present throughout the lake. Spread of the EWM will still happen. Treatment will probably need to be done every year to attain some control.

Cost: approximately $1100-1500/acre for granular 2,4-D (Navigate or Sculpin); Approximately$500/acre for liquid 2,4-D.

5. Eurasian watermilfoil spot treatments using Diquat.
   (1) Pros: Less contact time is needed using diquat than 2,4-D (herbicide that is typically used). Given flowing water, less contact time is beneficial.
   (2) Cons: Diquat is a contact herbicide- only the portions of the plant that contact the herbicide are affected. The above ground portion of the plant will die, but the roots will be left unharmed. All plants in the treated area will die- natives and invasives. The use of diquat is for seasonal control only, not long term control or eradication.

   Cost: approximately $600/acre.

6. Drawdown. Drawdown the level of the lake during the winter in order to freeze the roots of Eurasian watermilfoil.
   (1) Pros: May be able to achieve control without the use of chemicals.
   (2) Cons: Very dependent on weather. The ground must freeze, causing damage to the plants roots. It would have to be a very drastic drawdown to hit all areas effected by EWM, but even a partial drawdown could do some damage. Would have to work very closely with Xcel energy. Winter recreation concerns would also need to be addressed- how would a drawdown affect the American Birkebeiner, snowmobiling, etc.

   Cost: Monitoring costs only. Loss of revenue by Xcel may be covered through a DNR grant.

7. Harvesting. Use a harvesting machine to cut and remove EWM from the lake.
   (1) Pros: Can remove a lot of the plant biomass out of the lake.
   (2) Cons: Can provide nuisance relief, but no real control. May cause a lot of plant fragments that can establish in new areas.
   (3) Other considerations: Can a harvester travel into the areas where plant removal is needed- stumps and/or depth issues?

   Cost: $150,000 to purchase a harvesting machine. A consultant may also be hired to come to Lake Hayward and harvest EWM or CLP, however that also brings the risk of introducing an aquatic invasive species to the lake.

8. Diver hand pulling/harvesting or DASH (Diver Assisted Suction Harvesting). Divers may be hired to hand pull Eurasian watermilfoil on their own or with the assistance of a suction harvester.
   (1) Pros: Can target and remove plants from a specific area on the lake without the use of chemicals.
   (2) Cons: Costly. Removal is very time consuming.

Cost: Unknown at this time. DASH concept is new for the Hayward area. A local contractor is exploring the idea. Other lakes have used SCUBA divers for small infestations, paying for their oxygen and food for the day. Consultants in eastern WI charge approximately $1000/.25 acres.

Specific Options:

Eurasian watermilfoil: *Myriophyllum spication* and *Myriophyllum spicatum X Myriophyllum sibiricum* (Hybrid)

Eurasian watermilfoil will never be eradicated from Lake Hayward. The purpose of this APM Plan is to develop acceptable EWM conditions based on environmental and economic considerations. Control actions will be outlined based on the amount of EWM found in the lake in any given season.

In the 2013 Point-Intercept Plant Survey, plants were found in 73% of the lake. It is reasonable to expect EWM to be found in many of the areas available for plant growth. A goal of control treatments is to reduce the amount of EWM, while maintain the native population in many areas to provide competition for EWM.

Eurasian watermilfoil had a rapid expansion in Lake Hayward from 2012 to 2013, from less than 1 acre to over 23 acres. Given the potential rapid expansion of EWM in the lake, close attention should be paid on the population every year. Fall and spring surveys should be done every year to determine the state of the EWM population and determine the appropriate control plan for the lake. While Curlyleaf pondweed is also a problem in the lake, it is a temporary problem during the season. Control of curlyleaf pondweed will be addressed, but a concern is that EWM will gradually outcompete CLP and become a season long problem in areas where CLP is now found.

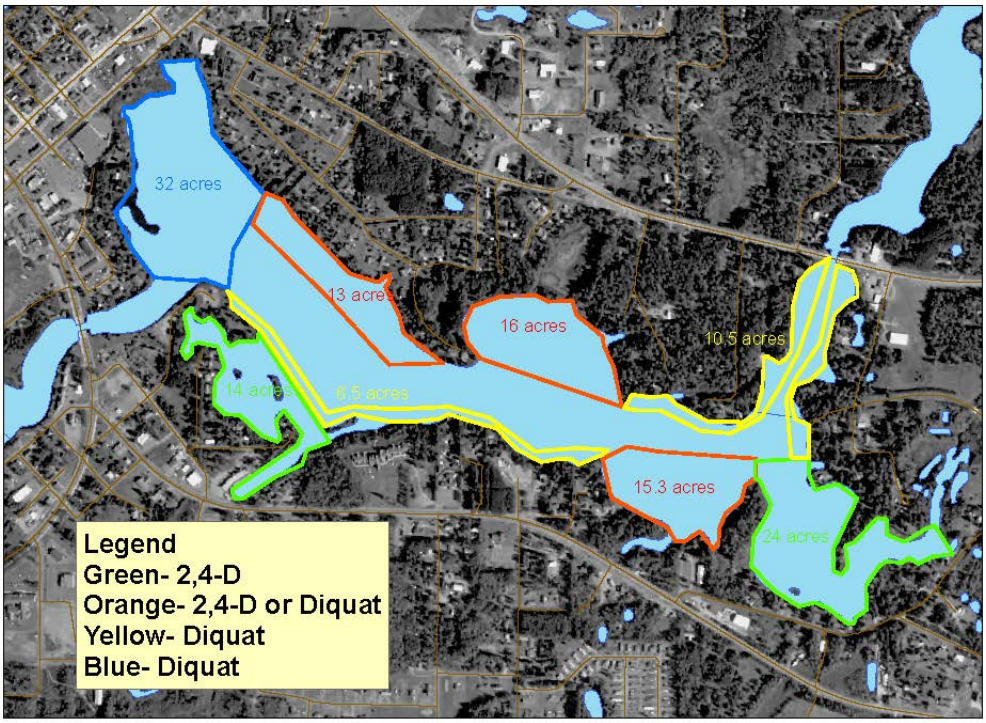
Consideration must also be given to the fact that Lake Hayward is a flowage. Moving water means herbicide retention time around target plants may not be long enough for adequate herbicide uptake and die off of the plants. See the 2013 Herbicide Concentration Monitoring Summary at the end of this report to learn more about rates and retention times in the lake.

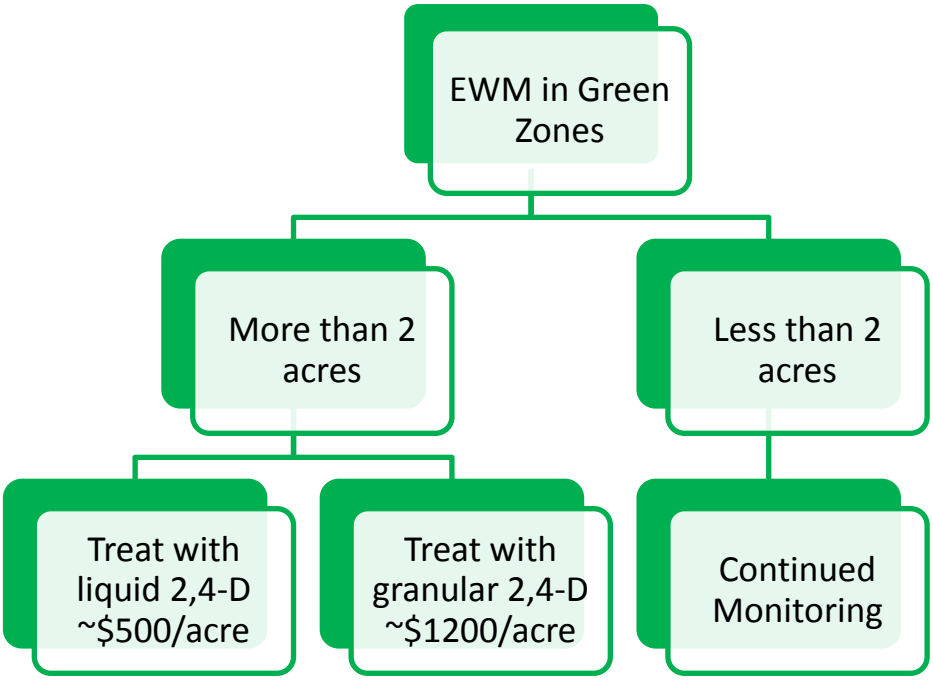
Currently in the fall of 2014, EWM was found scattered throughout 10 acres, or 5% of the lake. At this level, very few large clumps or surface mats were found. Recreation is not impacted at this level and little harm is expected to the native plant population.

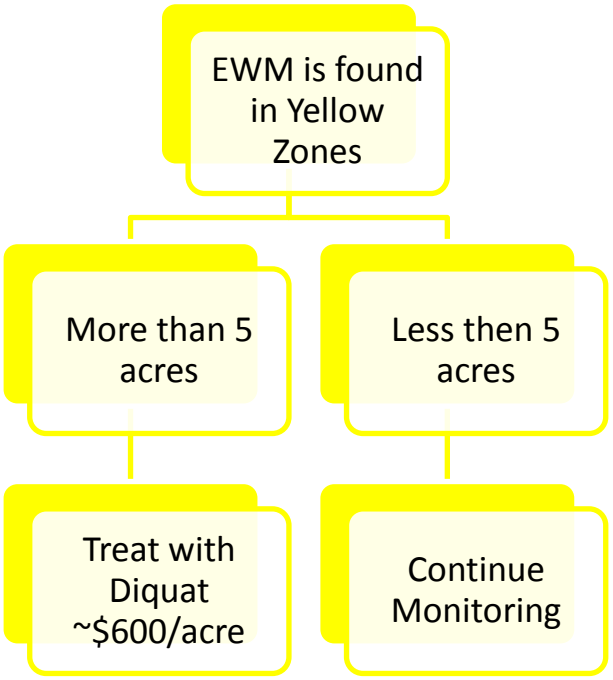
The following diagrams outline what control treatments will be triggered based on the amount of EWM found in Lake Hayward in specific areas. The final treatment decisions made will be based on this guidance along with input from the Lake Hayward Property Owners board of directors, the Wisconsin Department of Natural Resources, and the consultant performing the herbicide application. Current, available funding, whether grant funding or fund raising through the lake

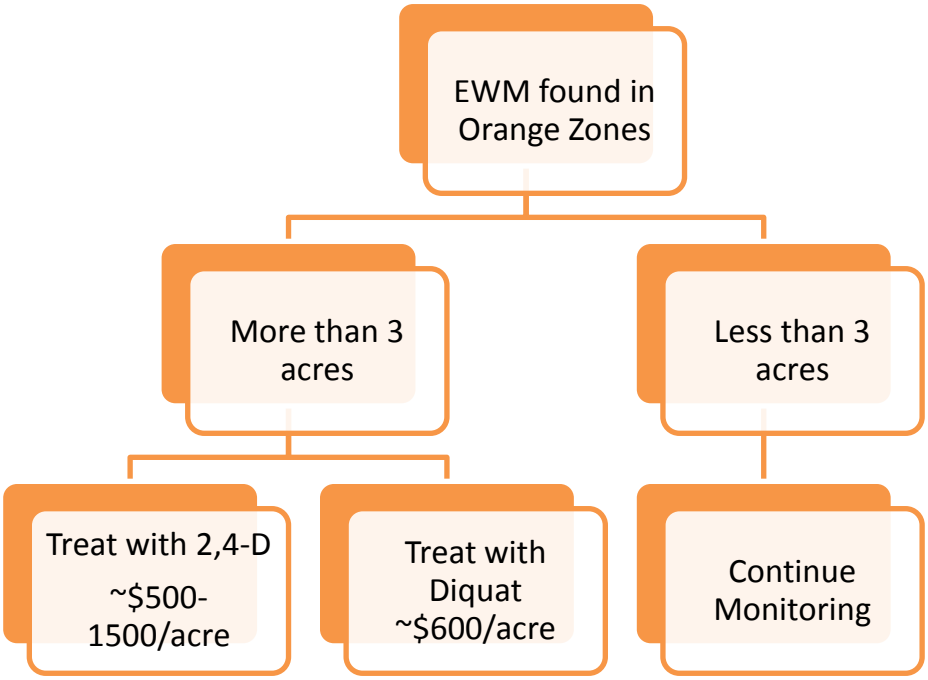
association will be a driver what is actually attainable each year. A visual survey will be completed each fall to determine the status of EWM in the lake and plan for possible spring treatment.

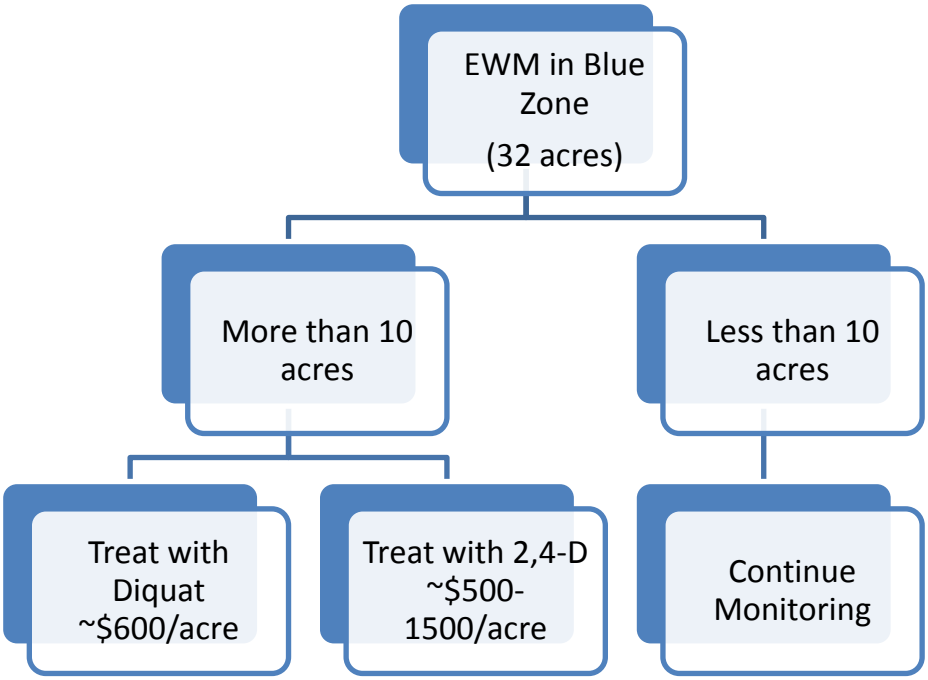
Lake Hayward Herbicide Recommendation Zones




EWM in Green Zones
More than 2 acres
Less than 2 acres
Treat with liquid 2,4-D ~$500/acre
Treat with granular 2,4-D ~$1200/acre
Continued Monitoring


EWM is found in Yellow Zones
More than 5 acres
Less then 5 acres
Treat with Diquat ~$600/acre
Continue Monitoring


EWM found in Orange Zones
More than 3 acres
Less than 3 acres
Treat with 2,4-D ~$500-1500/acre
Treat with Diquat ~$600/acre
Continue Monitoring


EWM in Blue Zone (32 acres)
More than 10 acres
Less than 10 acres
Treat with Diquat ~$600/acre
Treat with 2,4-D ~$500-1500/acre
Continue Monitoring

Curlyleaf Pondweed (*Potamogeton crispus*)

Curlyleaf pondweed (CLP) can occupy large acreages in Lake Hayward. However, unlike Eurasian watermilfoil, CLP dies back every year around the 4th of July. In 2013, CLP was found in almost 30% of the lake in the June 17-18 survey, but was only found in 9 locations in the July 26-28 survey due to the natural senescence of the plant. In 2014, very little CLP was found in the lake. Plants that were present were small, did not reach the surface of the lake, and were easily uprooted. It is thought that the harsh overwinter conditions in 2013-14 may have reduced the amount of under ice growth that normally occurs with CLP. For whatever reasons, CLP was not able to grow to the levels normally seen in the lake.

Due to the fact that the plant is only a nuisance for a few months in the lake and that it has been in the lake for many years, Lake Hayward Property Owners Association has decided to not control Curlyleaf pondweed using chemical means.

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife has been present in Lake Hayward from the early 1990s, if not earlier. A self-sustaining population of biocontrol beetles (*Galerucella* sp.) is present in the lake. The population of beetles keeps seems to keep the purple loosestrife on the lake in small numbers. Occasionally, purple loosestrife is found in small numbers at the City of Hayward beach and park. Plants in this area should be pulled, or flower tops removed. Purple loosestrife plants on property owners shorelines should be removed by hand pulling or by cutting flower tops off. Rodeo may be used to chemically treat plants after flower tops are cut off.

Xcel Energy maps and monitors the purple loosestrife infestation on the lake every summer. The LHPOA should coordinate with Xcel Energy to receive the maps and notify property owners of any areas with increasing infestations.

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.

Monitoring Success

The plant population in Lake Hayward will be monitored to determine if control strategies are working. A point-intercept survey will be done every 5 years, if Wisconsin Department of Natural Resources Aquatic Invasive Species grant funds are available. Visual surveys will be done every year by the lake association to determine the extent of the EWM, CLP, and natives. The 2013 Plant Survey will be used as a baseline document in order to determine if plant populations are increasing or decreasing. Given the high density of native, and sometimes invasive, plant species in the lake, an overall decrease in plant populations to levels that do not hinder recreation in the bays will be deemed successful. It is the hope of the LHPOA that native plant diversity remains consistent, but overall levels of plants decrease.

If it appears that recommended control actions are adversely impacting native plants (ex. removing them from entire bays), actions will be ceased and plans will be discussed with Sawyer County and the WI DNR.

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.
    - Follow recommendations in the plan to control EWM at acceptable limits. Use yearly monitoring efforts to guide control efforts.
    - Continue water quality testing in conjunction with the WI DNR Citizen Lake Monitoring Network to ensure water quality is not changing on the lake due to EWM control.
    - Survey EWM monitoring sections monthly from May-September to determine changes in area and density. Appoint a lead person to collect the information.
    - A visual survey should be done every fall (September-October) to determine if an herbicide treatment will be planned for the following spring.
    - If EWM control is occurring with a WI DNR AIS Established Control grant, pre- and post- monitoring will be done.
    - If EWM control is anticipated, contact a consultant, the WI DNR, and apply for a permit in January. Permit costs may be reimbursed by an AIS Grant from the WI DNR.

2. Establish acceptable levels of invasives to maintain or enhance native fish and other lake dependent animals.
    - Follow recommendations in the plan to control EWM at acceptable limits.
    - Work with WI DNR Fisheries to ensure that control work does not affect native fish populations.
    - Monitor any noticeable changes in animal populations on the lake.

3. Monitor Curlyleaf pondweed, purple loosestrife, and other aquatic invasive species.
    - While monitoring for EWM, note any changes to the curlyleaf pondweed and purple loosestrife populations.
    - Contact Sawyer County or the WI DNR if rapid increases of other aquatic invasive species are seen.
    - Contact Sawyer County or the WI DNR if an unusual plant or animal is found.

4. Reduce nuisance plant growth in recreation areas.
    - Educate property owners on the benefits of shoreline buffers in reducing plant growth in the lake.
    - Work to reduce nutrient input into Lake Hayward by encouraging best shoreline practices and a no-fertilizer policy use on lawns.

5. 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.

6. 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 LHPOA 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 Lake Hayward.

7. Protect and enhance water quality.
    - Work with property owners to encourage shoreline buffers.
    - Work with the City of Hayward to identify ways to limit runoff into the lake.

- Work with Sawyer County Highway Department to ensure culverts are in good condition and erosion is not happening around roadways and the lake.
- Continue monitoring water quality through Citizen Lake Monitoring Network.

Timetable

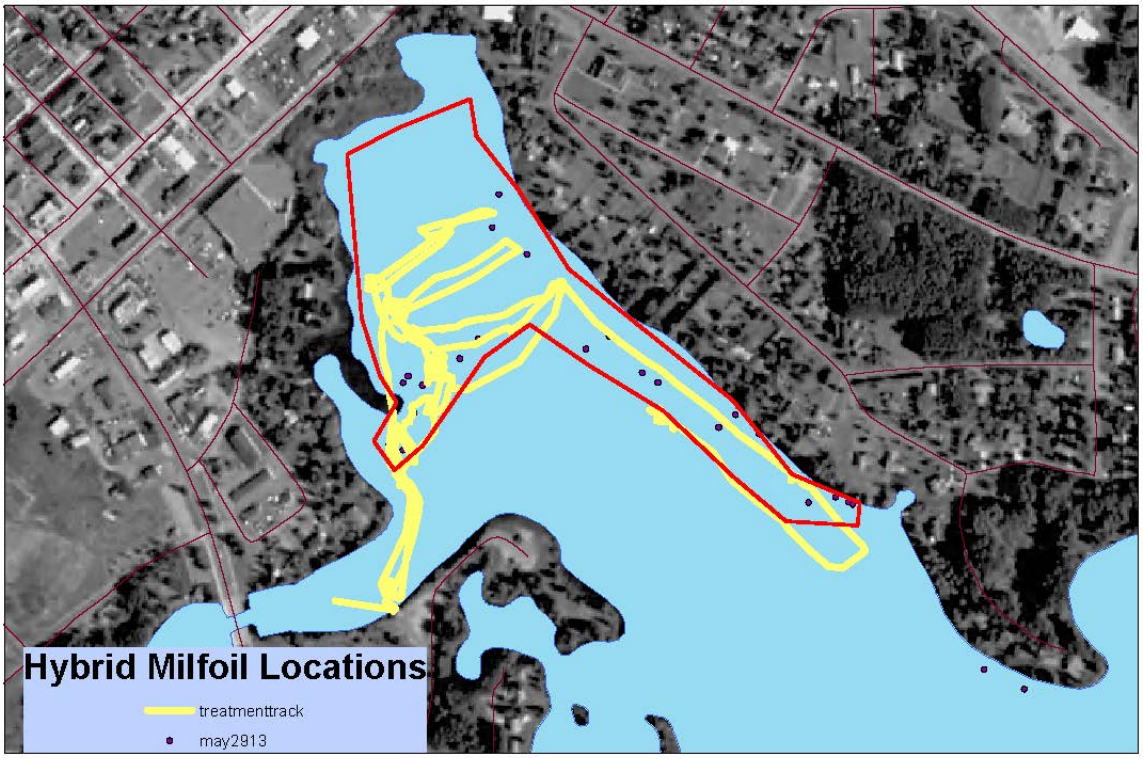
Timeline	Activity	Responsible Party	Hours	Payment
General EWM Activities				
May-June	Map EWM locations	LHPOA/AIS Coord	8	Volunteer
May-September	Water quality testing	LHPOA	40	In-kind/volunteer
June-July	Hand pull EWM	LHPOA	20	Volunteer
July-August	Point-Intercept Survey	LHPOA/DNR		AIS Grant
September-October	EWM Survey for spring treatment	LHPOA/AIS Coord	3	Volunteer/in-kind/paid
December	Write yearly summary	LHPOA	1	Volunteer
EWM Herbicide Activities				
January-March	Apply for control permit	LHPOA/ AIS Coord/Consultant	2	Volunteer/paid
March-April	Hire herbicide applicator	LHPOA	2	Volunteer
May	Survey for EWM	LHPOA/AIS Coord	4	In-kind/volunteer
May-June	Herbicide Treatment	Herbicide Applicator	5	LHPOA/Grant
July	Survey treatment area 3 weeks post treatment	LHPOA, AIS Coord, Consultant	2	Grant/in-kind/volunteer
July-August	Post-treatment monitoring	OLPOA, Consultant	20	Grant/in-kind/volunteer
September-October	Fall EWM visual survey	LHPOA, AIS Coord, Consultant	3	Grant/in-kind/volunteer
Yearly Goals				
2015	Implement CBCW Program	LHPOA, DNR		Grant/in-kind
2016	Increase awareness of buffer zone benefit to the lake	LHPOA, Sawyer County		Volunteer
2017	Educate property owners on lawn care pros and cons to lake	LHPOA, Sawyer County		Volunteer
2018	Point-Intercept Plant Survey	LHPOA, DNR		AIS Grant
2019	Work with City of Hayward on water inputs to Lake Hayward	LHPOA, City of Hayward		Volunteer

Specific Activities:

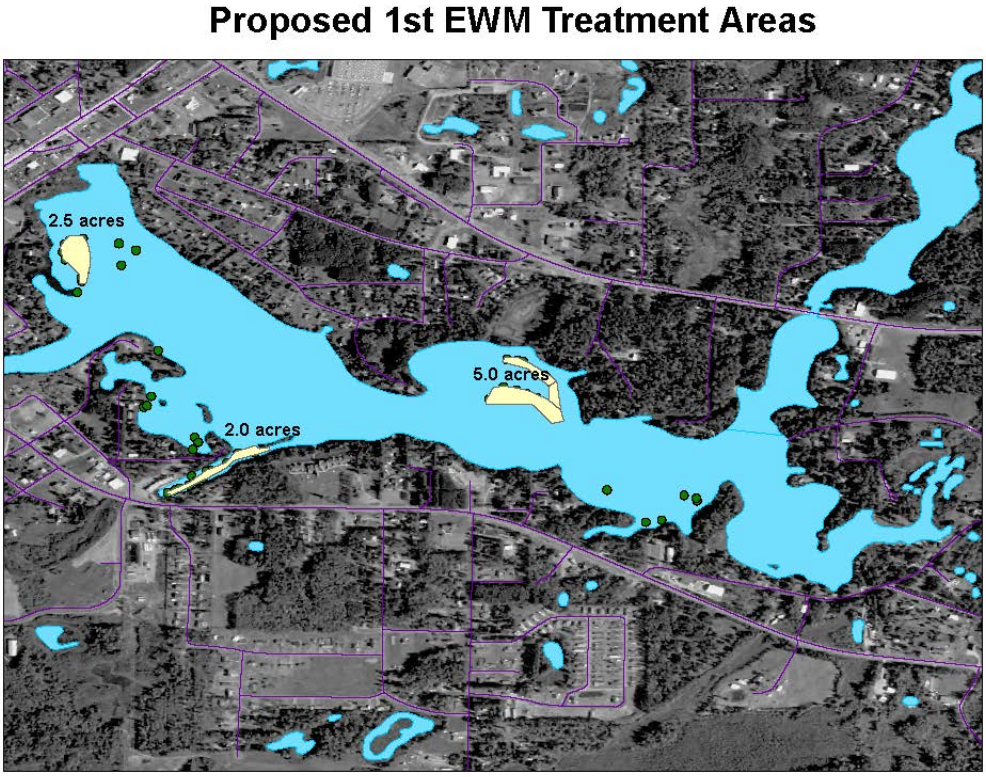
2015

LHPOA will implement a Clean Boats, Clean Waters program with a grant from the WI DNR. LHPOA will be responsible for implementing the program and entering data into the Wisconsin DNR SWIMS (Surface Water Integrated Monitoring System). LHPOA will also set-up a meeting to discuss drawdown options with the WI DNR (Alex Smith, alex.smith@wisconsin.gov), Xcel Energy (Matthew Miller, matthew.j.miller@xcelenergy.com), Sawyer County Zoning and Conservation (Pat Brown, pat.brown@sawyercountygov.org), and the National Park Service (Byron Karns, byron_karns@nps.gov).

July 2, 2013 Treatment



2014 Actual Treatment Based on Proposed Treatment Map



Appendix 1:

AQUATIC PLANT MANAGEMENT STRATEGY

Northern Region WDNR
Summer, 2007

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a" whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.
4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

State Statute 23.24 (2)(c) states:
"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.
7. The requirements for plans that the department may require under sub. (3) (b). “

State Statute 23.24(3)(b) states:
“The department may require that an application for an aquatic plant management permit contain a plan for the department’s approval as to how the aquatic plants will be introduced, removed, or controlled.“

Wisconsin Administrative Code NR 109.04(3)(a) states:
“The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.”

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan): a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval. b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

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* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

Documentation of *impairment of navigation* by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

Documentation of the *nuisance* must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

DEFINITIONS

Manual removal: Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.

Native aquatic plants: Aquatic plants that are indigenous to the waters of this state. Invasive

aquatic plants: Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Sensitive area: Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).

Rapid Response protocol: This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.

Draft: Lake Hayward, Sawyer County (WBIC 2725500), 2,4-Dichlorophenoxyacetic Acid, Dimethylamine Salt, Herbicide Concentration Monitoring Summary, 3

15 May 2015

John Skogerboe

Lake Hayward is listed as a mesotrophic drainage lake on the WI DNR web site. The lake has an area of 191 acres, a maximum depth of 17 ft and a mean depth of 5 ft. On 2 July 2013, 23 acres were treated with a liquid formulation of dimethylamine salt of 2,4-dichlorophennoxyacetic acid (2,4-D) applied as DMA 4 IVM to control hybrid milfoil (*Myriophyllum sibiricum* x *Myriophyllum spicatum*) (Figure 1).

Water sample sites were established at 7 sites to monitor 2,4-D concentrations and quantify exposure times (Figure 2). Four sample sites (HY1, HY2, HY3 and HY4) were located in herbicide treatment target areas, and three sites (HY5, HY6, and HY7) were located in untreated areas.

Water samples were collected using an integrated water sampler which collects a water sample from the entire water column. Water samples were collected from sample sites at time intervals of 3, 7, 24, 72, and 120 hours after treatment (HAT). Water samples were taken to shore after completion of each sample interval, and 3 drops of sulfuric acid were added to each sample bottle to fix the herbicide and prevent degradation. Samples were then stored in a refrigerator, until shipped to the US Army Engineer Research and Development Center (USAERDC) in Gainesville, FL for analysis of 2,4-D.

Peak concentrations of 2,4-D in water samples collected from sites HY1, HY2, HY3, and HY4 ranged from 48 to 1496 ug/L ae compared to the treatment area target concentration of 3500 ug/L ae (Figure 3). All concentrations of 2,4-D were near or less than the 100 ug/L ae irrigation standard at 72 HAT. Concentrations of 2,4-D at sample site HY1 were less than 100 ug/L ae at all sample intervals. Only sample site HY5 at 3 HAT showed 2,4-D concentrations > 100 ug/L ae in untreated areas (Figure 4).

Figure 1. 2013 Lake Hayward 2,4-D Treatment Areas

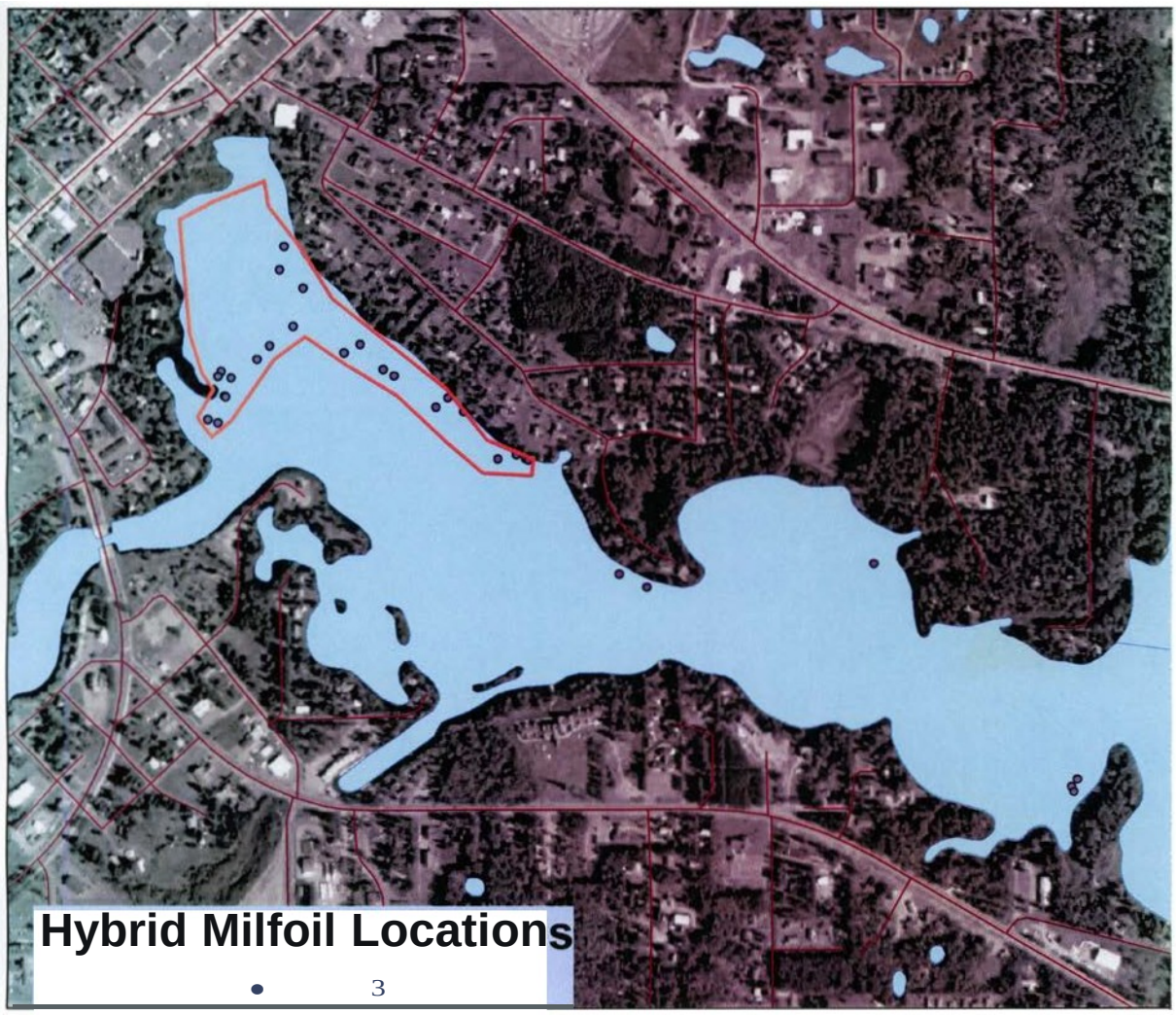


Figure 2. 2013 Lake Hayward 2,4-D Sample Locations

Figure 3

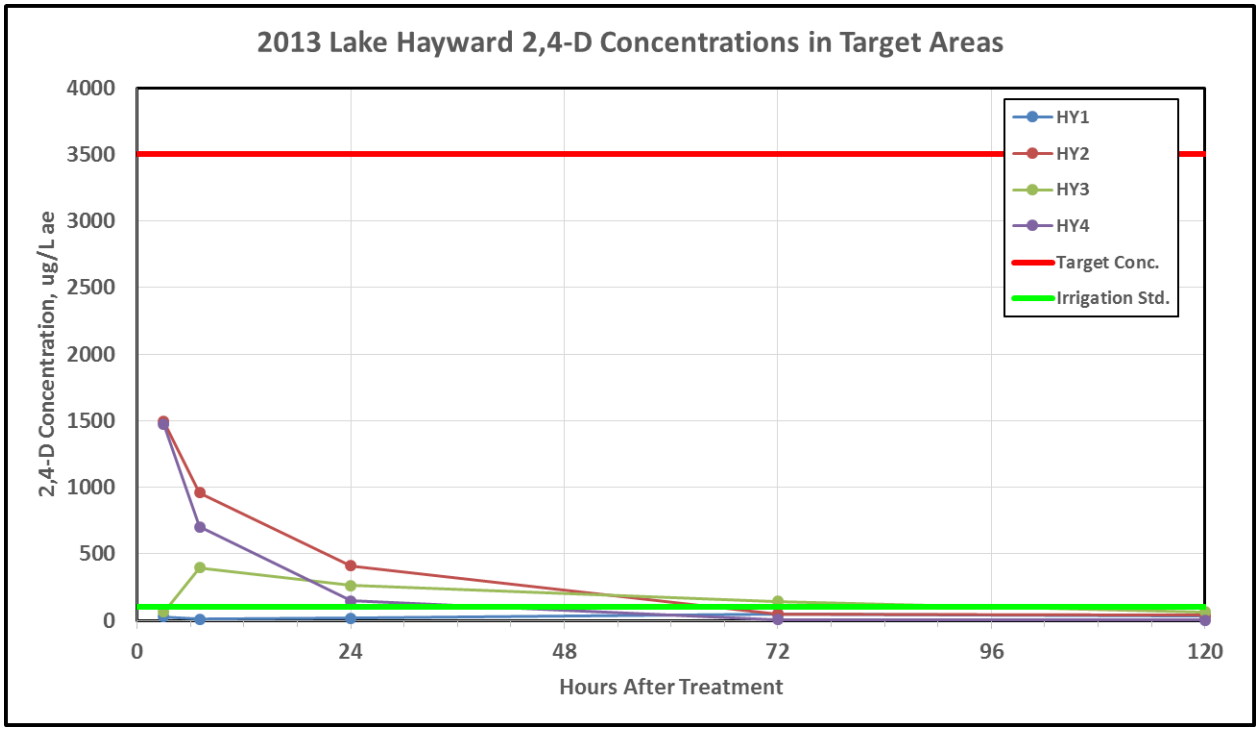
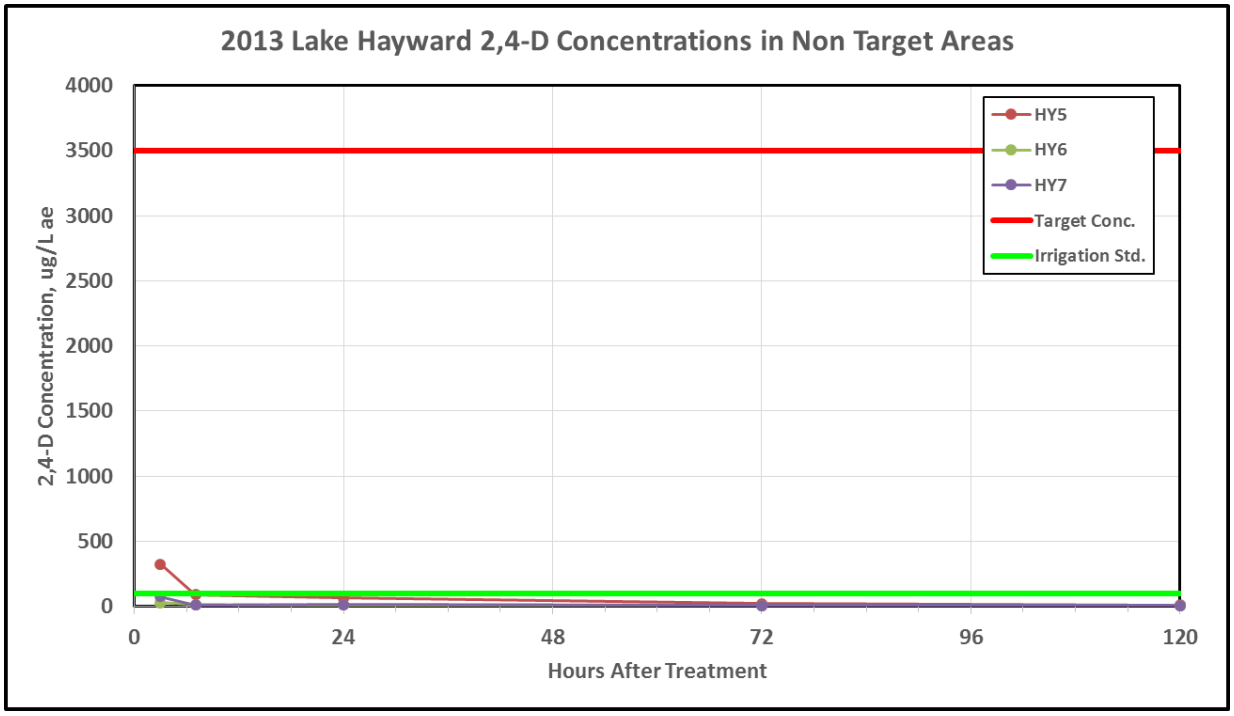


Figure 4


2013 Lake Hayward 2,4-D Concentrations in Non Target Areas
2,4-D Concentration, ug/L ae
4000
3500
3000
2500
2000
1500
1000
500
0
0
24
48
72
96
120
Hours After Treatment
HY5
HY6
HY7
Target Conc.
Irrigation Std.