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POSKIN LAKE, BARRON COUNTY

2020-24 AQUATIC PLANT MANAGEMENT PLAN
WDNR WBIC: 2098000

Prepared by: Dave Blumer, Lake Educator & Heather Wood, Lake Management Assistant

December 13, 2019,

P O S K I N L A K E A S S O C I A T I O N
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AQUATIC PLANT MANAGEMENT PLAN-POSKIN LAKE

PREPARED FOR THE POSKIN LAKE ASSOCIATION

INTRODUCTION

In 2009, the Poskin Lake Association (PLA) applied for and was awarded a three-phase lake management planning grant. At this time, the PLA was concerned about poor water quality in the lake and wondered what impact aquatic plant growth might be having on it. In addition to the water quality concerns, curly-leaf pondweed (CLP), a non- native aquatic invasive species, was known to be in Poskin Lake. The PLA wanted to know the extent of the population and decide what, if any, management would be appropriate to control CLP. They also wanted to know if Eurasian water milfoil (EWM) was present in the lake as it is in other nearby Barron County lakes including Echo, Horseshoe, Shallow, Beaver Dam, Duck, and Lower Vermillion. Lower Vermillion Lake is upstream of Poskin Lake on the Vermillion River providing a source for natural introduction in addition to the possibility of human introduction via the two boat launching facilities on the lake. In order to address these concerns, the PLA contracted with Short Elliot Hendrickson (SEH) to develop an Aquatic Plant Management (APM) Plan to guide management. This APM Plan contained six overall goals for this project. The six goals for the 2009 APM Plan were as follows:

- AIS education and prevention planning
- AIS control and management
- Water quality monitoring
- Promotion of shoreland best management practices
- Native species preservation, enhancement, and protection
- Project assessment and evaluation

Due to the small extent and limited density of CLP in 2009, the PLA decided to forego any form of active plant management. Increases in CLP levels since that time prompted the PLA to again consider active management. As a prerequisite to updating the 2009 APM Plan in 2019 and to compare how the lake's vegetation had changed since the last point-intercept surveys, the PLA and the Wisconsin Department of Natural Resources (WDNR) authorized CLP density and bed mapping surveys on May 23rd and June 12th, and a full point-intercept survey of all aquatic plants on July 15, 2018 to be completed by Endangered Resource Services, LLC (ERS). The 2018, CLP surveys found less CLP than was found within Poskin Lake in 2009. It should be noted that in 2018, CLP growth was down in many regional lakes due to poor spring and early summer growing conditions in NW Wisconsin. While this is encouraging, additional CLP survey work should be done in subsequent years to accurately assess the amount in Poskin Lake. Regular monitoring and mapping of CLP is included in this plan. Also, specific criteria are given to be used to determine when CLP management through the use of herbicides, physical removal, and/or harvesting should be completed.

PUBLIC PARTICIPATION AND STAKEHOLDER INPUT

Since early 2019, several drafts of the goals, objectives, and actions have been made available to members of the Poskin Lake Association Board and the general constituency. On June 15, input on the new APM Plan was gathered at the Poskin Lake Association Annual Meeting and Picnic. Several points of discussion were had including issues with CLP management, native plant management, herbicides verses harvesting, contracted harvesting, small-scale harvesting, and water quality.

The original plan was modified to include a navigation lanes component as a result of this meeting. The APM Plan, Appendices, and Point-intercept Aquatic Plant Survey Report have all been placed on the LEAPS client webpage for viewing by members of the PLA and the general public.

OVERALL MANAGEMENT GOAL

The overall management goal for Poskin Lake is to maintain or enhance the quality and usability of the lake through management of both native and non-native aquatic plants, educational outreach, and shoreland best management practices. Aquatic plant management on Poskin Lake will be focused on keeping CLP at a level where management is maintaining the level of CLP within the lake as well as managing native plants to increase usability of the lake. Increasing the quality of the shoreland habitat and reduction of nutrient loading through property owner outreach and education is also a large part of this plan.

IMPLEMENTATION GOALS

The following is a list of goals defined in this Aquatic Plant Management Plan for Poskin Lake. These can also be found in Appendix A along with the objectives and actions associated with each goal.

Goal 1: Prevent the expansion of curly-leaf pondweed in Poskin Lake.

Goal 2: Reduce navigation and nuisance impairments caused by dense growth native aquatic vegetation.

Goal 3: Maintain or improve current (2018) measurements of the health of the native aquatic plant community in Poskin Lake.

Goal 4: Monitor changes in the water quality of Poskin Lake.

Goal 5: Reduce the threat that new aquatic invasive species will be introduced into and go undetected in Poskin Lake.

Goal 6: Promote and support nearshore, riparian, and watershed best management practices that will improve fish and wildlife habitat, reduce runoff, and minimize nutrient loading into Poskin Lake.

Goal 7: Assess the progress and results of this project annually and report to and involve other stakeholders in planning efforts.

WISCONSIN'S AQUATIC PLANT MANAGEMENT STRATEGY

The waters of Wisconsin belong to all people. Their management becomes a balancing act between the rights and demands of the public and those who own property on the water's edge. This legal tradition called the Public Trust Doctrine dates back hundreds of years in North America and thousands of years in Europe. Its basic philosophy with respect to the ownership of waters was adopted by the American colonies. The US Supreme Court has found that the people of each state hold the right to all their navigable waters for their common use, such as fishing, hunting, boating and the enjoyment of natural scenic beauty.

The Public Trust Doctrine is the driving force behind all management in Wisconsin lakes. Protecting and maintaining that resource for all of Wisconsin's people is at the top of the list in determining what is done and where. In addition to the Public Trust Doctrine, two other forces have converged that reflect Wisconsin's changing attitudes toward aquatic plants. One is a growing realization of the importance of a strong, diverse community of aquatic plants in a healthy lake ecosystem. The other is a growing concern over the spread of Aquatic Invasive Species (AIS), such as Eurasian water milfoil (EWM). These two forces have been behind more recent changes in Wisconsin's aquatic plant management laws and the evolution of stronger support for the control of invasive plants.

To some, these two issues may seem in opposition, but on closer examination they actually strengthen the case for developing an Aquatic Plant Management Plans (APMPs) as part of a total lake management picture. Planning is a lot of work, but a sound plan can have long-term benefits for a lake and the community living on and using the lake.

The impacts of humans on Wisconsin's waters over the past five decades have caused public resource professionals in Wisconsin to evolve a certain philosophy toward aquatic plant management. This philosophy stems from the recognition that aquatic plants have value in the ecosystem, as well as from the awareness that, sometimes, excessive growth of aquatic plants can lessen our recreational opportunities and our aesthetic enjoyment of lakes. In balancing these, sometimes competing objectives, the Public Trust Doctrine requires that the State's public resource professionals be responsible for the management of fish and wildlife resources and their sustainable use to benefit all Wisconsin citizens. Aquatic plants are recognized as a natural resource to protect, manage, and use wisely.

Aquatic plant protection begins with human beings. We need to work to maintain good water quality and healthy native aquatic plant communities. The first step is to limit the amount of nutrients and sediment that enter the lake. There are other important ways to safeguard a lake's native aquatic plant community. They may include developing motor boat ordinances that prevent the destruction of native plant beds, limiting aquatic plant removal activities, designating certain plant beds as critical habitat sites and preventing the spread of non-native, invasive plants, such as EWM.

If plant management is needed, it is usually in lakes that humans have significantly altered. If we discover how to live on lakes in harmony with natural environments and how to use aquatic plant management techniques that blend with natural processes rather than resist them, the forecast for healthy lake ecosystems looks bright. To assure no harm is done to the lake ecology, it is important that plant management is undertaken as part of a long range and holistic plan.

In many cases, the development of long-term, integrated aquatic plant management strategies to identify important plant communities and manage nuisance aquatic plants in lakes, ponds or rivers is required by the State of Wisconsin. To promote the long-term sustainability of our lakes, the State of Wisconsin endorses the development of APMPs and supports that work through various grant programs.

There are many techniques for the management of aquatic plants in Wisconsin. Often management may mean protecting desirable aquatic plants by selectively hand pulling the undesirable ones. Sometimes more intensive management may be needed such as using harvesting equipment, herbicides or biological control agents. These methods require permits and extensive planning.

While limited management on individual properties is generally permitted, it is widely accepted that a lake will be much better off if plants are considered on a whole lake scale. This is routinely accomplished by lake organizations or units of government charged with the stewardship of individual lakes.

LAKE CHARACTERISTICS

In order to make recommendations for aquatic plant and lake management, basic information about the water body of concern is necessary. A basic understanding of physical characteristics including size and depth, critical habitat, water quality, water level, fisheries and wildlife, wetlands and soils is needed to make appropriate recommendations for improvement.

PHYSICAL CHARACTERISTICS

Poskin Lake is a 154 acre drainage lake located in west-central Barron County. It reaches a maximum depth of 30ft in the central basin southwest of the Vermillion River Outlet and has an average depth of 16ft. The lake's bottom substrate is predominantly organic muck, although a narrow ring of sand and rock occurs along most shorelines of the main basin (Figure 1).

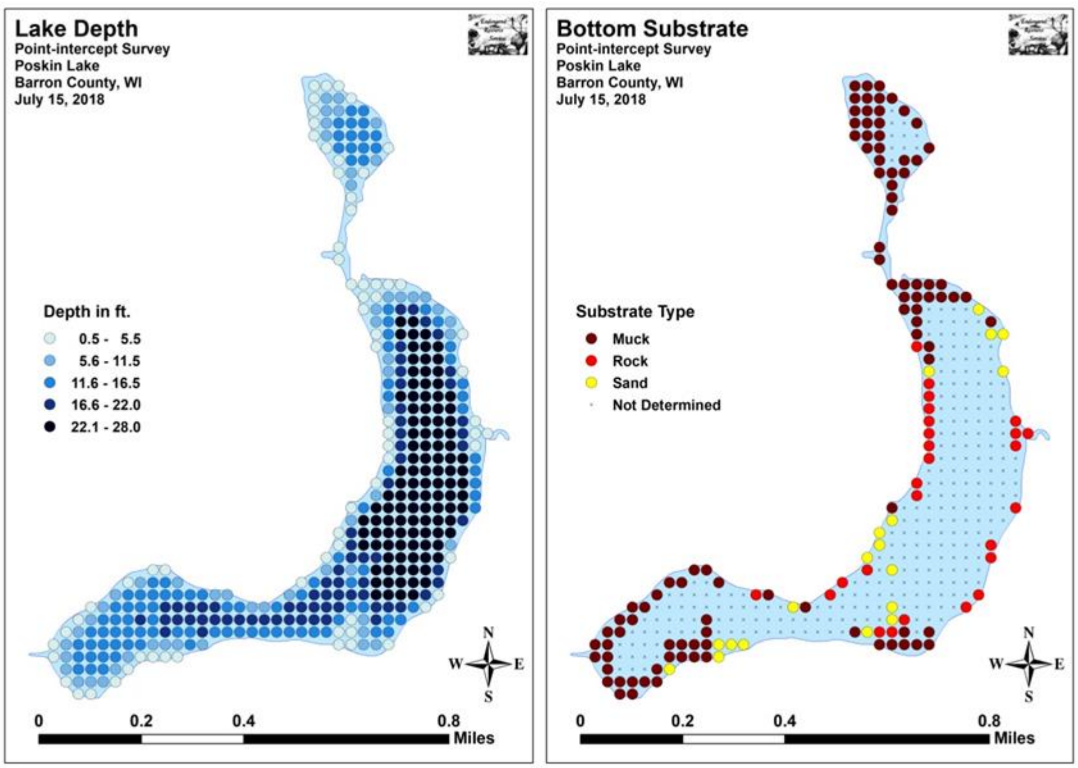


Figure 1: Poskin Lake depth (left) and bottom substrate (right)

WATER QUALITY

Water clarity and water chemistry are important indicators of water quality. Secchi disk readings of water clarity have been collected by Wisconsin Citizen Lake Monitoring Network (CLMN), formerly the Self-help Lake Monitoring Program, volunteers since 2003. The WDNR website indicates CLMN volunteers began collecting water chemistry data in 2008 with a few years lacking any or sufficient data.

The appearance of the water in the lake is predominately murky. The color of the water ranged from green to brown with brown being the predominant reported coloration. Perception is based on a volunteers' familiarity with lake conditions at any given time of year and was predominantly listed as being "enjoyment somewhat impaired".

WATER CLARITY

Water clarity is a measurement of how deep sunlight can penetrate into the waters of a lake. It can be measured in a number of ways, the most common being an 8" disk divided into four sections, two black and two white, lowered into the lake water from the surface by a rope marked in measurable increments (Figure 2). The water clarity reading is the point at which the Secchi disk when lowered into the water can no longer be seen from the surface of the lake. Water color (like dark water stained by tannins from nearby bogs and wetlands), particles suspended in the water column (like sediment or algae), and weather conditions (cloudy, windy, or sunlight) can impact how far a Secchi disk can be seen down in the water. Some lakes have Secchi disk readings of water clarity of just a few inches, while other lakes have conditions that allow the Secchi disk to be seen for dozens of feet before it disappears from view.

Figure 2: Black and white Secchi disk

Figure 3 shows the average yearly and summer (July-September) Secchi disk readings since CLMN began in 2003. In 2018, the average summer (July-September) Secchi disk reading for Poskin Lake at the Deep Hole was 3.79 feet. The average for the Northwest Georegion was 8.7 feet putting Poskin Lake well below average for the area. The Secchi readings have a fairly narrow range from as low as 2.63 feet in 2003 up to 4.38 feet in 2005. The trendlines in Figure 3 show a downward trend when considering Secchi readings from the entire open water season, but a nearly steady trend when looking at just Secchi readings taken during the summer months (July/August).

Typically the summer (June-Aug) water was reported as MURKY and BROWN. This suggests that the Secchi depth to be mostly impacted by algae and suspended sediments. Algal blooms are generally considered to decrease the aesthetic appeal of a lake because people tend to prefer clearer water to swim in and look at. The overall perception of Poskin Lake, as reported by volunteers, is primarily ranked as "3- Enjoyment somewhat impaired (algae)" with only 1 of the total 79 reports being "5-Enjoyment substantially impaired (algae)." Algae are always present in a balanced lake ecosystem. They are the photosynthetic basis of the food web. Algae are eaten by zooplankton, which are in turn eaten by fish. Without the algae in the system there would be no fisheries to speak of.

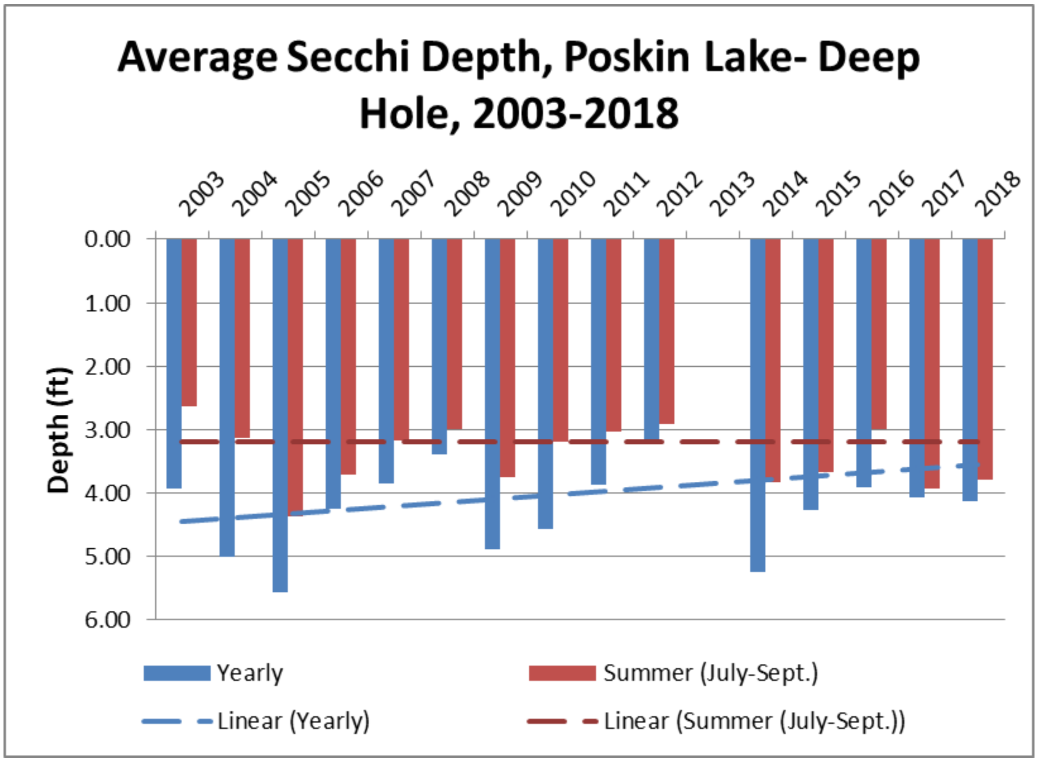


Figure 3: Average yearly and summer (July-September) Secchi disk readings at the Deep Hole

TROPHIC STATE INDEX

One of the most commonly used metrics of water quality is the trophic state of a lake. The trophic state is defined as the total load of biomass in a waterbody at any given time (Carlson & Simpson, 1996). To determine the trophic state of any given lake, the Tropic State Index (TSI) is generally used. This index uses the three main variables of Secchi depth, total phosphorus, and chlorophyll concentration. TSI values are technically limitless, but when applied, they almost always fall between 0 and 100. To make sense of these values, they are broken into different trophic states. The four main trophic states are oligotrophic (TSI<40), mesotrophic (TSI 40-50), eutrophic (TSI 50-70), and hypereutrophic (TSI>70) (Figure 4). Oligotrophic lakes are usually very clear, clean lakes with low nutrient levels. Mesotrophic lakes are moderately clear with some nutrients and more plants present within the system. Eutrophic lakes have excess nutrients that support a great deal of algae growth, and may have a large aquatic plant community. Hypereutrophic lakes are typically very green with dense algae and limited plant growth.

Based on TSI values calculated from Secchi readings taken from 2003 through 2018, Poskin Lake is classified as eutrophic lake (Figure 5). The summer (July-September) Secchi depth TSI has varied from 57.7 in 2014 up to 61.8 in 2012. The overall average summer for Secchi depth TSI is 59.5 which indicates a eutrophic state.

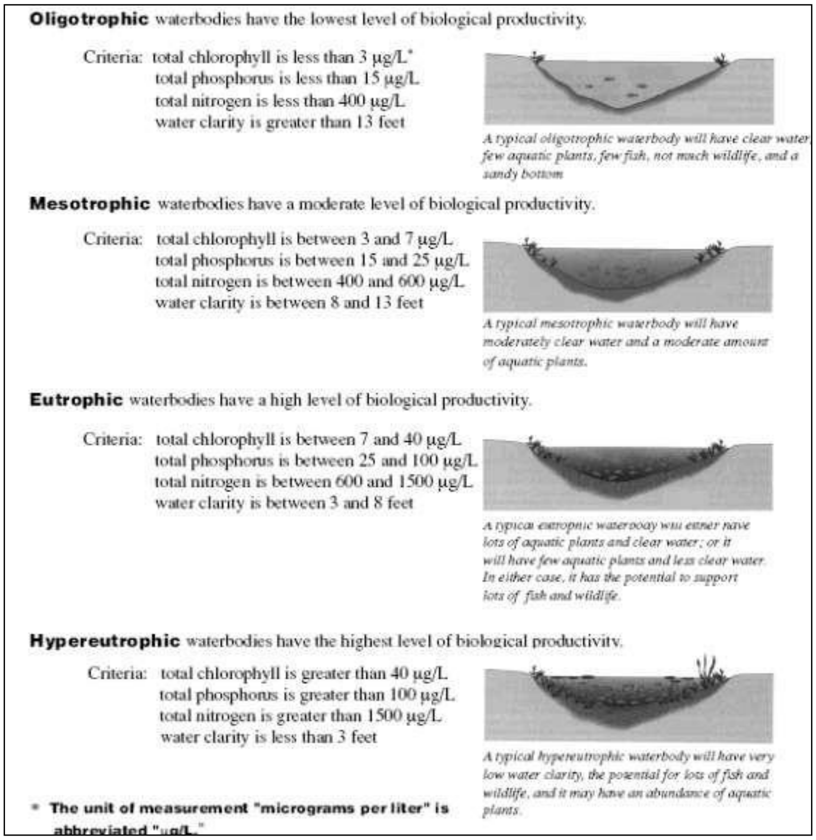


Figure 4: Trophic status in lakes

Since 2008, several other water chemistry variables used to quantify water quality in a lake have been collected. Total Phosphorus and Chlorophyll-a are considered more accurate representations of the trophic state of a lake then Secchi readings alone. Total phosphorus is a measurement of all types of phosphorus, a nutrient needed for plant growth, in the surface water. Chlorophyll-a is a measurement of the green pigment in the algae suspended in the water, so indirectly it is a measurement of the amount of algae in the water. The higher these two values are, the more eutrophic the lake is.

With the exception of 2013, total phosphorus and chlorophyll-a have been collected on a monthly basis during the summer since 2008. This data shows annually higher TSI values than the Secchi data alone. The summer average from 2008 through 2018 for total phosphorus concentrations was 58.3 with a high of 61 in 2014 and a low of 55.3 in 2018. This suggests Poskin Lake is a eutrophic system. In Poskin Lake, the average summer chlorophyll-a TSI values are usually higher than the total phosphorus values and the Secchi values. The average seasonal TSI for chlorophyll-a was 61.9 with a high of 68 in 2014 and a low of 56.8 in 2018. This means Poskin Lake is a fairly stable, eutrophic lake. When looking at trendlines for total phosphorus and chlorophyll-a values before 2013 there seems to be a worsening trend in water quality (Figure 6), but from 2014-2018 trendlines are almost constant (Figure 7), with perhaps a slight improvement, once again indicating a fairly stable eutrophic lake.

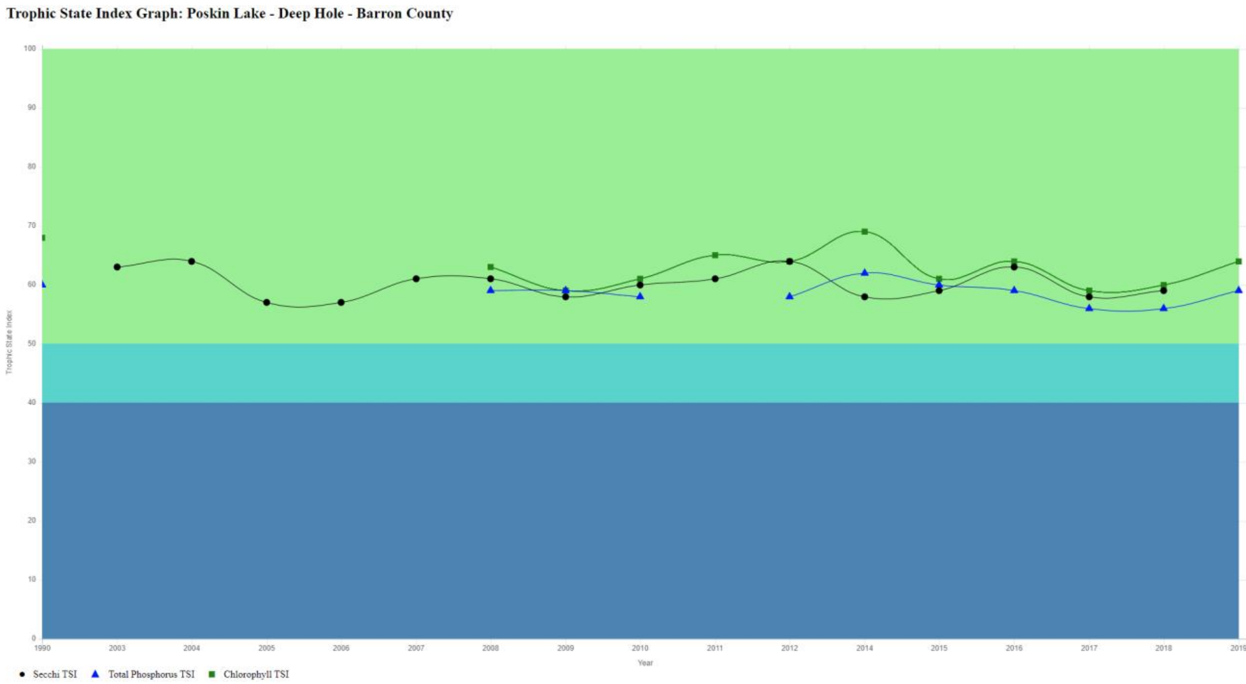


Figure 5: Trophic State Index (TSI) graph for Poskin Lake CLMN data (light green-eutrophic, light blue-mesotrophic, blue-oligotrophic)

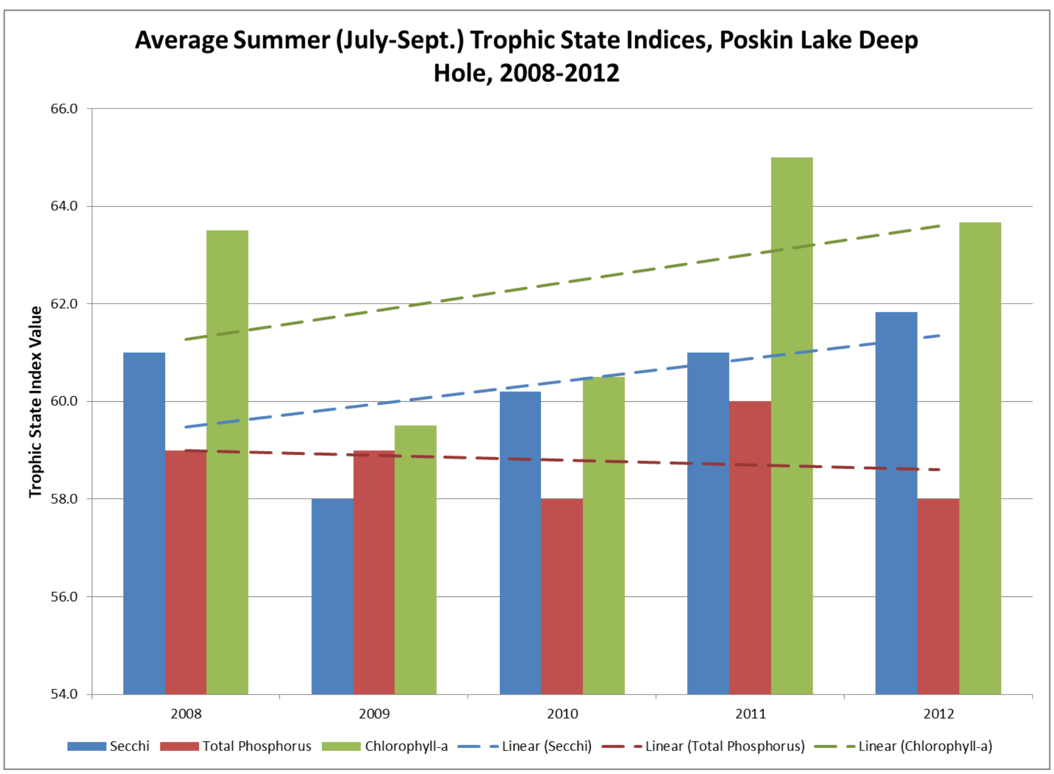


Figure 6: Average summer (July-Sept.) Trophic State Index w/trendlines 2008-2011 (the TSI value for total phosphorus in 2011 is estimated based on changes in both Secchi and chlorophyll-a values)

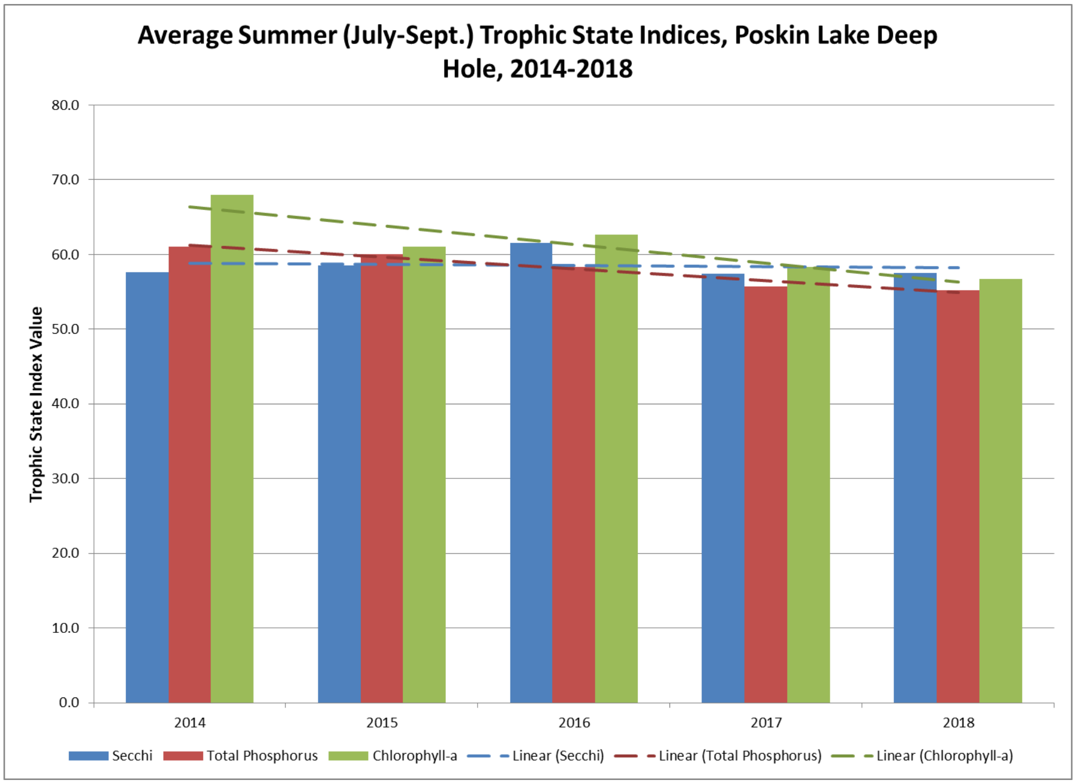


Figure 7: Average summer (July-Sept.) Trophic State Indices w/trendlines 2014-2018

TEMPERATURE AND DISSOLVED OXYGEN

Temperature and dissolved oxygen are important factors that influence aquatic organisms and nutrient availability in lakes. As temperature increases during the summer in deeper lakes, the colder water sinks to the bottom and the lake develops three distinct layers as shown in Figure 6. This process, called stratification, prevents mixing between the layers due to density differences which limits the transport of nutrients and dissolved oxygen between the upper and lower layers. In most lakes in Wisconsin that undergo stratification, the whole lake mixes in the spring and fall when the water temperature is between 53 and 66°F, a process called overturn. Overturn begins when the surface water temperatures become colder and therefore denser causing that water to sink or fall through the water column. Below about 39°F, colder water becomes less dense and begins to rise through the water column. Water at the freezing point is the least dense which is why ice floats and warmer water is near the bottom (called inverse stratification) throughout the winter.

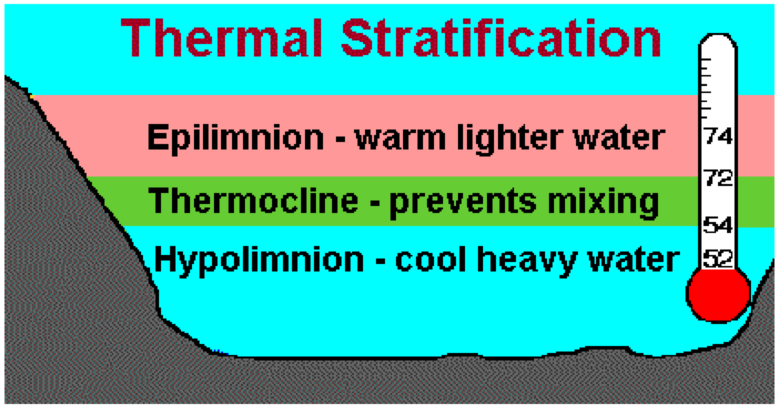


Figure 8: Summer thermal stratification

During the summer months, the upper warm layer, called the epilimnion, remains well oxygenated due to wind and wave action and photosynthesis. The middle layer, called the metalimnion or thermocline, is where changes in temperature and dissolved oxygen are greatest. This middle layer acts as a barrier that prevents warmer, oxygen rich waters in the upper layer from mixing with colder, deeper waters It is common for dissolved oxygen levels to be depleted in the lower layer, called the hypolimnion, as there is no source of new oxygen and the decomposition of organic matter consumes oxygen.

A dissolved oxygen level of 2mg/l or less, called hypoxia is an important criterion of sediment phosphorus release. When near-bottom dissolved oxygen is at 2-mg/l or less the sediment-water interface is likely anoxic (no oxygen). This lack of oxygen causes the chemical bonds between phosphorus and the iron in the sediments to break which releases free phosphorus back into the water column. If the phosphorus released from sediments reaches the upper part of the lake through spring or fall overturn or when natural or human induced wave action mixes the lake, it can provide a significant internal source of phosphorus to fuel algae blooms.

Poskin Lake stratifies, at the deep hole, relatively early in the summer. The thermocline is usually established by mid-June at around 3-4 meters (9.8-13.1 feet) and shifts up to around 2 to 3 meters (6.5-9.8 feet) by mid-July. In the years where data has been collected into October, the thermocline is still usually in place for the readings taken in early October, but oxygen levels suggest that overturn has begun by the time mid-month readings are taken. This means that the deep hole in Poskin Lake remains stratified for several months each summer. This means it is possible that the high levels of phosphorus seen in the summer could be due, at least in part, to a constant release from sediments at the bottom of the lake. This has not been confirmed, but future studies could be done to determine how much phosphorus is released from the lake bed on an annual basis.

FISHERIES AND WILDLIFE

Poskin Lake is considered a warm water fishery. All of the available survey data is from 2010, but it is unlikely that the fisheries have been significantly changed since then. Overall, Poskin Lake appears to have healthy bass, northern pike, and walleye populations along with a good panfish population (Table 1). WDNR fisheries data shows that the bass population has typically been strong with fish averaging 13 to 20 inches. Northern pike are also common with an average size ranging from 20 to 23 inches.

Table 1: Summaries of 2010 fisheries surveys

2010 Spring Fisheries Assessment				
Species	Relative Abundance (catch per mile)	Minimum Length (Inches)	Maximum Length (Inches)	Average Length (Inches)
Walleye	6.11	11	25.5	19.63
Black Crappie	42	6	9.5	8.55
Bluegill	241	2.5	7.5	6.15
Largemouth Bass	9.78	9	20.5	13.34
Northern Pike	1.71	18	28.5	23.18
Pumpkinseed	1	6	6	6
Rock Bass	3	7	8	7.75
Yellow Perch	16	2.5	6.5	4.16

2010 Fall Juvenile Assessment				
Species	Relative Abundance (catch per mile)	Minimum Length (Inches)	Maximum Length (Inches)	Average Length (Inches)
Largemouth Bass	21.5	4.5	13.31	19.5
Northern Pike	5	14	29	20.38
Walleye	5.25	6	25	14.04

The walleye fishery appears to be in good health within Poskin Lake with a size range from 6 to 26 inches and average sizes of 14 to 20 inches. These size ranges indicate that several generations of walleye are present within the lake meaning that there is a decent survival rate from one year to the next. The WDNR has been stocking walleye on a regular basis since 1996 with just under 2500 large walleye fingerlings being released into Poskin Lake in 2017.

Two species of special concern and one species that is listed as threatened within Wisconsin are also suspected to be found in the same township and range as Poskin Lake (T34N R13W). The species of special concern are the water shrew, a wetland mammal species, and the Least darter, a minnow species found in warm, quiet waters with dense vegetation. The state listed threatened species is the Ozark minnow. This is a small fish species that prefers clear slow moving streams with cobbled bottoms. The species of special concern are listed with no laws offering any sort of explicit protection, but it is suspected that these are at risk of becoming threatened or endangered. The threatened species are afforded special protections which make it illegal to take, transport, possess, process or sell without the appropriate permit.

The Poskin Lake Watershed is one of several smaller watersheds which make up the larger Yellow River Watershed. The Yellow River Watershed covers 239 square miles (152,960 acres) and is located primarily within the western portion of Barron County with small parts extending into Washburn and Burnett Counties (Figure 7). Land use in the Yellow River Watershed is primarily agricultural (38%), forest (28.40%) and a mix of grassland (20.50%) and other uses (13.00%). This watershed has 415.31 stream miles, 2,929.80 lake acres and 11,565.29 wetland acres. The Poskin Lake Watershed covers approximately 23 square miles which accounts for approximately 10% of the entire Yellow River watershed.

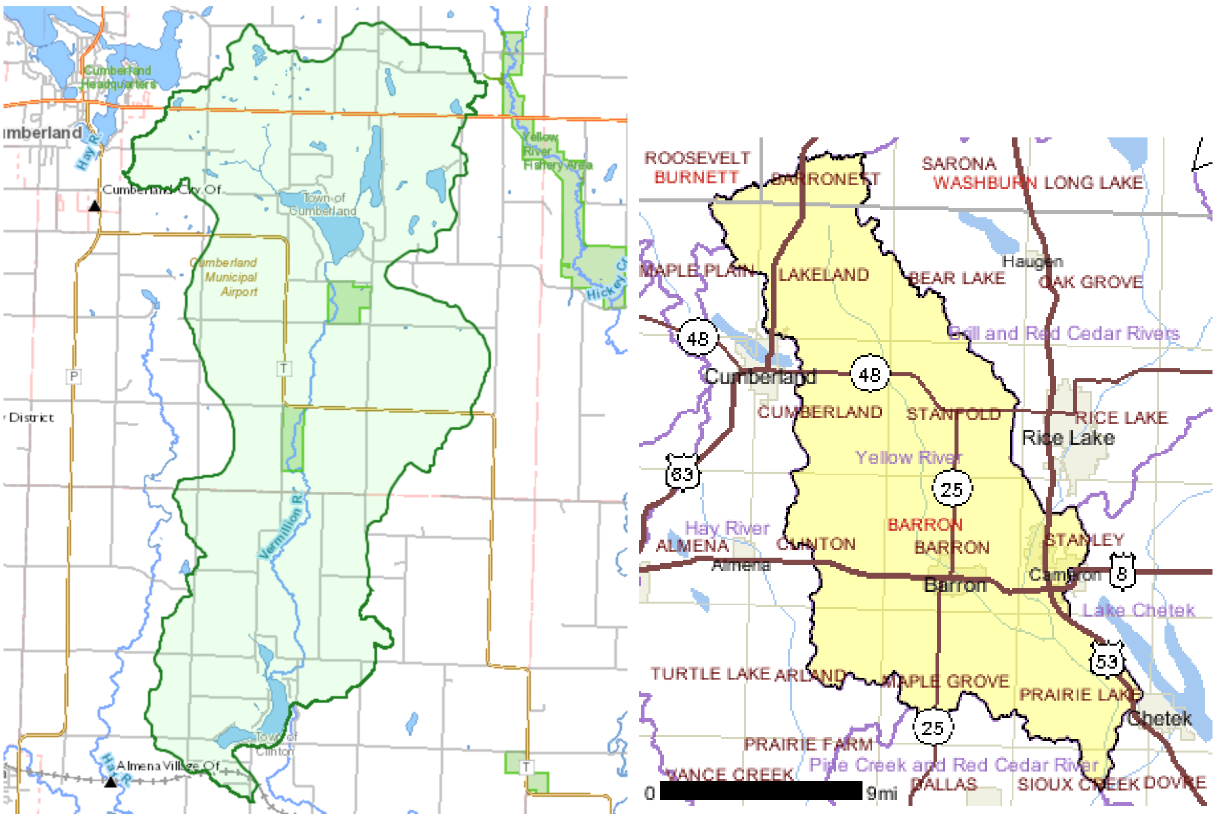


Figure 9: Poskin Lake Watershed (left) and Yellow River Watershed (right)

LAND USE

Within the Poskin Lake Watershed, the vast majority (69%) of land use is agricultural. This is broken into 43.1% pasture and 25.9% row crops. After agricultural use, 16.4% is forest cover with the remaining 15% being comprised of a relatively even mix of open water, light development (i.e. roads and residential property), and wetlands (Table 2). The forested areas are spread fairly evenly throughout the watershed. One of the largest wetland complexes within the watershed lines the Vermillion River as it feeds into the northern part of Poskin Lake (Figure 8).

Table 2: Land use within the Poskin Lake Watershed

Poskin Lake Watershed Land Use		
	Total Area (Acres)	Percentage of Watershed
Open Water	535.61	3.6%
Light Development	804.39	5.5%
Heavy Development	13.97	0.1%
Barren	10.42	0.1%
Forest	2,410.82	16.4%
Scrub/ Grassland	148.73	1.0%
Pasture	6,356.94	43.1%
Crops	3,815.44	25.9%
Wetland	644.41	4.4%

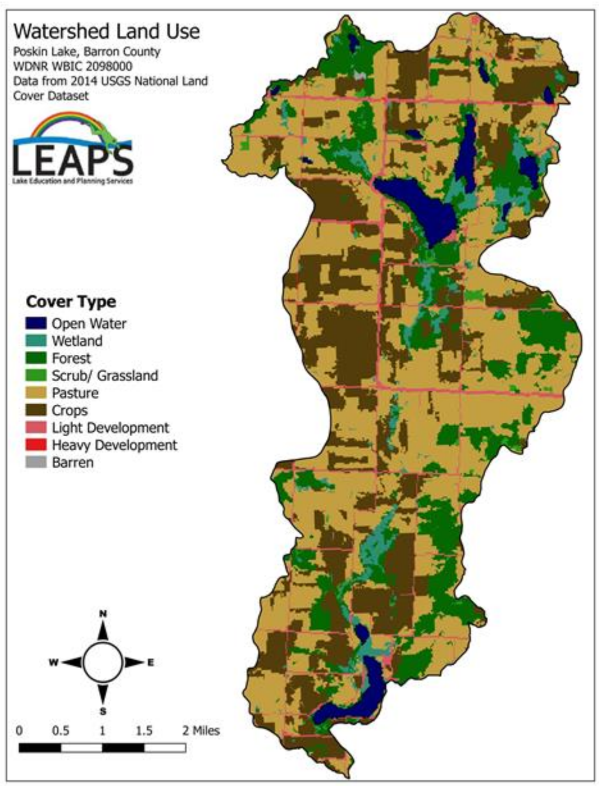


Figure 10: Land use within the Poskin Lake Watershed

SOILS

Soils are classified into four main hydrologic soil groups (A, B, C, and D) to indicate their potential for producing runoff. Group A soils have a high infiltration rate which makes the potential amount of runoff very low. These soils are, generally very sandy and allow water to pass through unimpeded. Conversely, group D soils have a very low infiltration rate making their runoff potential fairly high. Group D soils are generally very dense with high amounts of organic material. This causes water to move slowly through group D soils often resulting in standing water on flat surfaces and flowing water over sloped surfaces. Group D soils are usually contained to wetland areas.

There are also three sub groups (A/D, B/D, and C/D) these indicated the infiltration rate of the soils with respect to the water table. If the water table is high and blocking infiltration, these soils are considered to have a high runoff potential and placed into group D, but when the water table is lower, these soils are similar to the first grouping. The majority (56.7%) of the Poskin Lake watershed fall into Group B soils. Most of the remaining area is comprised of either group C (10.6%) or C/D (11.1%) soils (Table 3). While most of the watershed is covered with soils that have moderate infiltration rates, the areas closest to Poskin Lake fall into groups C and C/D which have fairly slow infiltration rates (Figure 9).

Table 3: Soil classes within the Poskin Lake Watershed

Soil Group	Percentage of Watershed	Infiltration Rate
A	8.3%	High
B	56.7%	Moderate
C	10.6%	Slow
D	0.0%	Very Slow
A/D	5.3%	High when drained, very slow when undrained
B/D	4.1%	Moderate when drained, very slow when undrained
C/D	11.1%	Slow when drained, very slow when undrained
Water	3.8%	N/A

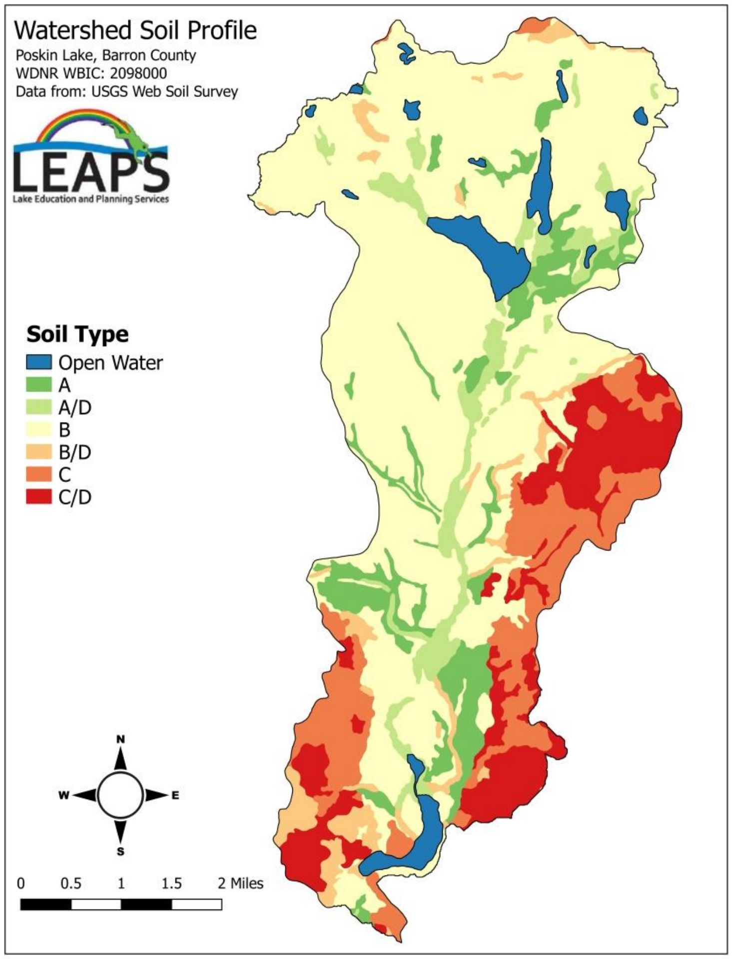


Figure 11: Hydrologic soil profile of the Poskin Lake Watershed

WETLANDS

A wetland is an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions. Wetlands have many functions which benefit the ecosystem surrounding Poskin Lake. Wetlands with a higher floral diversity of native species support a greater variety of native plants and are more likely to support regionally scarce plants and plant communities. Wetlands provide fish and wildlife habitat for feeding, breeding, resting, nesting, escape cover, travel corridors, spawning grounds for fish, and nurseries for mammals and waterfowl.

Wetlands also provide flood protection within the landscape. Due to the dense vegetation and location within the landscape, wetlands are important for retaining stormwater from rain and melting snow moving towards surface waters and retaining floodwater from rising streams. This flood protection minimizes impacts to downstream areas. Wetlands provide water quality protection because wetland plants and soils have the capacity to store and filter pollutants ranging from pesticides to animal wastes.

Wetlands also provide shoreline protection to Poskin Lake by acting as buffers between land and water. They protect against erosion by absorbing the force of waves and currents and by anchoring sediments. This shoreline protection is important in waterways where boat traffic, water current, and wave action cause substantial damage to the shore. Wetlands also provide groundwater recharge and discharge by allowing the surface water to move into and out of the groundwater system. The filtering capacity of wetland plants and substrates help protect groundwater quality. Wetlands can also stabilize and maintain stream flows, especially during dry months. Aesthetics, recreation, education and science are also all services wetlands provide.

There is a not a lot of wetland areas within the Poskin Lake Watershed, but the ones that are present happen to be located in very beneficial areas (Figure 10). Large portions of the Vermillion River, the main tributary into Poskin Lake, are bordered by wetland areas. This includes a large swath of wetland area that borders the northern area where the river enters the lake. The large northern area extends down and boarders most of the northern shoreline as well as about half of the lake's western shoreline. While these wetland areas help filter and protect the lake, if property owners on the lake begin removing the natural buffers already in place runoff containing nutrients, sediments, and other pollutants from rainfall and snowmelt will be able to enter the lake more readily. This can lead to a reduction in water quality despite the presence of wetland areas filtering a large portion of the lake.

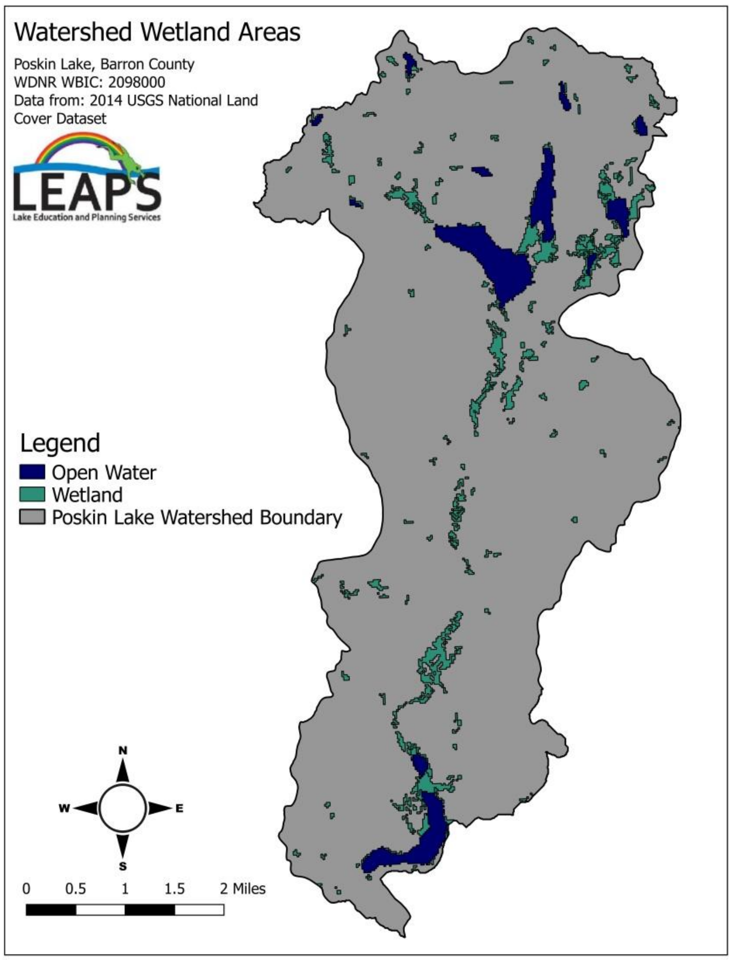


Figure 12: Wetland areas within the Poskin Lake Watershed

COARSE WOODY HABITAT (WOLTER, 2012)

Coarse woody habitat (CWH) in lakes is classified as trees, limbs, branches, roots, and wood fragments at least 4 inches in diameter that enter a lake by natural (beaver activity, toppling from ice, wind, or wave scouring) or human means (logging, intentional habitat improvement, flooding following dam construction). CWH in the littoral or near-shore zone serves many functions within a lake ecosystem including erosion control, as a carbon source, and as a surface for algal growth which is an important food base for aquatic macro invertebrates. Presence of CWH has also been shown to prevent suspension of sediments, thereby improving water clarity. CWH serves as important refuge, foraging, and spawning habitat for fish, aquatic invertebrates, turtles, birds, and other animals. The amount of littoral CWH occurring naturally in lakes is related to characteristics of riparian forests and likelihood of toppling. However, humans have also had a large impact on amounts of littoral CWH present in lakes through time. During the 1800's the amount of CWH in northern lakes was increased beyond natural levels as a result of logging practices. But time changes in the logging industry and forest composition along with increasing shoreline development have led to reductions in CWH present in many northern Wisconsin lakes.

CWH is often removed by shoreline residents to improve aesthetics or select recreational opportunities (swimming and boating). Jennings et al. (2003) found a negative relationship between lakeshore development and the amount of CWH in northern Wisconsin lakes. Similarly, Christensen et al. (1996) found a negative correlation between density of cabins and CWH present in Wisconsin and Michigan lakes. While it is difficult to make precise determinations of natural densities of CWH in lakes it is believed that the value is likely on the scale of hundreds of logs per mile. The positive impact of CWH on fish communities have been well documented by researchers, making the loss of these habitats a critical concern.

Fortunately, remediation of this habitat type is attainable on many waterbodies, particularly where private landowners and lake associations are willing to partner with county, state, and federal agencies. Large-scale CWH projects are currently being conducted by lake associations and local governments with assistance from the WDNR where hundreds of whole trees are added to the near-shore areas of lakes. For more information on this process visit: http://dnr.wi.gov/topic/fishing/outreach/fishsticks.html (last accessed on 1-4-2018). These types of projects are more formally called "tree drops" but are popularly are called "fish sticks" (Figure 11).

Figure 13: Coarse woody habitat-Fishsticks projects

The woody debris within Poskin Lake has not been quantified, but interested property owners are still able to install fish sticks projects in the lake adjacent to their property if they follow the proper channels for permitting and obtaining the trees.

SHORELANDS

How the shoreline of a lake is managed can have big impacts on the water quality and health of that lake. Natural shorelines prevent polluted runoff from entering lakes, help control flooding and erosion, provide fish and wildlife habitat, may make it harder for aquatic invasive species to establish themselves, muffle noise from watercraft, and preserve privacy and natural scenic beauty. Many of the values lake front property owners appreciate and enjoy about their properties - natural scenic beauty, tranquility, privacy, relaxation - are enhanced and preserved with good shoreland management. And healthy lakes with good water quality translate into healthy lake front property values.

Shorelands may look peaceful, but they are actually the hotbed of activity on a lake. 90% of all living things found in lakes - from fish, to frogs, turtles, insects, birds, and other wildlife - are found along the shallow margins and shores. Many species rely on shorelands for all or part of their life cycles as a source for food, a place to sleep, cover from predators, and to raise their young. Shorelands and shallows are the spawning grounds for fish, nesting sites for birds, and where turtles lay their eggs. There can be as much as 500% more species diversity at the water's edge compared to adjoining uplands.

Lakes are buffered by shorelands that extend into and away from the lake. These shoreland buffers include shallow waters with submerged plants (like coontail and pondweeds), the water's edge where fallen trees and emergent plants like rushes might be found, and upward onto the land where different layers of plants (low ground cover, shrubs, trees) may lead to the lake. A lake's littoral zone is a term used to describe the shallow water area where aquatic plants can grow because sunlight can penetrate to the lake bottom. Shallow lakes might be composed entirely of a littoral zone. In deeper lakes, plants are limited where they can grow by how deeply light can penetrate the water.

Shorelands are critical to a lake's health. Activities such replacing natural vegetation with lawns, clearing brush and trees, importing sand to make artificial beaches, and installing structures such as piers, can cause water quality decline and change what species can survive in the lake.

PROTECTING WATER QUALITY

Shoreland buffers slow down rain and snow melt (runoff). Runoff can add nutrients, sediments, and other pollutants into lakes, causing water quality declines. Slowing down runoff will help water soak (infiltrate) into the ground. Water that soaks into the ground is less likely to damage lake quality and recharges groundwater that supplies water to many of Wisconsin's lakes. Slowing down runoff water also reduces flooding, and stabilizes stream flows and lake levels.

Shoreland wetlands act like natural sponges trapping nutrients where nutrient-rich wetland sediments and soils support insects, frogs, and other small animals eaten by fish and wildlife.

Shoreland forests act as filters, retainers, and suppliers of nutrients and organic material to lakes. The tree canopy, young trees, shrubs, and forest understory all intercept precipitation, slowing runoff, and contributing to water infiltration by keeping the soil's organic surface layer well-aerated and moist. Forests also slow down water flowing overland, often capturing its sediment load before it can enter a lake or stream. In watersheds with a significant proportion of forest cover, the erosive force of spring snow melts is reduced as snow in forests melts later than snow on open land, and melt water flowing into streams is more evenly distributed. Shoreland trees grow, mature, and eventually fall into lakes where they protect shorelines from erosion, and are an important source of nutrients, minerals and wildlife habitat.

NATURAL SHORELANDS ROLE IN PREVENTING AQUATIC INVASIVE SPECIES

In addition to removing essential habitat for fish and wildlife, clearing native plants from shorelines and shallow waters can open up opportunities for invasive species to take over. Like tilling a home garden to prepare it for seeding, clearing shoreland plants exposes bare earth and removes the existing competition (the cleared shoreland plants) from the area. Nature fills a vacuum. While the same native shoreland plants may recover and reclaim their old space, many invasive species possess "weedy" traits that enable them to quickly take advantage of new territory and out-compete natives.

The act of weeding creates continual disturbance, which in turn benefits plants that behave like weeds. The modern day practice of mowing lawns is an example of keeping an ecosystem in a constant state of disturbance to the benefit of invasive species like turfgrass, dandelions, and clover, all native to Europe. Keeping shoreline intact is a good way to minimize disturbance and minimize opportunities for invasive species to gain a foothold.

THREATS TO SHORELANDS

When a landowner develops a waterfront lot, many changes may take place including the addition of driveways, houses, decks, garages, sheds, piers, rafts and other structures, wells, septic systems, lawns, sandy beaches and more. Many of these changes result in the compaction of soil and the removal of trees and native plants, as well as the addition of impervious (hard) surfaces, all of which alter the path that precipitation takes to the water.

Building too close to the water, removing shoreland plants, and covering too much of a lake shore lot with hard surfaces (such as roofs and driveways) can harm important habitat for fish and wildlife, send more nutrient and sediment runoff into the lake, and cause water quality decline.

Changing one waterfront lot in this fashion may not result in a measurable change in the quality of the lake or stream. But cumulative effects when several or many lots are developed in a similar way can be enormous. A lake's response to stress depends on what condition the system is in to begin with, but bit by bit, the cumulative effects of tens of thousands of waterfront property owners "cleaning up" their shorelines, are destroying the shorelands that protect their lakes. Increasing shoreline development and development throughout the lake's watershed can have undesired cumulative effects.

SHORELAND PRESERVATION AND RESTORATION

If a native buffer of shoreland plants exists on a given property, it can be preserved and care taken to minimize impacts when future lake property projects are contemplated. If a shoreline has been altered, it can be restored. Shoreline restoration involves recreating buffer zones of natural plants and trees. Not only do quality wild shorelines create higher property values, but they bring many other values too. Some of these are aesthetic in nature, while others are essential to a healthy ecosystem. Healthy shorelines mean healthy fish populations, varied plant life, and the existence of the insects, invertebrates and amphibians which feed fish, birds and other creatures. Figure 12 shows the difference between a natural and unnatural shoreline adjacent to a lake home. More information about healthy shorelines can be found at the following website: https://healthylakeswi.com/ (last accessed 3-15-2019).

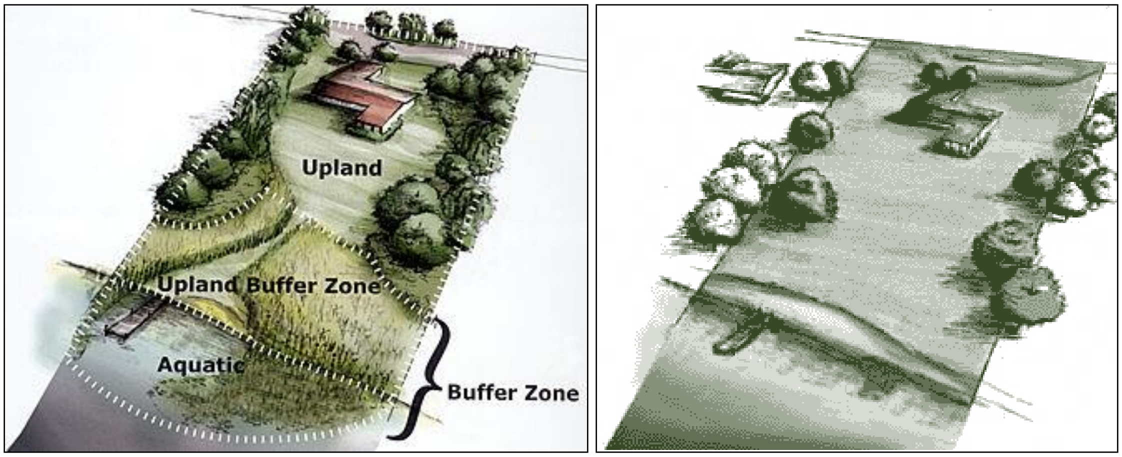


Figure 14: Healthy, AIS Resistant Shoreland (left) vs. Shoreland in Poor Condition

The habitat surrounding Poskin Lake has not been assessed, so the condition is not currently known. If property owners are interested in ways to improve their lake shore property, information on WDNR grant eligible projects can be found at https://healthylakeswi.com/.

AQUATIC PLANT SURVEYS

Using a standard formula that takes into account the shoreline shape and distance, water clarity, depth and total acreage, Michelle Nault (WDNR) generated a 403 point sampling grid for Poskin Lake prior to the original 2009 Endangered Resource Services, LLC (ERS) survey. Using this same grid in 2018, in preparation for the 2019 revision of the management plan and to compare how the lake's vegetation may have changed since the last point-intercept surveys, the PLA and the WDNR authorized an early season CLP point-intercept survey on May 23rd, a CLP density and bed mapping survey on June 12th, and a full point-intercept survey for all aquatic plants on July 15th, 2018.

WARM-WATER FULL POINT-INTERCEPT MACROPHYTE SURVEYS

Warm-water point-intercept surveys were conducted in 2009 and 2018 in preparation for future management planning. Table 4 shows a brief comparison of summary statistics for both surveys. The PLA contracted with Endangered Resource Services, LLC (ERS) to complete these warm-water point-intercept surveys as well as the early season CLP surveys.

Table 4: Comparison of Survey Statistics for 2009 and 2018

Summary Statistics:	2009	2018
Total number of points sampled	403	403
Total number of sites with vegetation	86	84
Total number of sites shallower than the maximum depth of plants	112	93
Frequency of occurrence at sites shallower than maximum depth of plants	76.8	90.3
Simpson Diversity Index	0.88	0.87
Maximum depth of plants (ft)	10.5	9.0
Mean depth of plants (ft)	3.8	3.9
Median depth of plants (ft)	3.0	3.5
Average number of all species per site (shallower than max depth)	2.86	3.17
Average number of all species per site (veg. sites only)	3.72	3.51
Average number of native species per site (shallower than max depth)	2.77	3.11
Average number of native species per site (sites with native veg. only)	3.60	3.44
Species richness	26	19
Species richness (including visuals)	32	25
Species richness (including visuals and boat survey)	35	30
Mean rake fullness (veg. sites only)	Est. 2.52	2.21

Total plant richness was low with just 19 species found in the rake (down from 26 in 2009). This total increased to 30 species when including visuals and plants seen during the boat survey, but it was also down from the 35 total species we documented in 2009. Mean native species richness at sites with native vegetation also saw a non-significant decline (p=0.31) from 3.60 species/site in 2009 to 3.44/site in 2018 (Figure 13).

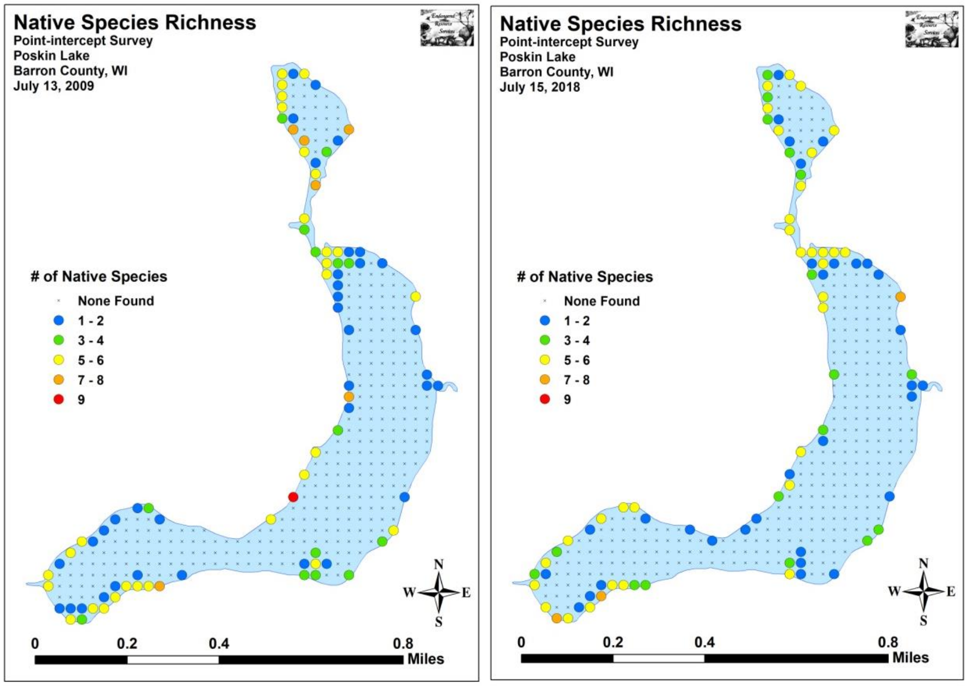


Figure 15: 2009 and 2018 Native Species Richness

In addition to a decrease in overall richness, there was a moderately significant decline in total rake fullness ($p<0.01$) from a high 2.52 in 2009 to a high/moderate 2.21 in 2018. This decrease was appeared to be particularly pronounced in Little Poskin Lake with little noticeable change in density occurring near the outlet (Figure 14).

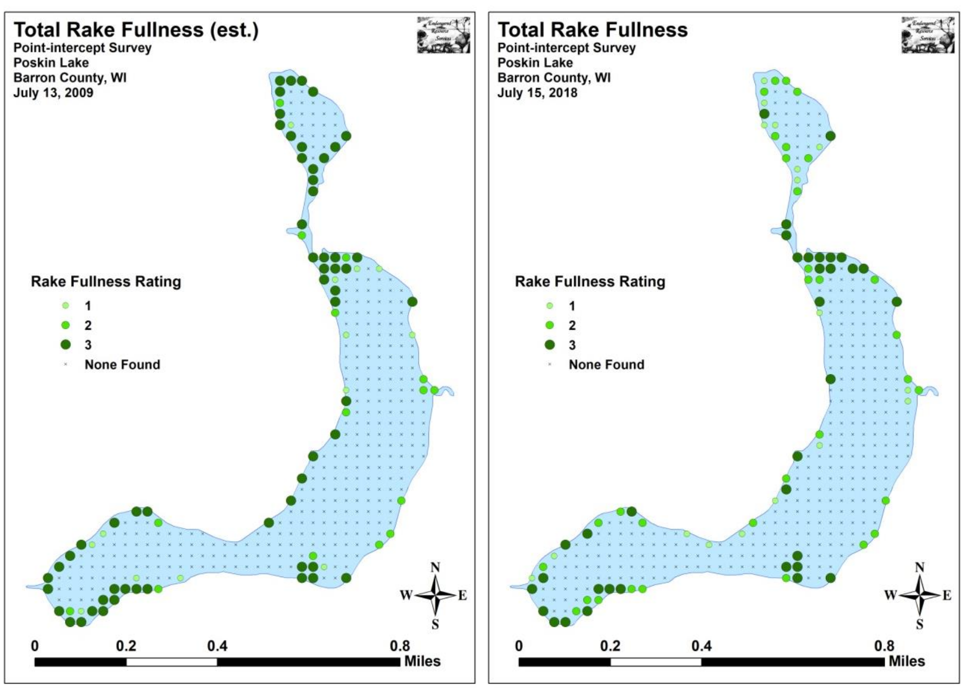


Figure 16: 2009 and 2018 Total Rake Fullness

Growth in 2018 was slightly skewed to deep water as the mean plant depth of 3.9ft was more than the median depth of 3.5ft. Both of these values were higher than in 2009 when the mean was 3.8ft and the median was 3.0ft (Figure 15). In July 2018, ERS found plants growing to 9.0ft (down from 10.5ft in 2009) (Table 4). The 84 points with vegetation (approximately 20.8% of the entire lake bottom and 90.3% of the littoral zone) were nearly identical to the 2009 survey when plants were found growing at 86 points (21.3% of the bottom and 76.8% of the littoral zone) (Figure 16).

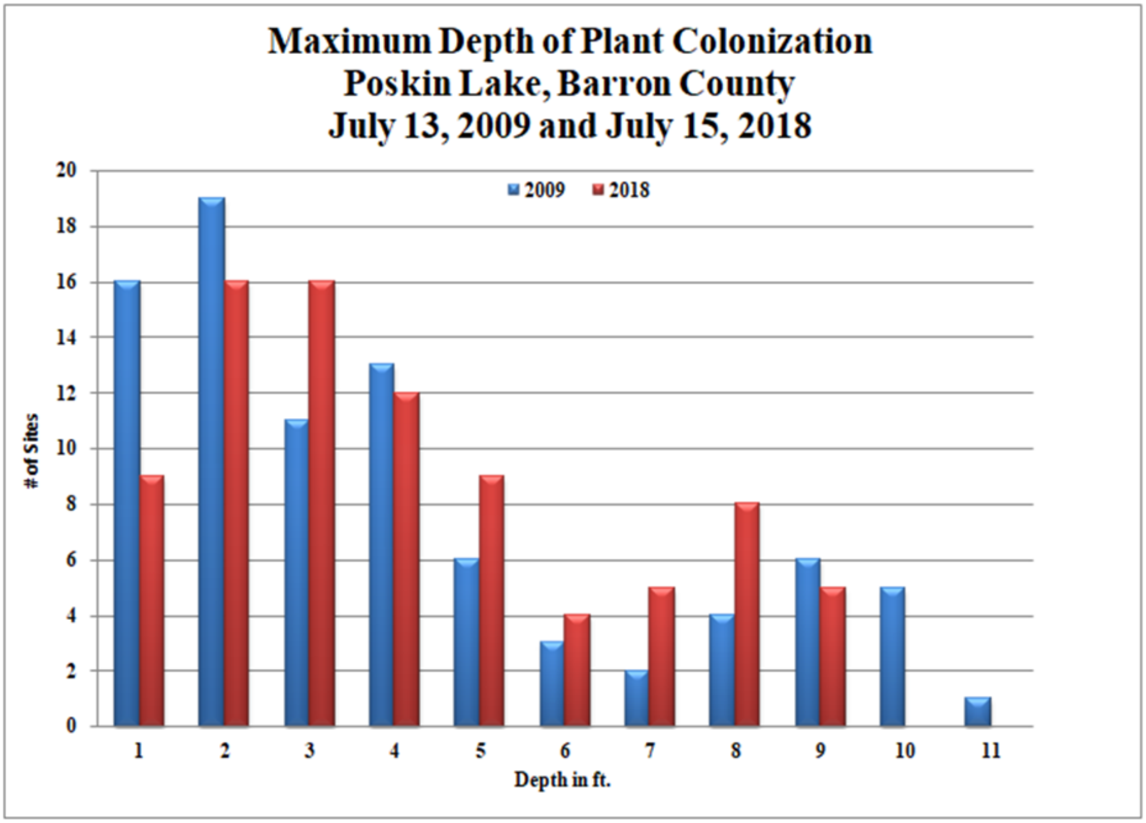


Figure 17: 2008 and 2018 plant colonization depth chart

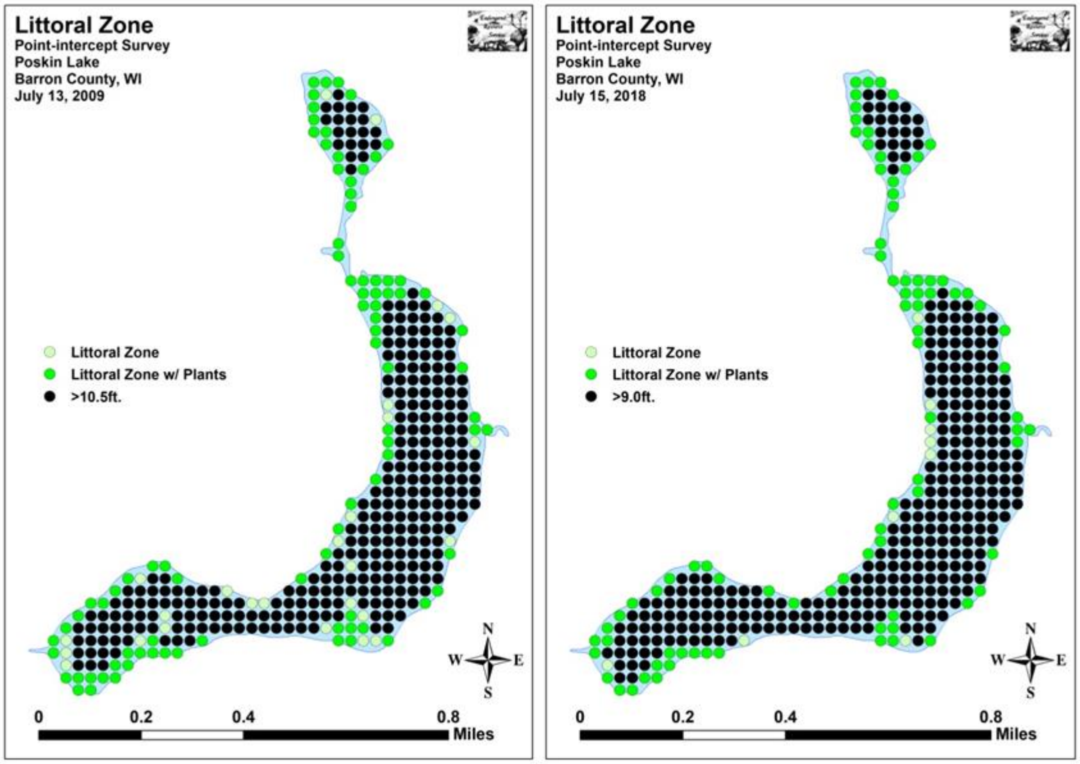
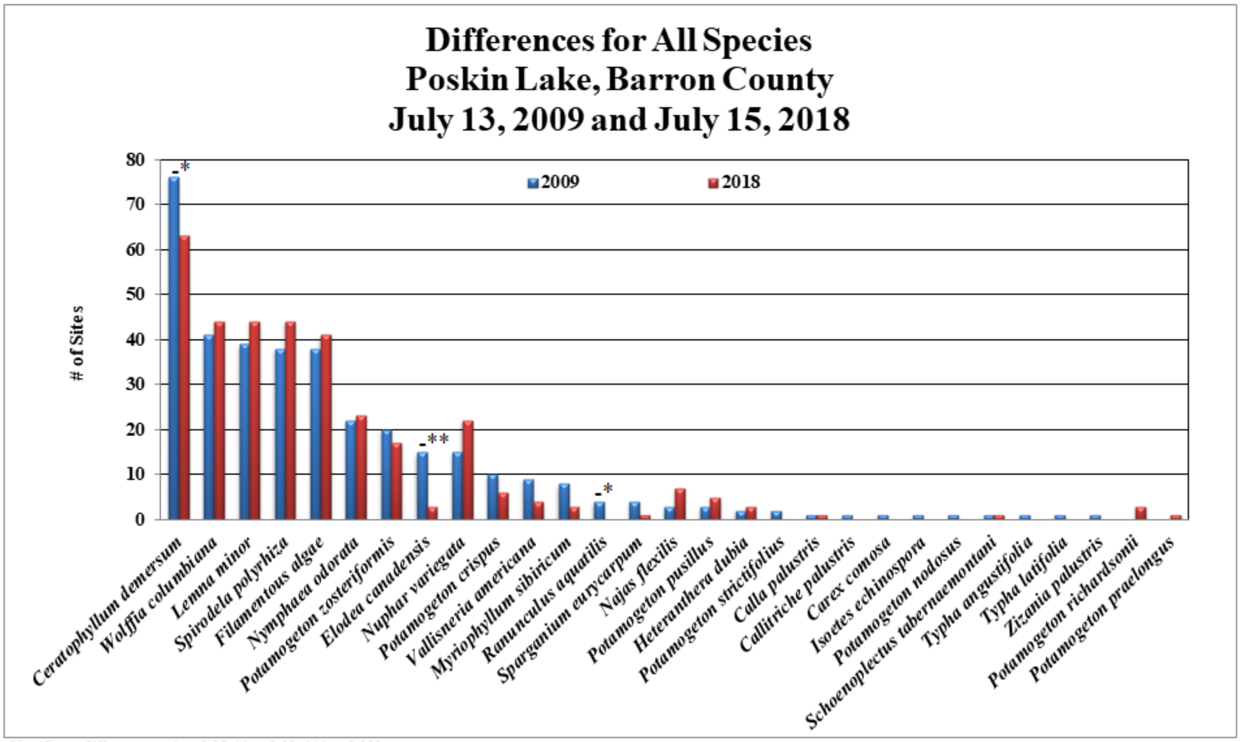


Figure 18: 2009 and 2018 littoral zone

Lake-wide, three species showed significant changes in distribution from 2009 to 2018. Common waterweed suffered a moderately significant decline; and Coontail and White water crowfoot saw significant declines (Figure 17). In the 2009 survey, coontail, common watermeal, small duckweed and large duckweed were the most commonly seen species being found at 88.37%, 47.67%, 45.35%, and 44.19% of survey points with vegetation respectively and accounted for 60.63% of the total relative frequency. In 2018, Coontail, Small duckweed, Large duckweed, and Common watermeal were again the most common plant species. Surveyors found them at 75.00%, 52.38%, 52.38%, and 52.38% of sites with vegetation, and they accounted for 66.10% of the total relative frequency.



Significant differences = * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 19: Plant species with significant changes from 2009 to 2018

SIMPSON'S DIVERSITY INDEX

A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's Diversity Index, the index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be more resistant to invasion by exotic species. In Poskin Lake, diversity was quite high in 2018 with a Simpson Index value of 0.87. This was slightly lower than the 2009 survey which had a Simpson Index value of 0.88, but this is not enough of a drop to raise any sort of alarm.

FLORISTIC QUALITY INDEX (FQI)

This index measures the impact of human development on a lake's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the point-intercept survey, and multiplying it by the square root of the total number of plant species (N) in the lake. Statistically speaking, the higher the index value, the healthier the lake's aquatic plant community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, North Central Hardwood Forests, Driftless Area and Southeastern

Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Poskin Lake is in the Northern Central Hardwood Forests Region.

In 2009, a total of 25 native index species were identified in the rake during the point-intercept survey. They produced a mean C of 5.6 and a FQI of 28.2. In 2018, a total of 18 native index plants were identified in the rake during the point-intercept survey. The index plants found produced a mean C of 5.6 and a FQI of 23.6 (Berg, 2018). Nichols (1999) reported an average mean C for the North Central Hardwood Forests Region of 5.6 putting Poskin Lake precisely at average, for this part of the state in both years. The 2018 FQI of 23.6 was slightly higher than the mean FQI of 20.9 for the North Central Hardwood Forests Region (Nichols, 1999).

WILD RICE

Wild rice is an aquatic grass which grows in shallow water in lakes and slow flowing streams. This grass produces a seed which is a nutritious source of food for wildlife and people. The seed matures in August and September with the ripe seed dropping into the sediment, unless harvested by wildlife or people. It is a highly protected and valued natural resource in Wisconsin. Only Wisconsin residents may harvest wild rice in the state. According to the WDNR Surface Water Data Viewer, Poskin Lake is not wild rice water, however during both the 2009 and 2018 plant survey wild rice was identified, just not on the rake at any of the survey points (Figure 19). It was a visual plant at three survey points in 2018. The total rice population in 2018 was only estimated to be several hundred plants. Surveyors noted that most of the rice plants were still submerged and covered with filamentous algae which would make it difficult for the rice to emerge, and the plants that had emerged appeared to be promptly cropped by local wildlife.

Photos taken in 2010 and 2011 documented a fairly significant population of wild rice in Little Poskin Lake (2010), and in both Little Poskin and the main Poskin Lake in 2011 (Figure 19).

In the 2010 Aquatic Plant Management Plan, it was recommended that the PLA remove barriers that restrict flow built onto the existing Poskin Lake dam at the outlet of the Vermillion River in order to encourage wild rice growth in the lake. If this has not been done, the PLA should consider doing this as well as actively working to reestablish wild rice within the north basin. Because wild rice pulls a large amount of nutrients from the sediments each year, a large wild rice population in the undeveloped north basin could help improve water quality throughout the lake.

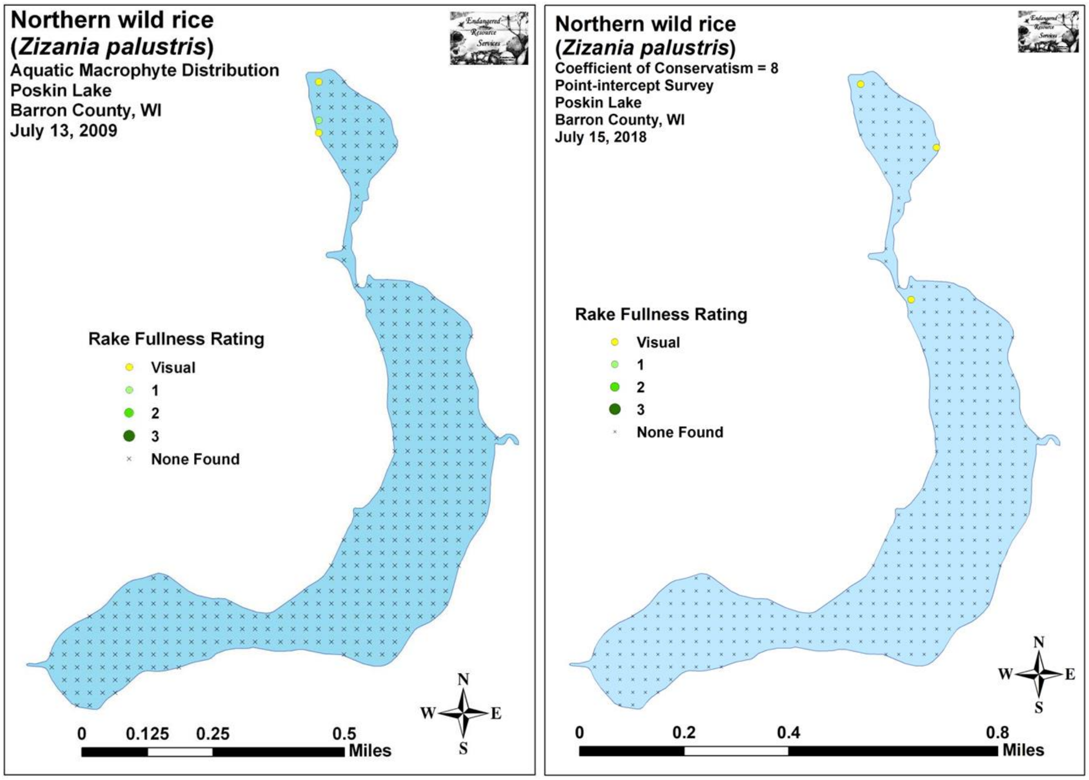


Figure 20: 2009 and 2018 Poskin and Little Poskin Lake Wild Rice

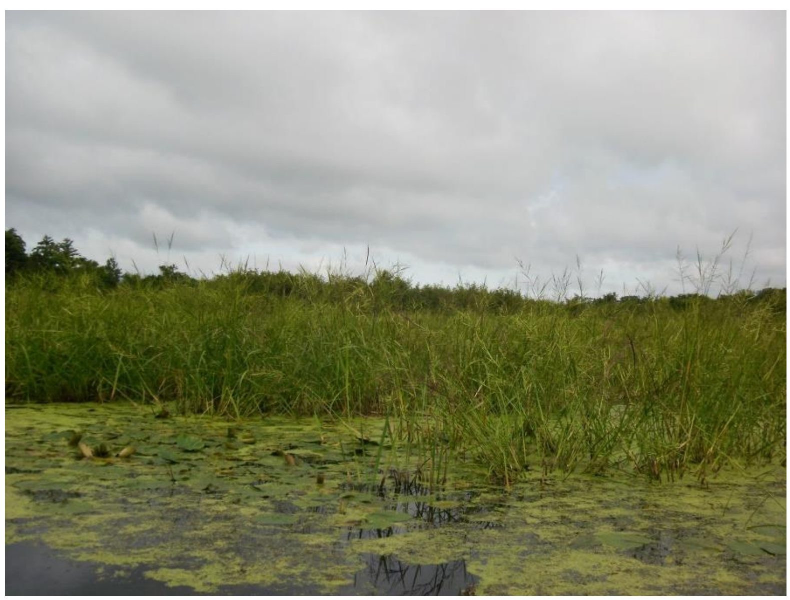


Figure 21: 2011 Wild Rice on the north end of Poskin Lake

CLP SURVEYS

In 2009, ERS mapped a single Curly-leaf pondweed bed along the north shoreline of the main basin that stretched from the channel to Little Poskin east to the Vermillion River Inlet (Figure 20). Covering 0.71 acre

(0.46% of the lake's 154 acres), it was mixed with canopied Coontail and didn't occur in front of any residences making it unlikely to cause navigation impairment. The 2018 bed-mapping survey located three beds totaling 0.47 acre (0.31% of the lake's surface area). This represented a 0.24 acre decline from the 2009 bed mapping survey (Figure 20).

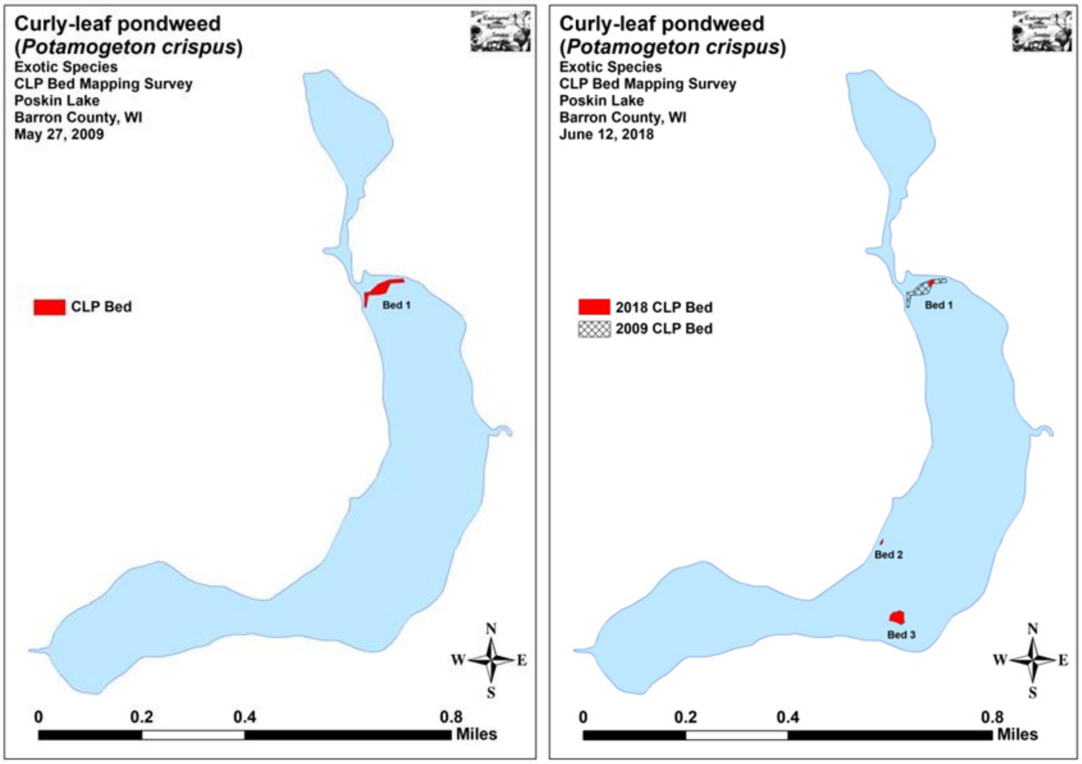


Figure 22: 2009 & 2018 CLP bed mapping Survey

After having ringed the north end of the lake in 2009, Bed 1 (Figure 20) shrunk to a small core area in <5ft of water in 2018. Even within the bed, Curly-leaf pondweed was often patchy and much of this part of the north bay was a barren silt flat with little vegetation of any kind. Outside of the bed, Coontail was found that extended to the edge of the littoral zone. Surveyors noted Bluegills throughout the area and had to wait for people to finish angling before they were able to complete the survey. In Bed 2 (Figure 20) CLP was canopied and monotypic, but the bed's extremely small size and mixed density made it more of a patch than a true bed. ERS also noted that, because it was so narrow, it was easily motored around or through making it a likely non-issue in regards to navigation. Bed 3 (Figure 20) may have been better described as a "High Density Area" as CLP often wasn't the dominant plant and tended to occur more as patches imbedded within the native plant community. Although the CLP in the area was not terrible, the overall density of vegetation likely made it at least a minor navigation impairment. Tempering any navigation concerns was the fact that this area represents the best native plant bed on the lake, and, as such, was full of fish and surrounded by anglers during the survey.

AQUATIC INVASIVE SPECIES

In 2009 curly-leaf pondweed was verified to be present in Poskin Lake. The same year, Chinese mystery-snails were also vouchered as present within the lake. In addition to the species already present within Poskin Lake, there are many others that could be introduced. Most of these species are considered aquatic, although some are also considered shoreland or wetland type invasive species.

NON-NATIVE, AQUATIC INVASIVE PLANT SPECIES

Curly-leaf pondweed (CLP) is the only known aquatic invasive plant species in the lake. CLP is a submerged vegetation species (rooted to the bottom of the lake and growing under the surface of the water) that has the potential to outcompete more desirable native aquatic plants. Reed canary grass can be found in some of the wetlands surrounding Poskin Lake. Reed canary grass is a shoreland or wetland plant not generally problematic within the lake, but can be very problematic on the shores and in the wetlands adjacent to the lake. More information is given for each non-native species in the following sections.

CURLY-LEAF PONDWEED

Curly-leaf pondweed (CLP) is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia (Figure 21). It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early August. CLP is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine.

CLP spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring. It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, CLP plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. CLP forms surface mats that interfere with aquatic recreation.

CLP has been found in several patches within Poskin Lake. In 2018, plant surveyors found that CLP was present throughout the lake, but it was not acting overly invasive and appeared to be “just another plant species” in the lake’s plant community.

Figure 23: CLP Plants and Turions

EURASIAN WATERMILFOIL

Eurasian water milfoil (EWM) (Figure 22) is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, EWM is difficult to distinguish from Northern water milfoil. EWM has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

EWM grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

Unlike many other plants, EWM does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, and bait buckets; and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, EWM is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of EWM provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms in infested lakes.

Figure 24: EWM fragment with adventitious roots and EWM in a bed

EWM has not been found within Poskin Lake, but should still be monitored for regularly. There are several nearby lakes that have EWM and/or variations of a hybrid between EWM and the native Northern watermilfoil know as hybrid watermilfoil (HWM). HWM is present within nearby Horseshoe Lake and Rice Lake while EWM can be found in Echo Lake and Beaver Dam Lake. EWM is also found within the east basin of Lower Vermillion Lake. This is particularly concerning for Poskin Lake because the Vermillion River travels through this basin before it flows south and into Poskin Lake. The 2018 plant survey of Poskin Lake saw no EWM within the lake, but it should be regularly monitored for, and the PLA should create a EWM Rapid Response Plan in case EWM is able to find its way into Poskin Lake.

PURPLE LOOSESTRIFE

Purple loosestrife (Figure 23) is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers that vary from purple to magenta possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, more than 20 states, including Wisconsin have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

Purple loosestrife has not been found around Poskin Lake, but it has been found in several nearby wetlands including those surrounding Upper Turtle Lake, Echo Lake, Horseshoe Lake, and Beaver Dam Lake. Monitoring efforts should include purple loosestrife.

Figure 25: Purple Loosestrife

REED CANARY GRASS

Reed canary grass (Figure 24) is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as bergs and spoil piles.

Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring and then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in just a few years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, and deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites.

Reed canary grass is located in a few locations along the shoreland of Poskin Lake. During the 2018 plant survey within the lake, surveyors noted that Reed canary grass was often a dominant plant just beyond the lakeshore in adjacent wetlands and next to mowed or otherwise disturbed shoreline areas.

Figure 26: Reed Canary Grass (not from Poskin Lake)

NON-NATIVE AQUATIC INVASIVE ANIMAL SPECIES

Currently, there is only one non-native animal species, Chinese mystery snails, found in Poskin Lake. Several additional non-vegetative, aquatic, invasive species are in nearby lakes, but have not been identified in Poskin Lake. It is important for lake property owners and users to be knowledgeable of these species in order to identify them if and when they show up in Poskin Lake.

MYSTERY SNAILS

The Chinese mystery snails and the banded mystery snails (Figure 25) are non-native snails that have been found in a number of Wisconsin lakes. There is not a lot yet known about these species, however, it appears that they have a negative effect on native snail populations. The mystery snail's large size and hard operculum (a trap door cover which protects the soft flesh inside), and their thick hard shell make them less edible by predators such as rusty crayfish.

The female mystery snail gives birth to live crawling young. This may be an important factor in their spread as it only takes one impregnated snail to start a new population. Mystery snails thrive in silt and mud areas although they can be found in lesser numbers in areas with sand or rock substrates. They are found in lakes, ponds, irrigation ditches, and slower portions of streams and rivers. They are tolerant of pollution and often thrive in stagnant water areas. Mystery snails can be found in water depths of 0.5 to 5 meters (1.5 to 15 feet). They tend to reach their maximum population densities around 1-2 meters (3-6 feet) of water depth. Mystery snails do not eat plants. Instead, they feed on detritus and in lesser amounts algae and phytoplankton. Thus removal of plants in your shoreline area will not reduce the abundance of mystery snails.

Lakes with high densities of mystery snails often see large die-offs of the snails. These die-offs are related to the lake's warming coupled with low oxygen (related to algal blooms). Mystery snails cannot tolerate low oxygen levels. High temperatures by themselves seem insufficient to kill the snails as the snails could move into deeper water.

Many lake residents are worried about mystery snails being carriers of the swimmer's itch parasite. In theory they are potential carriers, however, because they are an introduced species and did not evolve as part of the lake ecosystem, they are less likely to harbor the swimmer's itch parasites.

Figure 27: Chinese Mystery Snails (not from Poskin Lake)

RUSTY CRAYFISH

Rusty crayfish have not been identified in Poskin Lake, but they can be found in several nearby waters including Upper Turtle Lake as well as the Red Cedar River.

Rusty crayfish (Figure 26) live in lakes, ponds and streams, preferring areas with rocks, logs and other debris in water bodies with clay, silt, sand or rocky bottoms. They typically inhabit permanent pools and fast moving streams of fresh, nutrient-rich water. Adults reach a maximum length of 4 inches. Males are larger than females upon maturity and both sexes have larger, heartier, claws than most native crayfish. Dark "rusty" spots are usually apparent on either side of the carapace, but are not always present in all populations. Claws are generally smooth, with grayish-green to reddish-brown coloration. Adults are opportunistic feeders, feeding upon aquatic plants, benthic invertebrates, detritus, juvenile fish and fish eggs.

The native range of the rusty crayfish includes Ohio, Tennessee, Kentucky, Indiana, Illinois and the entire Ohio River basin. However, this species may now be found in Michigan, Massachusetts, Missouri, Iowa, Minnesota, New York, New Jersey, Pennsylvania, Wisconsin, New Mexico and the entire New England state area (except Rhode Island). The Rusty crayfish has been a reported invader since at least the 1930's. Its further spread is of great concern since the prior areas of invasion have led to severe impacts on native flora and fauna. It is thought to have spread by means of released game fish bait and/or from aquarium release. Rusty crayfish are also raised for commercial and biological harvest.

Rusty crayfish reduce the amount and types of aquatic plants, invertebrate populations, and some fish populations--especially bluegill, smallmouth and largemouth bass, lake trout and walleye. They deprive native fish of their prey and cover and out-compete native crayfish. Rusty crayfish will also attack the feet of swimmers.

On the positive side, rusty crayfish can be a food source for larger game fish and are commercially harvested for human consumption.

Rusty crayfish may be controlled by restoring predators like bass and sunfish populations. Preventing further introduction is important and may be accomplished by educating anglers, trappers, bait dealers and science teachers of their hazards. Use of chemical pesticides is an option, but does not target this species and will kill other aquatic organisms.

It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except the Mississippi River). It is also illegal to release crayfish into a water of the state without a permit.

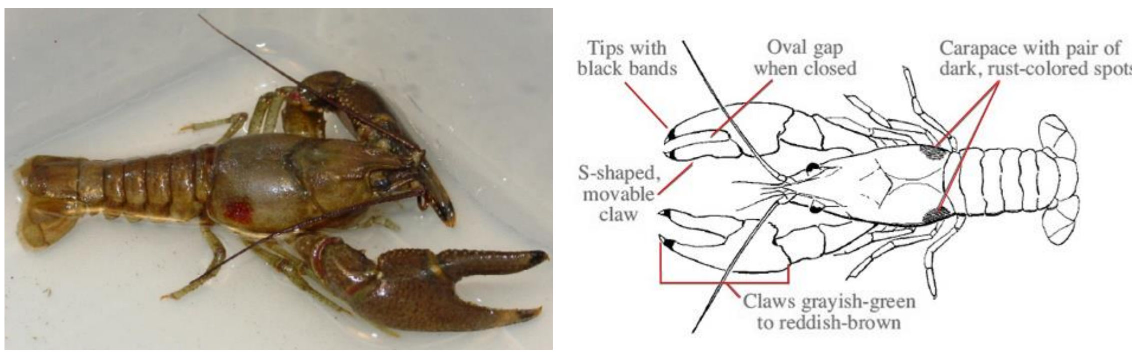


Figure 28: Rusty Crayfish and identifying characteristics

ZEBRA MUSSELS

Zebra mussels have not been identified in Poskin Lake.

Zebra mussels (Figure 27) are an invasive species that have inhabited Wisconsin waters and are displacing native species, disrupting ecosystems, and affecting citizens' livelihoods and quality of life. They hamper boating, swimming, fishing, hunting, hiking, and other recreation, and take an economic toll on commercial, agricultural, forestry, and aquacultural resources. The zebra mussel is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.

Zebra mussels feed by drawing water into their bodies and filtering out most of the suspended microscopic plants, animals and debris for food. This process can lead to increased water clarity and a depleted food supply for other aquatic organisms, including fish. The higher light penetration fosters growth of rooted aquatic plants which, although creating more habitat for small fish, may inhibit the larger, predatory fish from finding their food. This thicker plant growth can also interfere with boaters, anglers and swimmers. Zebra mussel infestations may also promote the growth of blue-green algae, since they avoid consuming this type of algae but not others.

Zebra mussels attach to the shells of native mussels in great masses, effectively smothering them. A survey by the Army Corps of Engineers in the East Channel of the Mississippi River at Prairie du Chien revealed a substantial reduction in the diversity and density of native mussels due to Zebra Mussel infestations. The East Channel provides habitat for one of the best mussel beds in the Upper Mississippi River. Future efforts are being considered to relocate such native mussel beds to waters that are less likely to be impacted by zebra mussels.

Once zebra mussels are established in a water body, very little can be done to control them. It is therefore crucial to take all possible measures to prevent their introduction in the first place. Some of the preventative and physical control measures include physical removal, industrial vacuums, and back flushing.

Chemical applications include solutions of chlorine, bromine, potassium permanganate and even oxygen deprivation. An ozonation process is under investigation (patented by Bollyky Associates Inc.) which involves the pumping of high concentrations of dissolved ozone into the intake of raw water pipes. This method only works in controlling veligers, and supposedly has little negative impacts on the ecosystem. Further research on effective industrial control measures that minimize negative impacts on ecosystem health is needed.

Figure 29: Zebra Mussels

While zebra mussels have not been identified in Poskin Lake, they were found in western Washburn County in 2016. This was the first time that zebra mussels had been found in Northwestern Wisconsin. This discovery heightens the importance of monitoring and prevention activities for all northwestern Wisconsin lakes.

AIS PREVENTION STRATEGY

Poskin Lake currently has some established AIS, but there are many more that could be introduced to the lake. The PLA has and will continue to implement a watercraft inspection and AIS Signage program at the public access point on the lake. Information will be shared with lake residents and users in an effort to expand the watercraft inspection message. In addition to the watercraft inspection program, an in-lake and shoreland AIS monitoring program will be implemented. Both of these programs will follow UW-Extension Lakes and WDNR protocol through the Clean Boats, Clean Waters program and the Citizen Lake Monitoring Network Aquatic Invasive Species Monitoring program.

Additionally, having an educated and informed lake constituency is the best way to keep non-native aquatic invasive species at bay in Poskin Lake. To foster this, the PLA should host and/or sponsor lake community events including AIS identification and management workshops; distribute education and information materials to lake property owners and lake users through the newsletter, webpage, and general mailings.

MANAGEMENT ALTERNATIVES

Nuisance aquatic plants can be managed a variety of ways in Wisconsin. The best management strategy will be different for each lake and depends on which nuisance species needs to be controlled, how widespread the problem is, and the other plants and wildlife in the lake. In many cases, an integrated approach to aquatic plant management that utilizes a number of control methods is necessary. The eradication of non-native aquatic invasive plant species such as EWM or CLP is generally not feasible, but preventing them from becoming a more significant problem is an attainable goal. It is important to remember however, that regardless of the plant species targeted for control, sometimes no manipulation of the aquatic plant community is the best management option. Plant management activities can be disruptive to a lake ecosystem and should not be done unless it can be shown they will be beneficial and occur with minimal negative ecological impacts.

Management alternatives for nuisance aquatic plants can be grouped into four broad categories: manual and mechanical removal, chemical application, biological control, and physical habitat alteration. Manual and mechanical removal methods include pulling, cutting, raking, harvesting, suction harvesting, and other means of removing the physical plant from the water. Chemical application is typified by the use of herbicides that kill or impede the growth of the aquatic plant. Biological control methods include organisms that use the plant for a food source or parasitic organisms that use the plant as a host, killing or weakening it. Biological control may also include the use of species that compete successfully with the nuisance species for resources. Physical habitat alteration includes dredging, installing lake-bottom covers, manipulating light penetration, flooding, and drawdown. It may also include making changes to or in the watershed of a body of water to reduce nutrients going in.

Each of the above control categories are regulated by the WDNR and most activities require a permit from the WDNR to implement. Mechanical harvesting of aquatic plants and under certain circumstances, physical removal of aquatic plants, is regulated under Wisconsin Administrative Rule NR 109. The use of chemicals and biological controls are regulated under Administrative Rule NR 107. Certain habitat altering techniques like the installation of bottom covers and dredging require a Chapter 30/31 waterway protection permit. In addition, anytime wild rice is involved one or more of these permits will be required.

Informed decision-making on aquatic plant management implementation requires an understanding of plant management alternatives and how appropriate and acceptable each alternative is for a given lake. The following sections list scientifically recognized and approved alternatives for controlling aquatic vegetation.

NO MANAGEMENT

When evaluating the various management techniques, the assumption is erroneously made that doing nothing is environmentally neutral. In dealing with nonnative aquatic invasive species like CLP, the environmental consequences of doing nothing may be high, possibly even higher than any of the effects of management techniques. Unmanaged, these species can have severe negative effects on water quality, native plant distribution, abundance and diversity, and the abundance and diversity of aquatic insects and fish (Madsen, 1997). Nonindigenous aquatic plants are the problem, and the management techniques are the collective solution. Nonnative plants are a biological pollutant that increases geometrically, a pollutant with a very long residence time and the potential to "biomagnify" in lakes, rivers, and wetlands (Madsen, 2000).

Foregoing any management of CLP in Poskin Lake is not a recommended option. While the 2018 survey noted that CLP was behaving like it was "just another plant" it is still necessary to survey and monitor this regularly to prevent it from becoming a larger problem.

HAND-PULLING/MANUAL REMOVAL

Manual or physical removal of aquatic plants by means of a hand-held rake or cutting implement; or by pulling the plants from the lake bottom by hand is allowed by the WDNR without a permit per NR 109.06 Waivers under the following conditions:

- Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method (Figure 28)
- Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 is performed in a manner that does not harm the native aquatic plant community
- Removal of dislodged aquatic plants that drift on-shore and accumulate along the waterfront is completed.
- The area of removal is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1, or in an area known to contain threatened or endangered resources or floating bogs
- Removal does not interfere with the rights of other riparian owners
- If wild rice is involved, the procedures of s. NR 19.09 (1) are followed.

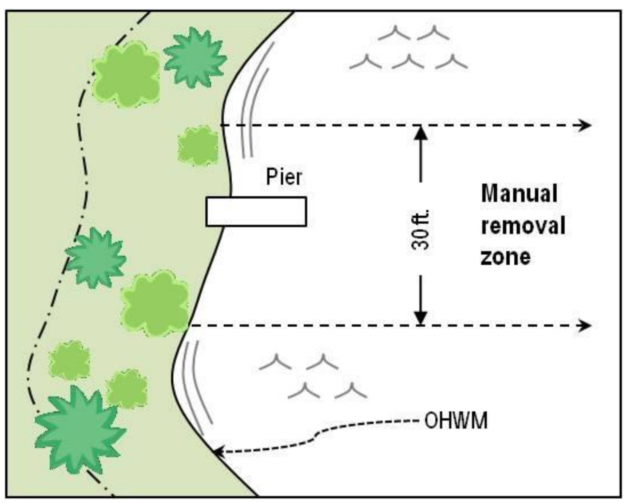


Figure 30: Aquatic vegetation manual removal zone

Although up to 30 feet of aquatic vegetation can be removed, removal should only be done to the extent necessary. There is no limit as to how far out into the lake the 30-ft zone can extend, however clearing large swaths of aquatic plants not only disrupts lake habits, it also creates open areas for non-native species to establish. Physical removal of aquatic plants requires a permit if the removal area is located in a "sensitive" or critical habitat area previously designated by the WDNR. Manual or physical removal can be effective at controlling individual plants or small areas of plant growth. It limits disturbance to the lake bottom, is inexpensive, and can be practiced by many lake residents. In shallow, hard bottom areas of a lake, or where impacts to fish spawning habitat need to be minimized, this is the best form of control. If water clarity in a body of water is such that aquatic plants can be seen in deeper water, pulling aquatic invasive species while snorkeling or scuba diving is also allowable without a permit according to the conditions in NR 106.06(2) and can be effective at slowing the spread of a new aquatic invasive species infestation within a lake when done properly.

Larger scale hand or diver removal projects have had positive impacts in temporarily reducing or controlling aquatic invasive species. Typically hand or diver removal is used when AIS has been newly identified and still exists as single plants or isolated small beds, but at least in one lake in New York State, it was used as a means to control a large-scale infestation of EWM. Kelting and Laxson (2010) reported that from 2004 to 2006 an "intensive management effort" which involved "the selective removal of Eurasian water milfoil using diver hand harvesting of the entire littoral zone of the lake at least twice each summer for three years" followed by three years of maintenance management successfully reduced the overall distribution of EWM in the lake.

If done on an annual basis, the CLP population could be somewhat contained through hand removal, but this would have to be done several years in a row, and likely completed entirely by volunteers. The man-power to complete this sort of operation would be difficult for the PLA to gather on a yearly basis, so this is not a recommended management option. However, the PLA should encourage property owners who wish to do physical removal of CLP along their own shoreline.

DIVER ASSISTED SUCTION HARVESTING

Diver assisted suction harvesting or DASH, as it is often called, is a fairly recent aquatic plant removal technique. It is called "harvesting" rather than "dredging" because, although a specialized small-scale dredge is used, bottom sediment is not removed from the system. The operation involves hand-pulling of weeds from the lake bed and inserting them into an underwater vacuum system that sucks up plants and their root systems taking them to the surface. It requires water pumps on the surface (generally on a pontoon system) to move a large volume of water to maintain adequate suction of materials that the divers are processing (Figure 29). Only clean water goes through the pump. The material placed by the divers into the suction hose along with the water is deposited into mesh bags on the surface with the water leaving through the holes in the bag. The bags have a large enough 'mesh' size so that silts, clay, leaves and other plant material being collected do not immediately clog them and block water movement. If a fish or other living marine life is sucked into the suction hose it comes out the discharge unharmed and is returned to the body of water. It can have some negative impacts to other nearby non-target plants if not done carefully, particularly those plants that are perennials and expand their populations by sub-sediment runners (Eichler, Bombard, Sutherland, & Boylen, 1993).

In Wisconsin and Michigan, suction harvesting of unwanted aquatic plants is gaining popularity as a treatment method. There are several companies in the mid-west that are offering DASH services. Some of these companies are also building equipment that lake organizations and consultants can purchase to start up their own DASH program. There is one local company out of the Chippewa Falls, WI area that offers contracted DASH services.

Figure 31: DASH - Diver Aided Suction Harvest (Chuck Druckery, 2016 Wisconsin Lakes Convention Presentation)

Any form of CLP management has to be completed several years in a row in order to reduce the turion supply within the treated areas. Because of this, the cost of contracting DASH services or purchasing DASH equipment would likely outweigh the level of CLP control it offers. As such, DASH is not a recommended management option in this management plan.

MECHANICAL REMOVAL

Mechanical management involves the use of devices not solely powered by human means to aid removal. This includes gas and electric motors, ATV's, boats, tractors, etc. Using these instruments to pull, cut, grind, or rotovate aquatic plants is illegal in Wisconsin without a permit. DASH is also considered mechanical removal. To implement mechanical removal of aquatic plants a Mechanical/Manual Aquatic Plant Control Application is required annually. The application is reviewed by the WDNR and other entities and a permit awarded if required criteria are met. Using repeated mechanical disturbance such as bottom rollers or sweepers can be effective at control in small areas, but in Wisconsin these devices are illegal and generally not permitted.

LARGE-SCALE MECHANICAL HARVESTING

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water (Figure 30). The size, and consequently the harvesting capabilities, of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is between 4 and 20 feet wide, and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1,000 cubic feet (by volume) or 1 to 8 tons (by weight). Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day, and the average lifetime of a mechanical harvester is 10 years.

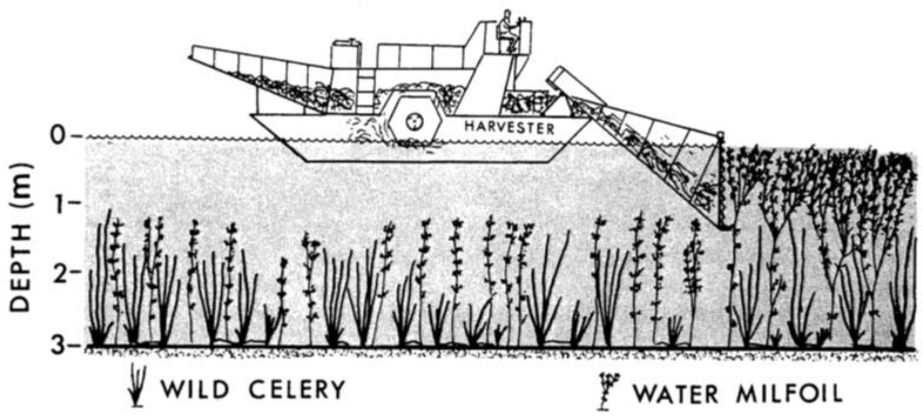


Figure 32: How a Harvester Works (Engle, 1987)

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results - open water and accessible boat lanes - are immediate, and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur as a result of the decaying of this plant matter is prevented. Additionally, repeated treatments may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. The removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area. This loss of plants results in a subsequent loss of the functions they perform, including sediment stabilization and wave absorption. Shoreline erosion may therefore increase. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem as a whole. While the results of harvesting aquatic plants may be short term, the negative consequences are not so short lived. Harvesting aquatic plants is a little like mowing the lawn. Some plants may grow back quickly and have to be harvested again in the same season. This is usually dependent on the amount of use a harvested area gets once harvesting has been completed, particularly when harvesting access channels. If these channels are used frequently by boaters, then they will likely be kept open. If they are not frequented by boaters, the plants will likely grow back. If this happens, it probably means it was not necessary to harvest the channel in the first place, and the benefits of doing so should be reevaluated. Although the harvester collects most of the plants that it cuts, some plant fragments inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time as well as cost.

Timing is also important. The ideal time to harvest CLP is just before the plant sets turions (reproductive structures) as this will reduce the risk of spreading new turions within the lake, remove the most biomass, and has the most potential for removing excess nutrients added from decaying CLP. Harvesting can begin sooner, but may have to be repeated in those early areas. If the harvesting work is contracted, the equipment should be inspected before and after it enters the lake. Since these machines travel from lake to lake, they may carry plant fragments/seeds/turions with them, and facilitate the spread of aquatic invasive species from one body of water to another. There is currently only one harvesting contractor in Northwestern Wisconsin, so there is little flexibility in terms of scheduling.

Based on the 2018, survey results large-scale harvesting would likely be a large solution to a small problem. While it would likely be a good control method if competed regularly, the cost would likely outweigh the benefits and this could have a negative impact on the native plants as well. If the CLP begins to exceed an acre of dense growth, large-scale harvesting should be reexamined as a management alternative. At this time, large-scale harvesting is not a recommended management action, but that could change if the CLP population expands.

SMALL-SCALE MECHANICAL HARVESTING

There are a wide range of small-scale mechanical harvesting techniques, most of which involve the use of boat mounted rakes, scythes, and electric cutters. As with all mechanical harvesting, removing the cut plants is required. Commercial rakes and cutters (Figure 31) range in prices from $200 for rakes to around $3000 for electric cutters with a wide range of sizes and capacities. Using a weed rake or cutter that is run by human power is allowed without a permit, but the use of any device that includes a motor, gas or electric, would require a permit. Dragging a bed spring or bar behind a boat, tractor or any other motorized vehicle to remove vegetation is also illegal without a permit. Although not truly considered mechanical management, incidental plant disruption by normal boat traffic is a legal method of management. Active use of an area is often one of the best ways for riparian owners to gain navigation relief near their docks. Most aquatic plants won't grow well in an area actively used for boating and swimming. It should be noted that purposefully navigating a boat to clear large areas is not only potentially illegal it can also re-suspend sediments, encourage aquatic invasive species growth, and cause ecological disruptions.

Figure 33: Aquatic Mower & Weedshear Weed Cutter (weedersdigest.com)

Small-scale harvesting could be used effectively to manage CLP on Poskin Lake, even small, less dense areas. The same equipment could be used for control of dense growth native vegetation. With a small investment to purchase a boat mounted type weed cutter and some rakes, coupled with some volunteer time, and the proper WDNR permits, the areas of greatest impact to navigation could be improved. Kirby Lake is located just north of Cumberland, WI about 25 miles north of Poskin Lake. A few years ago, the Kirby Lake District purchased a boat-mounted weed cutter and used it to open channels to maintain access from property owners to open water. They required participating land owners to provide some of the volunteer labor needed to remove the vegetation once cut.

BOTTOM BARRIERS AND SHADING

Physical barriers, fabric or other, placed on the bottom of the lake to reduce plant growth may provide temporary relief, but also inhibits fish spawning, affects benthic invertebrates, and could cause anaerobic conditions which may release excess nutrients from the sediment. Gas build-up beneath these barriers can cause them to dislodge from the bottom; and sediment can build up on them allowing vegetation to re-establish. Bottom barriers are typically used for very small areas and provide only limited relief. Currently the WDNR does not permit this type of control.

Creating conditions in a lake that may serve to shade out aquatic plant growth has also been tried with mixed success. The general intention is to reduce light penetration in the water which in turns limits the depth at which plants can grow. Typically dyes have been added to a small water body to darken the water. Bottom barriers and attempts to further reduce light penetration in Poskin Lake are not recommended.

DREDGING

Dredging is the removal of bottom sediment from a lake. Its success is based on altering the target plant's environment. It is not usually performed solely for aquatic plant management but rather to restore lakes that have been filled in with sediment, have excess nutrients, inadequate pelagic and hypolimnetic zones, need deepening, or require removal of toxic substances (Peterson, 1982). In shallow lakes with excess plant growth, dredging can make areas of the lake too deep for plant growth. It can also remove significant plant root structures, seeds turions, rhizomes, tubers, etc. In Collins Lake, New York the biomass of CLP remained significantly lower than pre-dredging levels 10-yrs after dredging (Tobiessen, Swart, & Benjamin, 1992). Dredging is very expensive, requires disposal of sediments, and has major environmental impacts. It is not a selective procedure so it can't be used to target any one particular species with great success except under extenuating circumstances. Very limited dredging is allowed without a permit if certain requirements are met. Normally, dredging should not be performed for aquatic plant management alone. It is best used as a multipurpose lake remediation technique (Madsen, 2000).

Dredging is not a recommended management action for Poskin Lake.

DRAWDOWN

Drawdown, like dredging, alters the plant environment by removing water in a water body to a certain depth, exposing bottom sediments to seasonal changes including temperature and precipitation. A winter drawdown is a low cost and effective management tool for the long-term control of certain susceptible species of nuisance aquatic plants. A winter drawdown controls susceptible aquatic plants by dewatering a portion of the lake bottom over the winter, and subsequently exposing vascular plants to the combined effect of freezing and desiccation (drying). The effectiveness of drawdown to control plants hinges first on being able to draw the water down far enough to dewater the areas of most concern; and then on the combined effect of the freezing and drying. If freezing and dry conditions are not sustained for 4-6 weeks, the effectiveness of the drawdown may be reduced. Winter drawdowns are most effective for plants like EWM and lilypads that reproduce from rhizomes and vegetative runners under the sediment. They are much less effective for controlling plants that grow annually from seeds or turions like CLP and other pondweeds. In some cases, pondweed species may actually benefit from a winter drawdown, as competition with other plants species may be reduced following a drawdown. This can aide certain native species like wild rice, but it could also result in CLP doing better in a lake.

It is not possible to lower the water level in Poskin Lake far enough to impact areas with CLP growth. Because CLP has turions that grow annually, a drawdown would likely do limited damage to CLP populations within Poskin Lake and would likely harm several native species. As such, this is not a recommended management option for Poskin Lake.

BIOLOGICAL CONTROL

Biological control involves using one plant, animal, or pathogen as a means to control a target species in the same environment. The goal of biological control is to weaken, reduce the spread, or eliminate the unwanted population so that native or more desirable populations can make a comeback. Care must be taken however, to insure that the control species does not become as big a problem as the one that is being controlled. A special permit is required in Wisconsin before any biological control measure can be introduced into a new area.

Currently, there are no biological controls available for CLP control. It was thought at one time that the introduction of plant eating carp could help control CLP and EWM. It has since been shown that these carp have a preference list for certain aquatic plants. CLP is very low on this preference list (Pine & Anderson, 1991). Use of "grass carp" as they are referred to in Wisconsin is illegal as there are many other environmental concerns including what happens once the target species is destroyed, removal of the carp from the system, impacts to other fish and aquatic plants, and preventing escapees into other lakes and rivers. Several pathogens or fungi are currently being researched that when introduced by themselves or in combination with herbicide application can effectively control CLP and lower the concentration of chemical used or the time of exposure necessary to kill the plant (Sorsa, Nordheim, & Andrews, 1988). None of these have currently been approved for use in Wisconsin and are not recommended for use on Poskin Lake.

CHEMICAL CONTROL

Aquatic herbicides are granules or liquid chemicals specifically formulated for use in water to kill plants or cease plant growth. Herbicides approved for aquatic use by the U.S. Environmental Protection Agency (EPA) are considered compatible with the aquatic environment when used according to label directions. Some individual states, including Wisconsin, also impose additional constraints on herbicide use.

The WDNR evaluates the benefits of using a particular chemical at a specific site vs. the risk to non-target organisms, including threatened or endangered species, and may stop or limit treatments to protect them. The WDNR frequently places conditions on a permit to require that a minimal amount of herbicide is needed and to reduce potential non-target effects, in accordance with best management practices for the species being controlled. For example, certain herbicide treatments are required by permit conditions to be in spring because they are more effective, require less herbicide and reduce harm to native plant species. Spring treatments also means that, in most cases, the herbicide will be degraded by the time peak recreation on the water starts.

The WDNR encourages minimal herbicide use by requiring a strategic Aquatic Plant Management Plan for management projects over 10 acres or 10% of the water body or any projects receiving state grants. The WDNR also requires consideration of alternative management strategies and integrated management strategies on permit applications and in developing an APM Plan, when funding invasive species prevention efforts, and by encouraging the use of best management practices when issuing a permit. The WDNR also supervises treatments, requires that adjacent landowners are notified of a treatment and are given an opportunity to request a public meeting if they want, requires that the water body is posted to notify the public of treatment and usage restrictions, and requires reporting after treatment occurs.

The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, the relatively low cost, and the ability to somewhat selectively control particular plant types with certain herbicides. Disadvantages of using chemical herbicides include possible toxicity to aquatic animals or humans, oxygen depletion after plants die and decompose which can cause fishkills, a risk of increased algal blooms as nutrients are released into the water by the decaying plants, adverse effects on desirable aquatic plants, loss of fish habitat and food sources, water use restrictions, and a need to repeat treatments due to existing seed/turion banks and plant fragments. Chemical herbicide use can also create conditions favorable for non-native aquatic invasive species to outcompete native plants (for example, areas of stressed native plants or devoid of plants).

When properly applied, the possible negative impacts of chemical herbicide use can be minimized. Early spring to early summer applications are preferred because exotic species are actively growing and many native plants are dormant, thus limiting the loss of desirable plant species; plant biomass is relatively low minimizing the impacts of de-oxygenation and contribution of organic matter to the sediments; fish spawning has ceased; and recreational use is generally low limiting human contact. The concentration and amount of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Selectivity of herbicides can be increased with careful selection of application rates and seasonal timing. Lake hydrodynamics must also be considered; steep drop-offs, inflowing waters, lake currents and wind can dilute chemical herbicides or increase herbicide drift and off-target injury. This is an especially important consideration when using herbicides near environmentally sensitive areas or where there may be conflicts with various water uses in the treatment vicinity.

HOW CHEMICAL CONTROL WORKS

Aquatic herbicides are sprayed directly onto floating or emergent aquatic plants or are applied to the water in either a liquid or granular form. Herbicides affect plants through either systemic or direct contact action. Systemic herbicides are capable of killing the entire plant. Contact herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and able to re-grow.

Herbicides can be classified as broad-spectrum (kill or injure a wide variety of plant species) or selective (effective on only certain species). Non-selective, broad spectrum herbicides will generally affect all plants that they come in contact with. Selective herbicides will affect only some plants. Often dicots, like Eurasian water milfoil, will be affected by selective herbicides whereas monocots, such as common waterweed will not be affected. The selectivity of a particular herbicide can be influenced by the method, timing, formulation, and concentration used.

Endothall is considered primarily a contact herbicide. Its common trade name is Aquathol K® (liquid) or Super K® (granular). Endothall is a broad spectrum herbicide most commonly used to kill pondweeds like curly-leaf. Because CLP is an annual plant not dependent on existing root structure to grow, a contact herbicide like endothall can be very effective. It is not effective on roots, rhizomes, or tubers. Endothall has been described as a broad spectrum contact-type, membrane-active herbicide. Native aquatic plant sensitivity varies greatly among species. EWM and pondweeds such as CLP, Illinois pondweed, southern naiad, and sago pondweed are very sensitive to endothall, while coontail is moderately sensitive. Other plants such as common waterweed, wild celery, water stargrass, and many floating-leaf and emergent species are more tolerant of endothall. Endothall, therefore, has the potential to selectively control CLP and/or EWM in sites where native pondweeds do not dominate the plant community (Skogerboe and Getsinger, 2006).

Diquat is a non-selective, contact herbicide that will kill or injure a wide variety of plants by damaging cell tissues when absorbed by the foliage. It will not kill parts of the plant it does not come into direct contact with. Its common trade name is Reward® or Tribune®. Diquat is not effective in lakes or ponds with muddy water or plants covered with silt because it is strongly attracted to clay particles in the water. Bottom sediments must not be disturbed when this herbicide is used. At approved application rates Diquat does not appear to have any long or short term effects on most aquatic organisms.

Sonar® whose active ingredient is fluridone, is a broad spectrum herbicide that interferes with the necessary processes in a plant that create the chlorophyll needed to turn sunlight into plant food through a process called photo-synthesis. Rodeo® whose active ingredient is glyphosate is another broad spectrum herbicide that prevents an aquatic plant from making the protein it needs to grow. As a result the treated plant stops growing and eventually dies.

2,4-D and triclopyr are active ingredients in several selective herbicides including Sculpin G®, Shredder Amine 4®, Navigate®, DMA 4®, and Renovate®. These herbicides stimulate plant cell growth causing them to rupture, but primarily in dicots. These herbicides are considered selective as they have little to no effect on monocots in treated areas. Fluridone, glyphosate, 2,4-D, and triclopyr are all considered systemic. When applied to the treatment area, plants in the treatment area draw the herbicide in through the leaves, stems, and roots killing all of the plant, not just the part that comes in contact with the herbicide.

ProcellaCOR® is a new herbicide that acts similar to both 2,4-D and triclopyr, with less contact time needed. The active ingredient in ProcellaCOR® is an organic compound which mimics the plant hormone auxin. The auxins that are produced naturally within plants stimulate stem elongation while suppressing bud growth. However when auxin concentrations within plant tissues reach a certain threshold, the growth response is completely reversed. The plant begins to, essentially, prepare for a dormant period by stopping growth altogether and abscising leaves. At this point, additional auxins (or their mimics) will become toxic to the plant and result in cell death. This herbicide has just recently been approved for use in Wisconsin, but it is currently still considered to be in a testing phase. This herbicide is intended for use on EWM, so it should not be used on Poskin Lake.

Endothall and diquat are considered broad spectrum contact herbicides. They destroy the outer cell membrane of the material they come in contact with and therefore kill a plant very quickly. Neither of these is considered selective and has the potential to kill all of the plant material that they come in contact with regardless of the species. As such, great care should be taken when using these products. Certain plant species like CLP begin growing very early in the spring, even under the ice, and are often the only growing plant present at that time. This is a good time to use a contact herbicide like Aquathol, as few other plants would be impacted. Using these products later in the season, will kill all vegetation in contact with the herbicide and can provide substantial nuisance relief from a variety of aquatic plants.

It is possible to apply more than one herbicide at a time when trying to establish control of unwanted aquatic vegetation. An example would be controlling EWM and CLP at the same time with an early season application, and controlling aquatic plants and algae at the same time during a mid-season nuisance relief application. Applying systemic and contact herbicides together has a synergistic effect leading to increased selectivity and control. Single applications of the two could result in reduced environmental loading of herbicides and monetary savings via a reduction in the overall amount of herbicide used and of the manpower and number of application periods required to complete the treatment.

EFFICACY OF AQUATIC HERBICIDES

The efficacy of aquatic herbicides is dependent on both application concentration and exposure time, and these factors are influenced by two separate but interconnected processes - dissipation and degradation. Dissipation is the physical movement of the active herbicide within the water column both vertically and horizontally. Dissipation rates are affected by wind, water flow, treatment area relative to untreated area, and water depths. Degradation is the physical breakdown of the herbicide into inert components. Depending on the herbicide utilized, degradation occurs over time either through microbial or photolytic (chemical reactions caused by sunlight exposure) processes.

MICRO AND SMALL-SCALE HERBICIDE APPLICATION

The determining factor in designating chemical treatments as micro or small-scale is the size of the area being treated. Small-scale herbicide application involves treating areas less than 10 acres in size. The dividing line between small-scale and micro treatments is not clearly defined, but is generally considered to be less than an acre. Small-scale chemical application is usually completed in the early season (April through May). Micro treatments are as well, but may be used as follow-up spot treatments after an early season application, or in instances where a new infestation has been identified in a lake with EWM already or a in a completely new lake. Recent research related to micro and small-scale herbicide application generally shows that these types of treatment are less effective than larger scale treatments due to rapid dilution and dispersion of the herbicide applied. Some suggested ways to increase the effectiveness is to increase the concentration of herbicide used, use a contact herbicide like diquat that does not require as long a contact time to effective, or in some manner contain the herbicide in the treated area by artificial means. If combined micro or small-scale treatments exceed 10 acres or 10% of the littoral zone of a lake it is considered a large-scale treatment.

LARGE-SCALE HERBICIDE APPLICATION

Large-scale herbicide application involves treating areas more than 10 acres in size. Like small-scale applications, this is usually completed in the early-season (April through May) for control of non-native invasive species like EWM and CLP while minimizing impacts on native species. It is generally accepted that lower concentration of herbicide can be used in large-scale applications as the likelihood of the herbicide staying in contact with the target plant for a longer time is greater. If the volume of water treated is more than 10% of the volume of the lake, or the treatment area is ≥160 acres, or 50% of the lakes littoral zone, effects can be expected at a whole-lake scale. Large-scale herbicide application can be extended in some lakes to include whole bay or even whole lake treatments. The bigger the treatment area, the more contained the treatment area, and the depth of the water in the treatment area, are factors that impact how whole bay or whole lake treatments are implemented.

Pre- and post-treatment aquatic plant surveying and having an approved Aquatic Plant Management Plan are required by the WDNR when completing large-scale chemical treatments. Residual testing is not required by the WDNR, but highly recommended to gain a better understanding of the impact and fate of the chemical used. Due to the small-scale nature of CLP that has been found within Poskin Lake, large-scale applications will not likely be necessary in the foreseeable future unless there is a dramatic shift in the CLP population.

PRE AND POST TREATMENT AQUATIC PLANT SURVEYING

When introducing new chemical treatments to lakes where the treatment size is greater than ten acres or greater than 10% of the lake littoral area and more than 150-ft from shore, the WDNR requires pre and post chemical application aquatic plant surveying. The protocol for pre and post treatment survey is applicable for chemical treatment of CLP and EWM.

The WDNR protocol assumes that an Aquatic Plant Management Plan has identified specific goals for non-native invasive species and native plants species. Such goals could include reducing coverage by a certain percent, reducing treatments to below large-scale application designations, and/or reducing density from one level to a lower level. A native plant goal might be to see no significant negative change in native plant diversity, distribution, or density. Results from pre and post treatment surveying are used to improve consistency in analysis and reporting, and in making the next season's management recommendations.

The number of pre and post treatment sampling points required is based on the size of the treatment area. Ten to twenty acres generally requires at least 100 sample points. Thirty to forty acres requires at least 120 to 160 sampling points. Areas larger than 40 acres may require as many as 200 to 400 sampling points. Regardless of the number of points, each designated point is sampled by rake recording depth, substrate type, and the identity and density of each plant pulled out, native or invasive.

In the year prior to an actual treatment, the area to be treated must have a mid-season/summer/warm water point intercept survey completed that identifies the target plant and other plant species that are present. A pre-treatment aquatic plant survey is done in the year the herbicide is to be applied, prior to application to confirm the presence and level of growth of the target species. A post-treatment survey should be scheduled when native plants are well established, generally mid-July through mid-August. For the post-treatment survey, repeat the PI for all species in the treatment polygons, as was done the previous summer. For whole-lake scale treatments, a full lake-wide PI survey should be conducted.

CHEMICAL CONCENTRATION TESTING

Chemical concentration testing is often done in conjunction with treatment to track the fate of the chemical herbicide used. Testing is completed to determine if target concentrations are met, to see if the chemical moved outside its expected zone, and to determine if the chemical breaks down in the system as expected. Monitoring sites are located both within and outside of the treatment area, particularly in areas that may be sensitive to the herbicide used, where chemical drift may have adverse impacts, where movement of water or some other characteristic may impact the effect of the chemical, and where there may be impacts to drinking and irrigation water. Water samples are collected prior to treatment and for a period of hours and/or days following chemical application.

Pre- and post-treatment aquatic plant surveys and testing for herbicide residuals are not required by the WDNR for small-scale treatments. Nor is an approved Aquatic Plant Management Plan if the organization sponsoring the application is not using grant funding to help defer the costs. Even though not required by the WDNR, participating in these activities is recommended as it helps to gain a better understanding of the impact and fate of the chemical used.

Chemical concentration testing has never been done on Poskin Lake, and it is not recommended unless at some future point management efforts exceed 10% of the littoral zone. Chemical concentration testing done on other lakes has shown that application of herbicides in micro or small-scale treatment areas is less effective than treating large areas. Furthermore, chemical application in deep water or along deep water edges reduces the success of chemical management.

HERBICIDE USE IN POSKIN LAKE

Traditionally when herbicide is used to control CLP in a lake, it is used for a minimum of three years in a row with the intent to reduce both the amount of CLP in the lake and to reduce the number of CLP turions in the sediment beneath the treated area. Herbicides should be applied early in the spring, when CLP is actively growing and other native aquatic plants are not. Endothall based herbicides are the most commonly accepted and used herbicides for CLP control in Wisconsin. In shallower water or in areas with expected shortened herbicide/target plant contact time, diquat is often used. The amount of CLP in Poskin Lake is limited, so if herbicide is to be used in the lake to control CLP, it should be in specific, targeted areas where CLP density interferes with lake usage, or has the potential to out-compete native aquatic plant growth. Endothall, in its liquid or granular formulation, depending on size and depth of the area to be treated, should be the first choice for control, but diquat could be considered if the PLA and/or consultant believe it to be the better choice in any given area.

MANAGEMENT DISCUSSION

This APM Plan for Poskin Lake is intended to guide management implementation beginning in 2019 through the 2023 open water season. The original APM Plan for Poskin Lake was written in 2009 with these six broad goals:

- AIS education and prevention planning
- AIS control and management
- Water quality monitoring
- Promotion of shoreland best management practices
- Native species preservation, enhancement, and protection
- Project assessment and evaluation

When the original APM Plan was written, the CLP population found within Poskin Lake did not warrant any form of active management. In recent years, the CLP population within the lake has changed enough that the PLA is now implementing limited active management to prevent the CLP from becoming a larger scale nuisance. This means there is a slight shift in the focus of this plan from the 2009 plan, but education and constituent involvement will still be a large part of aquatic plant management moving forward. These six goals will guide aquatic plant management through the 2024 open water season:

- Prevent the expansion of curly-leaf pondweed in Poskin Lake.
- Maintain or improve current (2018) measurements of the health of the native aquatic plant community in Poskin Lake.
- Monitor changes in water quality.
- Reduce the threat that new aquatic invasive species will be introduced into and go undetected in Poskin Lake.
- Promote and support nearshore, riparian, and watershed best management practices that will improve fish and wildlife habitat, reduce runoff, and minimize nutrient loading into Poskin Lake.
- Assess the progress and results of this project annually and report to and involve other stakeholders in planning efforts.

Specific objectives and actions associated with each goal can be viewed in Appendix A. A timeline for implementation is located in Appendix B.

APPLICATION OF AQUATIC HERBICIDES

Several herbicides are used for control of CLP in a lake. The most commonly used are liquid or granular endothall based herbicides. Another aquatic herbicide that is commonly used to treat CLP contains the active ingredient diquat. Both are considered to be contact herbicides that will kill the vegetative plant parts it comes in contact with. In some cases this may mean the root (buried in the sediment) is not entirely killed, which may allow regrowth from existing root structures. One disadvantage is that contact herbicides like diquat and endothall are not plant selective. Both will kill all plants that it comes in contact with.

It should be recognized that any aquatic herbicide will kill target and non-target species assuming either the contact time is long enough or the concentration of the herbicide applied to the water is high enough. To reduce the impacts of herbicide use on non-target plant species, these herbicides are mostly applied at times during open-water when native aquatic plant species are not actively growing – usually in the early spring. CLP usually grows earlier in the season than most native plants- often times beginning to grow prior to ice out.

If the CLP within Poskin Lake reaches a level that requires treatment, the PLA should plan to commit to yearly treatments for the next three years to effectively reduce the CLP. Chemical treatment proposals should be based on the yearly CLP surveys the results of the prior year's treatment, and input from the PLA, WDNR, and other stakeholders.

In 2019, the PLA, under the guidance of Lake Restoration, Inc., completed a chemical treatment for CLP in Bed 3 (Figure 34). At the time, the most recent management plan had been completed in 2010, so there was no current plan to guide this management. Bed 3 is both a WDNR designated sensitive area and an area frequented by anglers due to the vegetation present in that area. Due to these factors, chemical management should not be continued in this area in the future unless the CLP reaches the conditions presented below in Objective 2 of Goal 1.

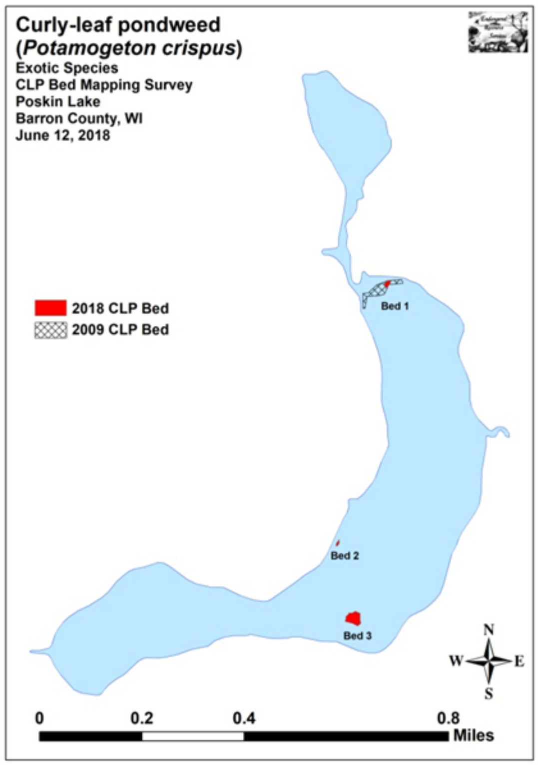


Figure 34: 2018 Curly-leaf Pondweed Bed Mapping

AQUATIC PLANT HARVESTING

Harvesting plans will be designed to enhance both the ecological balance and recreational uses of the lake. For Poskin Lake, this means no harvesting should be completed in the areas that support wild rice growth. Harvesting programs will be focused on improving access to the lake by creating navigation lanes for boat traffic beginning around the 4th of July holiday, unless CLP is targeted, then harvesting could begin in early June. Clear-cutting of aquatic vegetation adjacent to riparian shoreline for the purpose of creating weed free areas for swimming or other recreational purposes is not an acceptable use of the mechanical harvester and is not recommended. Landowners, however, are not prohibited from physically removing aquatic vegetation in these areas, provided guidelines presented in NR 109 are followed.

Having a plan to dispose of the vegetation harvested it extremely important for the success of a harvesting program. The PLA should reach out to membership and/or local land owners to establish a disposal location prior to beginning any harvesting.

AQUATIC PLANT SURVEYING

Poskin Lake has a healthy and diverse native aquatic plant community. It also has CLP, a potentially problematic non-native aquatic invasive species. Both native and non-native aquatic plant species need to be monitored to determine the desired and undesired impacts of management implementation. There are at least three levels of aquatic plant surveying that help better assess and understand how management actions affect the lake and the aquatic plants within it.

MEANDERING SURVEYS

Meandering surveys of the littoral zone (plant-growing zone) looking for a specific plant species like CLP are important as they generally are the first indicator that there is something that does not belong. Meandering surveys help find target plant species, document the location where target plants are found using GPS technology or general mapping, and provides an opportunity to physically remove the target plant or make it a part of another management action. Annual bed mapping of CLP is considered a meandering survey and serves to identify areas of concern for management in the following spring. The PLA will need to begin conducting annual meandering surveys each year to map out CLP beds and to survey the lake for any new AIS that may be introduced, particularly EWM.

PRE AND POST-TREATMENT POINT-INTERCEPT SURVEYS

Pre and post-treatment, point-intercept surveys are more quantifiable and document short-term changes in those areas under management. They consist of a set of points that can be surveyed at multiple times, usually before and after a chemical treatment. Statistical information can be gathered from the data collected during one of these surveys. The WDNR only requires pre and post-treatment, point-intercept aquatic plant surveying when greater than 10 acres of the littoral zone are proposed for treatment, or if a chemical treatment is grant funded. Currently, it is unlikely that chemical treatments in Poskin Lake funded by the PLA will exceed 1 acre and as a result, pre and post-treatment surveys will not need to be completed. If chemical management of any amount of CLP is funded by a grant, pre and post-treatment survey work will be completed.

WHOLE-LAKE, POINT-INTERCEPT, AQUATIC PLANT SURVEYS

Whole-lake, point-intercept surveys are intended to track changes to the aquatic plant community over time. Typically in a lake where management of aquatic plants (non-native or native) takes place, whole-lake surveys are recommended at least every five years using the same set of pre-designated points each time. The first time a whole-lake point-intercept survey is completed, the results serve as a baseline for future comparisons. After the first survey, the results from any future surveys can be compared to the first survey for changes. If any changes are identified, it is then possible to analyze what might have caused the changes. While changes naturally occur in most lakes from one year to another, management actions including management of CLP can also be a reason for change.

The last whole-lake, point-intercept survey of Poskin Lake was completed in 2018. The next whole-lake point-intercept survey will need to be completed in 2023 at the end of this current plan.

OTHER AIS MONITORING AND MANAGEMENT

In addition to monitoring and managing the CLP within Poskin Lake the PLA will participate in Citizen Lake Monitoring Network Aquatic Invasive Species Monitoring Program annually looking for Eurasian watermilfoil, purple loosestrife, zebra mussels, rusty crayfish, and other AIS not already in the lake.

COARSE WOODY HABITAT

Coarse woody habitat has never been formally quantified within Poskin Lake, but property owners around the lake would still be eligible for grant funding through the WDNR Healthy Lakes Initiative. Installations of coarse woody habitat, called fishsticks, can be partially funded with these grants. These installations are a great way to increase wildlife habitat and help reduce shoreline erosion from wave action.

POSKIN LAKE AQUATIC PLANT MANAGEMENT GOALS, OBJECTIVES, AND ACTIONS

GOAL 1:PREVENT THE EXPANSION OF CURLY-LEAF PONDWEED IN POSKIN LAKE.

An integrated approach to management including physical removal and the limited use of herbicides will be implemented between 2020 and 2024 to prevent CLP growth from reaching one acre of total coverage or a rake density of 2. CLP management actions will be completed in ways proven to cause the least harm to non-target plant species.

OBJECTIVE 1: DOCUMENT CHANGES IN CLP DISTRIBUTION AND DENSITY IN POSKIN LAKE.

Action Item: PLA volunteers will complete lake-wide CLP bedmapping in mid to late June each year to compare annual changes.

Action Item: The PLA will hire a specialist to complete a cold-water, CLP, point-intercept survey in 2023 and compare to results from the 2018 survey.

OBJECTIVE 2: REDUCE THE CURRENT (2018) DISTRIBUTION AND DENSITY OF CLP IN POSKIN LAKE TO THE POINT WHERE THERE ARE NO BEDS >1 ACRE IN SIZE WITH A RAKEHEAD DENSITY OF 3.

Action Item: The PLA and individual property owners will complete small-scale, manual removal of CLP in nearshore areas.

Action Item: The PLA will implement a 3-yr chemical treatment plan that in areas that meet or exceed the conditions below.

Conditions:

- Areas must be ≥ 1 acre in size
- Areas must have an average rake head density of 3
- The above conditions must persist for two or more consecutive years.
- Areas surveyed by volunteers that meet conditions above will be re-surveyed by a professional plant surveyor prior to the submission of a chemical application permit.
- Pre- and post-treatment aquatic plant survey work and herbicide concentration/dispersion monitoring will be completed as instructed by the WDNR.

Action Item: As an alternative to chemical management of CLP, the PLA may implement a small-scale harvesting plan to remove dense beds of CLP of any size under the following conditions.

Conditions:

- Contracted harvesting is already being considered /implemented for later season nuisance and navigation relief and CLP harvesting would be an extension of this, or
- The PLA owns and operates its own harvesting equipment (large or small-scale), and/or
- Chemical application is either not appropriate, or not allowed

GOAL 2: REDUCE NAVIGATION AND NUISANCE IMPAIRMENTS CAUSED BY DENSE GROWTH NATIVE AQUATIC VEGETATION.

While not occurring every year or in all parts of the lake, in some years, seasonal conditions promote dense growth of native aquatic plants that do cause some level of navigation impairment or nuisance conditions that cannot be avoided. The objective associated with this goal lays out the conditions under which native aquatic plant management using small or large-scale harvesting can potentially be implemented. If the conditions below are met, the PLA can apply for a harvesting permit from the WDNR to provide some relief. Applying for a permit does not guarantee that harvesting will be allowed, but it will set in motion the steps necessary in order to implement.

OBJECTIVE 1: INCREASE USABILITY OF THE LAKE WHILE MINIMIZING DAMAGE TO THE NATIVE ECOSYSTEM.

Action Item: When conditions below are met, apply for a native plant harvesting permit to maintain 20-ft navigation lanes in the lake (Appendix D).

Conditions:

- Lanes will have native plant densities that cause moderate or severe navigation impediment as determined by a professional aquatic plant surveyor.
- Wild rice is not impacted
- Harvesting is limited to water 3-ft or deeper
- Cutting depth will be no deeper than 2/3 of the water column
- Dump sites for harvested plants must be identified and approved by the WDNR before any harvesting can be completed.

GOAL 3: MAINTAIN OR IMPROVE CURRENT (2018) MEASUREMENTS OF THE HEALTH OF THE NATIVE AQUATIC PLANT COMMUNITY IN POSKIN LAKE.

A lake's native plants are the basis of the aquatic ecosystem. They capture the sun's energy and turn it into usable food, "clean" the water of excess nutrients, and provide habitat for other organisms like aquatic invertebrates and the lake's fish populations. Because of this, preserving them is critical to maintaining the lake's overall health.

The Poskin Lake ecosystem is home to a somewhat limited plant community that is typical of high-nutrient lakes with fair to poor water quality. This community can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent) with each zone having its own characteristic functions in the aquatic ecosystem. Depending on the local bottom type (sand, rock, sandy muck or nutrient-rich organic muck), these zones often had somewhat different species present.

Northern wild rice, a plant of significant wildlife and cultural value, is present as scattered individual plants throughout Little Poskin and in the channel leading to the main lake. The total rice population on the lake is at a couple hundred plants, and in 2018, there weren't any areas that were big enough or dense enough that they would offer profitable human harvest. Wild rice has many other benefits including providing food for wildlife, holding loose sediment in place, and using up available nutrients in the water. Because of both the ecological and cultural benefits provided by wild rice, it is a protected species in the State of Wisconsin, so no harvesting will occur in the areas where wild rice is currently or historically has been found.

OBJECTIVE 1: COMPARE MEASUREMENTS OF THE HEALTH OF THE NATIVE AQUATIC PLANT COMMUNITY IN POSKIN LAKE PRIOR TO AND AFTER A MULTI-YEAR AQUATIC PLANT MANAGEMENT PROJECT.

Action Item: The PLA will hire a specialist to complete a summer, whole-lake, littoral zone, point-Intercept Survey in 2023 and compare results to previous whole-lake, point-intercept survey results in 2018.

Action Item: The PLA will monitor and map known wild rice populations annually and survey the entire shoreline/littoral area for wild rice in 2020, 2022, and 2024.

GOAL 4: MONITOR CHANGES IS WATER QUALITY.

The Poskin Lake Association is already participating in the CLMN expanded monitoring program for water quality. Prior to 2019, the PLA had not completed any aquatic plant management, so changes in water clarity and quality were not directly driven by management actions implemented. Beginning in 2019, the PLA did start management of CLP. Although it is not expected that management actions taken will negatively impact water clarity or quality, monitoring to confirm that is important.

OBJECTIVE 1: MAINTAIN OR IMPROVE MEASUREMENTS OF WATER QUALITY IN POSKIN LAKE INCLUDING SECCHI, TEMPERATURE, DISSOLVED OXYGEN, TOTAL PHOSPHORUS, AND CHLOROPHYLL A.

Action Item: The PLA will continue to participate in the expanded level of the Citizen Lake Monitoring Network (CLMN).

GOAL 5: REDUCE THE THREAT THAT NEW AQUATIC INVASIVE SPECIES WILL BE INTRODUCED INTO AND GO UNDETECTED IN POSKIN LAKE.

Poskin Lake is at risk of new AIS, particularly EWM, being introduced in the lake. The PLA will begin to implement a watercraft inspection program according to WDNR/UW-Extension Lakes protocol. This program will either be volunteer-based, or paid for by the PLA through a small-scale CBCW grant. Watercraft inspection data will be entered into the WDNR SWIMS database annually.

Appropriate AIS signage will be maintained at the public access on Poskin Lake to improve the AIS awareness of many lake users.

AIS monitoring will be completed to monitor for possible new AIS following WDNR/UW-Extension Lakes protocol through the Citizen Lake Monitoring Network (CLMN) AIS Monitoring Program. Zebra mussels, spiny waterflea, hydrilla, banded mystery snails, and other species will be watched for and survey data entered into the WDNR SWIMS database annually.

OBJECTIVE 1: COMPLETE WATERCRAFT INSPECTION TIME ANNUALLY AND MAINTAIN APPLICABLE AIS SIGNAGE AT THE TWO POSKIN LAKE BOAT LANDINGS TO EDUCATE BOATERS AND OTHER LAKE USERS ABOUT AIS AND HOW THEY ARE TRANSFERRED FROM LAKE TO LAKE.

Action Item: The PLA will implement a Clean Boats, Clean Waters programs annually with a goal of up to 200 hours or more between the two landings.

Action Item: The PLA will inspect, maintain and/or improve AIS signage at all landings annually.

OBJECTIVE 2: LOCATE AND IDENTIFY ANY NEW AIS THAT MAY BE INTRODUCED TO POSKIN LAKE AS EARLY AS POSSIBLE.

Action Item: The PLA will implement an AIS Monitoring Program annually following guidelines provided by the Citizen Lake Monitoring Network.

OBJECTIVE 3: INCREASE OPPORTUNITIES FOR THE PLA CONSTITUENCY, PROPERTY OWNERS, VISITORS, AND OTHER LAKE USERS TO BE MADE AWARE OF AND LEARN ABOUT AIS.

Action Item: The PLA will annually distribute AIS education and identification materials to PLA constituency via newsletters, with social media outlets, at local businesses and during meetings and other events attended by PLA members.

Action Item: The PLA will plan and implement at least one event/opportunity annually for the PLA constituency and other community members to learn how to look for and identify AIS; learn who to report new findings too; and learn how to properly remove what they find from the lake.

OBJECTIVE 4: DETERMINE A PLAN OF ACTION TO FOLLOW IF A NEW AIS IS DISCOVERED IN POSKIN LAKE.

Action Item: The PLA will develop, maintain, and update as necessary, a formal AIS Rapid Response Plan in the first year covered by this plan.

GOAL 6: PROMOTE AND SUPPORT NEARSHORE, RIPARIAN, AND WATERSHED BEST MANAGEMENT PRACTICES THAT WILL IMPROVE FISH AND WILDLIFE HABITAT, REDUCE RUNOFF, AND MINIMIZE NUTRIENT LOADING INTO POSKIN LAKE.

An important part of controlling undesirable aquatic plant growth and the production of algae is reducing the amount of nutrients (mainly phosphorus) that enters the lake. The PLA will promote and encourage the implementation of simple and generally inexpensive best management practices including but not limited to shoreland buffers and the installation of rain gardens to reduce nutrient loading from the nearshore area.

Trees and other vegetation that naturally fall into a lake or that is intentionally placed in the lake by permit, is known as coarse woody habitat (CWH). CWH provides many benefits to fish and wildlife. Like aquatic vegetation, CWH is essential to the overall health of a lake and should be protected and enhanced, not eliminated. The PLA will provide information about and encourage property owner participation in protecting and/or enhancing CWH.

OBJECTIVE 1: ADOPT STATE OF WISCONSIN HEALTHY LAKES INITIATIVE.

Action Item: Apply for at least one Wisconsin Healthy Lakes Initiative Grants over the next five years to support projects that will improve fish and wildlife habitat and reduce runoff into Poskin Lake in the next five years.

GOAL 7: ASSESS THE PROGRESS AND RESULTS OF THIS PROJECT ANNUALLY AND REPORT TO AND INVOLVE OTHER STAKEHOLDERS IN PLANNING EFFORTS.

This APM Plan is not intended to be a static document, but rather a plan that makes room for management changes that still fall under the guise of the stated goals, but that may make attaining those goals easier and more efficient. Management actions implemented in each year of this plan will be evaluated for how well they helped meet stated goals and objectives. Small changes will be made automatically if it is determined they will improve outcomes. Larger management changes will be presented to the PLA, WDNR, and other Stakeholders for approval before implementation.

An end of project report summarizing the success and failures after five years of management will be completed. This report will be completed by the PLA and its retainers and shared with property owners, lake users, WDNR, and other Stakeholders. A whole-lake, summer, PI, aquatic plant survey will be completed following the last year included in this plan (2023) following the same procedures that were used in the past PI surveys. Results from all PI surveys will be compared to each other with the results leading to development of the next five years of aquatic plant management in Poskin Lake.

OBJECTIVE 1: BUILD AND SUPPORT NEW AND EXISTING PARTNERSHIPS EACH YEAR.

Action Item: The PLA will communicate with local, county, and state entities; schools and local business; clubs and organizations, etc. to generate support for management actions.

OBJECTIVE 2: COMPLETE ANNUAL PROJECT ACTIVITY AND ASSESSMENT REPORTS.

Action Item: The PLA and their Consultant will prepare end-of-year reports summarizing the management actions completed and how they impacted the lake and share/review them with the PLA constituency, partners, and the WDNR.

OBJECTIVE 3: PROVIDE MULTIPLE OPPORTUNITIES AND VENUES ANNUALLY FOR LAKE RESIDENTS, USERS, AND OTHER PARTNERS TO KEEP INFORMED ABOUT MANAGEMENT PLANNING AND IMPLEMENTATION ACTIVITIES.

Action Item: The PLA will distribute annually management planning and implementation information to PLA constituency via newsletters, with social media outlets, at local businesses, and during meetings and other events attended by PLA members.

IMPLEMENTATION AND EVALUATION

This plan is intended to be a tool for use by the PLA to move forward with aquatic plant management actions that will maintain the health and diversity of Poskin Lake and its aquatic plant community. This plan is not intended to be a static document, but rather a living document that will be evaluated on an annual basis and updated as necessary to ensure goals and community expectations are being met. This plan is also not intended to be put up on a shelf and ignored. Implementation of the actions in this plan through funding obtained from the WDNR and/or PLA funds is highly recommended. An Implementation and Funding Matrix is provided in Appendix B. A Calendar of Actions is provided in Appendix C. A sample harvesting plan for navigational purposes is included in Appendix D.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES GRANT PROGRAMS

The Aquatic Invasive Species (AIS) Prevention and Control grants are a cost-share effort by the DNR to provide information and education on types of existing and potential aquatic invasive species in Wisconsin, the threats that invasive species pose to the state's aquatic resources, and available techniques for invasive species control. These grants also assist in the planning and implementation of projects that will prevent the introduction of invasive species into waters where they currently are not present, controlling and reducing the spread of invasive species from waters where they are present, and restoring native aquatic communities.

There are five AIS Prevention and Control grants subprograms:

- Education, Prevention and Planning Projects (including Clean Boats Clean Waters)
- Early Detection and Response Projects
- Established Population Control Projects
- Maintenance and Containment Projects
- Research and Demonstration Projects

Several of these subprograms are applicable to Poskin Lake and the Poskin Lake Association.

EDUCATION, PREVENTION AND PLANNING PROJECTS

Education projects are intended to broaden the public's awareness and understanding of, and ability to identify, AIS; the threats that AIS pose to the health of aquatic ecosystems; the measures to prevent the spread of AIS; and the management practices used for control of AIS. Prevention projects are intended to prevent the introduction of new AIS into a waterbody/wetland, or prevent the spread of an AIS population from one waterbody to another unpopulated waterbody/wetland. Planning projects are intended to assist in the development of plans for the prevention and control of AIS. Eligible projects include:

- Educational programs including workshops, training sessions, or coordinated volunteer monitors. Projects will be reviewed for consistency with the DNR's statewide education strategy for controlling AIS including the use of existing publications and outreach materials.
- Development of AIS prevention and control plans
- Monitoring, mapping, and assessing waterbodies for the presence of AIS or other studies that will aid in the AIS prevention and control.
- Watercraft inspection and education projects following the guidelines of the DNR's Clean Boats, Clean Waters program.

This subprogram is not intended to provide support for any management action that may be taken.

ESTABLISHED POPULATION CONTROL PROJECTS

Established population control grants are intended to assist applicants in eradicating or substantially reducing established populations of AIS to protect and restore native species communities. Established populations are defined as substantial reproducing populations of AIS that are not pioneer populations. Eligible projects include activities recommended in a DNR-approved control plan including monitoring, education, and prevention activities. Ineligible projects include the following:

- Dredging
- Chemical treatments or mechanical harvesting of aquatic plants to provide single season nuisance or navigational relief.

- Maintenance and operation of aeration systems and mechanical structures used to suppress aquatic plant growth.
- Structural facilities for providing boat washing stations. Equipment associated with boat washing facilities is eligible if included in a management plan.

MAINTENANCE AND CONTAINMENT PROJECTS

Maintenance and containment grants are intended to provide sponsors limited financial assistance for the ongoing control of established AIS population without the assistance of an Established Population Control grant. These projects are intended for waters where management activity has achieved the target level of control identified in an approved plan that meets the criteria of s. NR 198.43, Wis. Adm. Code. Ongoing maintenance is needed to contain these populations so they do not re-establish throughout the waterbody, spread to other waters, or impair navigation and other beneficial uses of the waterbody.

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Appendix A

Poskin Lake APM Plan Goals, Objectives, and Actions

Appendix B

Poskin Lake APM Plan Implementation Matrix

Appendix C

Poskin Lake APM Plan Calendar of Actions

Appendix D

Poskin Lake Sample Harvesting Map