Bohners Lake Aquatic Plant Management Plan 2004

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INTRODUCTION

In 1989 the State of Wisconsin enacted the Lake Management Planning Grant program. The program was designed to provide cost-sharing assistance and incentives to local communities because they are the front line for lake management activities. The development of this Aquatic Plant Management Plan is one part of a continued effort by local residents to improve Bohners Lake. Bohners Lake is a 135 acre lake located in the Town of Burlington, Racine County, Wisconsin. The lake has a maximum depth of 30 feet and 1.9 miles of shoreline. The land area immediately surrounding the lake is primarily residential.

The Bohners Lake Improvement Association was formed more than 25 years ago to protect and enhance the quality of Bohners Lake. Because support was lagging as costly management activities were increasing, the community looked for a more stable way of managing Bohners Lake. When the Bohners Lake Sanitary District (District) assumed lake district powers under Wisconsin Statutes Chpt. 33, the Association assets were then turned over to the District and the Association was dissolved. All lake management activities are now handled by the District. To manage the day-to-day activities of the lake, the District created a committee to interact with the public, conduct meetings, develop action plans, and implement the plans. The committee includes landowners from both on and off the lake, as well as representatives from the District and the Town of Burlington.

Over the years, the community has worked with a number of consultants, with the Wisconsin Department of Natural Resources (WDNR), and Southeastern Wisconsin Regional Planning Commissioner (SERPC) in their efforts to protect and rehabilitate Bohners Lake. Watershed surveys, water quality monitoring, volunteer monitoring, well water sampling, dredging, goose control, plant management, and other lake management efforts have been undertaken by the District. In 2002, the District hired Aron & Associates to conduct an aquatic plant survey and re-evaluate the plant management plan that was originally developed in 1996.

PUBLIC INTERACTION

The plant management plan was developed by Aron & Associates, in cooperation with the Bohners Lake Sanitary District, the Committee, the WDNR, and the public. Public input and historical records were an important part of the development of this plan. Discussions, comments, and communications received over the past 5 years, were considered in the development of this plan. Comments and information were solicited from:

- residents and board members,
- lake users,
- community meetings,
- WDNR resource managers,
- WDNR records, and
- SEWRPC records.

The District intends to use this plan to guide future plant management decisions, and to educate the residents on the merits of the issues addressed in the plan.

GOALS & OBJECTIVES

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 goals of the District, broad statements, are outlined below. The goals are followed by more defined objectives to be used to accomplish each of the goals.

The District's goal is to optimize the preservation and enhancement of aquatic systems that includes water quality, fisheries, and wildlife while minimizing the conditions resulting from aquatic nuisances and to preserve and maintain recreational uses of Bohners Lake. To achieve the goal, the development of this plan is one component of an effort that has included water quality monitoring, community surveys, aquatic vegetation surveys, and wetland inventories.

The District desires to (listed in order of local importance):

- Control exotic and nuisance plant species. by:
  - —use of chemical treatments of nuisance species at least once per season.
  - —contract-harvesting between 40 and 80 hours per season.
  - —encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by.
  - —educating landowners and lake users in lake ecology.
  - —working with local governments to develop and enforce ordinances to protect Bohners Lake.
  - —continuing to monitor the DOT wetland restoration project within the watershed.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
  - —conducting community survey of residents and landowners within the next four years.
  - —distributing at least 2 newsletters annually.
  - —encouraging community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing management to the extent possible by:
  - —conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
  - —tracking annual progress of lake management activities.
  - —continue the volunteer monitoring program.

Chapter II

BACKGROUND

PHYSICAL DESCRIPTION

Bohners Lake is a kettle lake formed during the Lake Michigan glacier as many as 13,000 years ago. Hydrographic and morphologic data are provided in Table 1. The current lake level is maintained by a dam with a two foot head located on the outlet on the north shore. The lake has a large shoal area near the inlet on the South West end of the lake. The lake is nearly circular in shape. Gravel and sand dominates the near shore lakebed where the lowest densities of aquatic vegetation are found. Almost half of the shorelines are steeply sloped with some of the steep slopes extending into the lake.

Land use activities can directly affect the chemical and biological components of a lake, as well as plant growth patterns in a lake. To see this affect, it is helpful to look at lakes with storm drain outlets to see the more concentrated effects of rural and urban impacts. Often, the lakebed area near storm drains has 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, should focus on activities to minimize their impact on the lake.

Table 1 Hydrography and Morphology of Bohners Lake
Racine County, Wisconsin, 2003

Area = 135 acres
Shore length = 1.9 miles
Shore development factor* = 1.16
Watershed area = 1958 acres
Maximum depth = 30 feet
Mean depth = 9.2 feet
Ratio of watershed area to lake area = 14.5:1

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

Sources: WDNR

Civil Divisions

Bohners Lake is entirely within the Town of Burlington in Racine County. The Bohners Lake Sanitary District surrounds the Bohners Lake area and in 1995 installed a sanitary sewer system. The system replaced the septic systems around the lake, many of which were failing. Communication between the organizations is enhanced by regular communication between the groups.

Watershed

This drainage lake[1] has a direct inlet and receives water from the 1958 acres that comprise its watershed. As of 1993, the drainage area to Bohners Lake was comprised of woodlands (32%), wetlands (29%), agricultural (22%) and residential (17%)[2]. Since 1993, the residential development has continued to increase, mostly at the expense of the woodlands. Although the agricultural land area is relatively small, the RA Smith report indicated that the slopes and soils of the agricultural land contribute a large amount of runoff into the lake. A portion of agricultural land in the southern watershed area known as the "mint field" is being acquired by the Department of Transportation as part of a highway construction project around Burlington. The prior-converted wetland will be restored. This restoration will eliminate a large source of sedimentation. The steeply sloped areas of the watershed have the potential to cause serious erosion during development activities.

Soils

The predominant soils in the watershed are Casco, Fox, and Houghton muck. Muck soils are found in the inlet, outlet, and wetland areas. Silt loams are found along the east shore, and the area west of the lake. Loams and gravel loams comprise the remaining soils in the watershed. The soils on the steep slopes in the watershed are highly erosive.[3]

1. Drainage lakes have both an inlet and an outlet. Bohners Lake's inlet enters the lake on the southern shore. The dam is located on the north shore.
2. Bohners Lake Inlet Watershed Study, RA Smith & Associates, 1993
3. Soil Survey, Kenosha and Racine Counties, Wisconsin, USDA, Soil Conservation Service

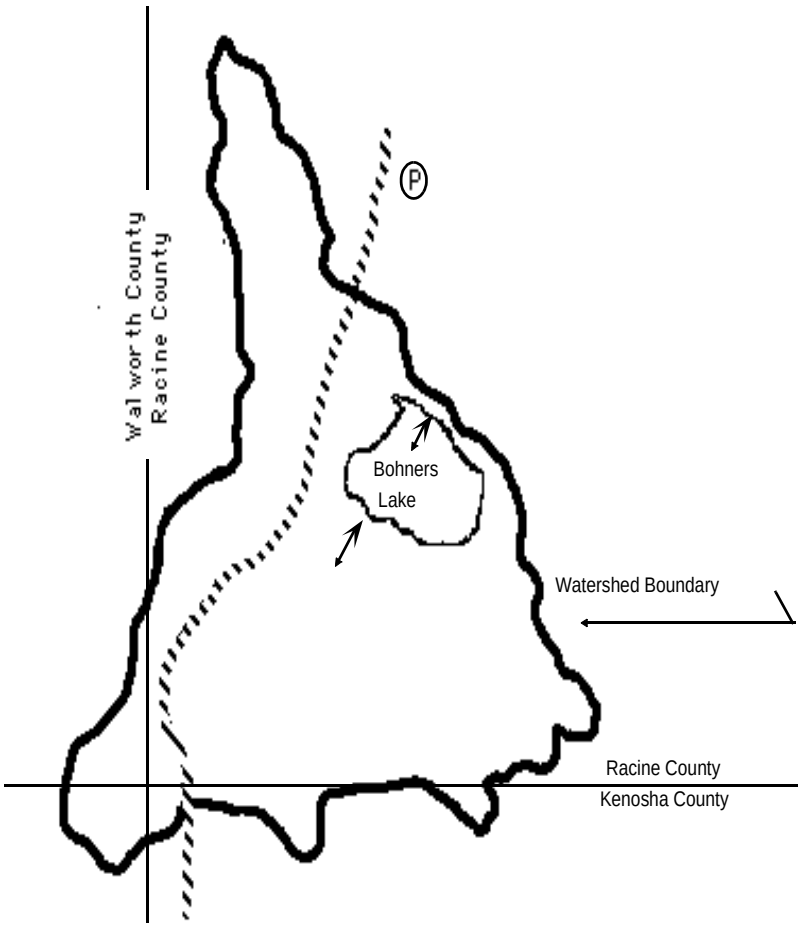


Figure 1. Direct Tributary to Bohners Lake

SHORELINE DEVELOPMENT & AESTHETIC FEATURES

Bohners Lake and its watershed are highly developed. The lake's very circular shoreline means that there are no quiet bays to provide refuge for fish, wildlife and humans seeking an area for quiet reflection. Most of the lake shoreline is developed with single-family residential, however, the varied landscape and steep slopes provide a more pleasurable aesthetic view than other comparably developed lakes. The steep shorelines can also contribute significant problems for the lake: disturbances by residents can result in serious erosion if preventive steps are not taken. The large wetland and woodland areas in the watershed provide a degree of water quality protection for the lake.

HISTORICAL CONDITIONS

There is limited, detailed historical information available on many lakes in Wisconsin. In 1969, the Wisconsin Department of Natural Resources (DNR) published the Bohners Lake, Lake Use Report No. FX-25. That report indicated that there was relatively little aquatic vegetation. The only pronounced concentration of plants was found along the shoreline near the inlet. The rest of the lake

had only scattered vegetation with muskgrass being the most dominant plant. Aquatic plants at that time rarely interfered with lake use activities. Coontail, muskgrass, duckweed (*Lemna minor*), Eurasian water milfoil, nitella and great bladderwort (*Utricularia vulgaris*) were identified in the 1969 survey.

An aquatic plant survey was conducted in 1995 and a plant management plan was developed. The survey found significant amounts of plants compared to the 1969 report. The data from the 1995 survey is included in the Aquatic Plant Chapter.

ECOLOGICALLY VALUABLE 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. But indeed, the affect 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, 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.

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 provides the guidance used to administer the WDNR's aquatic plant management program. The program seeks to protect native vegetation that is important to fish and wildlife. The WDNR may also restrict other 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. Legislation that was recently passed requires permits for activities including chemical treatment, aquatic plant harvesting, native species re-introductions, etc.

The WDNR has not conducted a Sensitive Area designation on Bohners Lake. Map 8 shows the areas of the lake that have the greatest aquatic plant diversity, one important component in the Sensitive Area program. However, because these areas also contain the greatest densities of exotic species, they may not be considered sensitive. The native species in these areas are extremely important to the long term health of the fisheries and vegetation diversity on Bohners Lake and should be protected.

Bohners Lake has very limited areas of natural shoreline. Residents should be encouraged to naturalize their shorelines. Aquatic vegetation in the nearshore areas stabilize soft sediments, preventing them from becoming resuspended into the water column because of wind or boating. The shallow areas of native aquatic plants should be preserved.

FISH AND WILDLIFE

Bohners Lake maintains a warm water fishery. Northern pike and panfish are plentiful. Large-mouth bass are abundant in the lake. The WDNR has occasionally stocked northern pike. A recent electrofishing survey produced 75 largemouth bass between 5 and 17.4 inches. Bluegills were the most abundant panfish found. Other species found were grass pickeral, pumpkinseed, black crap-pie, yellow perch, warmouth, northern pike, and carp[1]. Detailed survey of the fisheries are valuable tools for assessing the health of the Bohners Lake fishery. The District should continue to work with WDNR fisheries to ensure regular surveys take place to protect the quality of the fisheries.

The high level of residential development restricts the value of the resource to wildlife. The lake may be used by ducks, geese and other waterfowl primarily during migration. Shorelines that are highly developed, especially those with retaining walls, create problems and barriers for frogs and turtles that need access to land. Retaining walls have few, if any, spaces and cavities for small creatures to hide. This can impact the food source for fish.

A problem facing many lakes in Southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different species than the migratory goose and cause significant problems. The non-migratory geese remain in an area year-round. They especially like mowed lawns and open water, making lakeshore areas prime targets. People often enjoy watching a few of these geese, but the problems arise as the numbers increase. Problems include overgrazing lawns, droppings on lawns and beaches, and polluting water. Bohners Lake area has been trying to resolve their goose problem. The community has regular beach closings in spite of daily beach cleanup activities. The District is working with the USDA on a goose removal project to bring the numbers of geese down to an acceptable level.

WATER QUALITY

Water quality studies on Bohners Lake have been limited to Volunteer Self Help Monitoring, under guidance from the WDNR. Volunteers have collected data since 1989. According to the 2002 Annual Report[2], the lake is considered mesotrophic, with an average Trophic State Index of 28. Mesotrophic lakes are moderately fertile systems that support abundant aquatic plant growth and productive fisheries. The average Chlorophyll was 7 ug/l, ranging from a low of 1 ug/l on May 31, 2002 to a high of 19 ug/l on April 27, 1993. Total Phosphorus averaged 26 ug/l, with a low of 4 ug/l on April 2, 1995 to a high of 260 ug/l on July 21, 1993. Clarity of the lake is measured by use of a secchi disk, and readings ranged from a low of 4.75 feet on July 18, 1991 to a high of 17.5 feet on May 13, 1996. The highest clarity readings are typically found in May, with the lowest being found in July.

The Self-Help data may be accessed on the WDNR website by going to: www.dnr.state.wi.us/LakesSelfHelp/lakeshome.asp. Then select ”Annual Report” or “Download Chemistry and Secchi Data”. Then enter “BOHNER” and Racine County. The lake entry is case

1. Pers. Correspondence, D. Welch, WDNR
2. 2002 Self-Help Lake Monitoring Results For Bohner Lake (Racine County) Deep Hole, Wisconsin Department of Natural Resources

sensitive so be sure to enter BOHNER, or you may not reach the proper site. The 2002 annual report is included in the Appendix.

EXOTIC SPECIES

During the aquatic plant survey, Bohners Lake was evaluated for exotic species. Eurasian water-milfoil and curly-leaf pondweed are exotic plant species present in Bohners Lake. Purple loosestrife is a wetland exotic species present in the surrounding area. No zebra mussels have been found in Bohners Lake to date. Educational programs should focus on the preventative actions that can be taken by lake users to prevent the introduction of invasive, exotic species. This can include newsletter articles, and boat launch signage that explains how exotics are transferred from lake to lake and what actions can be undertaken by individuals to prevent infestation.

LAKE USE

Bohners Lake receives a high degree of recreational pressure. The majority of recreational uses are water-skiing, personal watercrafting, scenic viewing, swimming and fishing. There are three beaches on the lake: one owned by the Town, and two private Association beaches. Swimming conditions are affected by nuisance quantities of aquatic plants, which are chemically treated annually. Swimming is also limited by water quality problems, usually in mid-August when high coliform readings close the beach. The numbers of high coliform readings have been reduced since the District began a daily beach-cleanup program to remove goose droppings.

The small size of the lake restricts the area available for high speed boating activities. Nuisance aquatic plant problems further restricts the area available for boating activities. Another factor influencing lake use in 2002 and 2003 is the water level. Serious drought conditions have prevented the lake from maintaining its normal level. As of October 2003, the lake was down below the level influenced by the dam. This makes access for riparian landowners difficult, if not impossible.

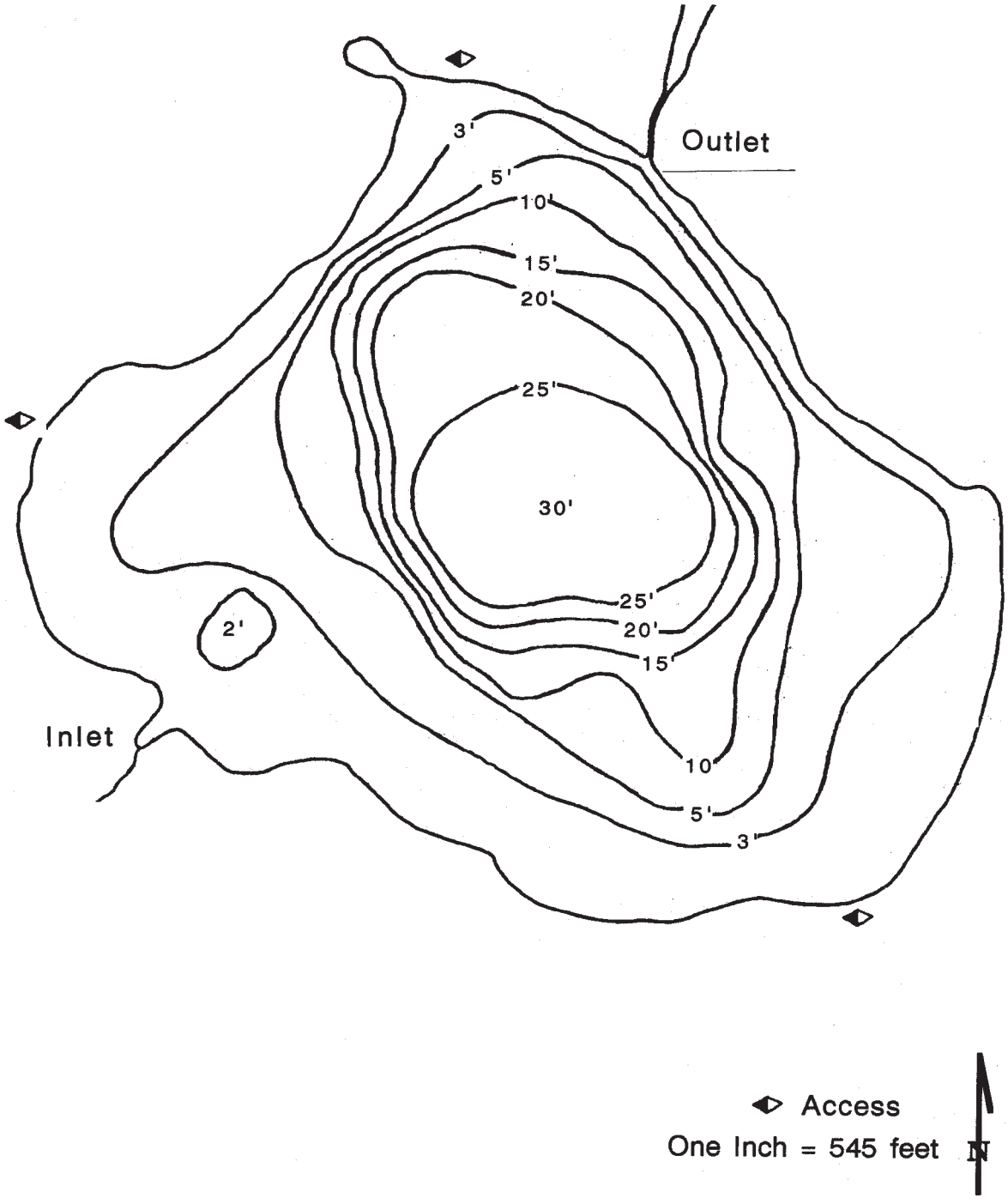
ACCESS LOCATIONS

Bohners Lake meets the WDNR standards for public access to an inland lake. The primary boat access to the lake is provided at a Town launch located on the northwest shore (Map 1). A public beach is located next to the launch. There are also two subdivision beaches, one on the West shore and one on the Southeast shore. The Southeast beach also has a private boat launch.

BOATING ORDINANCE

The Town of Burlington has a boating ordinance in effect on Bohners Lake. The local ordinances are occasionally reviewed and modified. A copy of the ordinance is included in the Appendix. In addition to the local ordinances, state laws are in effect on the lake and are enforced by the Conservation Wardens. The Town operates a boat patrol on Bohners Lake and installs and maintains the buoys.

Map 1 - Bohners Lake



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 as well as contributing to dissolved oxygen production. Invertebrates, upon which fish and wildlife depend 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 bind 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. Plants also stabilize sediments, helping control shoreline erosion, and turbidity. An aquatic plant monitoring program may provide an early warning signal that the lake is reacting to negative impacts from the watershed or recreational use activities.

Many aquatic plants are important food sources for waterfowl. Others provide habitat, spawning and shelter areas for fish and amphibians. Exotic plants 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 the plants. Protection of native species is an important means of reducing problems from exotic species. Just as crabgrass and dandelions are the first plant to invade a disturbed area of a backyard, Eurasian watermilfoil is 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 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, muskgrass, and others. 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 current 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.

Plants within the littoral zone are affected by a number of factors. Steeply sloping lake bed areas do not support the vegetation that flatter 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.

PLANT DESCRIPTIONS

Pondweeds

Pondweeds are important species of plants for a lake. Pondweeds do not grow as quickly or as dense. They 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. Exotic plant species do not provide these benefits as well as the native plant species. 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. Pondweeds support much greater populations of macroinvertebrates than exotic plant species such as Eurasian 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 12 aquatic plant species that should be protected and enhanced. The protected plants that are found in Bohners Lake are *Stuckenia pectinata* and *Vallisneria americana*. Other high value species in Bohners lake include *Potamogeton foliosus* and *Potamogeton gramineus*.

Curly-leaf Pondweed (*Potamogeton crispus*)

Curly-leaf pondweed 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. 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 is present in Bohners Lake and is increasing its range. The most effective means of control of curly-leaf pondweed is to protect the native plants and secondly, to prevent turion production. This means conducting plant management activities prior to the formation of the turions. Exercise caution when determining which plant management technique should be used because native pondweeds may be impacted.

Curly-leaf pondweeds are abundant in Bohners Lake. It is a problem around the shoal area of the lake where is grows prolifically.

Eurasian Watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil 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 restricted and swimming becomes dangerous in the long, stringy plants. Eurasian watermilfoil can contribute to stunted panfish populations by providing too much protection from predator fish (WND, 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).

Eurasian watermilfoil is a dominant plant in Bohners Lake. Because it is unknown how long the plant has been in Bohners Lake, total removal is unlikely. However, management activities should focus on protection of native plants, and management of Eurasian watermilfoil to minimize the spread of the plant. Non-management of Eurasian watermilfoil on other lakes in Wisconsin has led to increased competition over native plants, and a decline in the density and frequency of native plants.

Eurasian watermilfoil is a problem on Bohners Lake. The plant grows primarily in the deeper zones, and is a significant problem around the shoal.

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 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).

Muskgrass is a very important asset for Bohners Lake and should for the most part, be protected to help reduce infestations of other potential nuisances such as Eurasian watermilfoil. However, in some lakes, muskgrass can become very dense and problematic, prompting management actions to improve recreational access to waterways.

Muskgrass has occasionally created problems on Bohners Lake. Areas with the greatest problem are on the West and South shores where muskgrass limits boating access. It also collects algae and debris, causing odor problems for residents.

Widgeon Grass

Widgeon grass (Ruppia maritima) is a non-native aquatic plant that is rarely found in Wisconsin. Locally, it is found in Browns Lake in Racine County and in the Twin Lakes, Elizabeth and Mary Lakes, in Kenosha County. In those lakes, widgeon grass is most commonly found in deep water. Like other non-native plants, it can grow to very dense, nuisance conditions. Browns Lake controls the plant with harvesting. In the Twin Lakes, it grows primarily in deep water (8 to 12 feet), rarely reaches the surface and is not being actively managed. Plant fragments can be significant, creating problems for shoreline maintenance. Unlike most exotics, widgeon grass is beneficial. The seeds, tubers and foliage are excellent waterfowl food. Seeds provide food for birds. The plant provides food and cover for fish. Although it is usually found in deeper waters, in Bohners Lake dense populations are found in shallow water on the west side of the lake, where it interferes with lake use.

BOHNERS LAKE AQUATIC PLANTS

An aquatic plant survey was conducted by Aron & Associates (A&A) in June of 2003. The field work was conducted in accordance with DNR approved methods for aquatic plant surveys. Twenty transects that were established in the 1995 survey were used for the 2003, to allow comparison of data. Four depths were sampled along the transects at the 2, 4, 7, and 10 foot depths. Map 3 shows where the transects were surveyed. To ensure that all plant communities were documented, a general survey was conducted on the rest of the lake, following a zigzag pattern across the littoral zone of the lake.

Map 2 shows the area of Bohners Lake that was able to support aquatic plants in 2003. The 2003 survey data is included in the Appendix. Maximum rooting depth in 2003 was found to be fifteen feet, up from 12 feet in 1995.

During the 2003 survey, a total of 19 species was observed (Table 2). In general, Bohners Lake has a good diversity of aquatic plants. Of the 19, three species, Eurasian water milfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*), and widgeon grass (*Ruppia maritima*) are exotic (non-native) species. Exotic plant species in general provide less benefits to the resource than do native plants.

The greatest diversity of aquatic plants was found at the 7 foot sampling depth where a total of twelve plant species were found. Muskgrass (*Chara* sp.) was the dominant species in the two and four foot depths. Widgeon grass (*Ruppia maritima*) and sago pondweed (*Stuckenia pectinata*) were dominant at the seven foot depth. Widgeon grass (*Ruppia maritima*) and Eurasian watermilfoil (*Myriophyllum spicatum*) were dominant at the ten foot depth. Five species were found at all sample depths: Eurasian water milfoil (*Myriophyllum spicatum*), muskgrass, curly-leaf pondweed (*Potamogeton crispus*), sago pondweed (*Stuckenia pectinata*) and widgeon grass.

The “milfoil weevil” was not found in Bohners Lake during the plant survey or subsequent lake inspections.

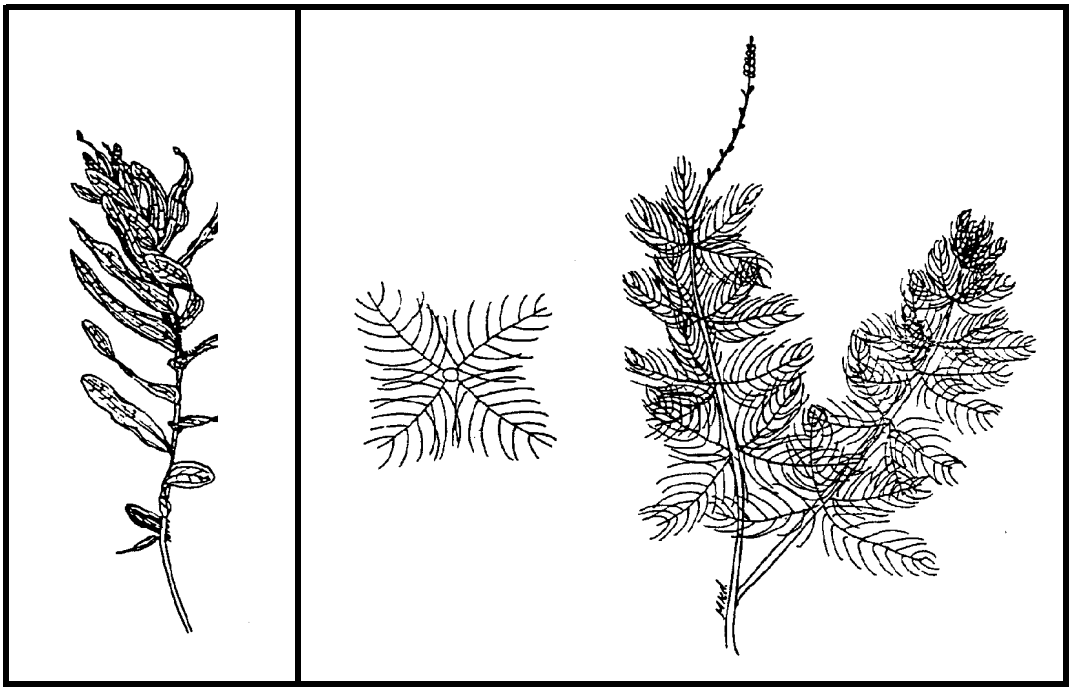


Figure 1. Curly-leaf Pondweed and Eurasian Watermilfoil.

Discussion

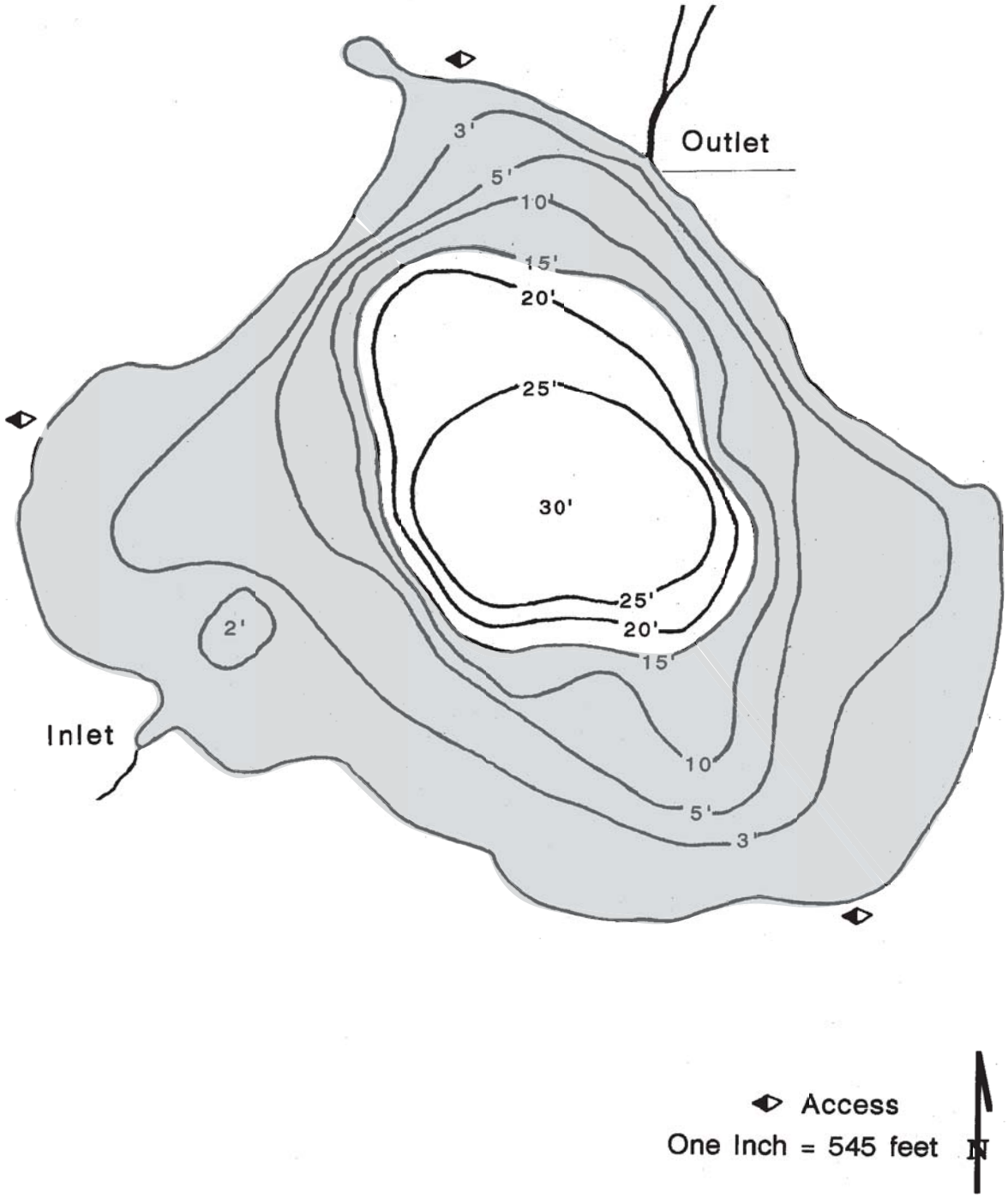
A number of changes have occurred in the aquatic plant community in Bohners Lake since the 1995 survey was conducted:

- The area available for aquatic plant growth has increased from 12 feet in 1995 to 15 feet in 2003. This allows plants to grow in areas that were previously unavailable.
- Eurasian watermilfoil expanded its range significantly. The District has conducted regular chemical treatment for the control of Eurasian watermilfoil in the near-shore areas. Those treatments are conducted once in early June and have proven very effective. Harvesting began in the late 1990s because Eurasian watermilfoil had increased and was inhibiting boating.
- Widgeon grass declined.
- Muskgrass survey data also showed a decline, however, that is largely due to the chemical treatment that was conducted in 2002. In 2002, muskgrass was a significant nuisance that covered much of the West and South shorelines. Attempts to remove the muskgrass using hand controls and mechanical harvesting were unsuccessful. The material was too dense

for the average landowner to handle, and the shallow conditions caused damage to the mechanical harvester and the lake bottom. The muskgrass was treated with Cutrine Plus, which had little, if any, affect. The muskgrass was then treated with Hydrothol which knocked back the nuisance conditions. The results lasted into 2003. Although there were initial concerns that the treatment was too effective, muskgrass was rebounding significantly by the end of the summer of 2003.

- Filamentous algae was a problem in the late 1990s and early 2000s. Dense stands of filamentous algae would cover acres of the lake, especially in the western shore and the shoal area. The algae would hang on the dense stands of Eurasian watermilfoil and curly-leaf pondweed. It would collect debris, it would raise the water temperature underneath the algae, and would cause odor problems. Delaying treatment resulted in multiple treatments that were less than effective. Early, aggressive treatment has been very efficient in controlling the problem quickly with much less chemical used.
- Variable-leaf pondweed has increased significantly since 1995. The increase has occurred primarily along the three to four foot depth contour. In some areas of the lake, the plants are very dense and hinder boating access.
- Beaches have been treated with contact herbicides annually for vegetation within the swimming areas. The treatments usually result in single season control. Each season, the vegetation returns, with the same diversity as the previous year prior to the treatments.
- Widgeon grass stands are dense, and the long, stringy plants are easily pulled out by boaters. When disturbed, widgeon grass creates large quantities of floating plant debris. The harvesting conducted the past few years has attempted to control the problem with floaters by harvesting the tops of the plants to minimize their disturbance.

Map 2 Area Available for Aquatic Plant Growth on Bohners Lake - 2003



Aron & Associates, 2003

Table 2 List of Plant Species in Bohners Lake, 2003

Scientific Name	Common Name
Ceratophyllum demersum	Coontail
Chara sp.	Muskgrass
Elodea canadensis	Elodea
Heteranthera dubia	Water stargrass
*Lemna minor**	Small duckweed
Myriophyllum spicatum	Eurasian water milfoil
Najas flexilis	Slender Naiad
N. marina	Spiny Naiad
Nitella sp.	Nitella
Nuphar sp	Yellow Water Lily
Nymphaea sp.*	White Water Lily
Potamogeton crispus	Curly-leaf Pondweed
*P. foliosus**	Leafy Pondweed
P. gramineus	Variable-leaf Pondweed
Ruppia maritima	Widgeon Grass
Stuckenia pectinata	Sago Pondweed
Utricularia vulgaris	Great Bladderwort
Vallisneria americana	Water Celery, Eel Grass

* Found in general survey only

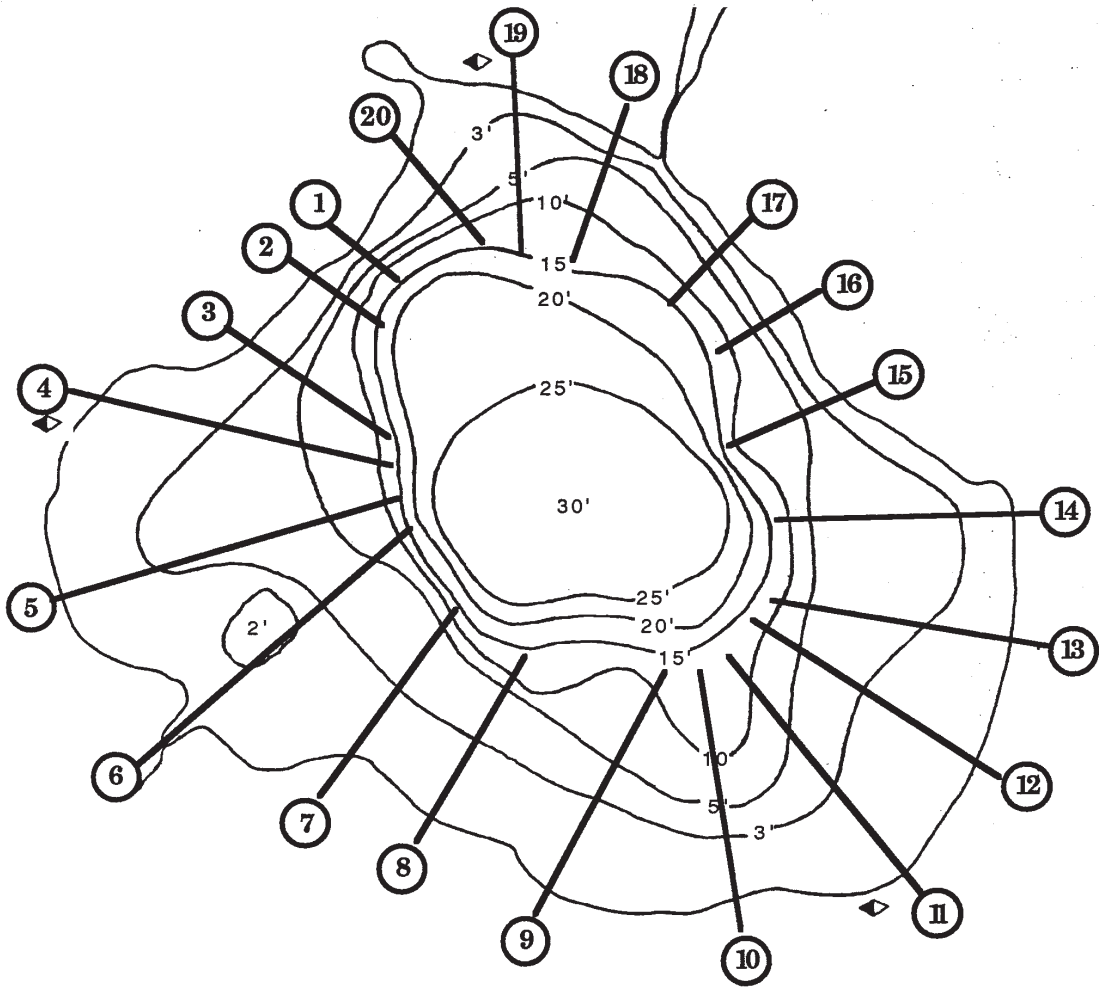
Source: Aron & Associates

Table 3. Species Distribution Comparison by Water Depth - 1995 and 2003

Species	2. 0 feet		4.0 feet		7.0 feet		10.0 feet	
	1995	2003	1995	2003	1995	2003	1995	2003
Ceratophyllum demersum	X	X	X			X	X	X
Chara sp.	X	X	X	X	X	X	X	X
Elodea canadensis	X	X		X		X		
Heteranthera dubia			X	X		X	X	X
Lemna minor	X							
Myriophyllum spicatum	X	X	X	X	X	X	X	X
Najas flexilis	X			X			X	
N. marina			X			X	X	X
Nitella sp.			X		X	X	X	X
Potamogeton crispus	X	X	X	X	X	X	X	X
Nuphar sp.		X						
P. gramineus	X	X	X	X		X		
Ruppia maritima		X	X	X	X	X	X	X
Stuckenia pectinata	X	X	X	X	X	X	X	X
Utricularia vulgaris	X	X			X		X	X
Vallisneria americana	X	X	X	X	X	X		

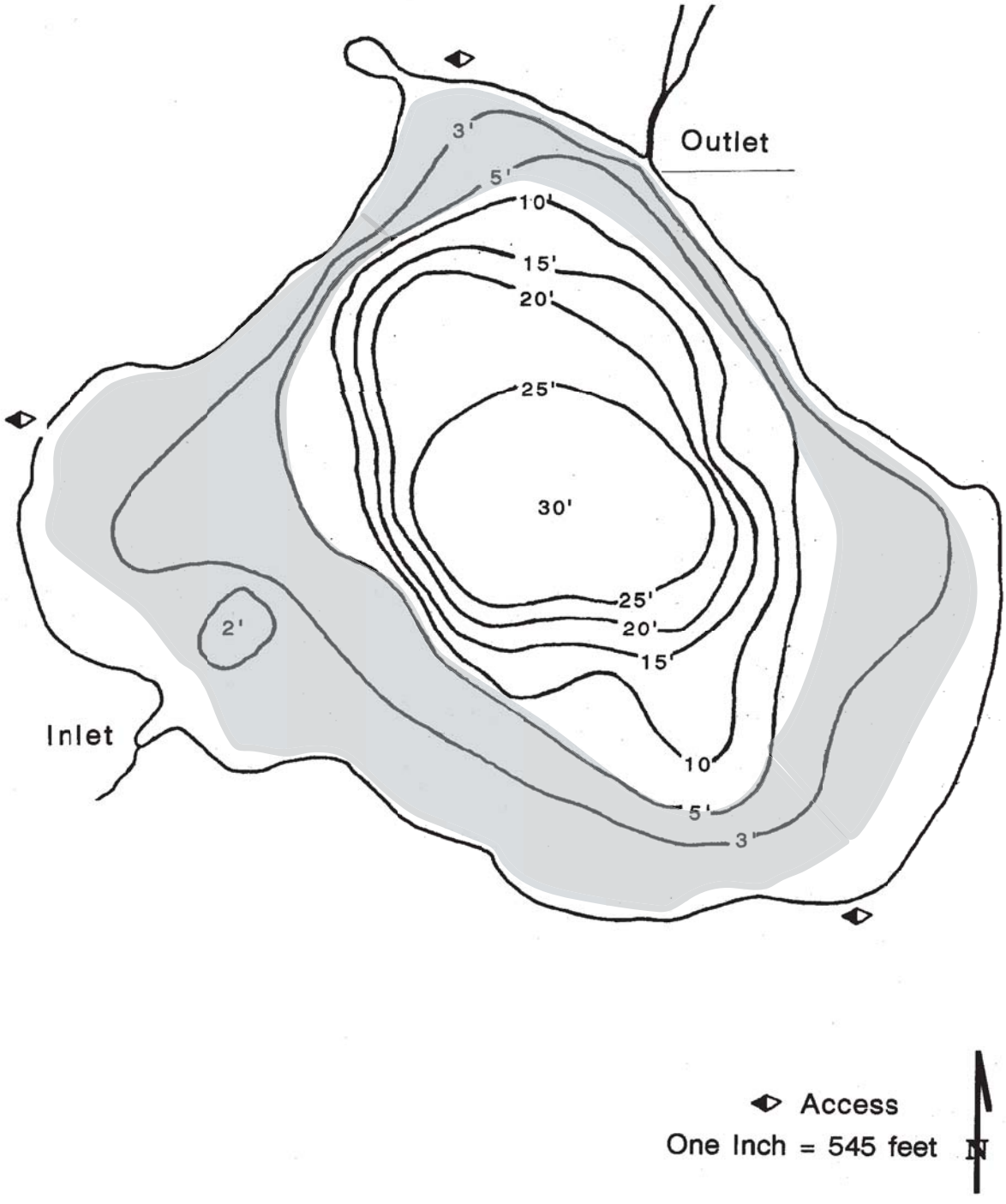
Source: Aron & Associates

Map 3 - Transect Locations on Bohners Lake - 2003



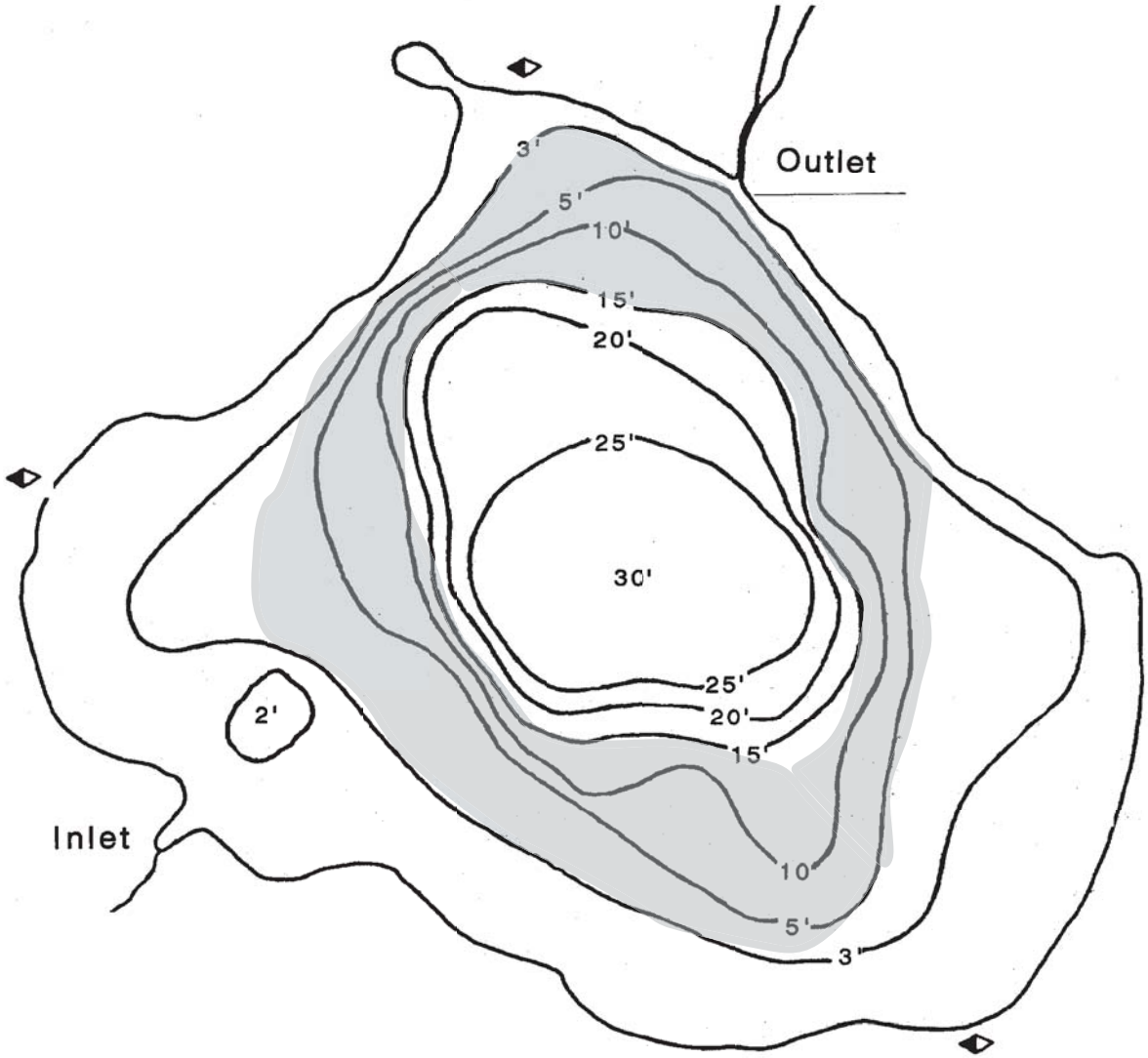
Aron & Associates, 2003

Map 4 - Areas with Abundant Muskgrass on Bohners Lake - 2003

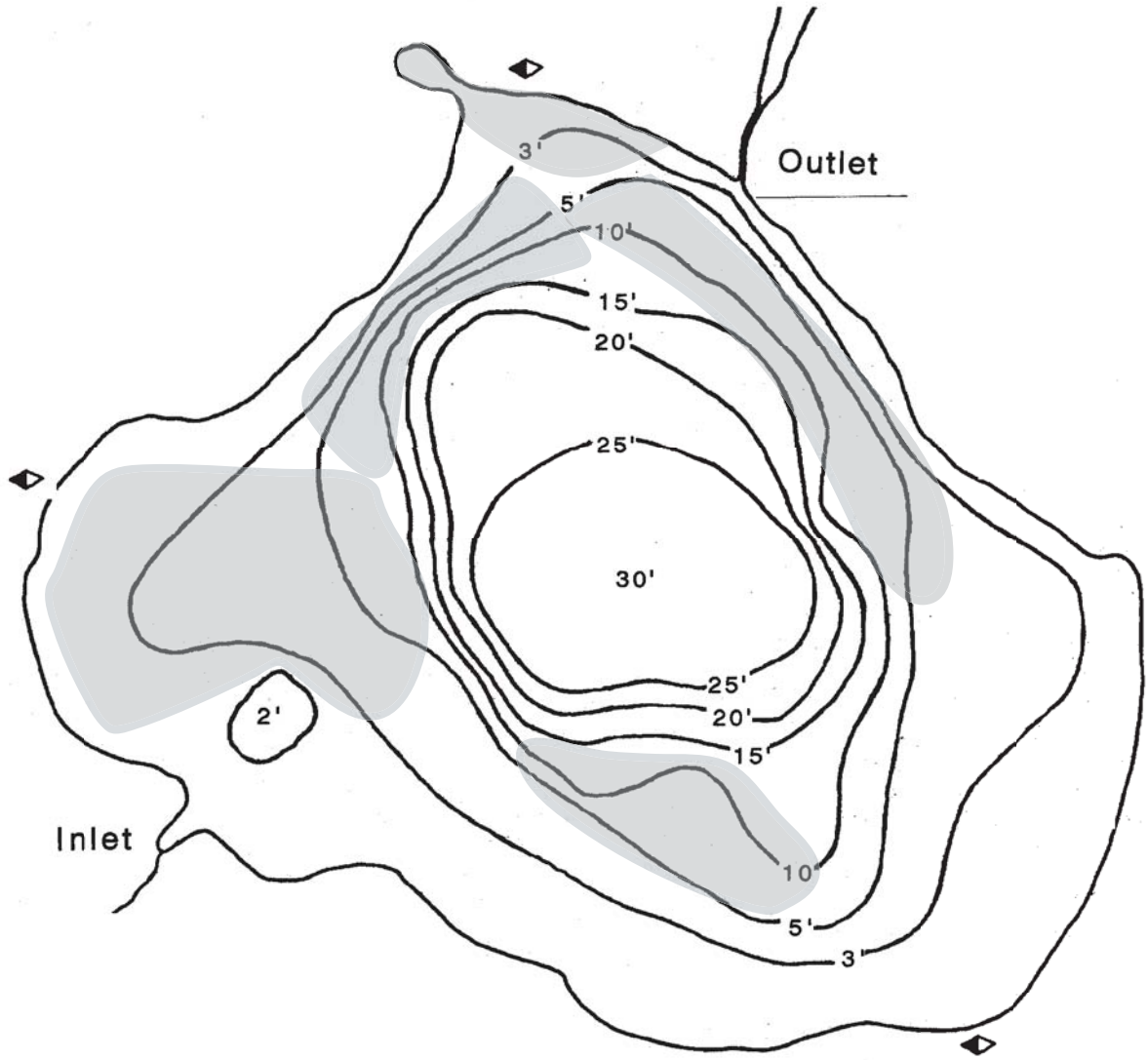


Aron & Associates, 2003

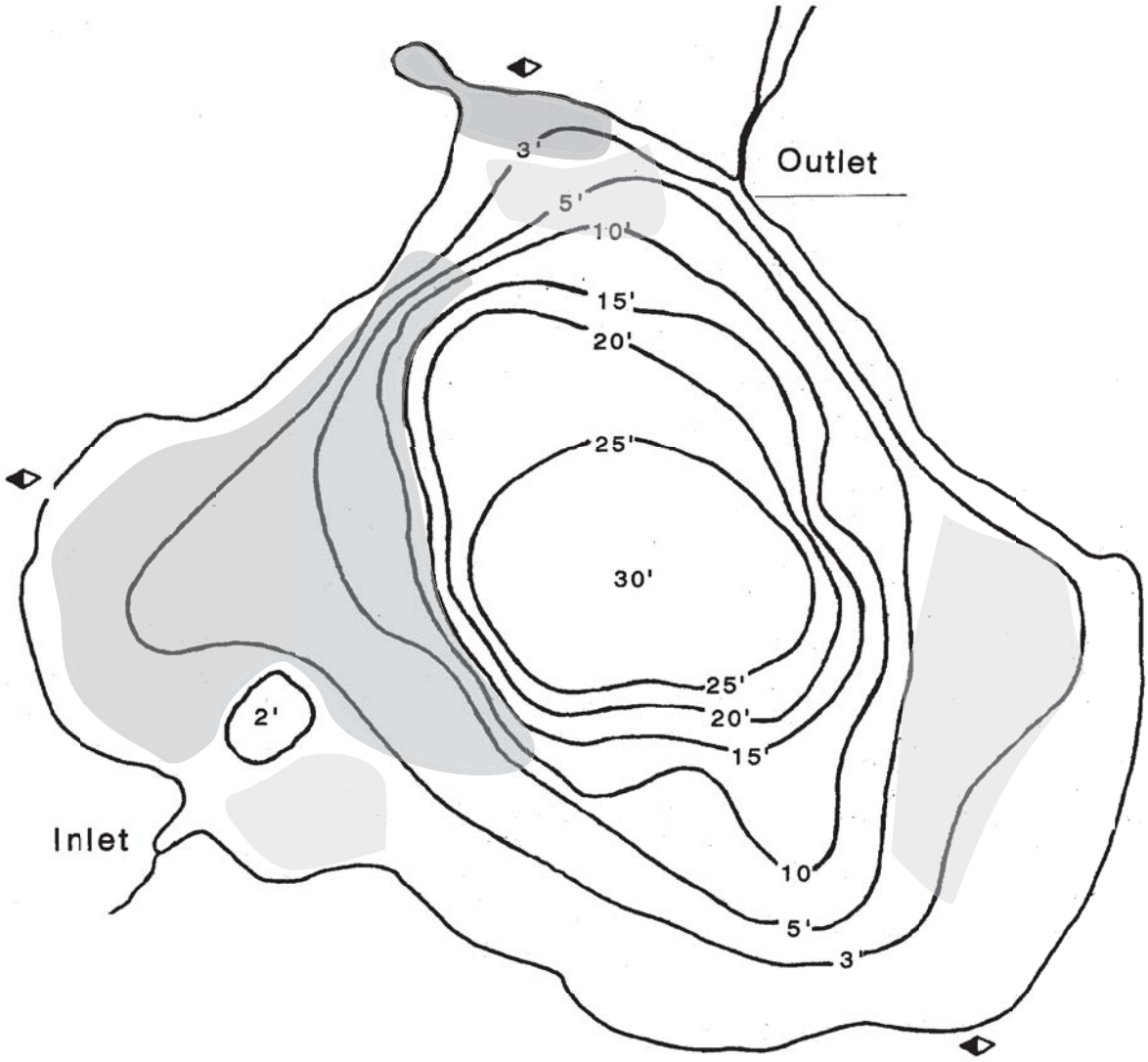
Map 5 - Areas with Abundant Widgeon Grass on Bohners Lake - 2003



Map 7 - Areas with Abundant Milfoil on Bohners Lake - 2003



Map 8 - Areas with Curly-leaf, Naiads, and Water Celery on Bohners Lake - 2003



Curly-leaf Pondweed
Naiads
Water Celery

Access

One Inch = 545 feet

N

Aron & Associates, 2003

Chapter IV

PROBLEMS

Bohners Lake is considered a quality water resource even though its waters and sediments 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 Bohners Lake.

The good water clarity contributes to plants thriving in depths of 13 feet. The fertile soils in the region contribute to the excessive plant problems in Bohners Lake. Carp also create problems in lakes, disrupting game fish spawning areas, suspending sediments, reducing water clarity, and negatively impact the aquatic plant conditions.

Although the Bohners Lake area is now sewered, for many years it was not, creating an additional contribution of nutrients which may have come from improperly maintained or malfunctioning individual septic systems. This is common in densely populated, older lake communities with septic systems.

Recent 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 recent USGS publication 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. However, 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.

When nuisance conditions exist, dense plant beds can limit boating. Dense plant beds may also impair swimming and contribute to stunted panfish populations by reducing opportunities for grazing by predators. Also, the canopies created by Eurasian watermilfoil collect debris and are unsightly and sometimes odiferous, for those desiring a pleasing scenic view. Parts of plants broken by wind and wave action, or by motors (even electric ones), float around the lake, create shoreline debris, and reroot into new areas. Also, swimming perils exist in long Eurasian watermilfoil and curly-leaf pondweed strands.

Eurasian watermilfoil, curly-leaf pondweed, muskgrass, filamentous algae, and widgeon grass are causing the aquatic plant nuisance problems in Bohners Lake.

Sedimentation from the watershed has also been a problem for the inlet and the lake. The inlet south of the lake has been dredged twice in recent years when sediment filled the small retention area south of the lake inlet. The inlet area of the lake was also dredged to remove the eroded sediments.

The District has been attempting to improve the quality of the watershed runoff. The southern watershed area through the inlet has been of primary concern. A farm field known as the “mint field” is being purchased by the Wisconsin Department of Transportation as part of a highway expansion project. This land is prior-converted wetland that will be restored. Local efforts have increased to limit the amount of sedimentation that enters Bohners Lake.

It is important to remember that it is far cheaper to prevent a problem than it is to correct a problem. A cars’ oil change costs only $20 but a new engine costs over $1000. 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. Stopping erosion and nutrients from entering the lake is much more cost effective than attempting to dredge or correct plant and algae problems.

Chapter V

HISTORICAL PLANT MANAGEMENT

CHEMICAL TREATMENT

Chemical treatment has been used by residents to control plants and algae, see Table 4. Early season chemical treatment of both plants and algae has produced better results, while using less chemical.

HARVESTING

Bohners Lake has harvested aquatic plants by using a contract harvester. For the past 4 years the District has hired an independent contractor for 1 to 2 weeks of the summer to harvest the nuisance vegetation and open boating lanes. In 2002, the contractor removed 85,000 lbs of vegetation from about approximately15 acres at a cost of $6670.00.

OTHER MANAGEMENT ACTIVITIES

Individual landowners have maintained their own immediate shorelines using low intensive activities such as raking and pulling plants.

Table 4 Chemical Treatment Summary - Bohners Lake*

Dates	Acreage	Chemicals Applied
June 1981	1.83	Aquathol K, Cutrine Plus
1983	25.5	Endothall, CuSO4
May, June, Aug 1988	27.3	Aquathol K, Cutrine Plus, 2,4-D
June, July 1989	6.6	Aquathol K, Cutrine Plus, Diquat
July 1990	5.5	Aquathol K, Cutrine Plus, 2,4-D
May, June 1992	7.35	Diquat, CuSO4
August 1993	3	Diquat, CuSO4
June 1994	6.93	Aquathol K, Cutrine Plus, 2,4-D
June 1995	6.1	Aquathol K, Cutrine Plus, 2,4-D
May 2000	3.9, 1.25, 3.9, 3.9	Cutrine Plus, 2,4-D, Diquat, Endothal
July 2000	3.9, .8, .85	Cutrine Plus, Diquat, Endothal
June 2001	5.5, 1.25, 1.25	2,4-D, Diquat, Endothal
Aug 2001	3.4, 5.4, .4, .4	Cutrine, plus, 2,4-D, Diquat, Endothal‘
May 2002	1.4, 4.4, 1.4	Cutrine plus, 2,4-D, Diquat
June 2002	8	Cutrine plus
July 2002	.92	Endothal
June 2003	4, 5, 4, 4.5	Cutrine plus, 2,4-D, Diquat, Endothal

*Source: WDNR

Chapter V

PLANT MANAGEMENT ALTERNATIVES

Control of exotic or nuisance plant species is an uphill battle. The very nature of the plant species survival provides the means to spread rapidly. Fragmentation is important for Eurasian watermilfoil. Wild celery can spread by releasing from the sediments and floating to new areas in late summer and fall. Curly-leaf pondweed spreads by creating turions from which new plants grow. It is now suspected that Eurasian watermilfoil can spread significantly through seeds as well as fragments (Aron, 2002).

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.

A discussion of a variety 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 will continue to expand its range in Bohners 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 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-established a balanced plant population.

Conclusion—Although No Management is technically a possibility for Bohners Lake, it should not be considered for the 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 water milfoil and coontail react unpredictably (Nichols 1991). 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 often 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 reachable by fish. Turtles and frogs hibernate in shoreline muds and can also 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 high recreational demands on the lake, lack of an adequate control structure on Bohners Lake, and because it is not effective for controlling milfoil and chara, drawdown for the purpose of aquatic plant control on Bohners 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. Based on the volume of the lake and the cost of alum, an alum treatment on Bohners Lake would cost approximately $30,000.

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—Without a more thorough review of water quality that determines nutrient release from the sediments is a problem on Bohners Lake, nutrient inactivation is not recommended at this time.

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 15 feet deep, the maximum rooting depth in the lake. Dredging is the most costly form of plant management control. Costs range from $5.00 per cubic yard up to $20.00 per cubic yard depending on site conditions, method used and disposal costs. A WDNR permit is required.

Conclusion—Dredging for aquatic plant control would not be considered a viable alternative for Bohners Lake without a very high cost and considerable disruption of the aquatic environment. Dredging may be an option for areas on Bohners Lake to address other problems.

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 is approximately $40,000 to $50,000 and an annual maintenance and operational cost of at least $5,000. Water quality problems may 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—Bohners Lake has good water clarity, and good dissolved oxygen levels so aeration should not be considered at this time.

SCREENS/BOTTOM BARRIERS

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 will reduce the opportunity for damage by outboard motors. Screens cost approximately $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, even native plants. WDNR approval is required.

Conclusion—Screens are a viable alternative for the limited applications by individual property owners to improve conditions in swimming areas, however, they are contradictory to the WDNR's goal of protecting native plants. They not viable for use on Bohners Lake.

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. 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 Bohners Lake.

In British Columbia, Canada, the larval stage of two aquatic insects, the caddis fly (*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) 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 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. In Wind Lake in Racine County, 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. This time lag can negatively affect the riparians 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). Additional research is needed before many of the biomanipulation techniques can be commonly implemented in lake management. Of greatest importance is the need to establish whether a given biological control organism will not become a nuisance itself.

Conclusion—Neither the Grass Carp, insects, nor fungus are viable alternatives for Bohners Lake. No signs of the weevil have been found in Bohners Lake.

NATIVE SPECIES REINTRODUCTION

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 populations 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.

Due to the species diversity, and abundance of aquatic plants in Bohners Lake, native species reintroduction or expansion has only limited application as a plant management alternative. Small, isolated destruction or removal of Eurasian watermilfoil beds could be combined with planting or transplanting Chara, water lilies or a number of different pondweeds. The planting of native emergent plant species such as bulrushes and associated upland plantings along developed shorelines could be considered. The emergent plant species will provide a buffer zone between the water and shoreline thereby reducing the effects of wave action upon the shore, and therefore reducing erosion. The emergent plants also provide important habitat for fish and macro invertebrates as well as increase the aesthetic value of Bohners Lake. Emergent plants should blend into shoreline buffer zones to further enhance their environmental value.

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—Plantings may be considered by the District or individual landowners. Landowners should be encouraged to allow the 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 nutrients in the lake used by the plants, 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.

HAND CONTROLS

A method of aquatic plant control on a small scale is hand or manual controls. These 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.

Landowners may remove plants from an area up to 30 feet wide without a permit (NR 109). The 30-foot area includes the swimming and pier areas. Landowners may remove Eurasian watermilfoil and curly-leaf pondweed from the remainder of their shorelines without a permit. Removal of native plants beyond that allowed in the 30-foot area will require a WDNR permit.

Manual 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 are very inexpensive when compared to other techniques. Various rakes and cutters are available for under $100. However, hand control is labor intensive and cutters pose risks to users because of their extreme sharpness.

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 Eurasian water milfoil, muskgrass, or curly-leaf pondweed (widgeon grass is rarely found near-shore). Landowners should maintain a natural area of vegetation both on their shoreline and in the water. The District may consider acquiring some rakes and cutters to loan out to property owners.

Riparian landowners may remove Eurasian watermilfoil and curly-leaf pondweed plants within their “riparian zone” without permit. 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 Eurasian watermilfoil spreads, landowners should not attempt to remove native plants. Doing so will create a far worse condition when Eurasian watermilfoil fills the void created by removing the native plants. Any additional removal may require a WDNR permit.

CHEMICAL TREATMENT

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. 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. 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.

Modern herbicides have been tested extensively to be sure they can be used safely. Tests include determining toxicity levels to be sure that humans, animals, and fish are not impacted. Test results

must also show that the herbicides do no bioaccumulate in fish or other organisms and that their persistence in the environment is low. Product labels contain the requirements for use. Material safety data sheets are available for all herbicides approved for use in Wisconsin. Chemicals must be used according to the approved use labels. Application rates, as well as any use restrictions, are indicated on the product labels. Licensed applicators must follow the label requirements.

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.

Chemical treatment has the advantage of being 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. It may also be the method of choice to treat early infestations of Eurasian watermilfoil when hand-pulling cannot be used.

Chemical control has the advantage that it is economical and very effective. The herbicides have been extensively tested prior to approval for use to be sure they can be used safely. Tests include determining toxicity levels, bioaccumulation rates, and their persistence in the environment. Product labels contain the requirements for use. Chemicals must be used according to the approved use applications. Application rates, as well as any use restrictions, are indicated on the product labels. Licensed applicators must follow the label requirements.

Treatments often need to be repeated at least annually. A single season treatment will not permanently eliminate the nuisance. Unless the entire lake is treated, invasive plant material will quickly re-enter the area. Although “mail order” chemicals can be purchased, their use is strongly discouraged and should not 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.

Under current laws, chemical treatment permits are issued for the shoreline areas, 150 feet out. It is possible to get a permit to treat beyond the shoreline zone, however extra planning and preparation will be required. A proposed whole-lake treatment for instance, will require a detailed plan that should include timing of treatment, dosage planned, pre-treatment data collection and a re-infestation plan.

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 applicators certified in aquatic application by the Wisconsin Department of Agriculture. 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.

The following sections explain the types of herbicides available and their mode of operation.

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 it comes 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.

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 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 chopper 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.

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.

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.

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.

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 takes at least 30 to 45 days contact time to kill

the plant. This prevents problems with low dissolved oxygen in treated areas. Fluridone is rapidly diluted and 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. 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.

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.

Conclusion— Use of chemical treatment on Bohners Lake is unusually complicated because of the nuisance species present in the most diverse areas. Usually 2-4-D is used on milfoil, but it is not effective on widgeon grass. Using Diquat to control the widgeon grass will mean that other plants in the area will also be affected even if they are beneficial species.

Native aquatic plant beds should not be chemically treated without a thorough review of the existing conditions. Changing plant conditions that create new shoreline nuisances may warrant chemical treatment of exotics. **Any chemical treatment conducted on Bohners Lake should only target the nuisance species.**

- There may be consideration given to treating Eurasian watermilfoil, muskgrass, widgeon grass, filamentous algae, and curly-leaf pondweed with the appropriate herbicide. Chemical treatment of the remaining plant communities would not be advised on Bohners Lake. It should be remembered that destruction of any native plant species populations will increase potential problems from Eurasian watermilfoil.
- 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.
- Proposed chemical treatments should be developed based on the existing nuisance. Shoreline muskgrass problems may be treated with Hydrothol, however, treatment areas should be restricted to boating lanes to ensure that muskgrass is removed only from areas necessary for access. Muskgrass treatments should take place only when a legitimate navigational concern exists. If muskgrass growth is within a foot or so of the surface in a navigational lane, treatment may take place.
- Filamentous algae should be treated early while the affected areas are small. Less chemical, as well as less potent chemical, will be needed to provide control.
- If conducted, curly-leaf pondweed treatments should be planned to try to prevent the production of turions, an important method of reproduction for the plant. The chemical treatment would help reduce the dormant apices[1] of the plant, another primary means of early

season reproduction (Nichols & Shaw 1986). These treatments would allow native plants a better opportunity for growth in the area.

- Bohners Lake may be a candidate for a Fluridone on a whole lake basis, however, further analysis should be done. While movement of water through Bohners Lake has been negligible the past 2 or 3 years, flow in the proposed treatment season would need to be considered. Removal of Eurasian watermilfoil lakewide would allow native plant species to thrive and spread in the areas currently dominated by Eurasian watermilfoil, however, other plants do contribute to the nuisance problem in Bohners Lake. Prior to applying for a whole lake permit, a treatment plan which evaluates further the State's criteria for whole lake permits to the conditions on Bohners Lake, should be developed as discussed earlier.
- Beach areas on Bohners Lake should be treated with contact herbicides to remove the plants in the areas for public safety. Elimination of native species in these areas is not a concern since the areas have consistently had the same plant communities come back each year.

HARVESTING

Selective 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 must 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.

Shoreline pickup programs can help control floating plant material (floaters) and plant debris, however, they are labor, and time intensive. They are very difficult to eliminate once the residents are used to the pickups. Debris that includes rocks, sticks, gravel, or other such material 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. If a shoreline pickup program is considered, plant debris should be placed on the ends of piers whenever possible.

1. The apex of a plant is the end farther from the stem (Fassett 1957)

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 by 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 and spread the problem. This creates a greater problem on lakes which do not conduct chemical shoreline treatments for Eurasian 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 Eurasian watermilfoil, harvesting favors the species that grow quickly. Because this is usually Eurasian 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 Eurasian 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 Eurasian watermilfoil.

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

Harvesting is a very costly management alternative. Purchase of equipment can exceed $100,000 in capital costs. State grants are only eligible to lakes which harvest a minimum of 30 acres, and have adequate public access. Although Bohners Lake has adequate access, not enough acreage is harvested, making the District ineligible for a grant. Only two contract harvesters are known to operate in Wisconsin, both charging approximately $125 per hour with a 40 hour minimum.

Conclusion—Harvesting on a limited basis has been shown to be effective at reducing the nuisances on Bohners Lake. Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds.

- Harvesting on Bohners Lake is not expected to take more than 2 weeks of harvesting, based on the current plant densities on the lake.

- Contract harvesting, properly supervised, should be considered to relieve nuisances and ensure access.
- The program should emphasize reducing nuisances rather than clear cutting.
- Harvesting should be used to remove large stands of Eurasian watermilfoil and curly-leaf pondweed.
- It can also be used to remove filamentous algae-covered nuisance beds such as that found near the shoal.
- Harvesting may be used to cut boat lanes through dense vegetation to provide access.
- Because contract time is limited, harvesting should begin with the boat lanes to ensure access for riparians, then work should begin on large dense stands of nuisance plants.
- Harvesting of muskgrass should not be done because on Bohners Lake the muskgrass problem occurs in shallow water (less than 3 feet deep). Control of muskgrass problems should be limited to chemical treatment.

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 DNR to develop ordinances.

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

- Any proposed ordinance must have prior review by the DNR.
- 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.
- An ordinance should be studied to ensure that it does not aggravate a different problem. Many communities 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 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.

Conclusion—Lake use ordinances may be considered for Bohners 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 District's goal is to optimize the preservation of aquatic systems that includes water quality, fisheries, and wildlife while minimizing the conditions resulting from aquatic nuisances and to preserve and maintain recreational uses of Bohners Lake. To achieve the goal, the development of this plan is one component of an effort that has included water quality monitoring, community surveys, aquatic vegetation surveys, and wetland inventories.

The District desires to (listed in order of local importance):

- Control exotic and nuisance plant species. by:
  - —use of chemical treatments of nuisance species at least once per season.
  - —contract-harvesting between 40 and 80 hours per season.
  - —encouraging landowners to protect native species.
- Preserve and enhance the natural lake environment by.
  - —educating landowners and lake users in lake ecology.
  - —working with local governments to develop and enforce ordinances to protect Bohners Lake.
  - —continuing to monitor the wetland restoration project within the watershed.
- Identify and expand local educational efforts that the District may undertake to improve the public's understanding of lake issues by:
  - —conducting community survey of residents and landowners within the next four years.
  - —distributing at least 2 newsletters annually.
  - —encouraging community participation in lake management activities.
- Conduct in-lake management activities with the long-range goal of minimizing management to the extent possible by:
  - —conducting year-end evaluations as to the success of plant management activities and the community reaction to the activities.
  - —tracking annual progress of lake management activities.

RECOMMENDATIONS

Management efforts should be directed toward protection and maintenance of the resource with a primary focus on controlling Eurasian watermilfoil and curly-leaf pondweed.

The large shoal on the Southwest end of the lake near the inlet should be re-evaluated every two or three years. If the shoal continues to be dominated by Eurasian watermilfoil and curly-leaf pondweed, the area should be chemically treated in late May or early June. If the shoal begins to shift to

an area with more native pondweeds, the nuisance species should be harvested by topping the plants to prevent seeding and turion production.

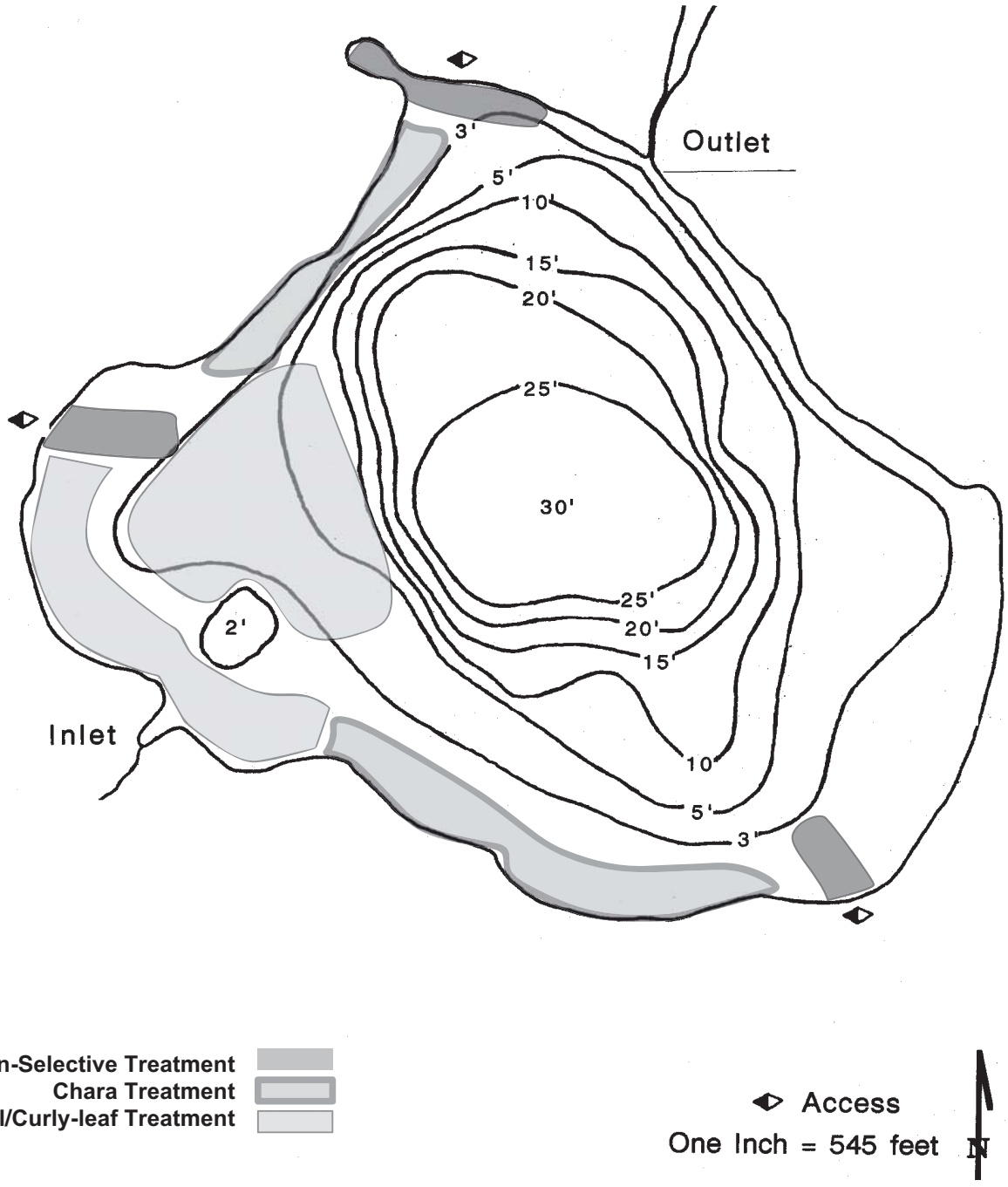
Chemical Treatment

- The District may continue to use chemicals to control nuisance plants. Treatments should minimize the effects on non-target plants. Care should be taken to avoid treating too much plant material at a time. Earlier, rather than later season treatments will accomplish this. Waiting until there are high densities to treat could place undue stress on the fish community by reducing oxygen concentrations post treatment.
- In the most diverse areas of the lake, treatment should focus on Eurasian watermilfoil. The shoal area may also be treated for curly-leaf pondweed. That should be done as early as possible to allow native plants the opportunity to grow without the shading and crowding from the early, very dense, curly-leaf populations.
- Shallow areas, specifically along the West and South shores in the three foot depths, may be treated for muskgrass. Hydrothal may be used *sparingly* to control muskgrass. This should only be done in areas where muskgrass is very dense, is a severe problem to boat traffic, and where very few other plants are present.
- The swimming beaches may be treated with non-selective herbicides to provide safe swimming conditions, limiting the non-selective treatment to the areas within the swimming buoys. Map 9 illustrates the areas for chemical treatments.
- The navigational channel on the Northwest shoreline may be treated with non-selective herbicides to maintain access.
- Based on conditions over the past 6 years, targets species for chemical treatment include: Eurasian watermilfoil, curly-leaf pondweed, muskgrass, widgeon grass, and filamentous algae.

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 the District when preparing to conduct chemical treatments.

- Complete and submit the WDNR permit application forms. Include treatment map, area sizes and name and addresses of all affected riparian landowners.
- Contact licensed firm to coordinate proposed treatment.
- When treatment areas will be greater than 10 acres, a public notice should be placed in the local paper informing the public about the proposed treatment. This will also inform those who may be using the public beaches.
- 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.

Map 9 - Chemical Treatment Areas on Bohners Lake - 2003



Although downstream impacts should be considered when planning chemical treatments, on Bohners Lake, the closest treatment area is only 200 by 150 feet and is more than 600 feet from the outlet. The quantities of chemicals used would be very diluted and ineffective if spread to the outlet. The recommendations in this plan assume that treatments will be conducted according to label restrictions and permits.

Harvesting

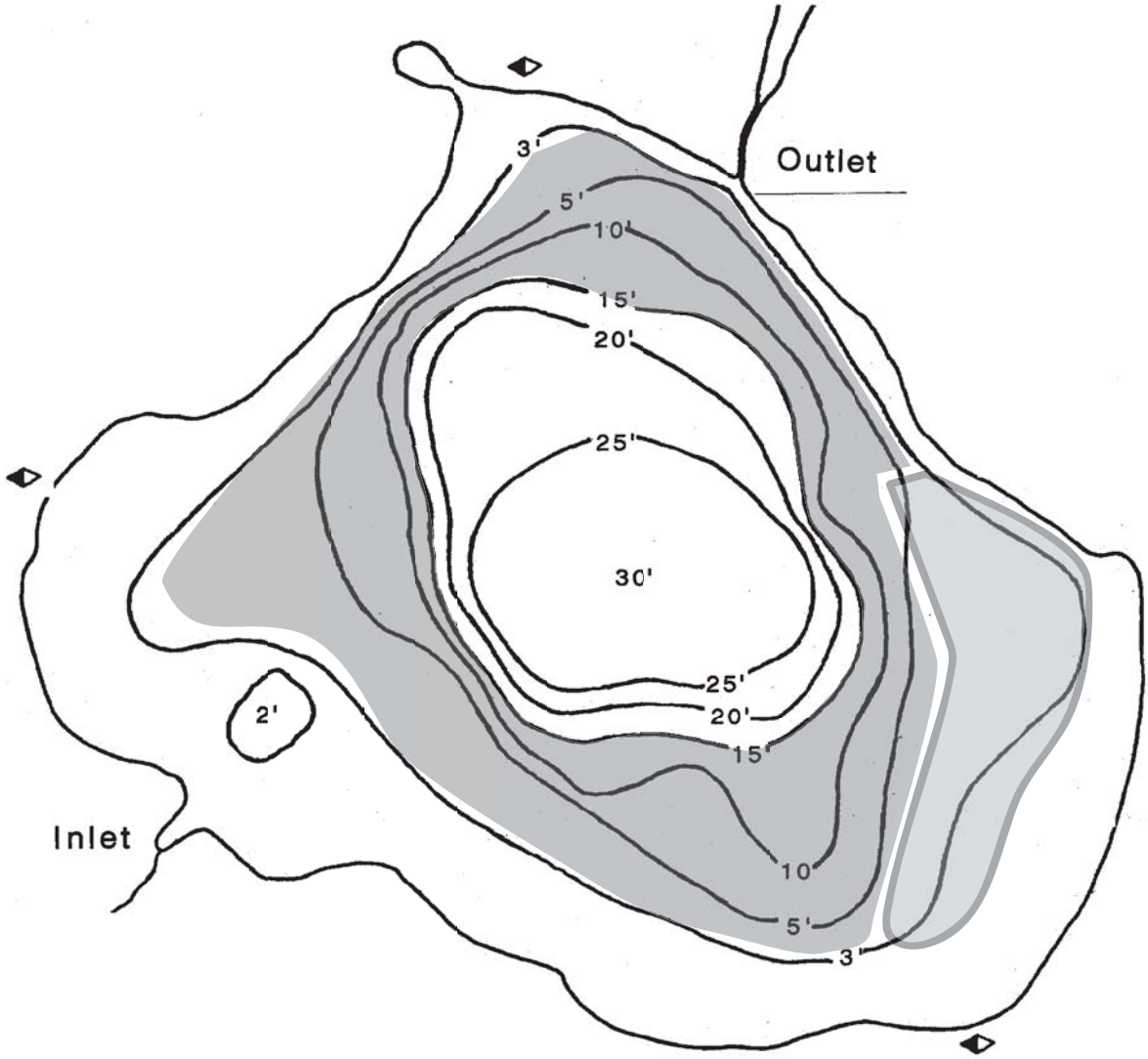
- The District may wish to consider the use of contract harvesting to provide relief from extreme nuisance conditions.
- Any harvesting done should be carefully planned to avoid beneficial plants. as much as possible.
- No harvesting should be done in shallow waters less than three feet deep.
- Native plants may be harvested if necessary to open access lanes.
- Pre-dominantly Eurasian watermilfoil areas should be “topped”, that is, the top 4 or 5 feet of plant material should be harvested, cutting above any native plants. This will allow light to reach the natives and will encourage their growth.
- Approximately 38% (51 acres) of the Bohners Lake surface area is between 3 and 15 feet deep, the actual area harvested annually is less than 20 acres. Because of the high cost, workload involved, and the small volume of plants harvested, it is not recommended at this time that harvesting equipment be purchased.

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.
- Contract harvesting company.
- Current administrative codes should be reviewed annually to ensure compliance.

Map 11 illustrates the Plant Management Activities for Bohners Lake.

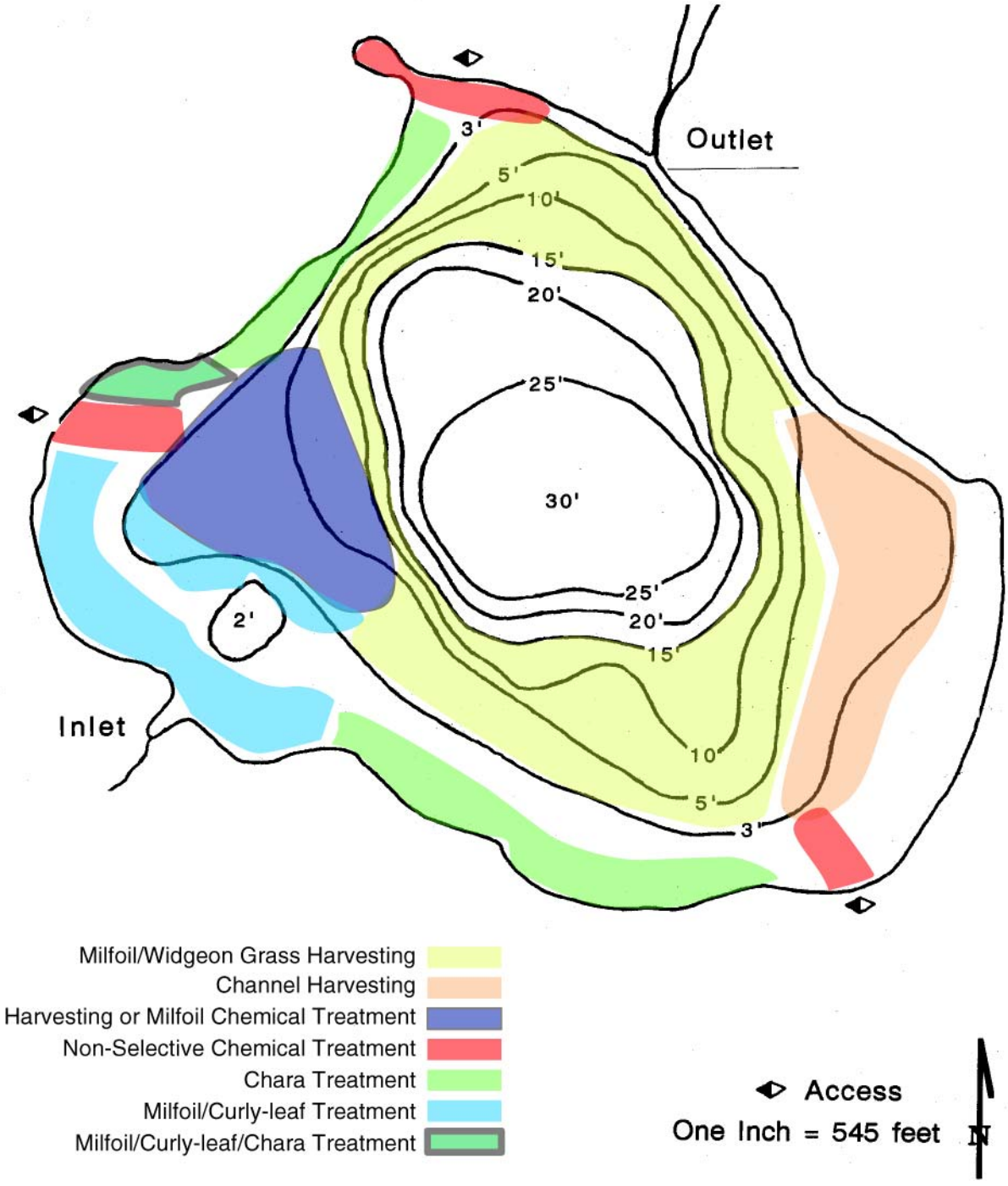
Map 10 - Harvesting Areas on Bohners Lake - 2003



Milfoil/Widgeon Grass Harvesting
Channel Harvesting

Access
One Inch = 545 feet
N

Map 11 - Plant Management Plan for Bohners Lake - 2003



Aron & Associates, 2003

Hand Controls

Riparians should be encouraged to use the least intensive method to remove nuisance vegetation. This could include minimal raking and pulling. Landowners amy 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 remove Eurasian watermilfoil and curly-leaf pondweed from the remainder of their shorelines without a permit. 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 some native plants to remain. This will help prevent infestation of the areas by Eurasian watermilfoil or curly-leaf pondweed. The native plants will also help stabilize the sediments.

The District should encourage landowners to use hand controls to manage the aquatic nuisances. Small swimming areas can be manually cleared without damaging the resource. The District may wish to consider acquiring rakes and cutters to loan to lake residents. Another idea the District may consider is to match energetic teens seeking summer help with those physically unable to do hand clearing.

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 aggravating nuisance conditions. Plant debris can be used in mulch piles or gardens.

Education and Information:

The District should take steps to educate property owners regarding their activities and how they may affect the plant community in Bohners Lake. Informational material should be distributed regularly to residents, landowners, and lake users and local government officials. A semi-annual or quarterly 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 also enlist the participation of the local schools. The schools could use Bohners Lake as the base for their environmental education programs. Burlington 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 continue to inform residents about the lake management activities that are undertaken and the reasons behind the activities.

Watershed Controls

The District should continue aggressive improvement of water runoff into Bohners Lake. All areas of the watershed should be toured regularly for identification of new problems. The District should attempt to acquire the agricultural lands that are identified in the RA Smith watershed report to be a problem for the lake. If acquisition is not possible an easement on the downslope portions of the land will also provide beneficial protection. The District should continue to maintain contact with the WDOT on the "mint field" wetland restoration progress during construction of the Burlington bypass.

The District should work with the Township officials to encourage rigid enforcement of erosion control in the watershed and consideration of lake-friendly methods of development and road construction. The District should also work with the County Conservation Department and the Natural Resource Conservation Department to improve participation in programs such as the Conservation Rehabilitation and Enhancement Program (CREP) that will protect Bohners Lake.

Land Use Planning

The District should take an active role in land use planning decisions in the Township. 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 also involve the District to ensure that future development includes lake protection.

Storm Water Planning

The District should review any new development proposals 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 assist the County and Town to develop and implement storm water ordinances. Another option to consider is the use of phosphorus-free or no phosphorus fertilizers. Some communities are considering fertilizer restrictions to protect their lakes.

Ordinances

The District may consider the development of ordinances. One possible area to protect is the shallow gravel area just out from the inlet. It should be noted that passing ordinances does not in and of itself, correct a problem. Enforcement is a key component of any ordinance development.

Contingency Plans

The District should be prepared for changing aquatic plant conditions that may fall outside the 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 quickly limits some of the options. Harvesting, for instance, cannot be used in water less than 3 feet deep.

- ***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, but it may eliminate a filamentous algae causing odor problems.

- ***Is the situation creating unsafe condition?***
  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 or short term?***
  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 the 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

PLAN EVALUATION AND REASSESSMENT

This plant management plan provides options for plant management from which the community may select 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 a nuisance aquatic plant situation:

- Have native aquatic plants increased in densities and diversity;
- Have nuisance species decreased in density and coverage;
- Has water quality or clarity 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;
- Has the District been able to prevent exotic species invasions;
- 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 Bohners Lake every three to five years. A summary of the past years management activities should be developed annually to facilitate comprehensive review of the entire program and effectiveness. The management plan should also be reviewed, and if necessary modified, every three to five years, to ensure its appropriateness to any changing conditions.

Chapter VIII

SUMMARY

- The management of aquatic plants on Bohners Lake should focus on management of nuisance species.
- The District should encourage landowners to grow more natural shorelines and emergents to minimize the areas disturbed for lake use.
- The District should provide landowners with information on erosion control, especially on the steeper shorelines.
- 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 and bottom barriers to control Eurasian water milfoil and curly-leaf pondweed only and should minimize the size of any areas that are cleared.
- Property owners should keep their shorelines free of floating plant debris to prevent spreading nuisance plants.
- The District may consider acquiring hand rakes and cutters to loan to property owners for localized control.
- The District may continue to use contract harvesting.
- Chemical treatments may continue, planning each treatment to ensure that only the target plants are affected.

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LOCAL CONTACTS

RACINE COUNTY

County Web Site www.racineco.com

County Executive	Phone: 262-636-3273
Office of the County Clerk Racine Courthouse 730 Wisconsin Ave Racine, WI 53403	Phone: 262-636-3121
Clerk of Circuit Court	Phone: 262-632-3770
Human Resources Department	Phone: 262-638-6680
Public Works/Parks 14200 Washington Ave Sturtevant, WI 53177	Phone: 262-886-.8440
Birth & Death Certificates, Marriage Records Register of Deeds	Phone: 262-636-3208
Racine/Kenosha UW Extension Service 14200 Washington Ave Sturtevant, WI 53177	Phone: 262-886-8470
Racine County Planning and Development 14200 Washington Ave Sturtevant, WI 53177	Phone: 262-886-8460
Racine County Historical Society 701 S Main St Racine, WI 53403	Phone: 262-636-3926

Wisconsin Department of Natural Resources

Water Resources and Chemical Permit Applications	Craig Helker (262) 884-2357
Water Reg and Zoning	Shane Heyel (262) 884-2356
Lake Planning Grant and Lake Protection Grant Applications	Heidi Bunk (262) 574-2130
Fisheries	Doug Welch (262) 884-2364

University of Wisconsin Stevens Point

Lake Specialists	Tamara Dudiak (715) 346-4744 Bob Korth (715) 346-2192
Project WET Coordinator	Mary Pardee (715) 346-4978
Adopt-A-Lake	Laura Felda (715) 346-3366

Wisconsin Association of Lakes (608) 662-0923

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.

basic

Alkaline.

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 presence 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 epilimnion.

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 substances 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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BOHNERS LAKE DATA 2003

YEAR	TRAN	DEPTH	MYRSPS	CHARA	POTCR	CERDE	RUPMA	POTPE	ELOCA	LEMMI	NAJFL	POTGR	VALAM	NI
2003	1	2												
2003	1	4		3	2			1				3		
2003	1	7	1		3			3	2					
2003	1	10												
2003	2	2		3	2			1				1		
2003	2	4		4				3	1					
2003	2	7	4	1	4		3	3						
2003	2	10	2		4			1						
2003	3	2		2										
2003	3	4		3	1		4	3						
2003	3	7		2	1		4							
2003	3	10	2	3			3							
2003	4	2		4	1		4							
2003	4	4		3	2		3							
2003	4	7		4			5							
2003	4	10	2		4	3	3							
2003	5	2						1						
2003	5	4						2						
2003	5	7		4			4							
2003	5	10	3		4	2	5							
2003	6	2			1			1						
2003	6	4					2							
2003	6	7					4							
2003	6	10	1		1	3	4							
2003	7	2	2			1		2						
2003	7	4	2	3	1			2						
2003	7	7		4				2				2		
2003	7	10				1	3							
2003	8	2		3										
2003	8	4		4	1		1	1						
2003	8	7	1		2		4							
2003	8	10	2		1	1	3							
2003	9	2		2								1		
2003	9	4	1	3				1						
2003	9	7	2				4	1						
2003	9	10	1	2			2							
2003	10	2		3										
2003	10	4		4				1						
2003	10	7		4			3	2						
2003	10	10					4							
2003	11	2		3				2						
2003	11	4		4				2				1		
2003	11	7		2	1		3	3				3		
2003	11	10												
2003	12	2		2										
2003	12	4		3			1		2		1	1		
2003	12	7	3				3	2				2		
2003	12	10	3				4							

YEAR	TRAN	DEPTH	MYRSPS	CHARA	POTCR	CERDE	RUPMA	POTPE	ELOCA	LEMMI	NAJFL	POTGR	VALAM	NI
2003	13	2		2										
2003	13	4		3			2							
2003	13	7	4	1			2	1						
2003	13	10	3				3							
2003	14	2												
2003	14	4												
2003	14	7	3											
2003	14	10	4											
2003	15	2												
2003	15	4	2		1			2				3		
2003	15	7		1			3	3				3		
2003	15	10												
2003	16	2												
2003	16	4	2				3	4				4		
2003	16	7						2				4		
2003	16	10	4				4	1						
2003	17	2												
2003	17	4	2				2	2			2	3		
2003	17	7	4			2	3	3				2		
2003	17	10	3			1	4	1						
2003	18	2												
2003	18	4												
2003	18	7	2											
2003	18	10	3											
2003	19	2		2					1				1	
2003	19	4		1				2	3		1	2	2	
2003	19	7	3				2	3				3	1	
2003	19	10	2				2	1						
2003	20	2												
2003	20	4		2				1				3		
2003	20	7		2	3	2		3						
2003	20	10				1		2						
			73	***96***	***40***	***17***	***113***	***71***	***9***	***0***	***4***	***41***	***4***	
			30	***35***	***20***	***10***	***36***	***37***	***5***	***0***	***3***	***17***	***3***	
			37.5	***43.75***	***25***	***12.5***	***45***	***46.25***	***6.25***	***0***	***3.75***	***21.25***	***3.75***	1
			2.433333	***2.74286***	***2***	***1.7***	***3.1388889***	***1.9189189***	***1.8***	***#DIV/0!***	***1.333333***	***2.41176***	***1.33333***	
			0.9125	***1.2***	***0.5***	***0.2125***	***1.4125***	***0.8875***	***0.1125***	***#DIV/0!***	***0.05***	***0.5125***	***0.05***	***0.***
1995 data totals			10	162	33	14	148	54	1	3	2	9	8	
			5	44	20	6	45	31	1	1	2	5	4	
			6.25	55	25	7.5	56.25	38.75	1.25	1.25	2.5	6.25	5	
			2	3.6818	1.65	2.33333	3.288889	1.741935	1	3	1	1.8	2	#D
			0.125	2.025	0.4125	0.175	1.85	0.675	0.0125	0.0375	0.025	0.1125	0.1	#D