Potters Lake

Aquatic Plant Management Plan, 2017

CHAPTER I - INTRODUCTION

Potters Lake is a 162 acre lake located in the Town of East Troy, Walworth County, Wisconsin. The lake has an average depth of 8 feet and a maximum depth of 26 feet. Potters Lake has a watershed area of 659.2 acres with a low (4.1:1) lake surface to watershed ratio. Lakes with low ratios are typically found to have better than average water quality because there is less opportunity for negative impacts from nonpoint source pollution problems. The lake and its watershed are part of the Honey-Sugar Creek Priority Watershed Project.

The Potters Lake Protection & Rehabilitation District (District) was created in 1975 to provide a stable taxing authority to fund aquatic plant management and other activities to improve Potters Lake. The District generally encompasses the shoreline area around Potters Lake. Aron & Associates was contracted in 2015 to conduct an aquatic plant survey and update the Potters Lake Aquatic Plant Management Plan.

WHY BOTHER?

Some may ask why aquatic plant management, and plant management planning, are important. Some say just cut it, or just spray it, or just pull it out.

Some answers to this question are more obvious than others:

- Recreational use impairments because of a nuisance plant condition, lead to pressures by constituents to "do something".
- Anglers who don’t catch fish, or can’t boat through weed masses, push for action.
- An algae problem may be extensive and smelly.
- Lake users cannot get their boats out from their piers.
- If your community wants to obtain grants to manage the nuisance conditions, a plan must first be developed to analyze the specific conditions, and possible management activities, prior to being awarded a grant.

Other answers to this question are more subtle:

- There may be significant economic impacts arising from a nuisance aquatic vegetation problem. Lakes that are popular fishing destinations may see businesses suffer as anglers stay away.
- Residential property values will decline on lakes with severe plant problems. An Army Corps of Engineering study on Lake Guntersville Alabama showed that property values declined 17% because of a Hydrilla infestation. Other studies show similar impacts on property values.
- It may be necessary to manage the lake to prevent the spread of exotic species to other lakes. This is particularly important because prevention and public education are the most successful ways to minimize the spread of exotic species.

It is necessary to manage invasive species to protect the plant diversity in the lake. Lakes with increased infestations of exotic species, lose diversity and density of native species over time. As diversity declines, the entire food chain may be affected.

Management of the nuisance speciesmay be the only way to bring the lake back into "balance".

Exotic species can completely disrupt the natural processes in the lake. Native plants are low growing while exotic plants tend to grow to the surface and form canopies. A major shift then takes place because light penetration cannot occur, stunting native plants. Another major shift takes place when the exotic plant’s canopies prevent the natural cooling effect that occurs in areas with native plant beds. When cooling and mixing are blocked, the temperature near the surface increases.

PUBLIC INTERACTION

The plant management plan was developed by Aron & Associates in cooperation with the District, the WDNR, and the public. Public input and historical records are an important part in the continual refinement of this plan. Important sources of information and comments include:

- The historical records of aquatic plant management
- Residents, board members and lake users
- Community meetings
- WDNR resource managers
- WDNR records and Southeastern Wisconsin Regional Planning Commission (SEWRPC) records

GOALS & OBJECTIVES

The goals and objectives on Potters Lake continue to focus on balancing the various uses and needs, while working to improve the long-term quality of the resource. The difficult task facing those who attempt to manage their lake is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those depending on the lake for "aesthetic viewing" desire an undisturbed lake surface.

The management of non-native plants, specifically, Eurasian watermilfoil (*Myriophyllum spicatum*), hybrid watermilfoil, curly-leaf ponweed and excessive amounts of native plants continue to be a great concern to the District. The invasive plants and very dense native plants restrict boating use in some areas of the lake. Controlling exotic plants, preventing new invasions of exotic species and protecting the diversity of the native plant population is crucial to the ecological balance of the resource.

The District desires to:

- Reduce and maintain levels of Eurasian water milfoil and hybrid watermilfoil to below 20% frequency
- Minimize fragments of aquatic plants that are caused by the high volume of boating traffic and natural processes.
- Control exotic and nuisance plant species and maintain recreation access for lake users by:
    - ◊ Use of selective chemical treatments
    - ◊ Harvesting
    - ◊ Encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by:
    - ◊ Educating landowners and lake users in lake ecology.
    - ◊ Work with the Town, County and State governments to review existing ordinances, and if necessary, develop and enforce ordinances to protect Potters Lake.
    - ◊ Continue to be vigilant regarding the watershed to protect Potters Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
    - ◊ Distributing at least 2 newsletters per year.
    - ◊ Encouraging community participation in lake management activities.

- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible:
    - ◊ Conduct year-end evaluations as to the success of plant management activities and the community reaction to the activities.
    - ◊ Track the annual progress of lake management activities.
    - ◊ Conduct water quality monitoring efforts to assist in the documention of results.
    - ◊ Develop a plan for quick response to invasive species.
- Maintain navigational access:
    - ◊ Aggressively treat Eurasian watermilfoil, hybrid watermilfoil and curly-leaf pondweed to prevent them from increasing their range in the Lake.
    - ◊ Maintain navigational access by controlling plants as necessary to maintain that access.
    - ◊ Treat filamentous algae mats on shorelines to prevent temperature increases and plant shifts, and to maintain navigational and recreational access.
    - ◊ Control vegetative mats that collect on the surface.
    - ◊ Control floating plant debris.
- Minimize the financial costs to the District by conducting projects with long-term, cost-effective results.

CHAPTER II - BACKGROUND

SHORELINE DEVELOPMENT & AESTHETIC FEATURES

Potters Lake has a small watershed of 544.63 acres (Table 1) draining into the 162 acre lake. The drainage area to Potters Lake is primarily residential land use comprising 37.4% of the drainage basin. Rural land uses are dominated by agricultural and other open space lands. The lake itself is 29% of the watershed. The District has acquired some of the wetlands in the watershed, and is working to improve runoff from the agricultural lands in the watershed, specifically lands to the East.

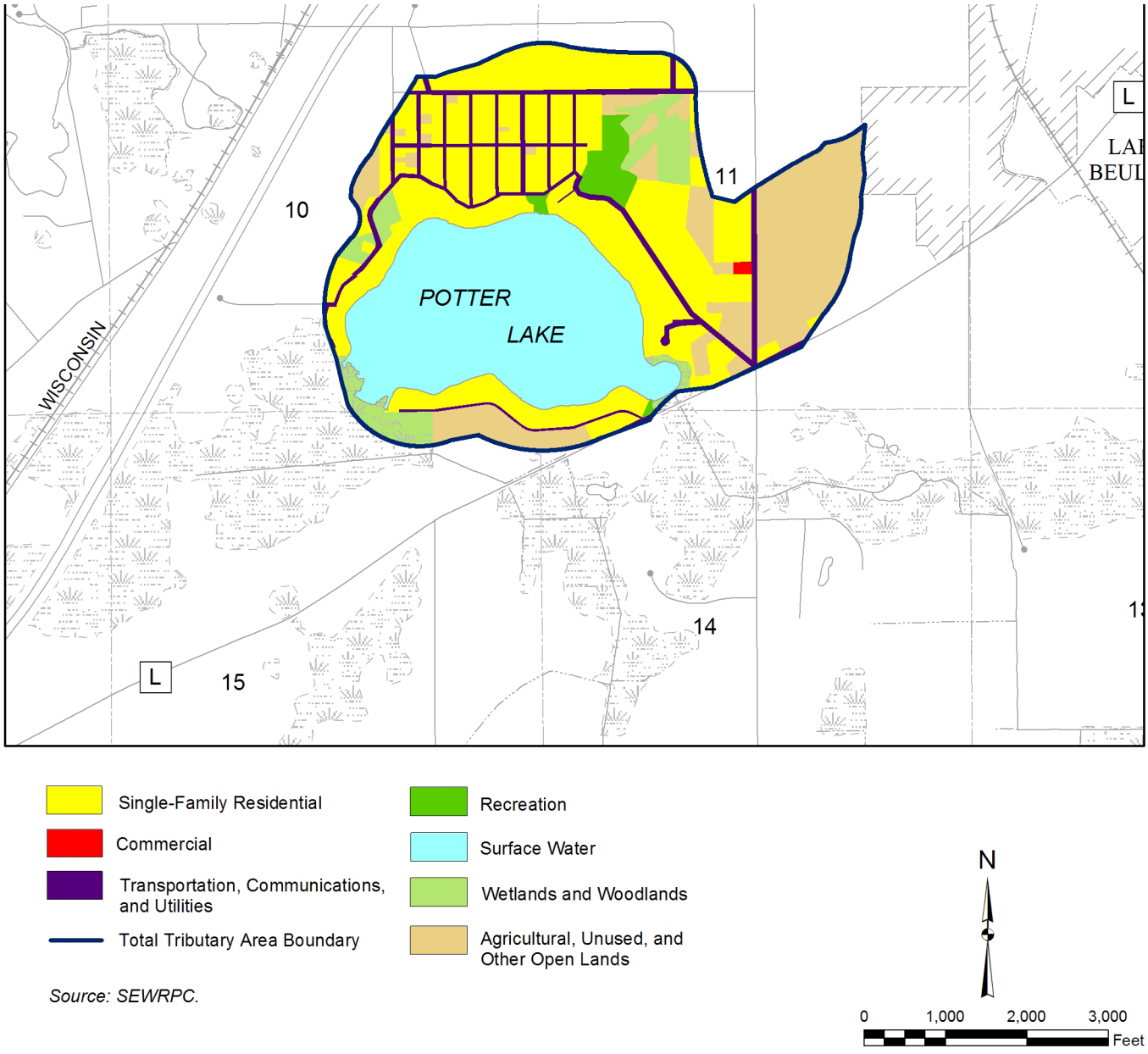


Figure 1 Land Use in Potters Lake Watershed

The potential development of rural lands in the watershed elevates the importance of stormwater runoff management and non-point source pollution for protection of water quality in lakes. Increases in impervious surfaces, runoff from construction sites, urban roads and parking lots, can all have devastating impacts on the quality of lakes. The negative impacts then lower the quality of life in a community centered around the lakes. These changes do not occur overnight and usually take years, even in the worst of situations. This time lapse increases the likelihood that the signs of damage are overlooked, minimized, or ignored.

Table 1. Land Use in the Potters Lake Watershed, 2008 (Source: SEWRPC)

Land Use	Acres	%
Residential	203.91	37.4
Commercial	.76	0.1
Agricultural	102.51	19.8
Recreational	12.01	2.2
Governmental/Transportation	35.26	6.5
Wetlands	9.72	1.8
Woodlands	21.88	4.0
Surface Water	158.57	29.1
TOTALS	**544.63**	**100.00**

Land use activities directly affect the chemical and biological components of a lake, as well as the plant growth patterns. To see a small sampling of negative impacts, it is helpful to look at lakes with storm drain outlets or inlet areas, where it is possible to see the more concentrated effects of rural and urban impacts. Often, the lakebed area near storm drains and inlets have different plant and sediment characteristics than other areas of the lake bottom. The runoff from individual homesites, development, and agricultural lands adds to the nutrients and sediments in a lake. That in turn increases the plant growth, sometimes to nuisance conditions. Nutrients, sediments and other materials entering the lake can severely impact the plants, fish and wildlife. Lower oxygen levels, fish kills, and sedimentation of spawning beds can result. Lake use activities, such as skiing and boating, that are conducted in areas of a lake with insufficient depths, can also result in the disruption of sediments. Education of the general public, especially the lake front property owners and landowners in the watershed, should focus on activities to minimize impact on the lake.

Although individual interpretations of aesthetics vary, the protection of the aesthetic qualities on the lakes' shorelines not only provide more natural views from on the water, but may also improve the quality of the resource when native, deep-rooted vegetation exists rather than manicured, fertilized lawns. Natural shorelines are also a natural deterrent to geese. Tall vegetation is less attractive to geese, who prefer neatly manicured lawns.

The quiet water adjacent to natural shorelines and wetland complexes, provide refuge for fish, wildlife and humans seeking an area for quiet reflection. Steeply-sloped lands extend into steeply-sloped lakebeds. These steep shorelines can also become significant problems for the lake. Disturbances by residents can result in serious erosion if preventative steps are not taken.

Environmental corridors in the watershed provide benefits that are vital to maintaining a good quality of life. Some of these benefits include recharging the groundwater, maintenance of the groundwater and surface water quality, reduction of soil erosion and protection of plant and animal diversity.

Expanding urban densities are mirrored by increased demands and increased impacts on the lakes. Often the water quality of the lakes decline as development and recreational use increases. There are however, tools available for communities to minimize the negative impacts. These include stormwater management plans and ordinances; protection of green space; erosion control plans and ordinances; and lake use zoning.

For Potters Lake, with the exception of wetland areas on the Southeast and Southwest, most of the shoreline is already developed. The small watershed has very few areas of agricultural or open space lands. The largest area is on the East side of the lake and is currently being farmed. The District has worked extensively with the Walworth County Land Conservation office to reduce problems from the watershed.

The critical direct runoff area enters Potters Lake on the Southeast end of the lake in what is referred to as the Boat Launch Bay. This area drains a large farmfield to the East that is sloped farmland. The runoff from the sloped land passes across a small, 5-acre section of land that had been cropped. Working with the Land Conservationist and the farmer, the land is no longer being cropped this has reduced the amount of sediment entering from the East, primarily during low flows.

According to the Brian Smetana, Walworth County LURM:

> *The field had a previous soil loss of 2.8 tons per acre per year with an average PI index of 2. With the field in hay there is basically no soil loss with a PI of 0, meaning no phosphorus input. PI is the Phosphorus index of the delivery of Phosphorous to a water body based on soil test, crop rotation, tillage used, distance to water body and slope to water body. It is calculated using the SNAP Plus program developed by UW Wisconsin.*
>
> *The farmer is leaving more residue on the sloped acreage, and is adding cover crops to the rotation so there should be a load reduction on those fields.*

The planting of the 5-acre field has resulted in a reduction of 10 pounds of phosphorus per year. Although the sloped land is still being farmed, discussions are ongoing about how to continue to reduce sediment erosion from the field.

Table 2. Hydrography and Morphology of Potters Lake
Walworth County, Wisconsin, 2016

Area	162 acres
Maximum length	4,200 feet
Maximum width	2,700 feet
Shoreline length	2.2 miles
Shore development factor*	1.23
Watershed area(including lake)	659.2 acres
Maximum depth	26 feet
Mean depth	8 feet
Volume	1304.2 acre feet
Area less than 3 feet deep	19%
Area greater than 20 feet deep	5.5%
Public frontage, boat launch	100 feet

* Shore development factor is defined as the ratio of shoreline to the circumference of a circle with the same area as the lake.

Sources: USGS, SEWRPC, WDNR

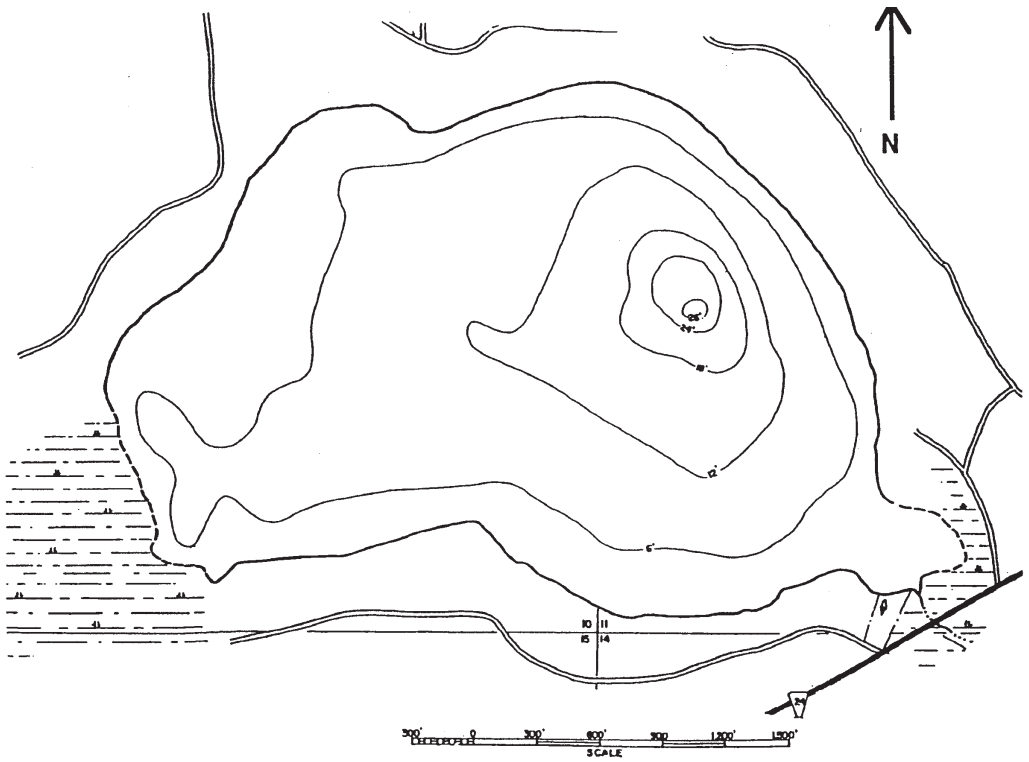


Figure 2 Potters Lake

ACCESS LOCATIONS

Potters Lake meets the WDNR standards for public access to an inland lake. One public access site is on the Southeast end of the lake and is owned and managed by the WDNR.

SENSITIVE AREAS

The level of development around lakes and the amount of recreational use lakes receive often diminish the value of the resources to fish and wildlife. Often, people tend to underestimate the affect they have on the rest of their environment. The effect can be significant. Wildlife will avoid areas frequented by boats and noisy lake users. Waves from the continuous use of watercraft can erode shorelines and drive furbearers from their nests. Neatly manicured urban lawns do not protect shorelines from the corrosive action of waves, nor do they provide wildlife with shelter or shade. Retaining walls do not provide areas for small invertebrates that are an essential element in the food supply for fish. Spawning areas can be disrupted by propellers or personal watercraft. Migrating birds and waterfowl seek quiet resting places or nesting areas. Aquatic vegetation stabilizes soft sediments, preventing them from becoming resuspended into the water column because of wind or boating. The natural cover, native plants, and minimal interaction with humans in these areas should be preserved.

In March 1989, the State enacted legislation to protect special or "Sensitive" lake areas from some negative impacts. The WDNR was charged to administer an aquatic nuisance control program which includes Sensitive Area Designation. Administrative Code NR 107 and NR 109 provide the guidance used to administer the WDNR's aquatic plant manage-ment (APM) program. The APM program seeks to protect native vegetation that is important to fish and wildlife. The WDNR may restrict activities that would prove detrimental to the native plants. These restricted activities may include dredging, filling, shoreline alterations or sand blankets. Many plant management activities are now regulated by the state. Administrative rules require permits for activities including chemical treatment, aquatic plant harvesting, native species re-introductions, among others.

The WDNR has not conducted a Sensitive Area designation on Potters Lake. Wisconsin Admin. Code 107 defines Sensitive Areas as those "offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water". These include valuable and diverse aquatic plant communities that support fish, riparian wetland areas, spawning habitat, and habitat for waterfowl.

Environmentally diverse areas on Potters Lake include the Southeast bay near the boat launch and the wetland fringe on the Southwest end of the lake. The Southeast bay, commonly called the boat launch bay, has a fringe of water lilies, with the open water area dominated by watermilfoil and elodea (*Elodea canadensis*). The Southwest wetland fringe is bordered by a cattail fringe with chara, elodea and Eurasian watermilfoil. Diverse aquatic vegetation stabilizes soft sediments, preventing them from becoming re-suspended into the water column by wind action or boating activities. The natural cover, native plants, and minimal interaction with humans in these areas should be preserved. Controlling invasive species and allowing the native aquatic plants to compete will help keep invasions of exotic plant species to a minimum and reduce management.

FISH AND WILDLIFE

Potters Lake is considered a good quality fishing lake that supports both predator and panfish populations. Predator fish include northern pike, grass pickerel and largemouth bass. Panfish include crappie, bluegill, pumpkinseed, rock bass, and yellow perch (WDNR).

The high degree of development of the lakeshore and the lack of extensive natural shoreline limit the areas that are available for spawning and nursery habitat. The native aquatic vegetation is important to provide the fisheries with spawning and nursery areas. Protection of emergent vegetation such as rushes, sedges, and cattails should be pursued to improve spawning habitat available for game fish. Wildlife's use of the area is limited because of the developed shoreline and lake use levels. Waterfowl frequent the lake primarily during spring and fall migration, when residential lake use is low. According to Luke Roffler, the WDNR Senior Fisheries Biologist:

> *DNR Fisheries Management staff completed a late spring electrofishing survey of Potter Lake on April 26, 2016. The survey targeted bass and panfish, though other species were also captured incidentally. Largemouth bass catch rate (20.0/mile) was within expectations, whereas size structure (15.5" average, 20.0" max) was much better than expected. Bluegill were the primary panfish sampled, with a catch rate of 110.0/mile and a relatively small size structure (5.0" average, 6.5" max). Pumpkinseed were the next most abundant panfish in the sample (22.0/mile, 5.0" average, 6.0" max). Yellow perch and black crappie were also captured in lower numbers. Other bycatch included 10 northern pike (18.5" average, 22.5" max) and a single 22.5" walleye.*
>
> *Recent stocking in Potter Lake has focused on northern pike to provide a popular fishing option and to maintain top predator pressure on the bass and panfish populations. Stocking is supposed to occur every other year, but production limitations have led to an inconsistent pike stocking history for Potter Lake. A total of 269 large fingerling pike were stocked in 2015 (8.9" average) and another 465 are scheduled for 2017.*

Table 3. Fish Stocking on Potters Lake, source: WDNR

Year	Fish Species	Quantity	Average Length
1999	Northern Pike	324	7.2"
2001		520	7.6"
2005		520	8.5"
2013		257	8.9"
2015		269	8.9"

A problem facing many lakes in Southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different sub-species than the migratory goose and they cause significant problems, both for residents and for the water quality of the lake. The non-migratory geese remain in the area year-round. They especially like mowed lawns and open water, making lakeshore areas prime targets. People often enjoy watching a few of the geese, espcially when there are gosslings, but the problems arise as the numbers increase. Non-migratory Canadian geese are present on Potters Lake. A program sponsored by the USDA to remove non-migratory Canadian geese has only been used a couple of times on the lake. Because of the increasing numbers of non-migratory Canadian geese, another roundup should be conducted.

WATER QUALITY

Water quality impacts many aspects of a lake. Excessive nutrients contribute to the growth of plants and algae. The types and densities of aquatic plants and algae affects water clarity, fisheries, and lake use. Suspended sediment that enters a lake also carries nutrients that contribute to water quality problems.

Collection of water quality data is a very important tool for lake managers. The information is critical to document changes in the lake over time, the impact of ongoing management activities, and the planning of future management actions. Water quality in a lake changes over time, so it is important to undertake and maintain a monitoring program.

Based on the limited data available (included in the Appendix), Potters Lake is considered to be a mesotrophic lake, that is, a lake with moderately clear water, with a possibility of low dissolved oxygen in the deep parts of the lake during the summer. Trophic state lake monitoring data for Potters Lake is available for review on the WDNR website by going to http://dnr.wi.gov/lakes. Information on the site may be downloaded, printed, or reviewed online.

The US Geological Survey is now conducting water quality monitoring. The District should entertain discussions to make the monitoring a part of their long term activities.

Total Phosphorus

Total phosphorus concentrations on Potters Lake exceed the minimum levels needed to support periodic nuisance algae blooms. In their regional water quality management plan for lakes in the region, the Southeastern Wisconsin Regional Planning Commission recommended water quality standard is 0.02 milligrams per liter (mg/L).

Total phosphorus in Potters Lake increased slightly after the first whole-lake treatment, but significantly after the second treatment. Because of unusual conditions, the Eurasian watermilfoil was extremely dense, and filled the entire water column just prior to the treatment. The change in nutrient levels in the lake may have been in response to the release of all the nutrients during the decomposition of so many plants. Nutrient levels in Potters Lake appear to have returned to the levels seen after the first whole-lake treatment and slightly higher than prior to the 1997 whole-lake treatment (2016 preliminary data)

Chlorophyll A

Chlorophyll A levels are more variable than total phosphorus concentrations. Chlorophyll A levels in 2016 returned to levels similar to those seen those after the first whole-lake treatment, however, there is not enough long term data prior to the whole-lake treatments to know if levels are higher as a result of the whole-lake treatments.

Secchi

Clarity in Potters Lake is usually between 2 to 6 feet. The clarity found in 2016 is consistent with that seen over the years. In shallow lakes, this is not unusual. Wind, waves, and boating can stir up bottom sediments. Those sediments can take days to settle out. For more information on Shallow Lake Ecology contact your WDNR Lake Specialist.

It is very important to continue to collect long term trend water quality data in order to better identify whether trend lines are improving or declining. Even though it is costly, the District is encouraged to commit to a long-range monitoring program.

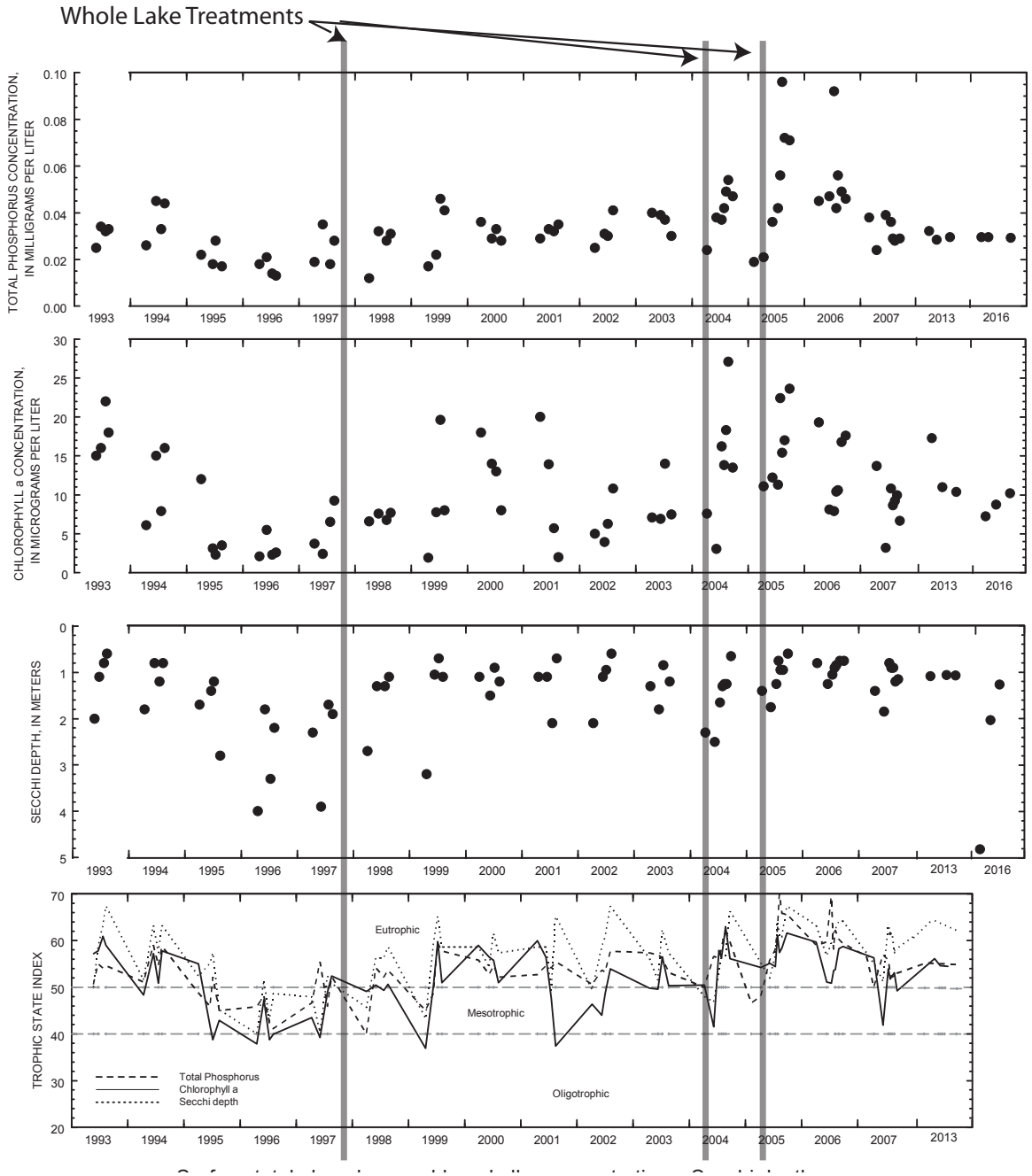


Figure 3 Surface Total Phosphorus, Chlorophyll A Concentrations, Secchi Depths, TSI Data, and Whole Lake Treatment Dates for Potters Lake, 1993 through 2007, 2016*

*1993 - 2007 USGS
2013, DNR
2016 USGS draft data.

EXOTIC SPECIES

During an aquatic plant survey in 2016, Potters Lake was evaluated for exotic species. Curly-leaf pondweed, Eurasian watermilfoil, hybrid milfoil, zebra mussels and purple loosestrife were present in and around Potters Lake. A hybrid watermilfoil was documented in Potters Lake. Starry Stonewort has not yet been found in Potters Lake. A WDNR fact sheet in the Appendix shows the restricted aquatic invasive species in Wisconsin.

Exotic plant species do not provide the benefits the native plant species provide. Exotic plant species tend to be more dense, and often grow to the surface where they interfere with recreational uses. Some exotic plant species will create 'canopies' that prevent light from reaching native plants underneath. These canopies also raise the temperature of the water beneath the canopies.

Purple loosestrife is an exotic perennial wetland herb that is present around Potters Lake. It is a prolific seed-producer that grows 3 to 7 feet tall, with purple flower spikes that bloom from July to September. This plant can quickly invade wetlands, crowding out more beneficial, native plants.

Zebra mussels were first found in Potters Lake and reported to WDNR in 2007, however, no further reports or samples have been provided of their presence in Potters Lake.

The District does conduct a Clean Boats Clean Water program to reduce the chances of a new invasion of exotic species.

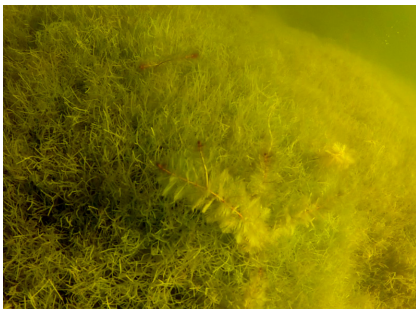


Figure 4 Strand of Milfoil in a Bed of Starry Stonewort

Figure 5 Starry Stonewort Fragments on Lakebed (note star-shaped Bulbil in center of photo)

Figure 6 One Way Invasives are Spread from Lake to Lake

Figure 7 Curly-leaf Pondweed

Figure 8 Eurasian watermilfoil

Figure 9 Purple Loosestrife

Hydrilla is a nuisance exotic plant that has not yet been located in Potters Lake, but has been found in Iowa, Indiana, and a pond in Wisconsin. The plant causes severe impairments that are very costly to combat. Regular inspections for the species should be conducted at the launch site.

Starry Stonewort is another exotic species that was initially found in Wisconsin in 2014, but has now been documented in at least 6 lakes in the state. This algae can spread rapidly and exhibits rapid growth once in a water body. Management becomes very difficult once invasive species are in a lake, so prevention is key to protecting Potters Lake.

LAKE USE

Potters Lake receives a moderate degree of recreational pressure. The majority of recreational uses are: water-skiing, personal watercrafting, scenic viewing, swimming, and fishing. Private beaches provide swimming opportunities. The lake experiences moderate lake use during weekdays. Weekends and holidays have the highest use levels on Potters Lake. Residents consider the lake to be "crowded" on weekends, but not weekdays (Aron, 1992, 1997). As traffic increases, the opportunity for use conflicts increase when those seeking a peaceful scenic vista, those desiring a speedy boating experience, and those looking for game fish all seek to use the same area at the same time.

BOATING ORDINANCE

The Town of East Troy has a local boating ordinance that is in force on Potters Lake. The Town operates a lake patrol, however, most of the actual patrol time is spent on neighboring Lake Beulah. Patrol on Potters Lake is on a complaint basis. Enforcement of the boating ordinance should be a priority in the community to protect the public safety and minimize use conflicts.

CHAPTER III - AQUATIC PLANTS

BACKGROUND

Aquatic plants are very important to the health of a lake. They provide food and cover for fish and wildlife. They also contribute to dissolved oxygen production. Invertebrates which fish depend on for food, spend much of their life cycle on or near plants. Young fish and wildlife use plants for shelter and protection from predators. Plants also stabilize sediments, helping control shoreline erosion, and turbidity. Without plants, nutrients in the water column are readily available to fuel algae blooms. Native plant beds rarely experience oxygen or pH problems that are often associated with exotic species. An aquatic plant monitoring program may also provide an early warning signal that the lake is reacting to negative impacts from the watershed. Loss of diversity or an increase in nuisance species can signal the existence of watershed problems.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish and amphibians. Exotic plant species do not provide these benefits as well as the native plant species. Exotic plant species tend to grow more densely, and often grow to the surface where they interfere with recreational uses. Some exotic plant species will create "canopies" that prevent light from reaching native plants underneath, raising water temperatures, and stressing native plants. Protection of native species is important to help reduce problems from exotic species. Just as crabgrass and dandelions are the first plant to invade a disturbed area of a backyard, exotic species like Eurasian watermilfoil are one of the first to invade disturbed sediments in a lake.

TYPES OF AQUATIC PLANTS

There are four types of aquatic plants: emergents, floating-leaved, submergents, and freely-floating. Emergent plants are rooted in the lakebed with the tops of the plant extending out of the water. The sediments and roots are either submersed or partially inundated with water. Common emergent species include bulrushes, cattails, and reeds. Floating-leaved plants are rooted in the lakebed and the leaves float on the waters surface. Floating-leaved plants usually have larger rhizomes. The most common of these plants are waterlilies. Floating- leaved plants are usually found in quieter, protected areas of a lake. Submergent plants grow completely submersed under the water, although flowering or seed portions may extend out of the water. These plants include pondweeds, Eurasian watermilfoil, and others. Muskgrass is an algae that is frequently discussed along with aquatic plants. Submersed plants are affected by the amount of light that can penetrate the water. Freely-floating plant species are entirely dependent on the water movement in a lake. These plants include coontail and duckweed. Freely-floating plants are found where ever the winds and water currents take them.

LITTORAL ZONE

The term littoral zone is commonly used to describe the area of the lake from the shore out to the depth where plants no longer grow. This area receives sufficient light to grow vegetation, with coarse sediments and fluctuating water temperatures. Depths of up to 11 feet are available for aquatic plant growth on Potters Lake.

Plants within the littoral zone are affected by a number of factors. Steeply sloping lake bed areas do not support the vegetation that flatter lakebed areas support. Soft sediments usually support more plants than hard sand or gravel areas. Exotic plants tend to favor soft sediments. Wind and wave action impacts plant growth.

Even the shape of the shoreline impacts plant growth. Interior bay areas of the shoreline collect sediments and debris, creating soft sediments that support abundant amounts of vegetation; while jutting shoreline areas tend to erode, sending their sediments into bays and depressional areas.

HISTORICAL PLANT MANAGEMENT

The District has conducted significant aquatic plant management activites over the years to keep Potters Lake open and available for recreational use. The District's early efforts focused on aquatic plant harvesting. As densities increased about levels that the harvesting could manage, the District switched to primarily chemical treatments, supplemented by harvesting.

Harvesting

The District began harvesting in 1976. According to historical records, vegetation has grown in depths up to 15 to 16 feet. Table 3 lists the maximum rooting depths between 1992 and 2012. Eurasian watermilfoil has been the target plant for the harvesting program since the program's inception. Many years the harvester could not keep up with the plant growth, restricting recreational use on the lake and creating significant shoreline maintenance for landowners. The use of a harvester has been integral to the control of aquatic plants in Potters Lake.

Chemical Treatment

The District has conducted agressive chemical treatments over the years, from the standard shoreline treatments to demonstration whole-lake treatments.

In September 1997, Potters Lake conducted its first whole-lake treatment using Sonar® with the active ingredient Fluridone. The treatment was expected to control 80% of the Eurasian watermilfoil. Forty-nine quarts of Sonar A.S. was applied in a single treatment via subsurface injection to achieve a level of 14 ppb over the entire lake. Because the treatment was a demonstration project, multiple-year water quality monitoring, and aquatic plant monitoring were also part of the project. As Eurasian watermilfoil re-entered the lake, spot treatments were conducted with 2,4-D to minimize the nuisance and to extend the life of the whole-lake treatment. The 1997 project controlled Eurasian watermilfoil completely for two years, and at more than 95% for the third year.

By 2004, Eurasian watermilfoil had returned to 100% frequency. A second whole-lake treatment was conducted in May 2004. That spring, Eurasian watermilfoil growth was explosive. The plants reached the surface in most of the lake by May before the treatment could be conducted. The lake was treated May 5, 2004 with a target fluridone concentration of 6 ppb. The significant amount of biomass led to a drop in measured fluridone concentrations, so the lake was retreated on June 11, 2004. Sonar was applied at 2.15 ppb to bring the lake back up to the target of 6 ppb. Some small plants remained during the summer survey. The material supplier warrantied the treatment, and the lake was retreated in spring 2005. On May 6, 2005 the lake was treated at a concentration of 8 ppb. On May 24 and June 6, 2005, concentrations remained about 5 ppb. The single treatment in 2005 was sufficient to eliminate Eurasian watermilfoil from the lake, so subsequent bump treatments and the tests were not conducted.

Eurasian watermilfoil was again found in Potters Lake in 2007. WDNR denied the request to conduct spot June treatments saying it would harm surrounding plants, so an attempt was made to hand pull the plants. This change in project philosophy by WDNR led to serious delays in reaction time, allowing the nuisance to continue to spread throughout the lake. Handpulling in poor clarity conditions, and warm water conditions where the plants were easily fragmented, was not effective. The plants continued to spread. A chemical treatment was finally conducted in September 2007 when approximately 10-1/2 acres were treated with 2,4-D.

The resulting spread of the plants continued into 2008 when flooding and very high water levels prevented treatments until late in summer. Eurasian watermilfoil and curly-leaf pondweed continued to expand their range in Potters Lake. A question about whether the lake had hybrid milfoil further delayed treatments in 2011, again allowing significant expansion of watermilfoil species to take place. Potters

Lake was confirmed to have a hybrid watermilfoil strain in 2011. Because of the difficulty identifying hybrid watermilfoil in the field, subsequent surveys combine both Eurasian and hybrid watermilfoils in a single dataset. They are referred to in this report as watermilfoil.

No harvesting was conducted by the District from 2004 through 2011. In 2012, the District acquired a harvesting permit and extensively harvested throughout the year, attempting to control the nuisance conditions. Chemical treatments were also conducted to manage watermilfoil. Management goals in 2012 through 2016 targeted watermilfoil while protecting natives. Native plants expanded their range significantly in that time period. Chemical treatment has been used as needed since 2012, supplemented by harvesting.

Table 4. Herbicide Treatments on Potters Lake, 2012 - 2016

Year	Date of Treatment	Total Acres	Quantity (gals)	Concentration (ppm)	Product
2012	5/21/2012	31.2	170	2	DMA 4
	9/12/2012	45.6	180	2	DMA 4
	10/10/2012	26	141.5	2	DMA 4
2013	8/16/2013	16.3	65	2	DMA 4
2014	5/20/2014	34.7	160	2	DMA 4
	5/20/2014		12	1	Aquathol K
	8/20/2014	28.75	120	2	DMA 4
2015	6/10/2015	27	141	2	DMA 4
	6/10/2015			1	Aquathol K
2016	5/11/2016	42.9	245	2 (for 37.3 acres)	DMA 4
	5/11/2016			3 (for 5.2 acres)	DMA 4
	7/20/2016	11.4	55	2 (for 7.5 acres)	DMA 4
	7/20/2016			3 (for 2.9 acres)	DMA 4

AQUATIC PLANTS - 2016

In June 2016, Aron & Associates conducted an aquatic plant survey on Potters Lake. This survey was part of ongoing efforts to improve the quality of Potters Lake and to respond to increasing concerns regarding the aquatic plant community. The information can be used to refine aquatic plant management activities. The information may also be used by future investigators to further document changes in the aquatic plant community and evaluate the impact of plant management and lake management techniques upon the plant communities.

In 2016, the maximum rooting depth in Potters Lake was 10.75 feet. Watermilfoil (Eurasian and hybrid) and curly-leaf pondweed were the aquatic invasive plant species located in Potters Lake in 2016. Regular inspections should be conducted at launch areas and any questionable plants should be sent for a positive identification. Swift response should follow any newly-identified invasive species. No new aquatic plant species were found in Potters Lake in 2016.

Plant Survey Methodology

The methodology for the grid survey follows the methods utilized by the Wisconsin Department of Natural Resources (WDNR) in their Long Term Trend Monitoring Program and modified in recent years by WDNR Bureau of Research. Prior to the 2016 survey work, a grid based on 100 sample points was provided by WDNR and was used to survey the plant community. The sample points are shown in Figure 10. The 2016 survey was based on a new map provided by WDNR with 245 sample points, Figure 11.

The data collected are provided in the Appendix.

Other Lake Inspections

Additional lake inspections were conducted during the summer of 2016 by Aron & Associates and Marine Biochemists. Those general survey results are included in the 2016 Review of Conditions on page 23.

Table 5. Comparison of Maximum Rooting Depths, Potters Lake, 1992 to 2016

Year	Maximum Rooting Depth, ft (m)
1992	15 (4.9)
1997	14 (4.3)
1998	15 (4.9)
1999	14 (4.3)
2000	14 (4.3)
2001	10 (3.0)
2002	14 (4.3)
2003	12 (3.7)
2004	16 (4.9)
2005	12.5 (3.8)
2006	12 (3.7)
2007	9.5 (2.9)
2008	9.5 (2.9)
2009	9.75 (3)
2011	10 (3.0)
2012	10 (3.0)*
2016	10.75 (3.3)

* Based on a general survey.

Table 6. Plant Survey Methodology, 1997 - 2016

Year	Week of Survey	Survey Method		
		Line Transect	Point Intercept - 100 Points	Point Intercept - 245 Points
1997	6-22-1997	X		
1998	6-17-1998	X		
1999	6-25-1999	X		
2000	6-26-2000	X		
2001	7-2-2001	X		
2002	6-23-2002	X		
2003	7-2-2003	X		
2004	7-6-2004	X	X	
2005	7-15-2005		X	
2006	6-14-2006		X	
2007	6-13-2007		X	
2008	6-30-2008		X	
2009	7-6-2009		X	
2011	7-1-2011		X	
2016	7-27-2016			X

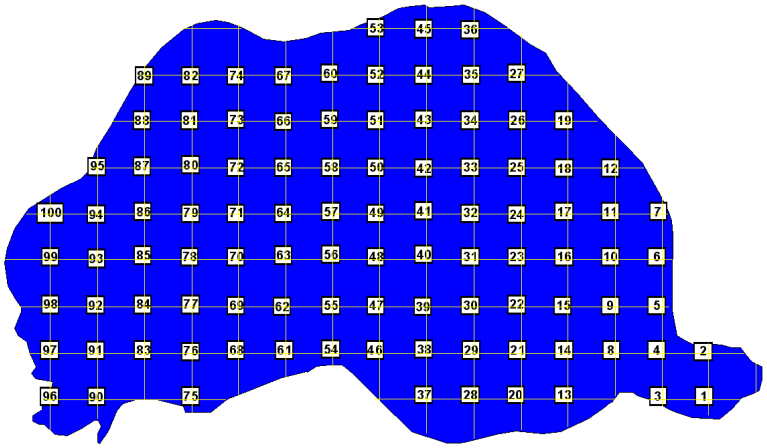


Figure 10 Point Intercept Survey Sample Points, Potters Lake, WI, 2004 through 2011.

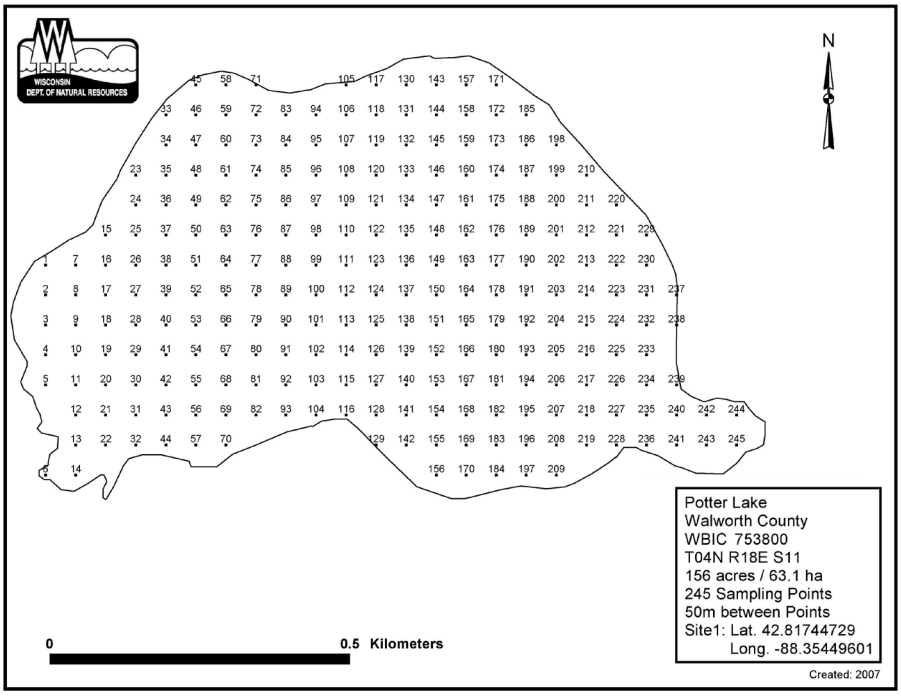


Figure 11 Point Intercept Survey Sample Points, Potters Lake, WI 2016.

Note: Over the years, the protocol for conducting surveys and analyzing the resulting data have changed. The type of survey required changed, see Table 6. Percent Frequency in Tables 7 and 8 is another change that has occurred. For years 1997 through 2009, % Frequency reflects the number of times the plant was observed compared to the total number of points. For years 2011 and 2016 % Frequency in Table 8 is the Frequency of occurrence at sites shallower that the maximum depth of plants.

Table 7. Aquatic Plant Species Observed in Potters Lake, 1997 - 2003*

	% Frequency						
Species	**1997**	**1998**	**1999**	**2000**	**2001**	**2002[a]**	**2003**
Chara sp.	62	46	68	91	96	88	52
Ceratophyllum demersum	38	41	4	4	0	5	8
Elodea canadensis	53	0	0	0	0	2	6
Lemna minor	—	—	—	—	—	—	—
Myriophyllum spicatum	99	0	0	0	0	66	56
Najas flexilis	22	0	0	0	0	0	6
Nitella sp.	—	—	—	—	—	—	—
Nuphar sp.	—	—	—	—	—	—	—
Nymphaea sp.	X	1	1	2	2	2	1
Potamogeton crispus	16	0	8	26	25	16	21
P. zosterformis	—	0	—	—	—	—	—
Stuckenia pectinata	21	19	21	76	60	55	28
Utricularia vulgaris	1	—	—	—	—	—	—
Zannichellia palustris	1	0	0	0	0	1	2
Zosteralla dubia	—	9	0		0	5	6
Total Number of Species	10	4	5	5	4	9	10

Table 8. Aquatic Plant Species Observed in Potters Lake, 2004 - 2016*

	% Frequency								
Species	**2004**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2011**	**2016**
Chara sp.	61	48	67	45	30	33	28	20	80
Ceratophyllum demersum	7	2	—	X	X	X	—	2	10
Elodea canadensis	4	2	—	—	—	—	1	64	41
Lemna minor	1	1	—	X	X	X	—	—	X
*Myriophyllum spicatum**	78	79	0	—	1	8	5	20	6
M. verticillatum	—	—	—	—	—	—	—	13	
Najas flexilis	4	3	—	X	X	1	3	31	10
Nitella sp.	—	—	—	—	—	6	1	—	—
Nuphar sp.	X	X	—	—	—	—	—	X	—
Nymphaea sp.	2	2	1	2	X	X	X	X	1
Potamogeton crispus	0	0	0	21	6	8	X	4	25
P. zosterformis	1	1	—	—	2	5	—	4	7
Stuckenia pectinata	24	12	17	7	2	1	3	2	22
Utricularia vulgaris	X	—	—	X	X	3	1	—	1
Zannichellia palustris	X	X	—	X	X	—	—	—	—
Zosterella dubia	—	X	2	2	1	5	1	—	—
Total Number of Species	12	12	4	10	12	12	10	11	12

a Two sampling periods averaged together.
X Found only in the general survey.
* Eurasian watermilfoil and hybrid watermilfoil
Shaded column indicates a whole-lake treatment season.

Refer to Plant Survey Methodology on page 19.

Table 9. Aquatic Plant Species Observed in Potters Lake, 2011 - 2016 Using % Frequency of occurrence at sites shallower that the maximum depth of plants. See Note on page 21.

	% Frequency	
Species	**2011**	**2016**
Chara sp.	20	80
Ceratophyllum demersum	2	10
Elodea canadensis	64	41
Lemna minor	—	X
*Myriophyllum spicatum**	20	6
M. verticillatum	13	
Najas flexilis	31	10
Nitella sp.	—	—
Nuphar sp.	X	—
Nymphaea sp.	X	1
Potamogeton crispus	4	25
P. zosterformis	4	7
Stuckenia pectinata	2	22
Utricularia vulgaris	—	1
Zannichellia palustris	—	—
Zosterella dubia	—	—
Total Number of Species	11	12

X Found only in the general survey.

* Eurasian watermilfoil and hybrid watermilfoil

2016 REVIEW OF CONDITIONS

Watermilfoil is continuing to expand its range and density in Potters Lake. On May 11, 2016, 43 acres of watermilfoil were treated with DMA4 at between 2 and 4 ppm, see Figure 12. The point intercept survey was conducted on June 28, 2016. At that time, the plant survey showed that there was very good control of watermilfoil from the May treatment, see "Watermilfoil, Potters Lake, 2016" on page 71.

Figure 12 Watermilfoil Treatment Map - May 11, 2016 - Potters Lake

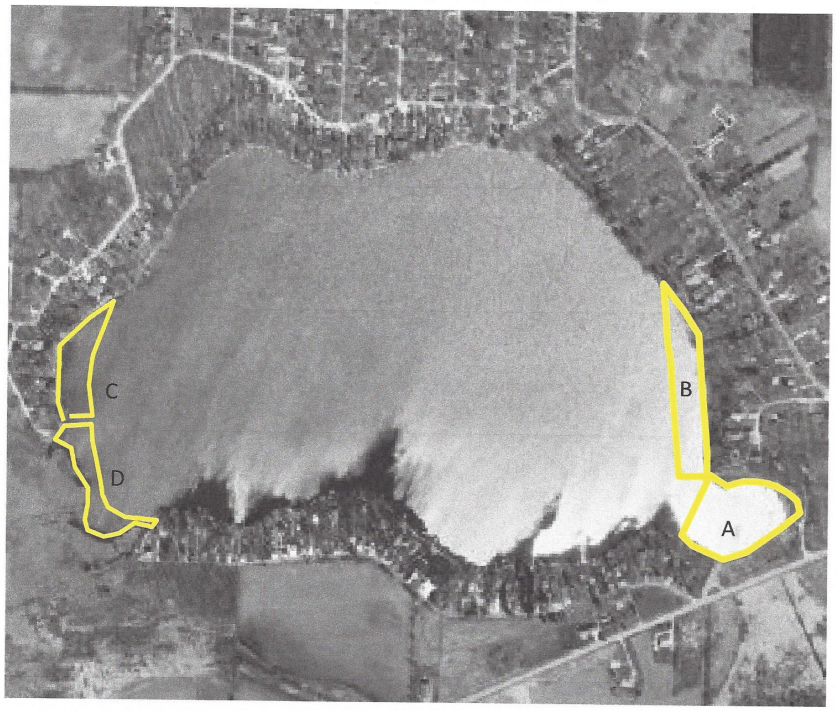


Figure 13 Watermilfoil Treatment Map - July 20, 2016 - Potters Lake (source: Marine Biochemists)

Another 11 acre watermilfoil treatment was conducted on July 20, 2016, see Figure 13. By August, watermilfoil had increased to over 21 acres, with seed heads visible at the surface. One area along the South shore had not needed treatment yet in 2016, all the other areas with watermilfoil had been treated earlier in the year. Where single isolated thin plants had been found in late June, dense, thick beds of watermilfoil were present in late August. The District tried to maintain navigational access by harvesting, but work could not keep up with the growth rates of the watermilfoil. Although a fall treatment was planned, it was not conducted.Residents' frustrations with plant conditions in 2016 were compounded by the lack of rain and low water levels on the lake that restricted many property owners use of the lake.

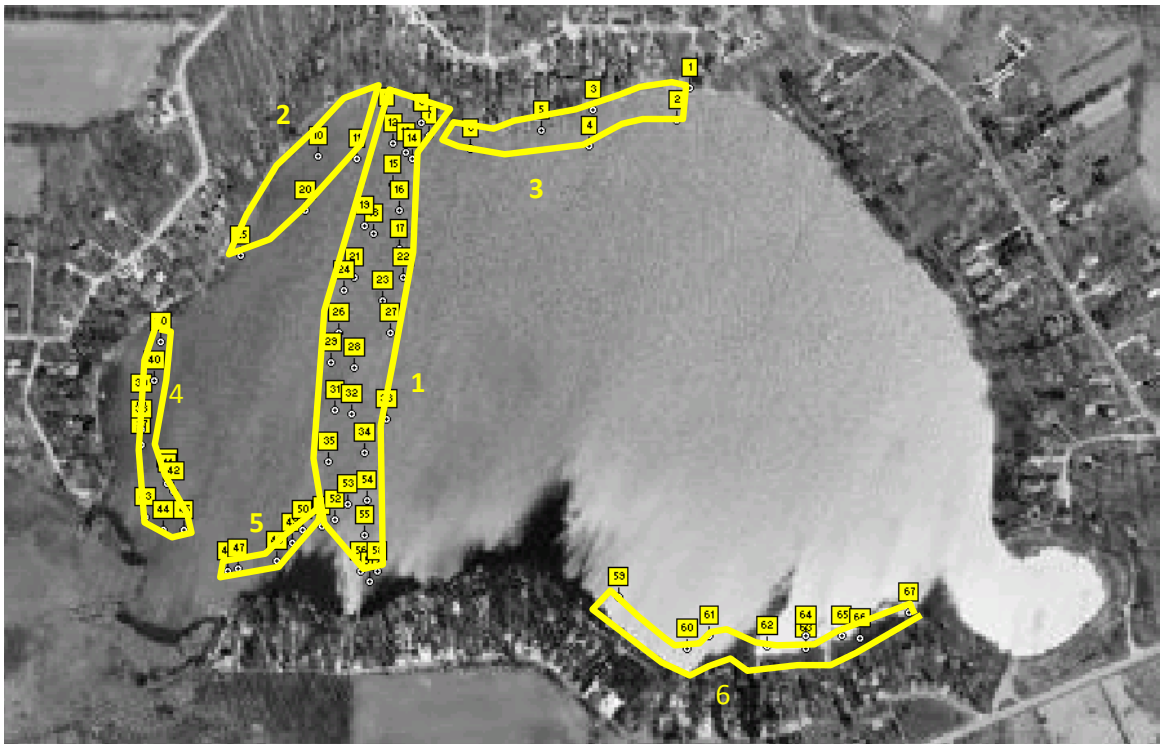


Figure 14 Watermilfoil Locations August 26, 2016 - Potters Lake (source: Marine Biochemists)

Elodea dominated the boat launch bay, restricting navigation. Elodea is now found frequently around the lake. Slender naiad has also been increasing in the lake. Both native plants are now close to levels found in 1997, the year of the first whole-lake treatment. Chara was found throughout the lake, most often in the shallower depths. Coontail and sago pondweed have increased in frequency since 2005.

PLANT SPECIES DESCRIPTIONS

PONDWEEDS

Pondweeds are important species of plants for a lake. Pondweeds do not grow as quickly or as dense as exotic species. They remain lower in the water column and do not create a dense canopy like exotic species such as Eurasian watermilfoil. Pondweeds support food and provide cover for fish. Most pondweeds provide good to excellent food for waterfowl. Different species of pondweeds become important at different times of the year. Pondweeds support much greater populations of macroinvertebrates than exotic plant species such as Eurasian or hybrid watermilfoil. Plant management on lakes should focus on protection and enhancement of the pondweeds, while controlling nuisance species.

The Wisconsin Legislature sought to protect native pondweeds in 1989 with the passage of NR107. That legislation names aquatic plant species that should be protected and enhanced. The protected plant that is found in Potters Lake is sago pondweed (*Stuckenia pectinata*). Other high value plants in Potters Lake are flat-stem pondweed (*P. zosterformis*) and slender naiad (*Najas flexilis*).

CURLY-LEAF PONDWEED

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant species. It gains an advantage over native plants by becoming established very early in the season. Curly-leaf pondweed tends to be more dominant in early summer, dying off in mid-July and August. Curly-leaf pondweed produces dormant structures called turions by the end of June and early July. The turions rest on the bottom until fall, when they begin to germinate and produce small plants. The fall growth over-winters in a green condition (Nichols and Shaw, 1990). In spring, when water temperatures and light intensities increase, Curly-leaf is ready to grow, out-competing other plants that must germinate from seeds or re-establish rootstocks. Curly-leaf reaches the peak of its life-cycle in June and July. Then it dies back in mid-July when other plants are beginning their peak growth periods. If curly-leaf pondweed dominates the plant community in a lake, the die-off can create algae blooms when the decaying plants release the nutrients that are readily available for use by algae. Curly-leaf pondweed provides a good food source for waterfowl, especially as an invertebrate substrate, which is also used by fish. Curly-leaf pondweed may provide good cover for fish as long as densities do not reach nuisance levels.

Curly-leaf pondweed has been present in Potters Lake. Surveys conducted earlier in the season provide a better picture of its range in the lake. Two of the most effective means of controlling curly-leaf pondweed are to protect the native plants and to use management tools to prevent turion production on the curly-leaf plants. One of those management tools could include conducting plant management activities prior to the formation of the turions. Early season, low-dose chemical treatments is another option available. Exercise caution when determining which plant management technique should be used because native pondweeds may be impacted by some management techniques that target curly-leaf pondweed.

EURASIAN WATERMILFOIL

Eurasian watermilfoil (*Myriophyllum spicatum*) is an exotic plant that quickly takes advantage of opportunities for growth. In many lakes it can become a severe nuisance, creating dense plants with large canopies on the surface that shade out other more desirable plant species. Fishing and boating is impaired or completely restricted. Swimming becomes dangerous in the long, stringy plants. Eurasian watermilfoil can contribute to stunted panfish populations by providing too much protection from predator fish (WDNR, 1988). Eurasian watermilfoil stands have been found to support fewer macro invertebrates than comparable stands of pondweeds and wild celery (Smith and Barko, 1990). This in turn affects the fisheries that can be supported by the plants. Eurasian watermilfoil has been thought to spread primarily by fragmentation, however, there is now evidence that seeds play a much more important role than previously believed (Aron, 2002). Hybrid watermilfoil was identified as present in Potters Lake in 2011. Hybrid water milfoil can present management challenges as it may be more difficult to treat. Eurasian watermilfoil and Hybrid watermilfoil are present in Potters Lake and continue to increase their range.

MUSKGRASS

Muskgrass (*Chara* sp.) is actually an algae, but is usually included in discussions of aquatic plant management. Muskgrass is low growing and can help prevent or reduce the growth of Eurasian watermilfoil. It can also protect lake sediments from the effects of boaters. Muskgrass can be a problem for some lakes, becoming very dense with large mats lifting off the lakebed and up into the boating areas. Muskgrass will not thrive in lakes with high turbidity problems. Muskgrass is an excellent producer of fish food for large and small mouth bass (Fassett, 1985). Distinctive characteristics include its musty smell whne crushed, and its coarse, grainy, calcium carbonate coating.

Nitella (*Nitella* sp) is similar to muskgrass, however, it does not have the musty odor and its stems are not coated with calcium carbonate. It too is an algae. Nitella tends to be found in the deeper zones in the lake, while muskgrass tends to be found in the shallower zones.

Nitella was not found in 2016. Chara was found in Potters Lake and is common throughout the lake.

COONTAIL

Coontail (*Ceratophyllum demersum*) is a somewhat bushy plant that prefers soft sediments. The plants do not have a root system and float in the water column. The seeds and foliage are used by waterfowl as a source of food. Coontail also provides good spawning habitat and cover for young fish. Coontail provides a source of food either directly or by supporting fish food fauna. Coontail is able to draw nutrients from the water column. Coontail may grow to nuisance conditions. It is frequently found growing among the Eurasian watermilfoil beds in the deeper zones of the lake.

Coontail is present in Potters Lake.

ELODEA

Elodea or common waterweed (*Elodea canadensis*) is a plant found usually found in soft, nutrient-rich sediments in water depths of 1 to 4 feet. It can survive under the ice and spreads primarily by fragmentation. It provides shelter for fish and food for muskrats and waterfowl. Elodea can grow to nuisance conditions, especially in shallow water. Rapid growth of Elodea may be linked to iron-rich sediments. Hydrilla, a highly invasive plant is similar in appearance to Elodea and should be surveyed for its presence.

WILD CELERY

Wild celery (*Vallisneria americana*) is a perennial plant that prefers hard substrates. The seeds and foliage are considered an excellent food source for waterfowl. Wild celery is a prime spawning habitat for northern pike. In late March to early April, the northern pike spawn on the wild celery that is left from the previous summers growth. Wild celery also provides cover for fish as well as supporting fauna that are utilized by fish for food. Wild celery may also grow to nuisance levels. When there are large areas covered by wild celery, problems occur as the plant releases from the sediment in July and August. Wild celery then floats in large mats, clogging shorelines and boating lanes.

Wild celery has not been found in Potters Lake.

SAGO PONDWEED

Sago pondweed (*Stuckenia pectinata*, formerly known as *Potamogeton pectinatus*) is an excellent food source, and cover, for fish. Sago pondweed has narrow leaves that create an open structure, reducing the likelihood of becoming a nuisance. The plant has the ability to survive in low light conditions. Because of its value to wildlife, sago is often planted in ponds and shallow lakes.

Sago pondweed is present in Potters Lake.

STARRY STONEWORT

Starry Stonewort (*Nitellopsis obtusa* L.) is an invasive species invading lakes in the Midwest. It gets its common name from the tiny, star-shaped bulbil that the algae produces. This bulbil is part of the reproductive structure of the algae. This is a non-native species of algae that is similar to Muskgrass, but its form is shaggier and much more aggressive. Starry Stonewort is spread quickly by fragmentation, a problem in lakes with high levels of recreational activities. The mats grow on the lake bed and can quickly dominate the plant community, choking out all other native and nuisance species. It can fill the water column in depths exceeding the rooting zone. Control and management is very difficult, increasing the importance of programs that keep recreational equipment clean of all fragments. A fact sheet, the *Aquatic Invasive Species Quick Guide* is included in the Appendix.

Starry Stonewort has not been identified in Potters Lake. Preventative efforts should be encouraged, such as Clean Boats, Clean Waters.

THE PROBLEM WITH INVASIVE SPECIES

As watermilfoil and curly-leaf pondweed increase in Potters Lake, the native plant diversity is threatened. Dense beds of exotics outcompete native plants, and cause their decline. As the diversity declines, the rest of the ecosystem upon which it depends, suffers. Fisheries are affected as panfish evade predation by game fish. As panfish increase, they consume zooplankton. That in turn allows algae to increase, affecting water clarity, which then affects sight-feeding predator fish. This can begin a shift towards an algae-based system and away from a clear-water system. To protect the native plants, the exotic species must be controlled to the extent possible.

Recreational interests are also negatively affected by exotic species. Zebra mussel invasions means that lake users must wear water shoes to protect their feet from the sharp shells. Boaters must work to remove mussels from boats, motors, and piers.

Transient boaters must conduct regular disinfections to prevent transporting exotics between lakes. Exotic plant species like Hydrilla and Starry Stonewort can choke waters and prevent boating activities. Long plant stems of watermilfoils and curly-leaf pondweed can entangle swimmers and have caused drownings. Plants covering the lake surfaces collect algae, and debris, increase water temperatures, and lead to unsightly, smelly waters. As these conditions increase, property owners become increasingly frustrated and property values decline.

NEW INFESTATIONS - TARGET LEVELS OF CONTROL

New infestations should be aggressively managed to eradicate the species from the system. Depending on the species, different levels of response may be needed. A reaction to a Hydrilla or Starry Stonewort invasion, should warrant a “top level” response of treating the invasion and surrounding areas, and surveying the lake continuously.

Steps should be taken to work with the Town, WDNR and Legislators to facilitate rapid response:

- The Legislature should be approached to develop state laws to allow local rapid response to take place.
- The WDNR should be approached to develop an emergency access plan should an infestation be found.
- Materials should be developed and produced to use in the event of an invasion. These would include press releases, public informational materials about the cause and effect of the invasion, and access site notices.

If a new exotic species is found, the following steps should be taken immediately:

- WDNR should be notified of the invasion.
- Take a digital photo of the plant in the setting where it was found and mark with a GPS. Then collect 5 – 10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers where present. Place in a Ziploc bag with no water. Place on ice.
- Fill out form http://dnr.wi.gov/lakes/forms/3200-125-plantincident.pdf
- Contact the DNR Aquatic Invasive Species Contact (currently Heidi Bunk, WDNR Lakes Biologist) and deliver the specimens, report, digital photo, and coordinates. Do this as soon as possible, but no later than four days after the plant is discovered. A board member and lake consultant should also be notified.
- Upon confirmation of species identification, a coordinated response plan should be developed in consultation with the DNR, the County, and lake consultants as needed.

- The District's chemical treatment contractor should be contacted to schedule an immediate treatment of the area where the exotic was found. States with experience in reacting to new invasive species invasions recommend treating a five acre area surrounding the initial site.
- A full, point-intercept survey of the lake should be conducted to determine the extent of the invasion.
- The site should be inspected throughout the season to ensure efficacy of the treatment.
- The survey and treatments should continue for at least three consecutive seasons to ensure eradication.
- Surrounding lakes should be notified of the infestation and advised to begin surveying.

GENERAL CONCLUSIONS

- Potters Lake has poor aquatic plant diversity but a very high density of aquatic plants.
- Native aquatic plant densities have increased since the last whole lake treatment and should be protected.
- Watermilfoil has also increased significantly over the last five years and is a serious threat to the ecological balance in the lake. Steps should be taken to reduce the amount of watermilfoil in the lake and to maintain it at levels below 20% frequency.
- Steps should be taken to eradicate any Purple Loosestrife and reed canary grass around the lake.
- Regular surveys should be conducted to identify and react to new invasive species early.

CHAPTER IV - PROBLEMS

The waters and sediments of Potters Lake contain sufficient amounts of nutrients to promote aquatic plant and algae growth. Phosphorus and nitrogen have been determined to be the most critical components that drive aquatic plant growth. Phosphorus is likely the limiting nutrient in Potters Lake.

The perceptions of the severity of problems by individuals are often dependent on their personal experiences. The management of lake problems is directly correlated with the management of expectations by individuals.

It is far cheaper to prevent a problem than it is to correct it later. An oil change of a car costs only $20 or $30 but a new engine costs well over $2000. The same holds true for lakes. Public information efforts to prevent problems and the cost of annual monitoring programs are much cheaper than major lake restoration projects. Preventing soil erosion, nutrients, and exotic species from entering the lake is much more cost effective than attempting to dredge or correct plant and algae problems.

Dense plant beds interfere with boat motors, and swimmers. Dense plants also contribute to stunted panfish populations by reducing opportunities for grazing by predators. Additionally, the excessive plants diminish the aesthetic value of a lake as shoreline debris increases. Property values decline as water quality declines and nuisance aquatic plants and algae increase.

The fertile soils in the region may contribute to the excessive plant problems experienced in Potters Lake. As the amount of impervious surfaces increase in the watershed of the lake, the potential for water quality problems, and the resulting aquatic plant problems, increases. Without adequate buffers, runoff carries sediment, and nutrients that fuel aquatic plant growth. The extensive shallow lake areas and high levels of recreational use also create problems in the lake, disrupting game fish spawning areas, suspending sediments, reducing water clarity, and negatively impacting aquatic plant conditions.

Publications also point to the role of various lake-side living activities as a significant source of nutrients. Maintenance of golf course type lawns, with high doses of fertilizers and pesticides are a big contributor of nutrients to lakes. A USGS publication, USGS Water-Resources Investigation Report 02-4130, cites a study conducted on Lauderdale Lakes in Walworth County. In that study, the quality of runoff from the use of no-phosphorus fertilized areas was nearly identical to that from non-fertilized areas. This indicates there is an advantage to limiting the application of fertilizers containing phosphorus. In addition, nitrogen also plays an important role in plant growth and should also be avoided. Other human activities that negatively impact water quality include the excess use of salt in winter, pet waste, and discharges from automobiles.

Recreational boating use, coupled with dense plant beds increase the amount of plants cut by boats, known as floaters, that wash up on shorelines and re-root. Parts of plants broken by wind and wave action, or by motors (even electric motors), float around the lake, create shoreline debris, and reroot into new areas. Also, perils to swimmers exist in long plant stems, including that of watermilfoil and curly-leaf pondweed.

Dense watermilfoil beds can contribute to stunted panfish populations by reducing opportunities for grazing by predators. Excessive curly-leaf pondweed can contribute to poor water clarity and algal problems. When curly-leaf pondweed begins to die off in early summer it releases nutrients into the water column.

Plant growth on Potters Lake has increased significantly over the past few years.

Watermilfoil is the nuisance plant species that leads to complaints from landowners. Many residents have lived on the lake since the early whole lake treatment and have been pleased with the conditions from 1996 through 2011. As watermilfoil has again dominated the plant community, complaints and concerns from property owners and lake users have risen.

Very dense beds of Elodea in the shallow areas, especially boat launch bay, also pose problems for navigational access. Dense watermilfoil plant beds along with shallow water levels that impede navigation are the primary problems facing the residents.

CHAPTER V - DISCUSSION-PLANT MANAGEMENT ALTERNATIVES

Control of exotic or nuisance plant species is an uphill battle. The very nature of all aquatic plant species survival provides the means to spread. For instance, wild celery can spread by releasing from the sediments and floating to new areas in late summer and fall. With exotic or nuisance plants, the growth and spread of the plants is more prolific. Fragmentation is important for Eurasian watermilfoil. It is now suspected that Eurasian watermilfoil can spread significantly through seeds as well as fragments (Aron, 2002). The recent documentation of hybrid species of milfoil confirms the importance of seeds in its reproduction. Curly-leaf pondweed spreads by creating turions from which new plants grow. Starry stonewort spreads by fragmentation and growth from the star-shaped bulbils.

Realistic expectations are important in aquatic plant management. It is unlikely that exotic plants species can ever be completely removed from a lake. It is more likely that a combination of lake management techniques, along with public education, are most effective in minimizing the long-term impact of exotic plant species in a lake.

Discussions of plant management alternatives follows.

NO MANAGEMENT

Nuisance levels of aquatic plants can be left to do what they will with no active management from people. Under this alternative, it should be expected that Eurasian watermilfoil and curly-leaf pondweed will continue to expand their range in Potters Lake. While the firm, sandy shorelines will not see much Eurasian watermilfoil growth, the soft sediment portions of the lake will likely see expanded areas of Eurasian watermilfoil. The downside of this is that the more shading from Eurasian watermilfoil, the less light can reach the native understory, further increasing water temperatures and reducing the native plant community, allowing Eurasian watermilfoil even more opportunity for growth. Expanded areas of Eurasian watermilfoil may impact the fisheries, increasing the areas for small panfish to hide from predators. While the short term cost of the No Management option is nothing, the long term cost may be much higher than if even minimal management occurred. Once seed beds are established, and the nuisance plants shade out the natives, it may take aggressive, costly activities to re-establish a balanced plant population. Although the budget line for “no-management” is low, the long term cost in lost recreational use and lower property values is high.

Conclusion—Although No Management is technically feasible for Potters Lake, it should not be considered in the best, long term interest of the water resource.

DRAWDOWN

Drawdown can be used to control some plant growth. Use of this method entails dropping the lake X number of feet for a period of time. This exposes the plants to extreme temperatures, drying and freezing. Some plants respond very favorably to drawdown, while other plants react negatively, or unpredictably. Eurasian watermilfoil and coontail react unpredictably (Nichols 1991). Locally, Big Muskego Lake was drawn down for a lake restoration plan. While Eurasian watermilfoil was reduced for a while, the plant returned to a level requiring aggressive management. Other lakes have had good success with extended drawdowns that thoroughly freeze the lakebed, especially those areas with soft sediments in shallow shoreline areas.

A source of water to refill the lake, and a means to draw the lake down, are also important considerations. The procedure is rarely effective. Some valuable plants can be destroyed while more nuisance plants can be encouraged. Time is also a factor in drawdowns. Usually a lake is drawn down for 4 to 6 months and needs to be repeated for maximum effectiveness. Drawdown also reduces the recreational opportunities on the lake. Timing of a drawdown can have a negative impact on fisheries if spawning areas are no longer accessible to fish. Turtles and frogs hibernate in shoreline muds and can be affected by drawdowns.

Costs associated with drawdowns depend on the outlet control structure. Pumping to lower the lake requires costs for equipment, electricity and staff. Costs can be minimal if the lake can be lowered by opening a gate.

Conclusion— Because of the recreational demands on the lake, because of the limitations of the control structure, because the exotic species are located throughout the lake, and because it is not effective for controlling milfoil, drawdown for the purpose of aquatic plant control on Potters Lake is not recommended.

NUTRIENT INACTIVATION

Nutrient inactivation is used to control the release of nutrients, primarily phosphorus, from the sediments. One of the most common substances used is aluminum sulfate, or alum. The alum treatment creates a floc formation covering the bottom sediments, preventing phosphorus from being released into the water. Nonpoint source pollution controls must be implemented prior to the use of alum, or the floc will be covered with newer nutrients. The cost of an alum treatment would be in excess of $200,000.

This treatment will not prevent plant growth but will reduce problems from algae growth. Improved water clarity from an alum treatment may increase aquatic plant densities. Water chemistry information must be collected prior to use to ensure sufficient buffering exists to prevent acidification and aluminum toxicity. Waters deeper than five feet are usually treated with Alum. WDNR approval is required. Many of the areas with the existing nuisance conditions would not be treated with alum, so localized problems would not be corrected and in fact may be increased.

Conclusion—Nutrient inactivation is not a viable tool for managing aquatic plants in Potters Lake.

DREDGING FOR AQUATIC PLANT CONTROL

Dredging is most often used to increase depths for navigation in shallow waters, especially for channels, rivers, and harbors. Dredging for the sole purpose of plant control has met with mixed success. To be considered successful for aquatic plant control, dredging would need to bring the lake bed to depths beyond 10 feet deep, the maximum rooting depth in the lake. Eurasian watermilfoil prefers soft sediments. To minimize rapid re-infestation of the remaining sediments, dredging would need to be done to a hard pan layer. Dredging is the most costly form of plant management control. Costs range from $5.00 to $30.00 or more per cubic yard depending on site conditions, method used and disposal costs. A WDNR permit is required. The availability of disposal sites often restrict the size and scope of dredging projects.

Conclusion—Dredging may be considered in Potters Lake to improve navigational lanes. Extra precautions should then be taken to protect the rest of the lake from problems during the dredging. Because of the very high costs, and considerable disruption of the aquatic environment, dredging for aquatic plant control purposes would not be considered a viable alternative for Potters Lake.

AERATION

Aeration entails installation, operation and maintenance of a system to artificially pump oxygen into the lake depths. Artificial aeration has been used to correct oxygen deficiency problems in lakes that produce numerous algae blooms and subsequent fish kills. Aeration is used when internal nutrient sources are high compared to external sources, if nuisance algae conditions exist, or if low oxygen levels are a problem. It is most useful on lakes with low dissolved oxygen levels and large internal releases of phosphorus.

Aeration is an expensive lake management technique. Initial capital costs for a lake this size would rum more than $300,000 and an annual maintenance and operational cost of approximately $40,000 to $50,000. Problems frequently result with improperly sized aeration systems so initial planning and engineering must be done carefully to prevent creating greater problems. Annual operational problems and costs are difficult for small lake organization budgets and staff.

There has been no documented effect of aeration on plant growth. WDNR approval is required.

Conclusion—Aeration on Potters Lake should not be considered at this time.

SCREENS

Light screens are similar to window screens that are placed on the lake bottom to control plant growth. Screens come in rolls that are spread out along the bottom and anchored by stakes, rods, or other weights.

Screens create little environmental disturbance if confined to small areas that are not important fish or wildlife habitat. Although they are relatively easy to install over small areas, installation in deep water may require SCUBA. Screens must be removed each fall and reinstalled in spring. Care must be taken to use screens where sufficient water depth exists, reducing the opportunity for damage by outboard motors. Screens cost more than $300 for a 700 sq. ft. roll. Screens may be used by individual home owners along their shorelines or piers to create swimming areas. A negative impact of using screens is that all plant species are affected by the installation of screens, even native plants. WDNR permit is required.

Conclusion—Screens are contradictory to the WDNR's stated goal of protecting native plants. They are not viable for use on Potters Lake.

WEED ROLLERS

Weed rollers are a mechanical device that can control weed growth in shallow areas. A post attaches to a pier. At the end of the post is a roller that moves in a slow arc, up to about 270 degrees.The roller agitates the top layer of sediment, preventing plants from growing. There have been discussions with WDNR about considering the use of the weed roller in Wisconsin lakes, but they currently do not allow their use. According to the manufacturer's website, Illinois does not require a permit to use a weed roller. Indiana requires a permit it if affects more than 625 sq Ft. Minnesota and Michigan require a permit to use a weed roller.

Conclusion—The weed roller may be another viable alternative for riparian landowners if the WDNR decides to allow their use.

BIOMANIPULATION

The use of biological controls for aquatic plant management purposes is currently limited to the grass carp and a few species of insects. Most of these controls are theoretically possible, however they have limited application. Non-native biological controls are risky: there are a number of instances where the solution caused new problems when a non-target organism was preferred by the introduced control. Non-native biological controls can also become a new nuisance itself. Biological controls also produce slower, less reliable, and less complete control than mechanical or chemical control activities.

Grass Carp (Ctenopharyngodon idella Val.) is an exotic species originally imported from Malaysia. It is considered to be a voracious eater of aquatic plants and prefers elodea, pondweeds and hydrilla. Studies have shown that Grass Carp can reduce or eliminate vegetation at low densities. Grass Carp generally will graze on more beneficial plants before going after Eurasian watermilfoil, thereby compounding nuisance problems. Overstocking can eliminate all plants. In the United States, only a few states allow the use of a sterile form of Grass Carp. Grass Carp are illegal in the State of Wisconsin and are not an option on Potters Lake.

In British Columbia, Canada, the larval stage of two aquatic insects, the caddisfly (Triaenodes tarda Milne.) and the chironomid larvae (Cricotopus sp.) have been observed to graze on Milfoil plants. These two insect species are currently being studied as forms of biological controls.

Recently, a naturally occurring fungus (Mycoleptodiscus terredtris) has been observed to effectively control a species of milfoil in New Hampshire.

A weevil (Eurhychiopsis lecontei) has been found to help control Eurasian watermilfoil in some lakes in Wisconsin and Illinois. The weevil does major damage to the milfoil plant as it is closely associated with it during its entire life cycle. The adult female lays eggs on the tips of the milfoil. When the larvae hatch, they feed in the growing tips and then burrow into the stem. Pupation (when the larvae changes to an adult) occurs in the stem. In fall, adult weevils burrow into the shoreline litter and remain until spring. Weevils mature from egg to adult within 30 days and reproduce from May through September. Lakes with intensive management using harvesters or chemicals are less likely to support good populations of the weevil. Weevils do not usually like other plants so it does not affect other plant species. Weevils are now available commercially.

Although the weevils can dramatically impact milfoil beds, it may not be enough to control the nuisance. The milfoil beds frequently reach the surface by mid-June, but the weevils' life-cycle on the lake does not begin to drop the milfoil until the beginning of July and many areas with the weevil show minimal signs of impact. This time lag and lack of more complete control, can negatively affect the riparian's acceptance of the weevil as a management technique.

Efforts to introduce the weevil into new lakes has not been successful enough to justify the expense of the weevils ($1.00 per weevil). As the technology, and science, as well as the experiences with weevils improve, the weevils may be a viable option for management of Eurasian watermilfoil on Potters Lake. Additional research is needed before many of the biomanipulation techniques can be commonly implemented in lake management (AERF, 2005).

Another beetle, Galerucella calmariensis (commonly referred to as Cella Chow), is being used around Wisconsin to combat the spread of purple loosestrife. Purple loosestrife is a wetland invasive species that is a prolific seed producer. Plants produce over 2 million seeds per season and can quickly take over a wetland, displacing native plants. It is illegal to sell or cultivate purple loosestrife in Wisconsin. The Cella beetle is being distributed into infested areas, especially those too large for manual control. Volunteers obtain incubator populations of the beetle, raise them through the beetles' four life-stages, and then release the new beetles into established purple loosestrife areas. The WDNR website http:// dnr.wi.gov/org/land/er/invasive/factsheets/loosecontrol.htm has specific information on purple loosestrife control, including manual, chemical, and biological.

Conclusion—Neither the Grass Carp, insects, nor fungus are viable alternatives for Potters Lake. The milfoil weevil may be considered on Potters Lake should it become cost effective to use. The purple loosestrife beetle, as well as hand and chemical controls, may be used to control purple loosestrife around Potters Lake.

NATIVE SPECIES INTRODUCTION-SHORELINE EDGES AND ADJACENT UPLANDS

Native plants are being re-introduced into lakes to try to diminish the spread of exotics and to try to reduce the need for other, more costly, plant management tools. Native plants are usually less of a management problem because they tend to grow in less dense popula¬tions and are more often low-growing. Native plants also provide better food and habitat for fish and wildlife.

Careful consideration of the species introduced needs to be given to avoid creating another problem.

Native species re-introduction or expansion has only limited application as a plant management alternative for Potters Lake.

Costs to conduct plantings vary with the number and type of plants, and whether volunteers or paid staff do the work. Successful plantings can be affected by a number of factors, including health of the new plants, weather, timing, bottom substrate, water clarity, and waterfowl grazing. The WDNR should be consulted before conducting any planting activities to ensure the protection of the resource, the necessity for a permit, and the likelihood of success.

Conclusion—Shoreline plantings and upland restoration may be considered by the District or individual landowners. Landowners should be encouraged to allow the upland shoreline edge to re-vegetate into a stable buffer zone. This could be done as simply as not mowing. This, along with supplemental plantings of native upland plants, would provide habitat for birds, turtles, frogs, and other wildlife, while helping to filter out nutrients and sediments. This will indirectly help with the in-lake nuisance aquatic plants by reducing the transport of nutrients into the lake, and by creating a more stable near-shore area. Natural shoreline vegetation also provides a natural barrier that Canadian geese avoid. Although an established buffer will require less work than a lawn, there will be maintenance required. This may include cutting, mowing, or elimination of exotic species such as purple loosestrife. Landowners should consult with a professional to determine specific maintenance requirements and scheduling for their shoreline buffers. Permits will be needed for aquatic plantings and the County should be consulted for the need for upland restoration permits.

HAND CONTROLS

A method of aquatic plant control on a small scale is hand or manual control. This can consist of hand pulling or raking plants. A rake with a rope attached is thrown out into the water and dragged back into shore. Plants are then removed and disposed of. Skimmers or nets can be used to scrape filamentous algae or duckweed off the lake surface. These methods are more labor intensive and should be used by individuals to deal with localized plant problems such as those found around individual piers and swimming areas. Hand controls cannot include the use of auxiliary power. For instance, a boat motor cannot be used to drag a rake. Hand controls are very inexpensive when compared to other techniques. Various rakes and cutters are available for under $100. Cutters pose risks to users because of their extreme sharpness. Although labor intensive, hand controls, especially using rakes, are an effective way to remove plants from a small area.

NR 109 allows riparian landowners to manually remove Eurasian watermilfoil and curly-leaf pondweed plants within their “riparian zone” without permits. Residents may remove other plants in a single area that is not more than 30 feet wide as measured parallel to the shoreline, including any swimming and pier areas, as long as the area is not a WDNR Sensitive Area. The 30-foot area must remain the same each year. It is illegal to remove native plants outside the 30-foot wide area without a permit.

Conclusion—Hand controls may be used by individual landowners to clear swimming areas. Landowners should be encouraged to be selective in their clearing, again focusing on watermilfoil or curly-leaf pondweed. Landowners should maintain a natural area of vegetation both on their shoreline and in the water.

Riparian landowners may manually (without any auxiliary power) remove watermilfoil and curly-leaf pondweed plants within their “riparian zone” without permits. Residents may remove plants in a single area that is not more than 30 feet wide, including any swimming and pier areas, as long as the area is not a WDNR Sensitive Area. However, because of the ease with which watermilfoil spreads, landowners should not attempt to remove native plants. Doing so will create a far worse condition when watermilfoil fills the void created by removing the native plants. Consult WDNR regarding any permits needed for removal of plants.

CHEMICAL TREATMENT

Chemical treatment of aquatic plants in lakes is governed by WDNR under Wisc. Admin Code NR107. Chemical treatment for the control of aquatic plants is one of the more controversial methods of aquatic plant control. Debate over the toxicity and long term effects of chemicals continues in many communities. Many changes have occurred over the years. Today, the half-life of the herbicides is days and weeks, rather than months and years. Instead of broadcast applications, todays treatments are often targeted. Very low application rates are used today, where in the past, much higher rates were used. A WDNR permit is required prior to any chemical treatment.

With chemical treatments, the plant material impacted by the treatment dies and contributes to the sediment accumulation on the lake bed. When plants are treated, the decaying process of the plants uses oxygen. Depending on the chemical used, if too much plant material is treated at once, oxygen depletion may occur, stressing or killing fish.

Another concern about the use of chemical treatments is the ability to quickly shift a lake from one dominated by aquatic plants to one dominated by algae. This shift can occur if most or all of the vegetation is treated. The algae then use all the available nutrients, creating algal blooms.

The importance of aquatic plants to the fisheries community is another reason to use caution when conducting chemical treatment or other management activities that remove large amounts of plant material. If too much plant material is removed, fisheries food and habitat are negatively affected.

Identification of the target species is very important. Different chemicals should be used for different plant species. Dosage also affects the results. Too little chemical may stunt growth but not kill the plant. Too much chemical may negatively impact fish, amphibians, or invertebrates. If native plant communities are destroyed by chemicals, the areas may be invaded by exotic plants such as Eurasian watermilfoil and curly-leaf pondweed. The formulation of the chemical, whether liquid or granular, is a factor to consider. Another factor to consider is the contact period the chemical would have with the vegetation.

Care should be taken to alternate the chemicals used whenever possible. This will help minimize the chance of the nuisance species developing a resistance to the chemical. Currently, there are only two documented species in Florida which have developed a resistance. However, the very nature of aquatic plant control reduces the options when resistance does occur.

Chemical treatment is more selective than harvesting. Chemical treatment may also be more appropriate in some situations, especially where mono-typic stands of exotics exist in shallow water where harvesters cannot work, such as in marina areas. It may also be the method of choice to treat early infestations of watermilfoil when hand-pulling cannot be used. When used appropriately, chemical treatment can be economical and effective.

Modern herbicides have been tested extensively. Tests include determining toxicity levels to be sure that humans, animals and fish are not affected. Test results must also show that the herbicides do not bioaccumulate in fish or other organisms and that their persistence in the environment is low. Product labels contain the requirements for use. Approved labels state that “there is reasonable certainty that the pesticide can be used with no unreasonable adverse affect on human health or the environment”. Material safety data sheets are available for all herbicides approved for use in Wisconsin. Chemicals must be used according to the approved use applications listed on the labels. Application rates, as well as any use restrictions, are indicated on the product labels. Licensed applicators must follow the label requirements.

Shoreline treatments may need to be repeated at least annually. Shoreline treatments will likely not eliminate the nuisance, especially when the deep water untreated areas have high densities of watermilfoil. Invasive plant material from elsewhere in the lake may quickly re-enter the area. Shoreline treatments are usually spot treatments to alleviate a nuisance condition, whereas whole-lake treatments are usually lake restoration-based treatments.

Whole-lake treatments have been used to eliminate Eurasian watermilfoil from a lake for at least three years (Aron, 2003), including Potters Lake. Large-area treatments (greater than 10 acres) have been used to dramatically reduce curly-leaf pondweed problems. Lake Barrington in northern Illinois has been successfully treated with Sonar™ for more than 5 years as part of a multi-faceted approach to shift the lake from one dominated entirely by curly-leaf pondweed, to one with a more diverse plant community. Long term studies of water quality and fisheries on lakes using whole-lake treatments are scarce. To date, there have been some documented negative impacts on water quality following whole-lake treatments (Hauxwell et al, 2006). Whole-lake treatments are not appropriate for all lakes and should be considered as part of a larger plant management plan.

Applicants may submit applications for permits that cover the whole lake area to allow treatment of exotic species where ever they may occur. Decisions on areas to treat will be made by WDNR on or near actual treatment days. This philosophy allows lake communities to be flexible, but effective in their treatments. It also minimizes delays that come from having to add to permitted areas during the treatment season.

Large-area treatments have been used to reduce Eurasian watermilfoil and curly-leaf pondweed, without the whole-lake impacts. These treatments are done early in the season, just as the plants begin to grow, usually in early April. When both curly-leaf pondweed and Eurasian watermilfoil are present, Aquathol K has been used to target both. 2,4-D products have been used when only Eurasian watermilfoil is present.

Although “mail order” chemicals can be purchased, their use is strongly discouraged and should never be used without a permit from WDNR. They may be completely ineffective if they are used to try to treat the wrong plant species. Unregulated, uneducated use may result in overuse of a chemical and cause damage to the “good” weeds, fish and wildlife, and humans.

Prior to any chemical treatment, a permit is required from WDNR. Only Wisconsin and EPA approved herbicides may be used, following all label directions and restrictions. In most situations, herbicides may only be applied by licensed applicators certified in aquatic ap¬plication by the Wisconsin Department of Agriculture, Trade, and Consumer Protection. Proper handling and application techniques must be followed, including those to protect the applicators. All applications must comply with current laws in the State of Wisconsin.

Although individuals may apply for permits to apply aquatic herbicides, residents are strongly encouraged to work with the District on any questions or concerns about aquatic plants prior to undertaking any plant management activities.

Systemic Herbicides — Systemic herbicides are translocated throughout the entire plant, including the roots. Examples of systemic herbicides are 2,4-D, Fluridone, and trichlopyr. 2,4-D and trichlopyr are used to control Eurasian watermilfoil in localized areas. Fluridone is primarily used to control Eurasian watermilfoil in whole-lake, or large area situations.

Contact Herbicides — Contact herbicides kill the exposed portions of the plant that they come into contact with. They are not translocated to roots and will only rarely kill entire plants. Herbicides with the active ingredients of diquat and endothall are common contact herbicides. Contact herbicides are frequently used to provides short-term nuisance relief. Contact herbicides may be affected by high levels of suspended sediment in the water column.

Copper Compounds — Copper sulfate is used for the control of algae. Cutrine Plus is an herbicide that uses copper as its active ingredient. This is used to control various types of algae. Although it can sometimes control Chara (also known as muskgrass), a more desirable algae, it is more commonly used to control filamentous, green and blue-green algae. Liquid formulations, especially the copper chelated products (those combined with other compounds that help prevent the loss of active copper from the water) are more effective. These tend to remain in solution longer, allowing more contact time between soluble copper and the algae cells. Cutrine Plus and Cleargate have no restrictions on lake use following a treatment.

Aquathol — Super K is a formulation containing the active ingredient endothall. This is a contact herbicide that prevents certain plants from producing needed proteins for growth. It is used to control certain pondweeds, coontail, and Eurasian watermilfoil. The timing of an application affects what plants are impacted. Aquathol has use restrictions including 1 day for swimming; 3 days for fish consumption and 7 to 25 days for irrigation and human and animal drinking.

Reward — Reward, previously known as Diquat, is a non-selective contact herbicide that is used to control a wide variety of plants. It is absorbed by plants and damages cell tissues. Reward kills the parts of the plants that it comes into contact with directly. Reward loses its effectiveness in muddy, silt-laden waters. If too much plant material is killed in an area, the decomposing vegetation may result in very low oxygen levels that may be harmful or fatal to fish. Areas that are treated with Reward cannot be used for activities requiring full or partial body contact for at least 24 hours after treatment. Animal consumption, irrigation, and other domestic uses require waiting at least 14 days after treatment. Reward works quickly, with results usually seen in 6 to 10 days. Reward has use restrictions including 1 day for swimming and 14 days for drinking or irrigation.

2,4-D (2,4-dichlorophenoxyacetic acid) — 2,4-D is a systemic herbicide which interferes with normal cell growth and division. Plants begin to die within a few days of liquid formulation treatments, and within a week to 10 days when granular formulations are used. The aquatic formulations of 2,4-D are only effective on certain species of aquatic plants. It is most commonly used to treat Eurasian watermilfoil. The timing and the dosage rate of an application is important to avoid impacting native plant species. Because it also impacts several desirable species including bladderwort, water lilies, and watershield, care should be taken to ensure that only the target nuisance plant species are present before treatment or that the dosage is low enough to protect natives. Treatments may be conducted using 1 - 3 ppm, following label restrictions. Generally, the larger the treatment area, the lower the dosage that is needed.

2,4-D products have a 24-hour swimming restriction and no fish consumption restictions, but treated water should not be used for irrigation until herbicide residues as less than 1 ppm.

Fluridone — Fluridone is an herbicide that inhibits the plant's ability to make food. Without that ability, the plant dies. The visual symptom of the effects of fluridone is bleaching of the terminal buds, or growing points, on the plant. This herbicide requires at least 30 to 45 days of contact time to kill the plant. This prevents problems with low dissolved oxygen in treated areas. Fluridone is rapidly diluted and is best used in larger treatment areas, generally 5 acres or more in size, preferably on a whole-lake basis. Prior to treatment there should be good flow data for the proposed treatment area. Rates of inflow, outflows, and ground water sources should be known prior to treatment. Without this information, applied material can be quickly flushed from a system or rendered ineffective. The WDNR has questions about the long term impact of Fluridone on water quality and fisheries since most available information is anecdotal. Fluridone can be used for a range of plant control, from species specific control to general control. Fluridone achieves its selectivity by the use of varying dosages. High treatment dosages control a wide variety of aquatic plants, while low dosages maintained over long periods of time have been used to control Eurasian watermilfoil with minimal impact on native plants. A couple of important plant species, specifically naiads and elodeas are highly susceptible to Fluridone. Lakes with an abundant amount of susceptible species should carefully evaluate the use of Fluridone. Fluridone has no use restrictions except for irrigation. Irrigation restrictions range from 7 to 30 days.

Trichlopyr — Trichlopyr is a newly-approved herbicide which kills the entire plant, and is effective at treating Eurasian watermilfoil. Trichlopyr is more suited to moving water applications than slow-acting herbicides such as fluridone. Trichlopyr has a 120-day use restriction for irrigation.

Conclusion— Chemical treatments may be conducted on Potters Lake. Treatments may be undertaken by individuals or the District with WDNR approval. Native aquatic plant beds that restrict navigational access to the main lake may be treated. Changing plant conditions that create new shoreline nuisances may warrant chemical treatment. Whole-lake and large-area treatments may also be conducted targeting watermilfoil and curly-leaf pondweed. Any other chemical treatments conducted on Potters Lake should target the exotic species, such as watermilfoil and curly-leaf pondweed, or to expand navigational access.

- Watermilfoil and curly-leaf pondweed may be treated with the appropriate herbicides. It should be remembered that destruction of any native plant species populations will increase potential problems from watermilfoil and other nuisance species.

- Treatments should be planned to treat early enough in the season to eliminate the nuisance with the least amount of herbicide and before the native plants have been impacted by dense growths of nuisance plants.
- Large scale, open water treatments may be considered to treat large areas of watermilfoil and curly-leaf pondweed in spring or fall.
- When larger area treatments are conducted in summer, WDNR may require the proposed treatment area to be divided and treated in stages over time to minimize dissolved oxygen problems.
- Proposed chemical treatments should be developed based on the current nuisance conditions.
- When conducted, curly-leaf pondweed treatments should be planned to try to prevent the production of turions, an important method of reproduction for the plant. These treatments would allow native plants a better opportunity for growth in the area.
- Potters Lake should be regularly surveyed for new invasions of exotic species, including Hydrilla and Starry Stonewort. If found, the plants, and a larger surrounding area should be agressively treated to eliminate the plants. The lake should then be agressively surveyed and treated for at least three years to ensure the nuisance has been eliminated. Refer to "New Infestations - Target Levels of Control" on page 28.

HARVESTING

Harvesting of aquatic plants in lakes is governed by WDNR under Wisc. Admin Code NR109. Harvesting is another lake management tool that is frequently used to control aquatic plants. Plants are cut off about five feet below the surface and conveyed to shore where they are then trucked to a disposal site. Harvesting aquatic plants removes biomass from the lake as well as nutrients. In the past, the presumption was that eventually plant growth in a lake with harvesting would cease to be a problem when nutrients have been removed. However, a lack of plant growth after harvesting will not normally be seen because incoming nutrients from the watershed will usually offset any nutrients removed during harvesting (Engel, 1990). The remaining plant material, that material below the cutting depth, will continue its life cycle. The decomposing material will contribute to the sedimentation in the lake, however, wind and wave action will move the material into deposition zones: usually the deep hole.

Harvesting should only be done in waters deeper than three feet. Harvesting should not be done in shallower areas because it will increase damage to the equipment, will disrupt bottom sediments and plants, and will open up lake sediments to invasion by exotic plant species. Skimming may be done in shallower waters, taking care to minimize disruption of the lake bed.

Shoreline pickup programs can help control floating plant material (floaters) and plant debris, however, they are labor, and time intensive. Shoreline pickup programs are very difficult to eliminate once the residents are used to the service. Debris such as rocks, sticks, gravel, or other such material that may be in debris piles will damage the equipment. When plant debris is on shore, the equipment must go up to shore to retrieve it, disrupting the sediments and rooted plants in the process. Harvesters are very large pieces of equipment that are highly susceptible to wind and waves, and are difficult to maneuver. This increases the chances for damage to riparians' piers and boats.

Off-load sites are very important to the continued operation of a harvesting program. Equipment must be able to pull in to shore with full loads. Large lake must have multiple off-load sites or the harvester will spend valuable, expensive time carrying full loads to shore. Multiple transport barges can be used when sites are limited, but that greatly increase equipment and staff costs.

Harvesting of fish lanes can open up areas so game fish can feed upon panfish. It also helps increase the size of panfish that remain, and can increase the size of the predator fish (Nichols, 1988).

Harvesting can reduce the recreational boating's impact on aquatic plants by opening navigation lanes and lessening the amount of plants that are cut off during boating activities.

Recreational use in dense milfoil beds, winds, and waves can create large amounts of "floaters" that can increase the spread of milfoil. Collection of the floaters as part of a harvesting program can help minimize the spread of the nuisance. Plant fragments that are not removed from a lake can settle into new areas, regrow, and spread the problem. This creates a greater problem on lakes which do not conduct chemical shoreline treatments for watermilfoil.

Harvesting can also cause problems if it is not done properly. Machines that are not properly maintained can discharge gas, oils and grease into lakes. Cutting too close to shore or into the bottom sediments can disrupt fish spawning and nursery areas. The sediments are also very damaging to the harvesting equipment and will increase maintenance costs significantly. Attempting to operate the equipment in shallow water (less than three feet deep) will disrupt the sediments and aquatic plants.

Harvesting is non-selective, that is, it harvests all plants in its path. Areas with native plants should be avoided whenever possible. In an area with a mix of plant species, including watermilfoil, harvesting favors the species that grow quickly. Because this is usually watermilfoil, it leads to re-harvesting areas often over the summer season. Harvesting also removes fish, turtles and invertebrates.

In a mixed plant bed with both watermilfoil and natives, cutting above the native plants will open up more sunlight to the understory, will encourage the native plant growth, and will remove any flowering portions of the watermilfoil.

Because of the increasing concern of the role seeds play in the spread of Eurasian watermilfoil, areas dominated by watermilfoil should be harvested early enough to prevent seed development.

Harvesting is a very costly management alternative. To begin a harvesting program, a number of pieces of equipment are needed including the harvester, a trailer, a truck to haul cut plants, a conveyor or claw to move plants from the harvester to the truck. A location to dump cut vegetation is needed in close proximity to the lake. Another major component is staffing the program. Although some groups successfully use volunteers to operate and maintain the equipment, most often that does not work well over time. A number of lake districts report that even paid staff are difficult to find and keep. Daily and seasonal maintenance, as well as repairs, require at least one staff experienced in large equipment. Purchase of the harvester alone can exceed $180,000 in capital costs. State grants for the acquisition of the harvester, conveyor and trailer are eligible to lakes which harvest a minimum of 30 acres, and have adequate public access. State grant funding percentages have been reduced in recent years, raising the local costs of the equipment.

A variation of harvesting is skimming. Skimming removes the surface plant material and debris, while leaving the bulk of the submerged plant material in place.

Contract Harvesters - If a lake uses a contract harvester, the contractor must ensure that the equipment is sanitized prior to launching. The WNDR protocol for vehicles that are transported between lakes should be followed.

Conclusion— Harvesting (or skimming) is a viable tool for attempting to manage aquatic plants in Potters Lake. Harvesting may be used to maintain recreational access as water levels allow. Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds.

LOCAL ORDINANCES AND USE RESTRICTIONS

Lake use ordinances have long been used to control activities on lakes. Local communities may adopt ordinances to protect public health, safety and welfare. Any proposed ordinances are sent to the DNR for review to be sure they comply with State Statutes. Ordinances must address issues that threaten public health, safety and welfare. Once approved by DNR, communities may then finalize and enforce the ordinances.

Historically, public health, safety and welfare was interpreted to mean peoples' physical issues associated with using the lake. Speeding and reckless use endanger lives and are usually controlled through local ordinances.

Recently there has been a growing realization that the lake's health has a bearing on public welfare. Lake use activities conducted in inappropriate areas of lakes can be very damaging to the lake ecosystem. Spawning habitat can be destroyed. Wildlife can be chased away. Aquatic plant communities can be disrupted, shifting the communities to plants less beneficial than the original.

With the state's acceptance of the environmental health premise, communities are looking at lake use zoning. Some have shoreline zones that are no slow wake. Others have restricted some or all of the lake to no-motors. Protection of specific species or valuable areas can be achieved by developing an ordinance to minimize intrusions.

Costs associated with ordinance development depends upon the problem, potential solutions, municipal cooperation, and municipal legal reviews. Grants are available through the WDNR to assist with the cost of developing ordinances.

It is important to keep in mind the following in the development of ordinances:

- Any proposed lake use ordinance must have prior review by the WDNR.
- An ordinance must not discriminate on a particular craft, ie if motors damage an area, all motors should be restricted, not just ski boats.
- An ordinance must be clearly understood and posted. Buoys (which must also be approved by the DNR) should warn boaters of areas to avoid.
- Any ordinance should address a particular problem. If boating damages a sensitive area of the lake, allowing boats in the area on alternating days does not achieve the protection sought.
- An ordinance must be reasonable and realistic. An ordinance that creates a slow no wake zone that affects all of the lake area less than three feet deep may not be enforceable. The general public could not know the extent of that area. A more reasonable approach would be to review the desired area and develop a plan based on a specific distance from shore. Buoys could then be used to identify that area.
- Any proposed ordinance should be studied to ensure that it does not aggravate a different problem. For example, many communities, including the lakes in the Town of Norway, Racine County, have shoreline slow no wake zones that exceed that of state law. On a small lake, enlarging that shoreline zone may provide more resource protection. It may also further concentrate other lake use activities such as skiing into an area that is too small to be safe.
- Any attempts to restrict lake use should be weighed along with the social and economic impacts. It is well documented that those most involved with lakes and lake protection are those same people who spend the most time on or around lakes. They either live on or have easy access to a lake. It is very difficult to convince outsiders that lake quality is a concern or that funds should be spent because they do not have a personal involvement. They have other priorities. Reducing public use of a lake will have a direct affect on their involvement and possibly their social and economic concern about a lake.
- Lake ordinances should be developed to protect health or safety, not to restrict a specific user group.
- Ordinances should reference, not duplicate state laws.

Conclusion—Lake use ordinances may be considered for Potters Lake, however, they should be carefully developed and studied to ensure that they address the problems without undue restrictions and that they will actually be enforced.

CHAPTER VI - PLANT MANAGEMENT PLAN

GOALS AND OBJECTIVES

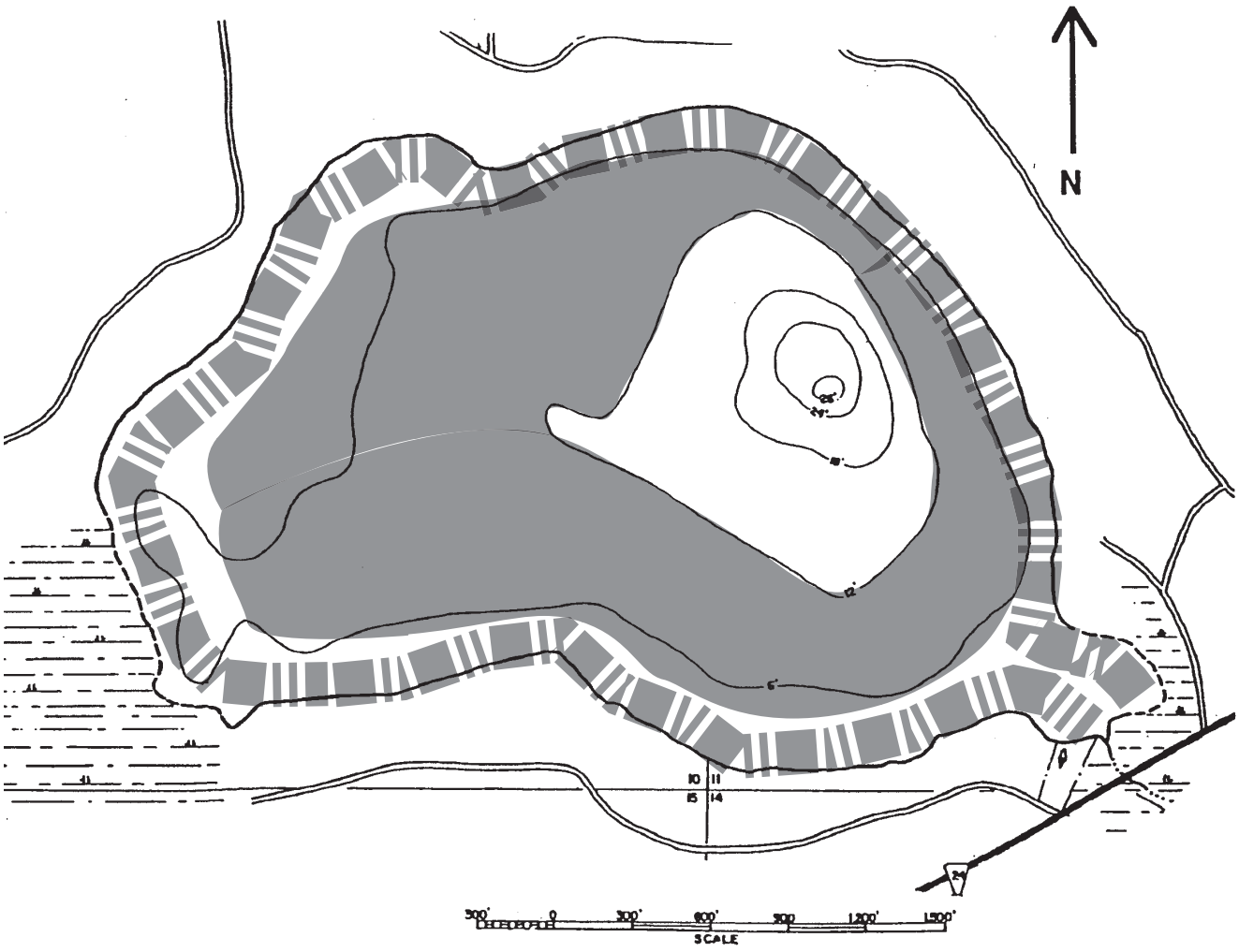
The goals and objectives on Potters Lake continue to focus on balancing the various uses and needs, while working to improve the long-term quality of the resource. The difficult task facing those who attempt to manage their lake is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those depending on the lake for "aesthetic viewing" desire an undisturbed lake surface.

The management of non-native plants, specifically, Eurasian watermilfoil (*Myriophyllum spicatum*), hybrid watermilfoil, curly-leaf ponweed and excessive amounts of native plants continue to be a great concern to the District. The invasive plants and very dense native plants restrict boating use in some areas of the lake. Controlling exotic plants, preventing new invasions of exotic species and protecting the diversity of the native plant population is crucial to the ecological balance of the resource.

The District desires to:

- Reduce and maintain levels of Eurasian water milfoil and hybrid watermilfoil to below 20% frequency
- Minimize fragments of aquatic plants that are caused by the high volume of boating traffic and natural processes.
- Control exotic and nuisance plant species and maintain recreation access for lake users by:
    - ◊ Use of selective chemical treatments
    - ◊ Harvesting
    - ◊ Encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by:
    - ◊ Educating landowners and lake users in lake ecology.
    - ◊ Work with the Town, County and State governments to review existing ordinances, and if necessary, develop and enforce ordinances to protect Potters Lake.
    - ◊ Continue to be vigilant regarding the watershed to protect Potters Lake.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
    - ◊ Distributing at least 2 newsletters per year.
    - ◊ Encouraging community participation in lake management activities.

- Conduct in-lake management activities with the long-range goal of minimizing the management as much as possible:
    - ◊ Conduct year-end evaluations as to the success of plant management activities and the community reaction to the activities.
    - ◊ Track the annual progress of lake management activities.
    - ◊ Conduct water quality monitoring efforts to assist in the documention of results.
    - ◊ Develop a plan for quick response to invasive species.
- Maintain navigational access:
    - ◊ Aggressively treat Eurasian watermilfoil, hybrid watermilfoil and curly-leaf pondweed to prevent them from increasing their range in the Lake.
    - ◊ Maintain navigational access by controlling plants as necessary to maintain that access.
    - ◊ Treat filamentous algae mats on shorelines to prevent temperature increases and plant shifts, and to maintain navigational and recreational access.
    - ◊ Control vegetative mats that collect on the surface.
    - ◊ Control floating plant debris.
- Minimize the financial costs to the District by conducting projects with long-term, cost-effective results.



Aquatic Plant Management Plan (permits needed)

- Chemically treat Eurasian watermilfoil and curly-leaf pondweed following plan guidelines.
- Harvest areas > 3 ft. deep when needed. Avoid native plants. Harvest navigational lanes in areas < 3 ft. deep to provide access only if chemical treatments cannot be conducted.

Harvesting Area Priorities (see Figure 16):
1) navigational channels to public access and restricted landowners
2) harvest slow-speed navigational channel
3) harvest open water areas

Chemical Treatment Areas:
All of lake's rooted zone
1) Chemically treat dense areas of Eurasian and hybrid milfoil where few natives are present
2) Chemically treat shoreline zones

Figure 15 2017-2021 Plant Management Plan for Potters Lake, Walworth County, Wisconsin

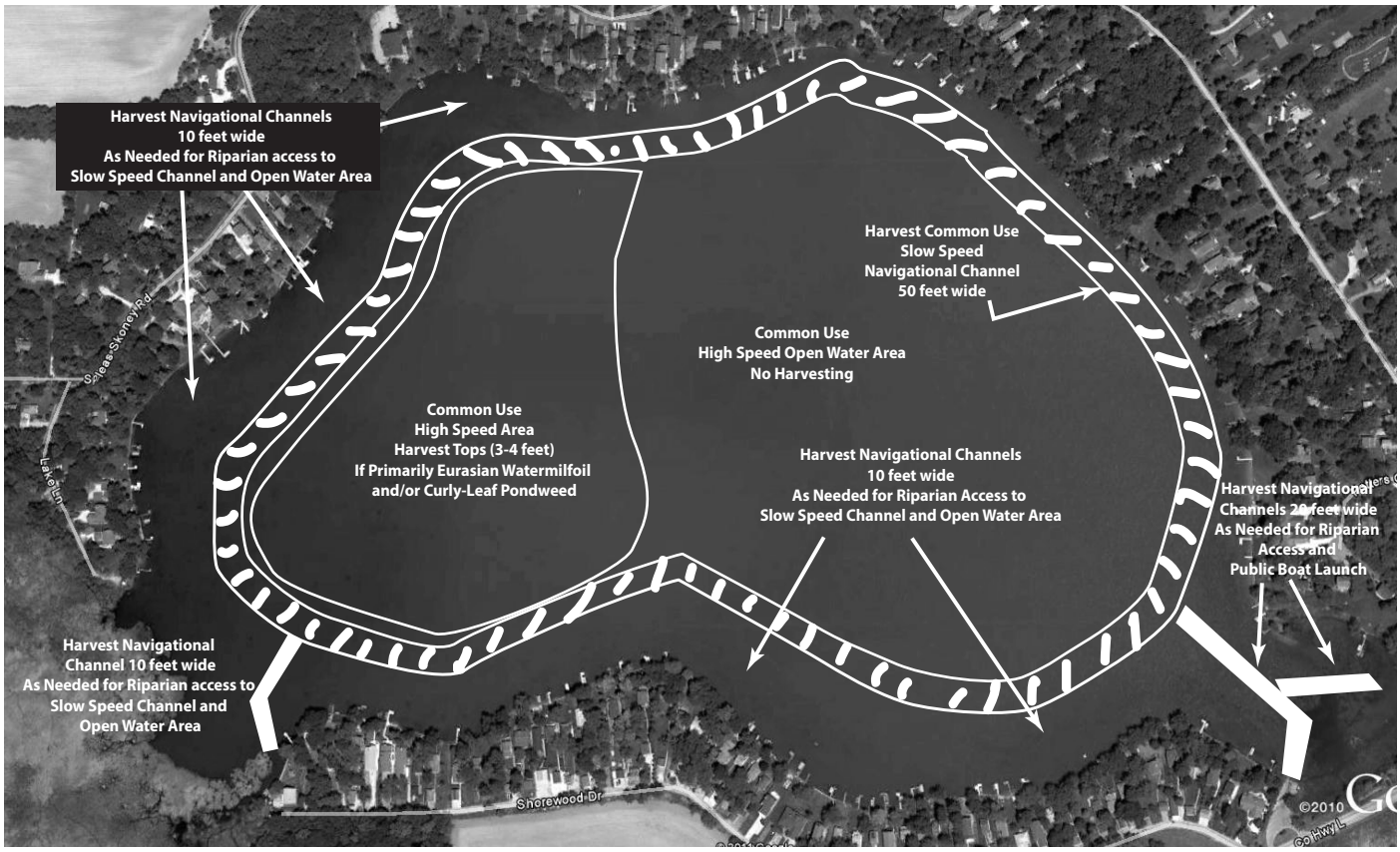


Figure 16 2017-2021 Harvesting Plan for Potters Lake,
Walworth County, Wisconsin

RECOMMENDATIONS

WATER QUALITY MONITORING

The District should conduct ongoing, detailed water quality monitoring on Potters Lake. Monitoring should include nutrients as well as clarity. This should be part of a regular, annual commitment by the District. When the District conducts large planning and project implementation using State grants, water quality monitoring costs can often be included in those project budgets to help defray the costs.

HAND CONTROLS

Riparians should be encouraged to use the least intensive method to remove nuisance vegetation from their shoreline areas. This could include minimal raking and pulling. NR109 allows landowners to remove plants from an area up to 30 feet wide without a permit. The 30-foot area includes the swimming and pier areas. Landowners may manually remove watermilfoil and curly-leaf pondweed from the remainder of their shorelines without a permit, without the use of auxiliary power. Removal of native plants beyond that allowed in the 30-foot area, will require a WDNR permit. If screens are considered by individuals, a WDNR permit will be required.

Riparians should be encouraged to allow native plants to remain. This will help prevent infestation of the areas by watermilfoil or curly-leaf pondweed. The native plants will also help stabilize the sediments.

The District should inform landowners about the importance of keeping their shorelines free of floating plant debris. Wave action can carry plant fragments into new areas, possibly spreading nuisance conditions. Plant debris can be used in mulch piles or gardens, or picked up in a roadside weed pickup program.

EDUCATION AND INFORMATION

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in Potters Lake. Informational material should be distributed regularly to residents, landowners, and lake users and local government officials. A newsletter to landowners and residents should be part of the annual plant management budget. Topics should include information relating to lake use impacts, importance and value of aquatic plants, land use impacts, etc. Information on shoreline restoration and plantings can be provided. Publications are available that list sources of plants and methods of creating buffers. Other issues that should be addressed may include landscape practices, fertilizer use, and erosion control. Existing materials are available through the WDNR and the UWEX. Other materials should be developed as needed.

The District should consider enlisting the participation of the local schools. The schools could use Potters Lake as the base for their environmental education programs. Some schools have a mandatory community service requirement that may be tapped to assist with lake management activities. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

The District should inform residents about the lake management activities that are undertaken and the reasons behind the activities. The District is currently updating their website and should work to ensure that the site contains up-to-date information.

The District may wish to conduct a community survey similar to that done in 1993 and 1997. The survey can provide valuable insight into the property owners' concerns about Potters Lake.

WATERSHED CONTROLS

The District should continue to work to improve the quality of water runoff into Potters Lake. The watershed should be toured regularly for identification of new problems.

The District should work with the Town and County officials to encourage rigid enforcement of erosion control in the watershed and consideration of lake-friendly methods and timing of development and road construction.

LAND USE PLANNING

Development proposals should be analyzed with the lake in mind and revised if necessary to protect the lake from damaging runoff. Long range planning should ensure that future development includes lake protection. The large farmland to the East of Potters Lake would be a certain if it was to be developed.

STORM WATER PLANNING

The District should review any new development proposals in the watershed to ensure that the lake will not be damaged by changes in flows or quality of stormwater. The District may consider applying for grants to assist with land use and storm water planning. The District may work with the Town and County to develop, refine, and implement storm water ordinances. The District should work with the Town to educate residents on the importance of the use of phosphorus-free fertilizer.

CHEMICAL TREATMENTS

Potters Lake has conducted many chemical treatments over the years, from shoreline treatments, to watermilfoil area treatments, to whole-lake eradication treatments. The 1997 and 2004/2005 whole-lake watermilfoil treatments using fluridone were very effective at eliminating watermilfoil from the lake for about four years. Subsequent regrowth after 1997 was very explosive in the 5th year after treatment (YAT). Because of the density and severity of growth, the decision to re-treat in 2004/2005 was made. After the

2004/2005 whole lake treatment, problems with approval to conduct the spot treatments as re-infestation occured, led to more extensive areas dominated by watermilfoil. Large area treatments have been conducted since 2012 to attempt to maintain watermilfoil at low levels. Watermilfoil has now reached levels that are difficult to control by either harvesting or chemical treatments. That in part may be due to the presence of hybrid watermilfoil and its resistance to control using 2-4,D. The District is planning to conduct a whole-lake Fluridone treatment in 2017. The goal of that treatment is to eliminate watermilfoil from the lake for at least 3 years, and then, maintain watermilfoil levels below 20% frequency of the rooted zone by using spot treatments.

Based on the history of the lake and the results of all the prior treatments and management, a number of specific recommendations are made here to eliminate watermilfoil from the lake for a period of time (3 to 5 years), and then to keep any re-establishment to less than 20% frequency.

Whole Lake Fluridone Treatment

A whole-lake Fluridone treatment should be conducted in 2017. The District should follow the project plan presented in Chapter VII on page 53. The whole-lake project should be followed by regular maintenance chemical treatments as needed as watermilfoil re-enters Potters Lake, to maintain frequency of less than 20%. Harvesting should not be needed for at least 5 years unless other plants restrict navigational access. Refer to the Harvesting Plan on page 45.

Maintenance Chemical Treatments

- Contact herbicides may be used in limited areas to reduce nuisance levels of native plants, including shallow navigational lanes.
- Watermilfoil and curly-leaf pondweed may be treated with the appropriate herbicides, following label restrictions. It should be remembered that destruction of any native plant species populations will increase potential problems from watermilfoil.
- Treatments should be planned for early enough in the season to eliminate the nuisance using the least amount of herbicide and before the native plants have been negatively impacted by dense growths of nuisance plants.
- Large scale, open water treatments may be considered to treat large areas of watermilfoil and curly-leaf pondweed as needed.
- When larger area treatments are conducted in summer, WDNR may require the proposed treatment area to be divided and treated in stages over time.
- Proposed chemical treatments should be developed based on the current nuisance conditions, but the District should continue to take the permit out to cover sufficient acreage in case additional plants are found.
- When conducted, curly-leaf pondweed treatments should be planned to try to prevent the production of turions, an important method of reproduction for the plant. These treatments would allow native plants a better opportunity for growth in the area and will reduce the nutrient release that occurs when curly-leaf pondweed dies in mid-summer.
- Potters Lake should be regularly surveyed for new invasions of exotic species, including Hydrilla and Starry Stonewort. If found, the plants, along with a larger surrounding area should be agressively treated to eliminate the plants. The lake should then be surveyed extensively for at least three years to ensure the nuisance has been eliminated. The District should follow recommendations in New Infestations of Exotic Species section below.

- WDNR Administrative Rule NR 107 should be consulted for the specific requirements for conducting a treatment. The following are some of the steps that should be followed by anyone preparing to conduct chemical treatments.
    - ◊ Complete and submit the WDNR permit application forms. Include treatment map, area sizes and names and addresses of all affected riparian landowners.
    - ◊ Contact a licensed firm to coordinate the proposed treatment.
    - ◊ When treatment areas will be greater than 10 acres, a public notice must be placed in the local paper informing the public about the proposed treatment. This will also inform non-riparians who may be using the lake.
    - ◊ Provide a copy of the WDNR application to any riparian landowner who is adjacent to the proposed treatment areas. This may be done by newsletter, or box drops.
    - ◊ At the time of treatment, WDNR-approved yellow posting signs must be posted in and adjacent to treatment areas, at least every 300 feet. The signs must indicate what chemical has been used, and any use restrictions and must remain posted for at least the time of any restrictions.
    - ◊ Current administrative codes should be reviewed annually to ensure compliance.

HARVESTING

- There will be no harvesting the year of the whole-lake treatment. If the navigational lanes in the boat launch bay are blocked by native plants, an herbicide treatment will be used to open the lanes for navigational access.
- The District may use harvesting or skimming to provide relief from nuisance conditions.
- Harvesting should not be done for at least two weeks in areas that are treated with herbicides.
- Any harvesting that is done should be carefully planned to avoid native plants as much as possible.
- Harvesting may create channels to provide navigational access.
- No harvesting should be done in shallow waters less than three feet deep except where providing navigational access to open water areas in the designated channels, including the boat launch channel and the slow speed navigational channel.
- Native plants may be harvested if necessary to open access lanes and minimize disruption and cutting by boaters.
- Educational efforts should be developed to inform the public about the benefits of a comprehensive plant management program, that gives equal consideration to fish, wildlife and native plants, while reducing recreational nuisances and unsafe situations.

WDNR Administrative Rule NR 109 should be consulted for the specific requirements for conducting harvesting. The following are some of the steps that should be followed by the District when preparing to harvest.

- Complete WDNR permit application forms. Include map, area sizes and name and addresses of all affected riparian landowners.
- Current administrative codes should be reviewed annually to ensure compliance.
- Records should be kept documenting loads and other pertinent information. The District should stress to the operators the importance of keeping accurate records.

- The District should provide operators with a copy of the harvesting permit and be sure it is read and understood, to ensure compliance with its provisions.
- Harvesting operators should be trained to identify target plant species.
- Operators should not cut plants in less than three feet of water unless providing access to open water areas.
- The District may continue to follow its current harvesting schedule as needed.
- Any turtles or game fish that may be harvested with the plants should be returned to the lake.
- Avoid harvesting in areas with spawning fish.
- Disposal of cut plants may continue to be disposed of locally.
- The District is required to summarize its harvesting records into an annual report to provide to WDNR.
- The District should review the plant management plan and operations every five years.
- The District should distribute informational materials to its members that include such topics as proper lawn and garden practices, land use impacts and the importance and value of aquatic plants.

General Harvesting Recommendations

The District should harvest areas of the lake on an as needed basis, prioritizing the areas as follows (refer to Figure 16) (from 2018 on - no harvesting will be needed the year of the whole-lake treatment):

—Harvest main navigational channels.

Harvest 50 foot wide slow speed navigational channel.

—Harvest secondary navigation channels.

Harvest 20 foot wide channels to boat launch and landowners.

Harvest 10 foot wide channels to provide landowner access to open water areas.

—Skim surface plant debris.

Emphasis of the program should be to harvest plants necessary to facilitate recreational use and remove unsafe conditions, rather than simply 100% removal of plants. Focus on providing access rather than clear cutting (removal of most or all plants in an area). Dense beds of watermilfoil may be clear cut to help minimize fragmentation and reduce the spread of the plant.

Harvesting staff needs to make sure that cutter bars are kept out of the sediments and to cut at least one foot above the native plant beds, being especially careful where Chara tends to dominate the plant community. Nuisance aquatic plants, especially watermilfoil, will likely expand their range if this recommendation is not followed.

If chemical treatment is not used in specific areas, harvesting may be used to relieve the nuisances up to the pier zone area as long as access is not restricted by depth.

Staff should concentrate harvesting efforts on the watermilfoil areas (especially to help reduce the amount of floaters that may be caused by boaters). Watermilfoil should be harvested before a canopy begins to form. No harvesting of areas that have only desirable native plant species.

Off-load areas should be kept free of plant debris. Any debris in the lake should be removed each time the harvester unloads.

Comprehensive and detailed records should be kept documenting:

- ◊ Date
- ◊ Hours worked - including harvest and down time
- ◊ Loads harvested - including plant types and densities
- ◊ Areas harvested - located on a map
- ◊ Weather conditions
- ◊ Other relevant information

Schedule For Harvesting

The District should establish a schedule based on the current nuisance conditions. A review of past harvesting records in conjunction with a pre-harvest survey should be conducted each spring to determine which areas need attention and which areas are undergoing a change from the previous year. If plants become a nuisance in mid-May, begin harvesting but note previous recommendations, especially with regard to fish spawning areas.

Harvested Fish & Wildlife

Care should be given to returning any captured game fish and turtles to the lake. If game fish are caught in quantities of more than a few per area, the harvesting crew should take the following actions:

- Reduce the operating speed of the harvester to give fish a chance to flee.
- If that does not help, then reduce cutting depth and see if problem is resolved.
- If fish are still being harvested, refrain from cutting the area and consult with WDNR or private consultant for further recommendations.

Off-Loading and Disposal Sites

Current disposal practices should continue. The District has a disposal site for use when chemical treatments are not conducted. Care should be taken to keep lake areas adjacent to off-load sites clean of cut vegetation. Staff should be instructed to remove any vegetation debris immediately upon off-loading the harvester.

Insurance

The District carries insurance which should be continued.

Other Activities

Other administrative records should be maintained.

- The District should ensure that the harvesters are complying with the WDNR permits, and all laws associated with exotic species control.
- The District should file its annual report with WDNR in compliance with permit requirements.

BOAT LAUNCH ACTIVITIES

The District should enlist property owners, volunteers, students or hired help to remove debris regularly in the near-shore and shoreline areas, especially at the boat launch. This will minimize the amount of plant fragments that are moved by trailers and will increase the chances of noticing new invasions of exotic species.

The District should continue to pursue efforts to minimize/prevent introductions of exotic species. This can include signage at the boat launch. This includes continuing the Clean Boats Clean Waters program using volunteers and staffing for the launch site to educate boaters about preventing the transport of invasive species.

NEW INFESTATIONS OF EXOTIC SPECIES

New infestations should be aggressively managed to eradicate the species from the system. Depending on the species, different levels of response may be needed. A reaction to a Hydrilla or Starry Stonewort invasion, should warrant a "top level" response of treating the invasion and surrounding areas, and surveying the lake continuously.

Steps should be taken to work with the Town, WDNR and Legislators to facilitate rapid response:

- The Legislature should be approached to develop state laws to allow local rapid response to take place.
- The WDNR should be approached to develop an emergency access plan should an infestation be found.
- Materials should be developed and produced to use in the event of an invasion. These would include press releases, public informational materials about the cause and effect of the invasion, and access site notices.

If a new exotic species is found, the following steps should be taken immediately:

- WDNR should be notified of the invasion.
- Take a digital photo of the plant in the setting where it was found and mark with a GPS. Then collect 5 – 10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers where present. Place in a Ziploc bag with no water. Place on ice.
- Fill out form http://dnr.wi.gov/lakes/forms/3200-125-plantincident.pdf
- Contact the DNR Aquatic Invasive Species Contact (currently Heidi Bunk, WDNR Lakes Biologist) and deliver the specimens, report, digital photo, and coordinates. Do this as soon as possible, but no later than four days after the plant is discovered. A board member and lake consultant should also be notified.
- Upon confirmation of species identification, a coordinated response plan should be developed in consultation with the DNR, the County, and lake consultants as needed.
- The District's chemical treatment contractor should be contacted to schedule an immediate treatment of the area where the exotic was found. States with experience in reacting to new invasive species invasions recommend treating a five acre area surrounding the initial site.
- A full, point-intercept survey of the lake should be conducted to determine the extent of the invasion.
- The site should be inspected throughout the season to ensure efficacy of the treatment.

- The survey and treatments should continue for at least three consecutive seasons to ensure eradication.
- Surrounding lakes should be notified of the infestation and advised to begin surveying.

CONTINGENCY PLANS

The District should be prepared for changing aquatic plant conditions that may fall outside the specific recommendations in this Plant Management Plan. While the final determination will be permitted by WDNR, developing local consensus on possible solutions is often needed. In evaluating whether to treat or harvest a “new” nuisance condition, the following should be considered:

- ***Are the plants native or exotic species?***

  If unsure, consult WDNR or an aquatic plant specialist to determine the species.

- ***Is the area in shallow or deep water?***

  This can quickly limit some of the options. Harvesting, for instance, cannot be used in water less than 3 feet deep. Different chemicalformulations may be needed for deep water treatments.

- ***Is the condition impeding or preventing recreational use, or is something else a factor?***

  Access channels may be created either by harvesting or chemical treatment. However, if water depth prevents access during a drought, chemical treatment will not open up boating access. However, chemical treatment may eliminate a filamentous algae that is causing odor problems.

- ***Is the situation creating unsafe conditions?***

  Dense, stringy weeds in a beach area, for instance, could create dangerous conditions for young swimmers.

- ***Will the considered option improve the situation long term, short term, or both?***

  The short term solution may eliminate the problem this summer, but make it worse in future years, while the long term solution may be the best over the long haul.

- ***Is the considered option detrimental to fish, wildlife, or humans?***

  If it is, maybe there are other options to solve the problem that would be safer.

- ***Will the considered option increase invasion by other nuisance species?***

  Consider whether the option will create “bare” lakebed that will quickly be invaded by weedy species, or whether the option will protect desirable vegetation while removing the nuisance.

CHAPTER VII - WHOLE-LAKE FLURIDONE TREATMENT PLAN

EXECUTIVE SUMMARY

This is a multi-year project which will begin in May 2017. It is being conducted at the request of Potters Lake P & R District. Marine BioChemists, with survey work by Aron & Associates, and permit approval by the Wisconsin Department of Natural Resources, propose to treat approximately 162 acres with Fluridone in late April 2017. The primary goal of the project is to eradicate Eurasian and hybrid watermilfoil and to create conditions that allow for effective localized control to keep watermilfoil below 20% frequency as it re-enters the lake. The project will create conditions that favor native species and will hopefully continue the slow shift of the plant communities in the lake to one with greater diversity; and to minimize the amount of harvesting needed to control the nuisance conditions. The lake is currently dominated by Eurasian watermilfoil (*Myriophyllum spicatum*) and hybrid watermilfoil. Control of curly-leaf pondweed is a secondary goal of the treatment.

This will be the third whole-lake treatment project of Potters Lake. The first treatment was conducted in 1997. The second whole-lake treatment was conducted in May 2004 and, because control was not achieved, again in May 2005.

Potters Lake will be treated with granular Fluridone at 4 ppb applied rate in very early spring, early April. The granular will be applied in the primary growth area of milfoil. A maximum of 4 ppb will be seen about 20 days post-application, and then the goal is to maintain a level of 2-4 ppb for the next 120 days. When levels drop below 2 ppb, 1-2 ppb will be applied to maintain a level of up to 4 ppb through the summer. In September/October, another 2 ppb will be applied to maintain 4 ppb through the winter. This protocol has been recommended by the manufacturer and has the best milfoil control with the least native impacts. No other milfoil treatment should be conducted in 2017. No chemical milfoil control should occur in 2018 until fluridone concentrations are below 1.5 ppb.

Residual samples will be collected to measure the level of Fluridone in the system after treatment. Samples will be collected 21, 42, 63, 84, 105 and 126 days after treatment (DAT) or until Fluridone is no longer detected in the lake. In 2018, a sample will be collected right after ice off and another in 20 days if the concentration at ice out is greater than 1.5 ppb. Samples will be collected at the deep hole.

Water quality and aquatic plant monitoring were conducted in 2016 in preparation for the 2017 treatment. Water quality monitoring will be conducted in 2017 and 2018. Aquatic plant monitoring using the PI protocol will be conducted in summer July in 2017.

Followup monitoring will be used to find re-infestation of watermilfoil and those plants will be treated as quickly as possible. The goal here is to extend the life of the project, and to lengthen the time before another whole-lake treatment is needed.

This treatment is expected to achieve at least 95% control of watermilfoil with the least possible impact on native plants.

Non-target vegetation in the treatment area includes Sago Pondweed, Coontail, Chara, Elodea, Slender Naiad and Water Lily. It is anticipated that the lower treatment dosage will minimize any non-target impact to these species. Water Lily and Chara are resistant to Fluridone and are not expected to be impacted with a treatment of this concentration.

- Active Ingredient: Fluridone
- Treatment Volume: 1296 acre feet
- Treatment Area: 162 acres, entire lake
- Rate of Application: 4 parts per billion then when below 2 ppb boost to 4 ppb
- Use Restrictions: 30 day irrigation precaution
- Manufacturer Guarantee: TBD
- Applicator Guarantee: TBD
- Plants Likely Controlled: Eurasian and hybrid watermilfoil, curly-leaf pondweed
- Plants Possibly Injured: Elodea, Naiad, Coontai

TREATMENT AREA

Approximately 162 acres, the entire lake, is planned to be treated with the Fluridone treatment. Based on existing maps for Potters Lake, the volume of the area affected by the treatment is approximately 1300 acre feet. Almost 90% of the lake is available for aquatic plant growth. Maximum rooting depth in 1992 was 15 feet; and in 2016, almost 11 feet. Fluridone will be applied to the entire lake, with higher concentrations applied in the "flats" area, the Western 1/3 of the lake.

TARGET SPECIES

Eurasian and hybrid watermilfoil are expected to be controlled by the treatment for at least three years. Curly-leaf pondweed will be controlled for one year.

TREATMENT STRATEGY

The treatment will be conducted between April 1 and May 1, 2017. The treatment will attempt to maintain a low dose of Fluridone in the lake over the entire summer, using a “bump” application as needed to maintain the proper dose. It is expected that Potters Lake will not be mixed at the time of treatment. The entire lake volume has been used to calculate the treatment dosage.

The product will be applied using a granular spreader.

The herbicide will be applied in varied concentrations, with the heavier concentrations to be applied in the areas with the greatest problems with watermilfoil. Doage will be adjusted according to the current depth.

Both the applicator and boat driver are certified and licensed with the Wisc. Department of Agriculture in Category 5, Aquatics. They will be equipped with all applicable safety equipment, including face shields, rubber gloves, aprons and boots.

The treatment is expected to take approximately 4 to 6 hours. The boat will not apply Fluridone closer than 150 feet from shore. However, the material will disburse throughout the lake, even within the 150-foot shore zone. The project is intended to distribute Fluridone at an initial concentration of 4 ppb. Maximum concentration in the lake is expected to peak about 4 ppb about 3 weeks after treatment. When levels drop below 2 ppb, 1-2 ppb will be applied to maintain a level of up to 4 ppb through the summer. In September/ October, another 2 ppb will be applied to maintain 4 ppb through the winter.

The treatment area will be posted by Marine BioChemists. The application will be conducted by Marine BioChemists, commercial applicators under contract with the District.

PUBLIC NOTICE/INPUT

Landowners in the treatment area will be notified prior to treatment. The District has discussed and approved this project at the 2016 annual meeting. It was also discussed and overwhelmingly supported at prior meetings in September 2015 and May 2016. Approximately 60 people attended each meeting, almost half of the district's residents.

Piers, trees and launch sites will be posted at least every 300 feet with the treatment notice. The District will publish an advance notice in the East Troy News following the criteria of Admin. Code NR 107. The District will send residents and property owners a copy of the permit application in compliance with NR107. The mailing will also state that the application and treatment plan will be at the East Troy Town Hall for anyone to review. The notice and information about the treatment will also be posted on the District website, potterslake.org.

The District will post the public launch as being closed during the treatment. To minimize conflict between lake use and the actual treatment time, property owners and the public will be asked to stay off the lake until the treatment is complete. This restriction should have minimal impact because of the time of year for the treatment.

The applicator will post a 24-hour advisory swimming precaution, however, according to the US EPA there are no restrictions on swimming, fishing or drinking immediately following treatment.

MONITORING

Aquatic Plants Monitoring

The aquatic plants in the lake has been surveyed frequently since 1996, using the line transect method until 2001 and then using the point intercept method. This same sampling method will be used to survey the vegetation during the project period. The specific methodology follows WDNR's requirements for PI surveys. In addition to the point-intercept survey, general meander surveys will be done around the shoreline. The maximum rooting depth will also be identified. A project report will be published providing the sampling data and a discussion of the results.

The District intends to continue to conduct general meander surveys of the lake at least annually, to determine the effectiveness of the treatment, look for any reinfestation of watermilfoil, any impact on non-target plants and to identify any new species not currently present in Potters Lake.

Dissipation/Residue Study

Water samples will be collected and analyzed for Fluridone concentrations. Samples will be collected at the center of the lake. Samples will be collected on day 21, 42, 63, 84, 105 and 126 days following treatment.

Water Quality Monitoring

The USGS has been contracted to conduct water quality monitoring on Potters Lake. The monitoring follows the USGS baseline sampling program.

PROJECT IMPACTS

Target Species

Watermilfoil is expected to be controlled by the treatment for at least three years. Curly-leaf pondweed will be controlled for one year.

Non-Target Impacts

Based on the product label, it is anticipated that there may be impacts to non-target plants in the lake. Non-target vegetation in the treatment area includes Slender Naiad, Coontail, Chara, Sago, Water Lily and Bladderwort..Chara is listed as tolerant. Water Lily is listed as intermediate. Elodea and the pondweed species are listed as susceptible to Fluridone, depending on the rate and timing of application. The low-dose, spring treatment will minimize the impact on most native species.

Affect On Landowners

According to Fluridone label precautions, there should be no irrigation from the lake for 30 days following the treatment for treatments of over 10 ppb. However, a precautionary restriction of 24 hours will be posted. Water from the lake should not be used to water vegetables and annuals for at least 14 days. Landowners should be advised to not use treated plant debris for mulch. There are no swimming or fishing restrictions following treatment with Fluridone. Lake use in early May is expected to be minimal. The closest residence to the treatment area is approximately 75 feet. There should be no affect on ground water from the treatment.

Affect On Fish, Wildlife

It is possible that predation on bluegills will increase because there will be less cover. This would lead to an increase in the size of bluegills remaining. Fish may be more difficult to catch. The reduced structure in the lake may make fish harder to find. When chemicals are applied according to label precautions, there should be no adverse impacts to fish and wildlife. There are no angling restrictions or precautions following treatment with Fluridone.

ANTICIPATED RESULTS

A control of at least 95% is expected for at least 2 years, with 80% control expected for at least 4 years.

There should be no control of Chara in the lake, and based on results seen during previous whole-lake treatments in Potters Lake, Chara will likely increase. There may be very minor impact on water lilies, and some short-term impacts on pondweed species, Elodea, and coontail. The treatment as planned will not produce the quick control that is usually associated with Diquat and 2,4-D treatments. Control will occur very gradually over 60-120 days. Water clarity in Potters Lake typically declines in summer months. The Fluridone treatment is not anticipated to have a noticeable impact on clarity. However, an overall decrease in vegetation biomass in the lake is likely to occur, which may result in slightly increased algae concentrations and sediment suspension and therefore reduced clarity.

Phosphorus concentrations in Potters Lake have been monitored by US Geological Survey (USGS) and WDNR (see Appendix). Because the phosphorus concentrations are relatively low, it is unlikely that the lake would be pushed toward one dominated by algae rather than plants.

Because Fluridone is highly fluid, it can be quickly diluted and flushed from a treatment area. Fluridone is expected to remain at stable conditions for sufficient time to control watermilfoil unless very heavy rains occur around the time of the treatment.

The project as designed should eliminate the likelihood of any large mats of dying vegetation. Growth of vegetation will be very low when the treatment occurs, and the effective does to treat milfoil we be maintained over a long period of time. This should prevent the issue of large biomass die-offs from occurring. It is however a possibility that a large die off a month or two after treatment will occur. Large mats may be harvested to reduce fish kill from low oxygen levels. It is possible that a large biomass die off in fall could lead to a partial winter fish kill. Impacts to water quality may also be seen with large biomass die-offs. However, one of the previous whole lake fluridone treatments on Potters Lake was conducted in fall and resulted in large amounts of dying vegetation, with little to no impact on dissolved oxygen under the ice. Low dissolved oxygen problems are not expected because the impacted amount of biomass will be much smaller.

Some loss of pondweed species in the 2017 season, along with the decreased impact of milfoil, could result in curly-leaf pondweed growing well in fall and winter of 2017. However, at the project treatment dose, one of the most susceptible plants in the lake is curly-leaf pondweed, so it is not expected to be found in 2017. Growth in 2018 from turions may take place.

REINFESTATION PLAN

Lake Inspections

Based on the results of the prior whole-lake treatments, eventual re-infestation of watermilfoil is expected. To minimize the impact, and to extend the life of the whole-lake treatment as long as possible, regular inspections will be conducted. See "Aquatic Plants Monitoring" on page 55. The general surveys will use rake tosses, depth finders and cameras to search for watermilfoil.

Spot Treatments

Although the Fluridone treatment is expected to provide at least 95% control initially, the District is prepared for reinfestation. Watermilfoil will continue to be a long-term management problem for the lake even with a successful treatment. The high level of lake use, including transient boaters, increases the likelihood of new introductions of watermilfoil from growth of plants or fragments.

Small isolated areas of watermilfoil, especially those found along the shoreline zone, will be treated using a 2,4-D product. The sites should be reinspected following treatment to ensure complete control of the plants. Watermilfoil may be mechanically harvested when levels again reach nuisance conditions, restricting navigation. Based on prior whole-lake treatments on Potters Lake, it is expected that harvesting will not be needed for at least 7 - 8 years.

No chemical treatment of any type or harvesting of vegetation in the lake should be conducted until the 2018 survey is conducted. This will ensure that the conditions are documented to allow re-inspection. The results should be included in future analysis of the project success.

Educational efforts of the District should emphasize protection of native plants. The role of aquatic plants in the complete lake system should also be stressed. Public access sites should maintain informational postings to educate users. Trailers should be thoroughly cleaned of all vegetation. Educational efforts and messages should be repeated regularly.

Clean Boats Clean Waters

The District will continue to rely on the Clean Boats Clean Waters inspection program at the boat launch. The inspectors will inspect boat trailers and provide informational material to lake users at the boat launch. This will minimize any re-introduction of watermilfoil and other invasive species through the recreational use of the launch site.

Additional informational material will continue to be provided to residents and lake users through the newsletters and the district web site.

CHAPTER VIII - PLAN REASSESSMENT/PUBLIC INPUT

This plant management plan provides options for plant management from which the community may select tools to accomplish their goals.

Future evaluation of the effectiveness of this plant management plan and the subsequent implementation efforts undertaken by the District should be based on whether the lake is in "better condition" from an aquatic plant nuisance situation:

- Have native aquatic plants increased in densities and diversity?
- Have nuisance species decreased in densities and coverage?
- Has the water quality improved?
- Does the general public, and more specifically, do the District residents have a better understanding of the lake, its environment, and the impacts on the resource?
- Do the District residents support the plant management activities of the District?
- Have there been new exotic species found in the lake?
- Are there ongoing public education efforts such as newsletters, websites, public meetings, etc, and are they being used by the public?

The District should review or contract to review, the plant populations of Potters Lake at least every five years, or as needed if conditions change dramatically. The chemical treatments that are conducted should be reviewed to facilitate evaluation of the management activities. The management plan should also be reviewed every five years.

The District plan has been developed as a result of public and local input. Community meetings have been held to discuss the plant and lake management and solicit input. The majority of the comments and input received is about the need for the management of the nuisance plants and the need to maintain recreational access to the open water areas of the lake.

CHAPTER IX - FEASIBILITY

The District is financially capable of managing the public resource, conducting aquatic plant management activities, and acquiring and maintaining harvesting equipment. The annual budget currently supports all the water quality monitoring, chemical treatments, harvesting, and other activities that the District undertakes in its efforts to manage the lake.

The District may seek grants to assist with the aquatic plant management program, using their taxing authority to provide funds for the local share of any grants. Grants are available for harvesting equipment, aquatic invasive species (AIS) control, and other lake management planning and protection efforts.

Grant requirements change over time, so WDNR should be consulted prior to grant application submittals.

CHAPTER X - SUMMARY

- The District should work with landowners' education to encourage protection of natural shorelines and emergent plant species such as sedges and rushes and floating leaf species like waterlilies and floating-leaf pondweeds.
- The District should be sure that the Town and County provide landowners with information on erosion control when landowners undertake construction activities.
- The District should continue to work with the County and the local farmer to reduce runoff from the agricultural land.
- Every effort should be made to reduce the amount of floating plant debris, especially watermilfoil fragments, in order to reduce opportunities for establishment in other areas.
- The District should distribute informational materials regularly to residents on such topics as proper lawn and garden practices, land use impacts and the importance and value of aquatic plants.
- Property owners should restrict the use of hand controls to control only watermilfoil and curly-leaf pondweed and should minimize the size of any native plant areas that are cleared.
- Early season chemical treatments should be conducted targeting watermilfoil and curly-leaf pondweed. Treatments should be conducted in spring when possible, as soon as plants are beginning to grow. This will minimize the amount of chemical needed while increasing the effectiveness. Additional watermilfoil treatments may be conducted in early summer or fall. Treatments may include open water, large-scale treatments to control watermilfoil and curly-leaf pondweed. WDNR may require summer season treatments to be staggered.
- Contact herbicides may be used to reduce native plant problems in limited shoreline areas and in navigational channels.
- The District should regularly inspect for signs of new exotic species invasions such as Hydrilla or Starry Stonewort. If found, the District should agressively treat the plants and surrounding areas to eliminate the nuisance and prevent the spread to other lakes. Surveys should be conducted for at least three years following treatment to be sure the plants do not return. Additional activities identified in this plan for rapid response should be implemented.

GLOSSARY

acid

Corrosive substances with a pH of less than 7.0.

acid rain

A polluting rain in which sulfur oxides from fossil fuels react with water vapor in the environment to form sulfuric acid.

adaptation

Any structure, the means an organism has to make them more likely to survive.

aerobic

Processes requiring oxygen.

algae

Microscopic organisms/aquatic plants that use sunlight as an energy source (e.g., diatoms, kelp, seaweed). One-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish.

algal bloom

Population explosion of algae in surface waters. This may be caused by an increase in nutrients.

alkalinity

The ability of water, or other substances, to absorb high concentrations of hydrogen ions. Substances with a pH greater than 7.0 are considered alkaline. Low alkalinity is the main indicator of susceptibility to acid rain.

ammonia

A form of nitrogen found in organic materials and many fertilizers.

anaerobic

Living or occurring without air or free oxygen.

annual

A plant that completes its life cycle in one year or one season.

annual turnover

This is when the lake mixes entirely from top to bottom.

aquatic

Organisms that live in or frequent water.

aquatic invertebrates

Aquatic animals without an internal skeletal structure such as insects, mollusks, and crayfish.

aquatic plants

Plants that grow and live in water. They may be floating, submerged or emergent.

asexual

Reproducing by fragmentation, turions, tubers, and/or other vegetative structures.

benthic zone

The bottom zone of a lake.

benthos

Organisms living on, or in, the bottom material of lakes and streams.

biomass

The total quantity of plants and animals in a lake. It indicates the degree of a lakes system's eutrophication or productivity.

blue-green algae

Algae that are associated with problem blooms in lakes. Some produce chemicals toxic to other organisms.

bog

An area characterized by soft, water-logged soil with mosses and other vegetation as the dominant plants.

calcium (Ca++)

The most abundant cation found in Wisconsin lakes. Its abundance is related to the pres-ence of calcium-bearing minerals in the lake watershed. Reported as milligrams per liter (mg/l) as calcium carbonate (CaCO3), or milligrams per liter as calcium ion (Ca++).

cation

This refers to chemical ions that carry a positive charge. Some cations present in lakes are calcium (Ca++), magnesium (Mg++), potassium (K+), sodium (Na+), ammonium (NH4+), ferric iron (Fe+++) or ferrous iron (Fe++), manganese (Mn++), and hydrogen (H+).

chloride (Cl-)

Is considered an indicator of human activity. Agricultural chemicals, human and animal wastes, and road salt are the major sources of chloride in lake water.

chlorophyll

A green pigment found in plants that is necessary for the process of photosynthesis.

clarity

Secchi disc is an 9-inch diameter plate with black and white painted sections that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. The readings should be taken on sunny, calm days.

conductivity (specific conductance)

Is the waters ability to conduct an electric current.

cultural eutrophication

Eutrophication that happens as a result of human activities when increased nutrients in runoff water drains into lakes.

decompose

Breakdown of organic materials to inorganic materials.

dissolved oxygen (DO)

The amount of free oxygen absorbed by the water and available to aquatic organisms for respiration.

diversity

Number of species in a particular community or habitat.

drainage basin

The total land area that drains toward the lake.

drainage lakes

Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

ecosystem

A system formed by the interaction of a community of organisms.

epilimnion

The epilimnion is the warm upper layer of a lake when the denser, colder water is on the bottom during stratification.

erosion

Movement of soil by water and wind.

eutrophication

The process by which lakes and streams are enriched by nutrients which results in increased plant and algae growth.

exotic

A non-native species of plant or animal that has been introduced.

filamentous algae

Algae that forms filaments or mats attached to sediment, weeds, piers, etc.

food chain

An arrangement of the organisms in an ecological community according to the order of predation in which each uses the next, usually lower, member as food source.

groundcover

Plants grown to keep soil from eroding.

habitat

The place where an animal or plant lives; its living and non-living surroundings.

herbicides

Chemicals designed to kill a variety of undesired plant species.

hydrologic (water) cycle

The process by which the earth's water is recycled. Atmospheric water vapor condenses into the liquid or solid form and falls as precipitation to the ground surface. This water moves along or into the ground surface and finally returns to the atmosphere through transpiration and evaporation.

hydrology

Study of the distribution, circulation, and properties of water.

hypolimnion

The lower, more dense, colder waters on the bottom of stratified lakes is the hypolimnion.

impervious surface

Ground cover that does not allow for infiltration of water, such as roads and parking lots, and increases the volume and speed of runoff after a rainfall or snow melt.

limiting factor

The nutrient or condition in shortest supply relative to plant growth requirements. Plants will grow until stopped by this limitation; for example, phosphorus in summer, temperature or light in fall or winter.

limnology

The study of inland lakes and waters.

littoral

The near shore shallow water zone of a lake, where aquatic plants grow.

macrophytes

Refers to plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects.

marl

White to gray accumulation on lake bottoms caused by precipitation of calcium carbonate (CaCO3) in hard water lakes. Marl may contain many snail and clam shells, which are also calcium carbonate. While it gradually fills in lakes, marl also precipitates phosphorus, resulting in low algae populations and good water clarity.

metalimnion

This is the thin layer in a stratified lake that lies between the hypolimnion and the epilim-nion.

non-point source

A source of pollution that comes from a variety of sources instead of a pipe.

nutrients

Elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances promote excessive plant growth.

pH

The numerical value used to indicate how acid or alkaline a solution is. The number refers to the number of hydrogen ions in the solution. The pH scale ranges from 1 to 14 with 7.0 being neutral. Acid ranges from 0 to 6. Alkaline ranges from 8 to 14.

phosphorus

Key nutrient influencing plant growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.

photosynthesis

The process by which green plants create food and oxygen.

phytoplankton

Microscopic plants and algae found in the water.

plankton

A small plant organisms and animal organisms that float or swim weakly through the water.

point source pollution

Air or water pollutants entering the environment from a specific point such as a pipe.

pollution

The contamination of water and other natural resources by the release of harmful sub-stances into the environment.

ppm

Parts per million.

retention time

(Turnover rate or flushing rate) The average length of time water resides in a lake. This can range from several days in small impoundments to many years in large seepage lakes.

runoff

The portion of rainfall, melted snow, or irrigation water that flows across the land surface or through pipes and eventually runs into lakes and streams.

seepage lakes

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long residence times and lake levels fluctuate with local ground water levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

thermocline

Stratification is the layering of water due to differences in density. Water's greatest density occurs at 39 °F (4 °C). As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to a depth of about 20 feet. The narrow transition zone between the epilimnion and cold bottom water hypolimnion) is called the metalimnion or thermocline.

trophic state

Eutrophication is the process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lakes trophic classification or state: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

turbidity

Degree to which light is blocked because water is muddy or cloudy.

turnover

Fall cooling and spring warming of surface water increases density, and gradually makes temperature and density uniform from top to bottom. This allows wind and wave action to mix the entire lake. Mixing allows bottom waters to contact the atmosphere, raising the water's oxygen content. However, warming may occur too rapidly in the spring for mixing to be effective, especially in small sheltered kettle lakes.

watershed

The land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

wetlands

Low-lying lands in which the soil is saturated with water at some time during the year.

zooplankton

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. They are the primary source of food for many fish.

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2016 AQUATIC PLANT SURVEY RESULTS

	A	B	C	D	E	Q	S	AC	AQ	BD	BN	CQ	DR	ED	EE	EF
1		**STATS**	Total vegetation	*Myriophyllum spicatum*,Eurasian water milfoil	*Potamogeton crispus*,Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Lemna minor, Small duckweed	Najas flexilis, Slender naiad	Nymphaea odorata, White water lily	Potamogeton zosteriformis, Flat-stem pondweed	Stuckenia pectinata, Sago pondweed	Utricularia vulgaris, Common blad	Vallisneria american	Wolffia
2	**Lake**															
3	**County**															
4	**WBIC**															
5	**Survey Date**															
6		**INDIVIDUAL SPECIES STATS:**														
7		**Frequency of occurrence within vegetated areas (%)**		5.93	25.19	9.63	80.00	41.48		10.37	0.74	6.67	22.22	0.74		
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		4.19	17.80	6.81	56.54	29.32		7.33	0.52	4.71	15.71	0.52		
9		**Relative Frequency (%)**		2.9	12.4	4.7	39.4	20.4		5.1	0.4	3.3	10.9	0.4		
10		Relative Frequency (squared)	0.23	0.00	0.02	0.00	0.16	0.04		0.00	0.00	0.00	0.01	0.00		
11		**Number of sites where species found**		8	34	13	108	56		14	1	9	30	1		
12		**Average Rake Fullness**	#DIV/0!	1.13	1.06	1.00	1.80	1.82		1.07	1.00	1.00	1.00	1.00		
13		**#visual sightings**		1					1		2		2	1		
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present		
15																
16		**SUMMARY STATS:**														
17		**Total number of sites visited**	**243**													
18		**Total number of sites with vegetation**	**135**													
19		**Total number of sites shallower than maximum depth of plants**	**191**													
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**70.68**													
21		**Simpson Diversity Index**	**0.77**													
22		**Maximum depth of plants (ft)****	**10.75**													
23		**Number of sites sampled using rake on Rope (R)**	**76**													
24		**Number of sites sampled using rake on Pole (P)**	**168**													
25		**Average number of all species per site (shallower than max depth)**	**1.43**													
26		**Average number of all species per site (veg. sites only)**	**2.03**													
27		**Average number of native species per site (shallower than max depth)**	**1.21**													
28		**Average number of native species per site (veg. sites only)**	**1.80**													
29		**Species Richness**	**10**													
30		**Species Richness (including visuals)**	**11**													

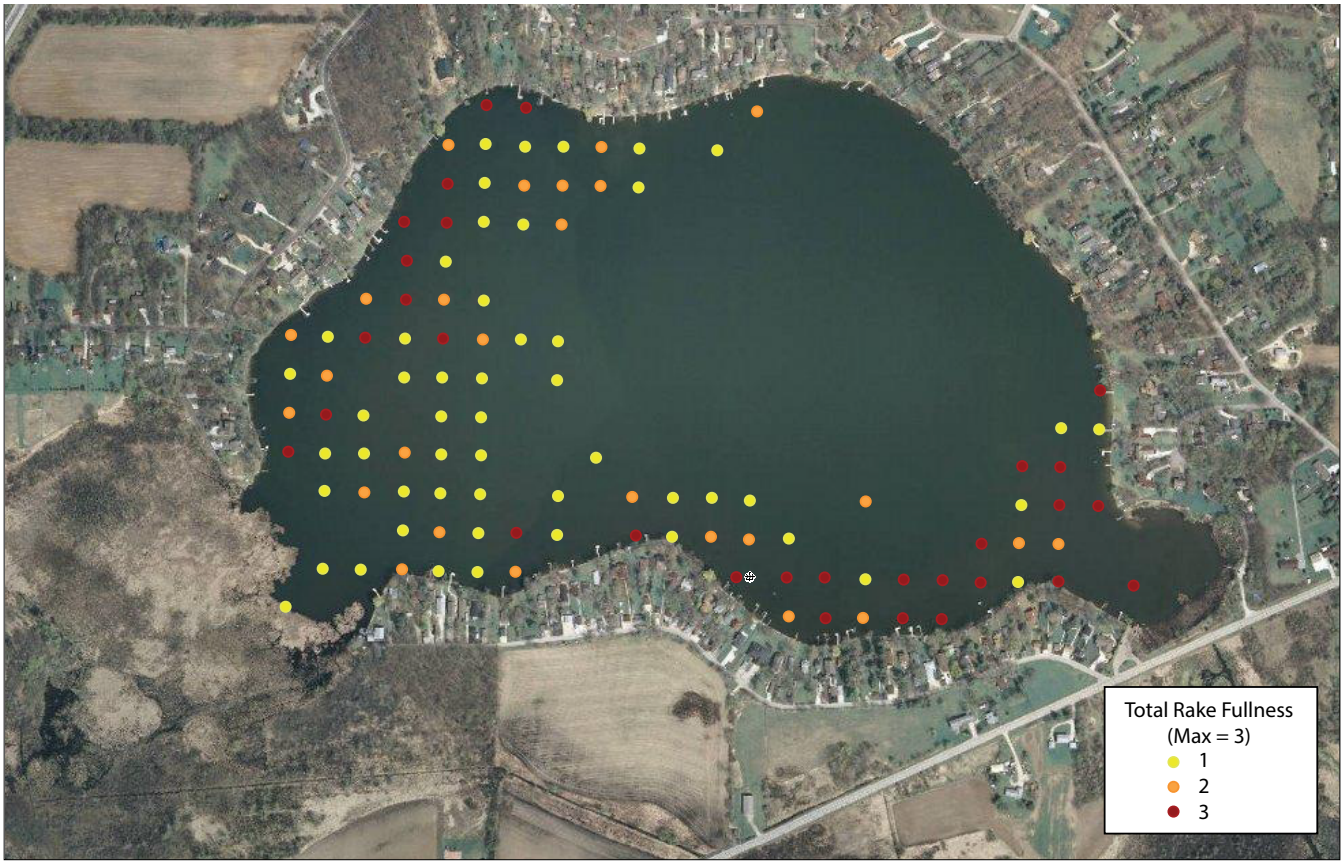


Figure 17 Chara, Potters Lake, 2016

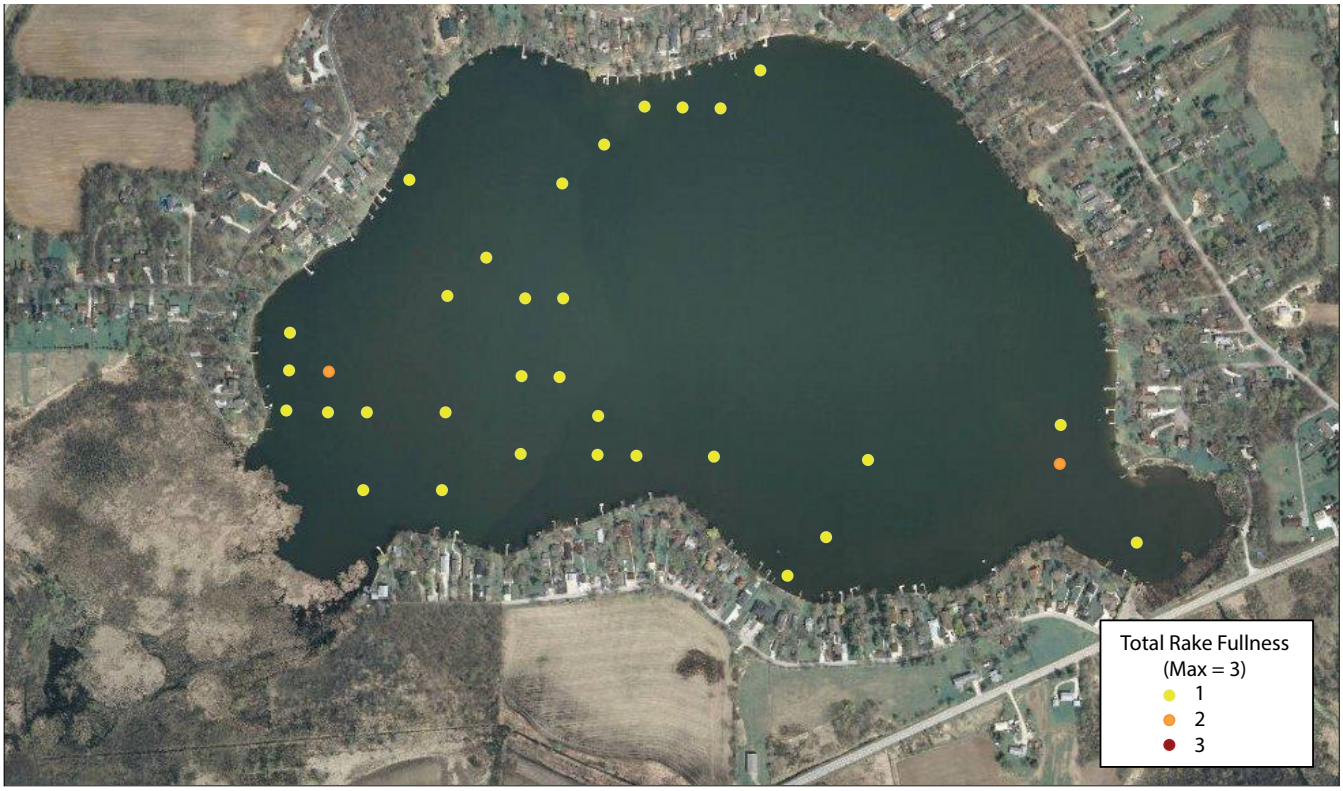


Figure 18 Curly-leaf Pondweed, Potters Lake, 2016

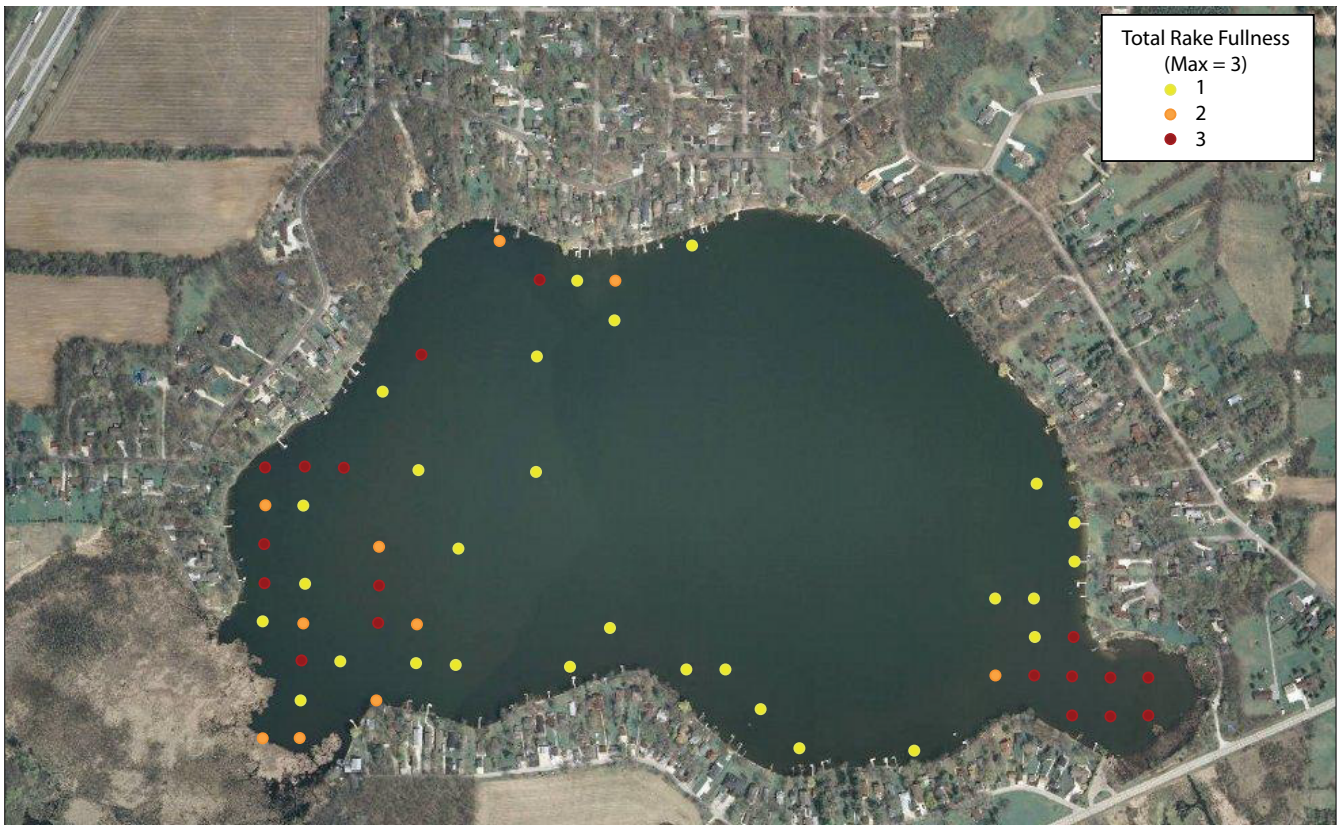


Figure 19 Elodea, Potters Lake, 2016

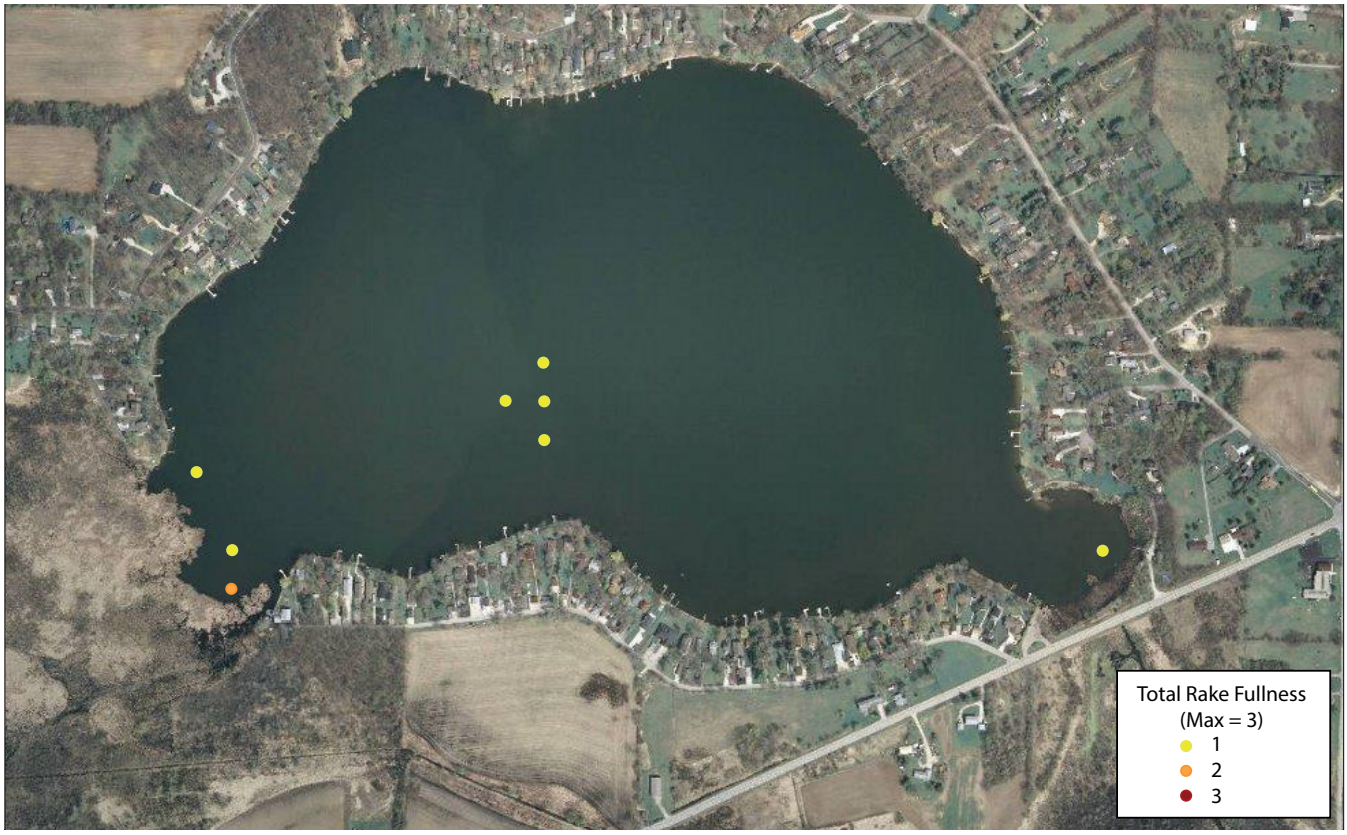


Figure 20 Watermilfoil, Potters Lake, 2016

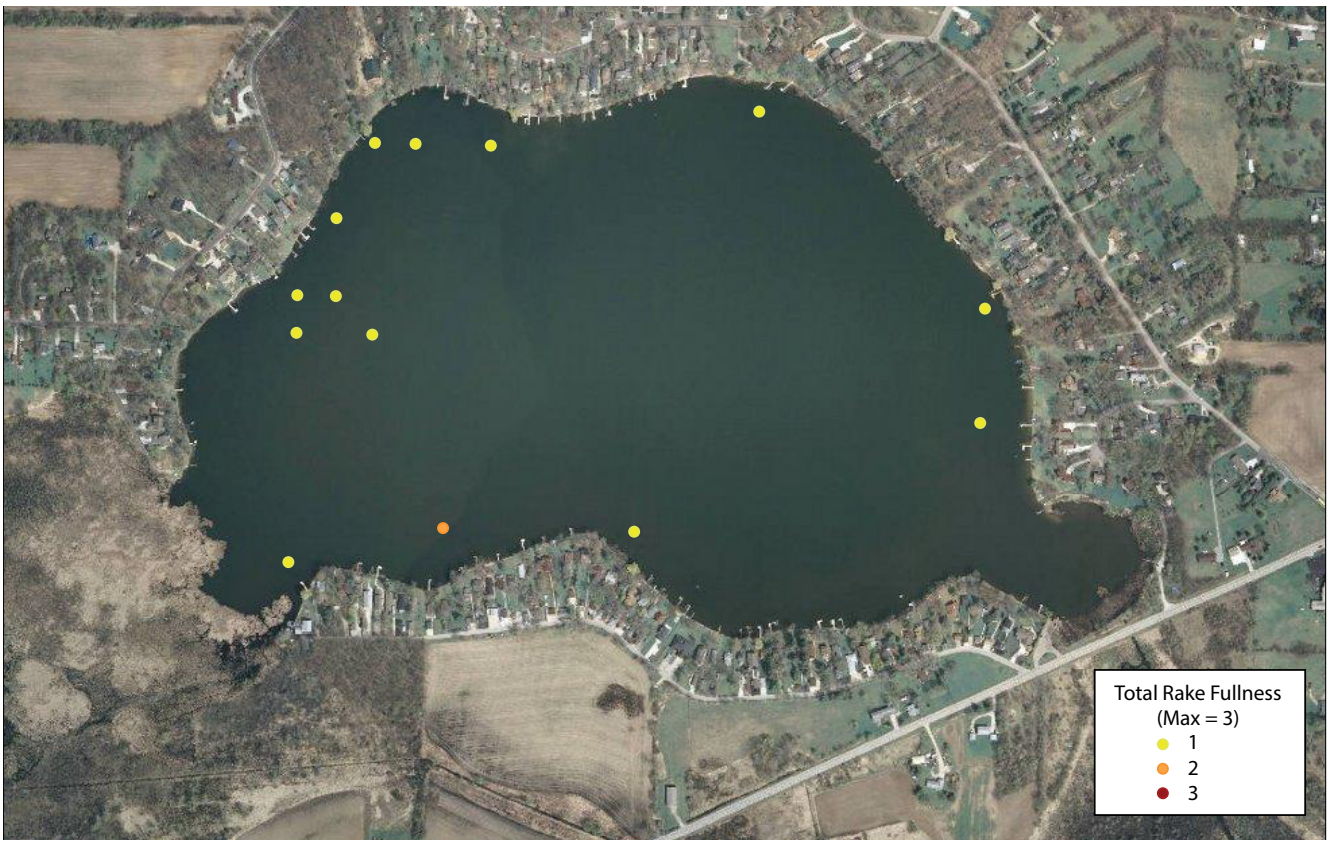


Figure 21 Slender Naiad, Potters Lake, 2016

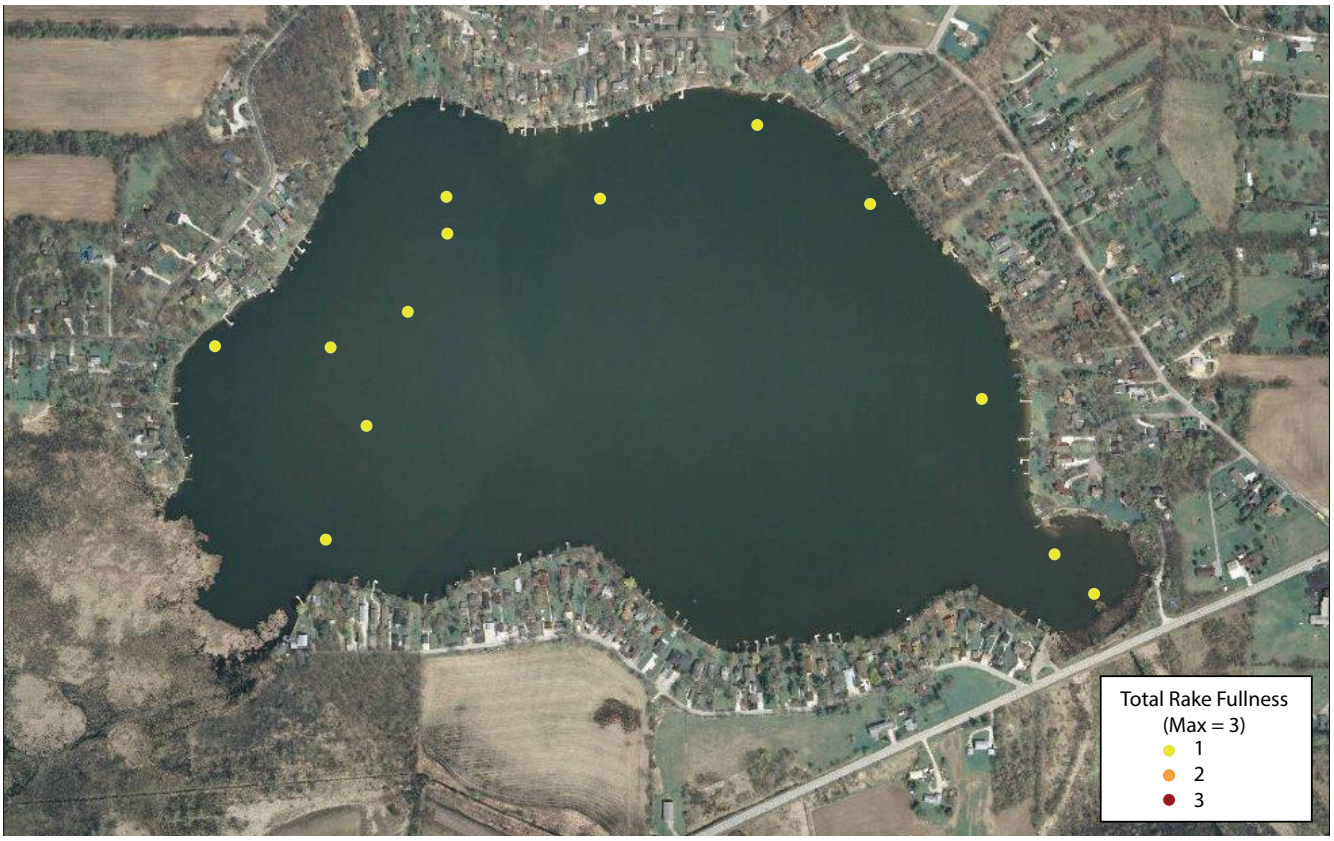
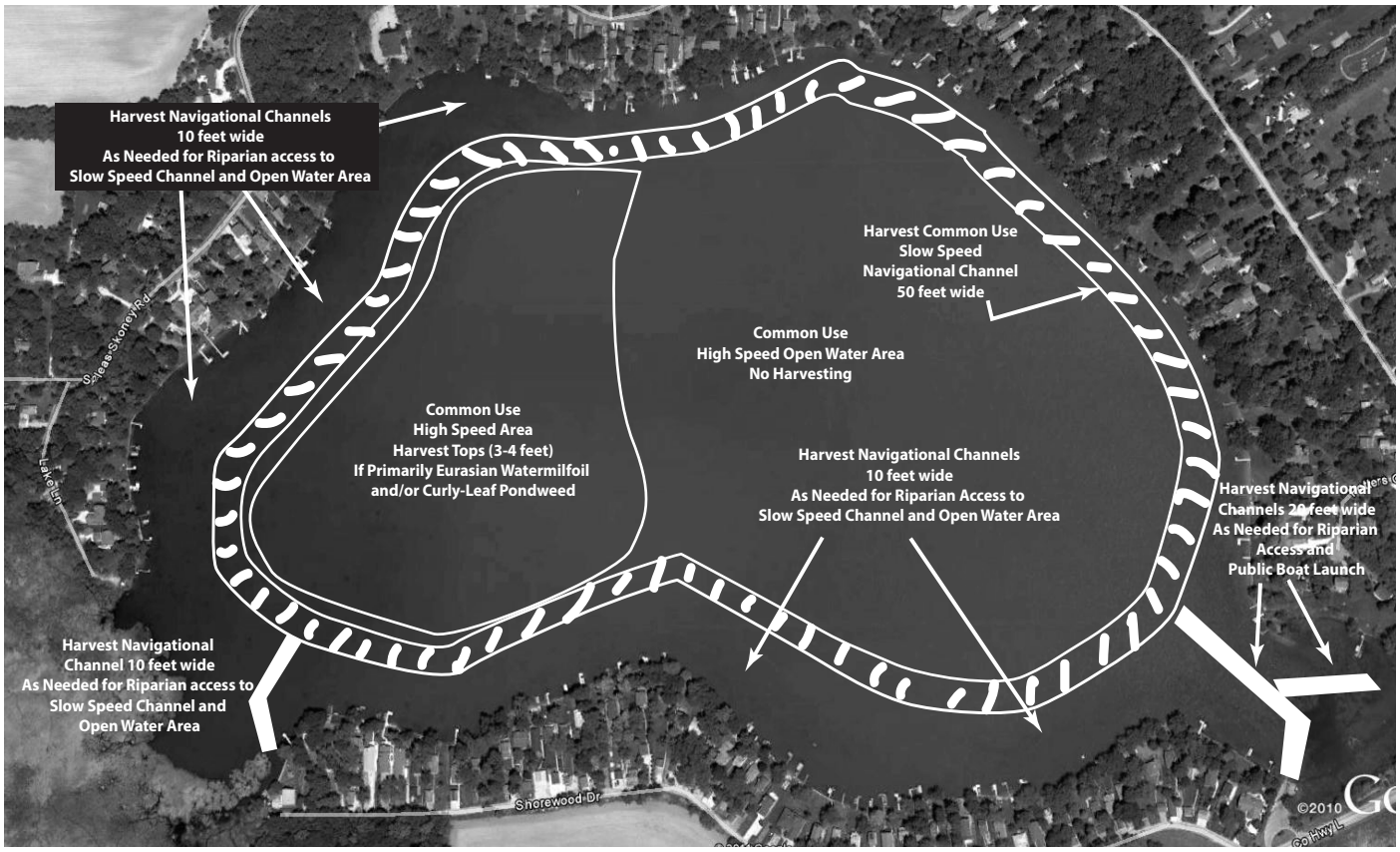


Figure 22 Coontail, Potters Lake, 2016

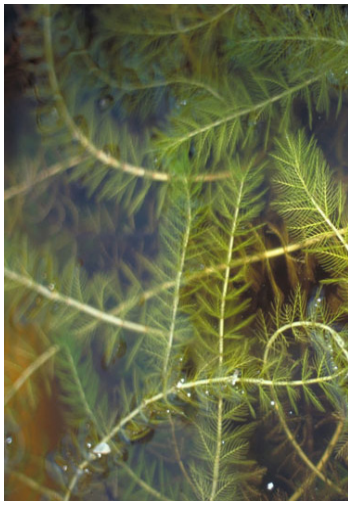
PULL OUT SUMMARY - USE ON-BOARD THE HARVESTER

- Harvest only areas that are at least 3 feet deep, except:
  - ◊ May create 10-foot wide navigational channels to aid landowners in reaching open water areas, even if water is less than 3-feet deep.
  - ◊ May harvest a 20-foot wide channel to the boat launch.
- Harvest a 50-foot wide slow-speed navigational channel around the lake, just inside the buoys.
- In the Common-Use, High Speed Area, areas with greater than 70% Milfoil may be clear cut.
- Harvest areas dominated by Milfoil and curly-leaf pondweed. Do not harvest native plants except as allowed by this plan and the WDNR permit.

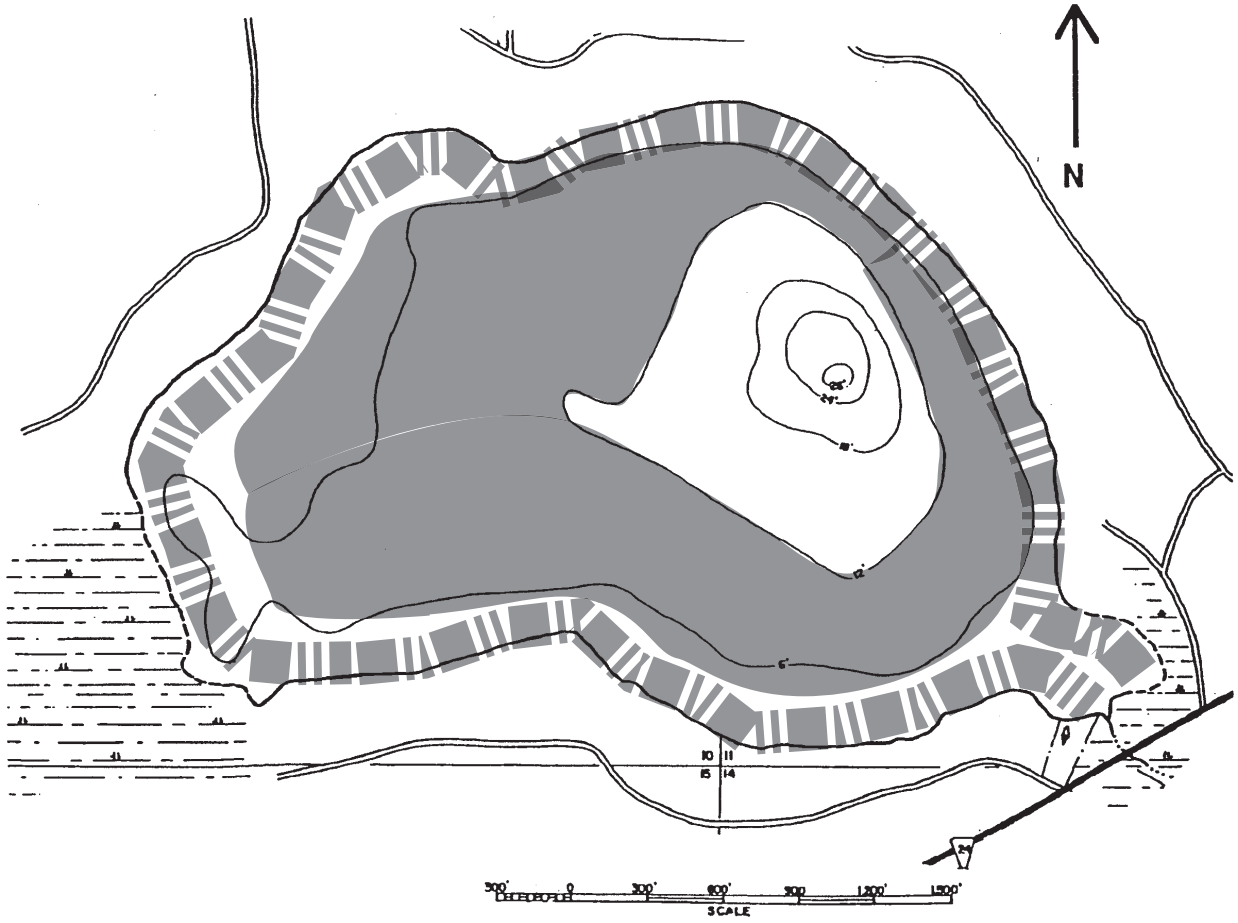


ADDITIONAL POINTERS

- Do not allow cutter bars to dig into sediments.
- Avoid areas with spawning fish.
- Keep a notebook of harvesting efforts, including hours worked, areas covered, loads of plants removed.
- Keep flotation devices on board the harvester at all times.
- Have a copy of the permit and this 2-page summary on the harvester. Refer to it often to be sure all permits are being followed.



OK to harvest: Curly-leaf pondweed (left), Eurasian watermilfoil (right).



Aquatic Plant Management Plan (permits needed)

- Chemically treat Eurasian watermilfoil and curly-leaf pondweed following plan guidelines.
- Harvest areas > 3 ft. deep when needed. Avoid native plants. Harvest navigational lanes in areas < 3 ft. deep to provide access only if chemical treatments cannot be conducted.

Harvesting Area Priorities (see Figure 16):
1) navigational channels to public access and restricted landowners
2) harvest slow-speed navigational channel
3) harvest open water areas

All of lake's rooted zone

Chemical Treatment Areas:
1) Chemically treat dense areas of Eurasian and hybrid milfoil where few natives are present
2) Chemically treat shoreline zones