George Lake Aquatic Plant Management Plan 2004

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CHAPTER 1

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 George Lake.

George Lake in the Town of Bristol in Kenosha County, is a valuable resource in the area, providing significant natural recreational opportunities. The lake is negatively impacted by nuisance aquatic vegetation, primarily Eurasian watermilfoil (*Myriophyllum spicatum*) and to a less extent, curly-leaf pondweed (*Potamogeton crispus*). The community desires to work to improve the lake, enhancing the long term potential of the lake.

This plan presents an inventory of the aquatic plant communities in George Lake and discussions with respect to the various options for long term management of the aquatic plants. The plan is funded in part by a Wisconsin Department of Natural Resources Lake Planning Grant awarded to the George Lake Rehabilitation and Protection District (District) under Wisconsin Administrative Code Chapter NR 190. This plan may also be used as a component of a comprehensive lake management plan, currently under development by the Southeastern Wisconsin Regional Planning Commission (SEWRPC).

PUBLIC INTERACTION

The plant management plan was developed by Aron & Associates, in cooperation with the George Lake Management District, the WDNR, and the public. Public input and historical records were an important part of the development of this plan. Discussions, comments, and communications 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
- Southeastern Wisconsin Regional Planning Commission (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 AND OBJECTIVES

The difficult task that often faces those who attempt to manage aquatic plants is that user needs often conflict. Fish and wildlife need aquatic plants to thrive. Boaters and swimmers desire relief from nuisance aquatic plants. Those using the lake for “aesthetic viewing” desire an undisturbed lake surface. Balancing all of these user needs takes a continuous effort.

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 George Lake. To achieve this 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’s objectives are to:

- Preserve native species within George Lake and its watershed.
- Protect sensitive areas.
- Control exotic and nuisance plant species.
- Protect and improve fish and wildlife habitat.
- Improve recreational opportunities.
- Lessen the negative ecological impacts of aquatic plant management while providing nuisance relief.
- Identify local educational efforts that the District may undertake to improve the public’s understanding of lake issues.
- Research potential sources of pollutants in the watershed.

CHAPTER 2

BACKGROUND

PHYSICAL DESCRIPTION

George Lake is located in the Town of Bristol, Kenosha County, Wisconsin. The general morphology of George Lake is shown in Table 1 and Map 3. George Lake has a surface area of 59 acres with a maximum depth of 16 feet and a mean depth of 6.4 feet. The lake is nearly circular in shape. In the early 1900's, a three-foot head dam was constructed at the George Lake outlet, stabilizing the water level. The dam is located on the Northeast end of the lake. The lake drains to the Dutch Gap Canal in the Des Plaines River watershed. The area draining to the lake is approximately 2,108 acres. George Lake's watershed area to lake area ratio is 30 to 1. Lakes with high watershed area to lake surface area ratios tend to be more susceptible to nonpoint source pollution. Because the watershed has a large percentage of wetland areas, this reduces the potential for problems from development. However, wetland protection should continue to be a priority for the District.

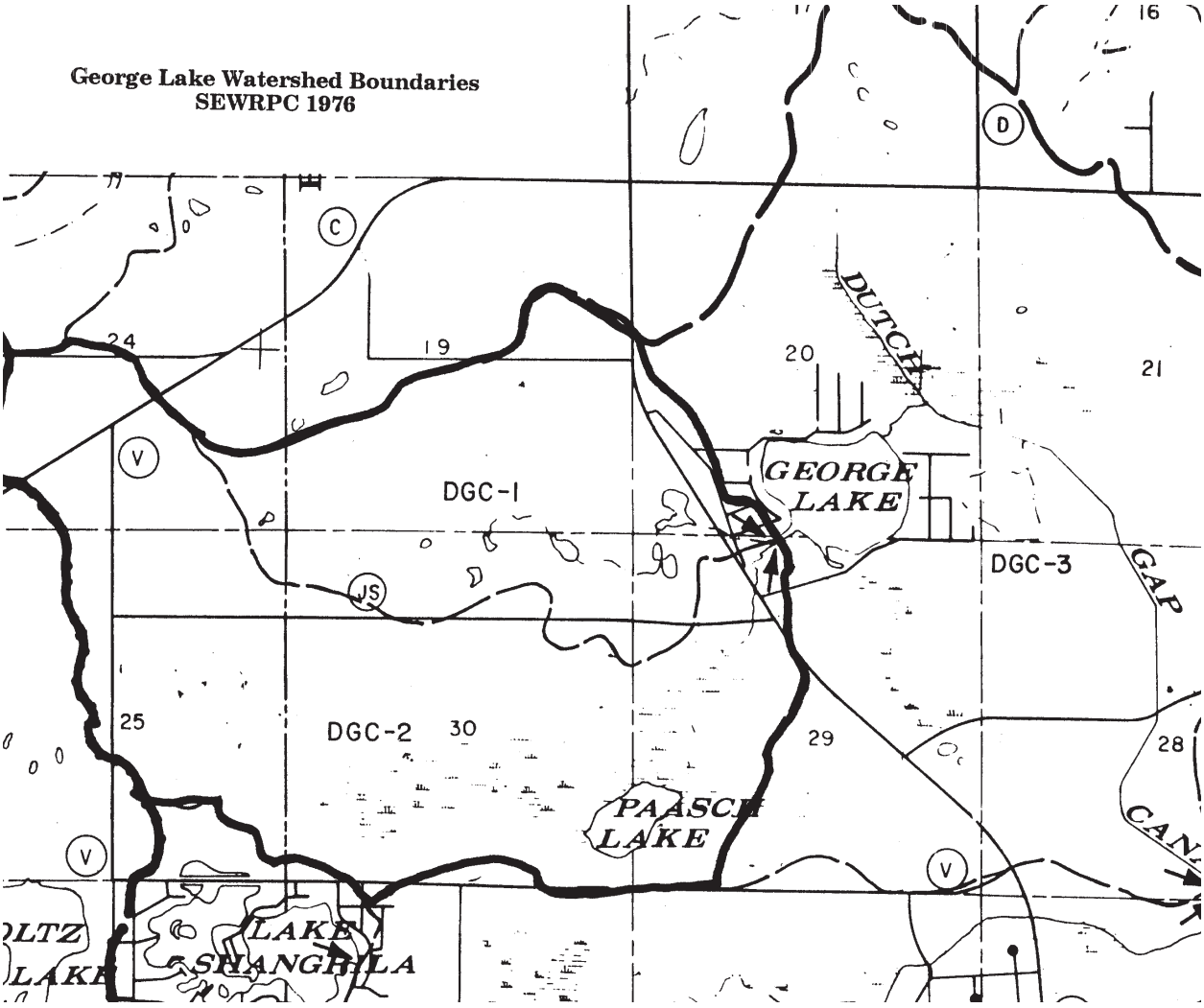
Most of the George Lake watershed lies to the West of the lake (Maps 1 and 2). Map 1 shows the watershed boundary delineated by the Southeastern Wisconsin Regional Planning Commission in 1976. Map 2 shows the watershed boundary identified in a 1993 George Lake Watershed Evaluation Planning Grant report by Aron & Associates. Land uses within the watershed are primarily rural and urban with a significant area of wetlands. Most of the shoreline of George Lake is developed, with single family homes. The majority of the watershed falls within the Township of Bristol, sections 19, 20, 29, and 30. A small portion lies within the Township of Salem sections 24 and 25. Watershed boundaries include Hwy V to South and West, 98th Street to the North, and George Lake to the East.

The majority of water entering George Lake from the watershed enters through two channels from wetlands. These areas include the wetland to the South, the Paasch Lake watershed, which flows into the lake via a culvert under 106th Street; and two channels that join together along the western shore.

The land in the area is generally silty clay with low permeability. Almost 30% of the watershed is considered by the SEWRPC as primary environmental corridor, most of which is wetlands.

Land use activities can directly affect plant growth patterns in the lake. The runoff from individual homesites, development, and agricultural lands adds to the nutrients and sediments in a lake. That in turn contributes to the plant growth, sometimes to nuisance conditions. To see this affect, it is helpful to look at areas near inlets or swales to see the more concentrated effects of rural and urban impacts. These lakebed areas have different plant and sediment characteristics than other areas of the lake bottom. Nutrients, sediments and other materials entering the lake can severely impact the plants, fish and wildlife. Some of the negative results can produce lower oxygen levels, fish kills and sediment filling in spawning beds and macro invertebrate habitat. Public and property owner education should focus on activities to minimize their impact on the lake. These educational activities may include proper disposal of pet wastes and auto fluids, minimizing use of salt and fertilizer, maintenance of vegetation cover, and erosion control.

Map 1 - George Lake Watershed, 1976



Map 2- George Lake Watershed, 1993

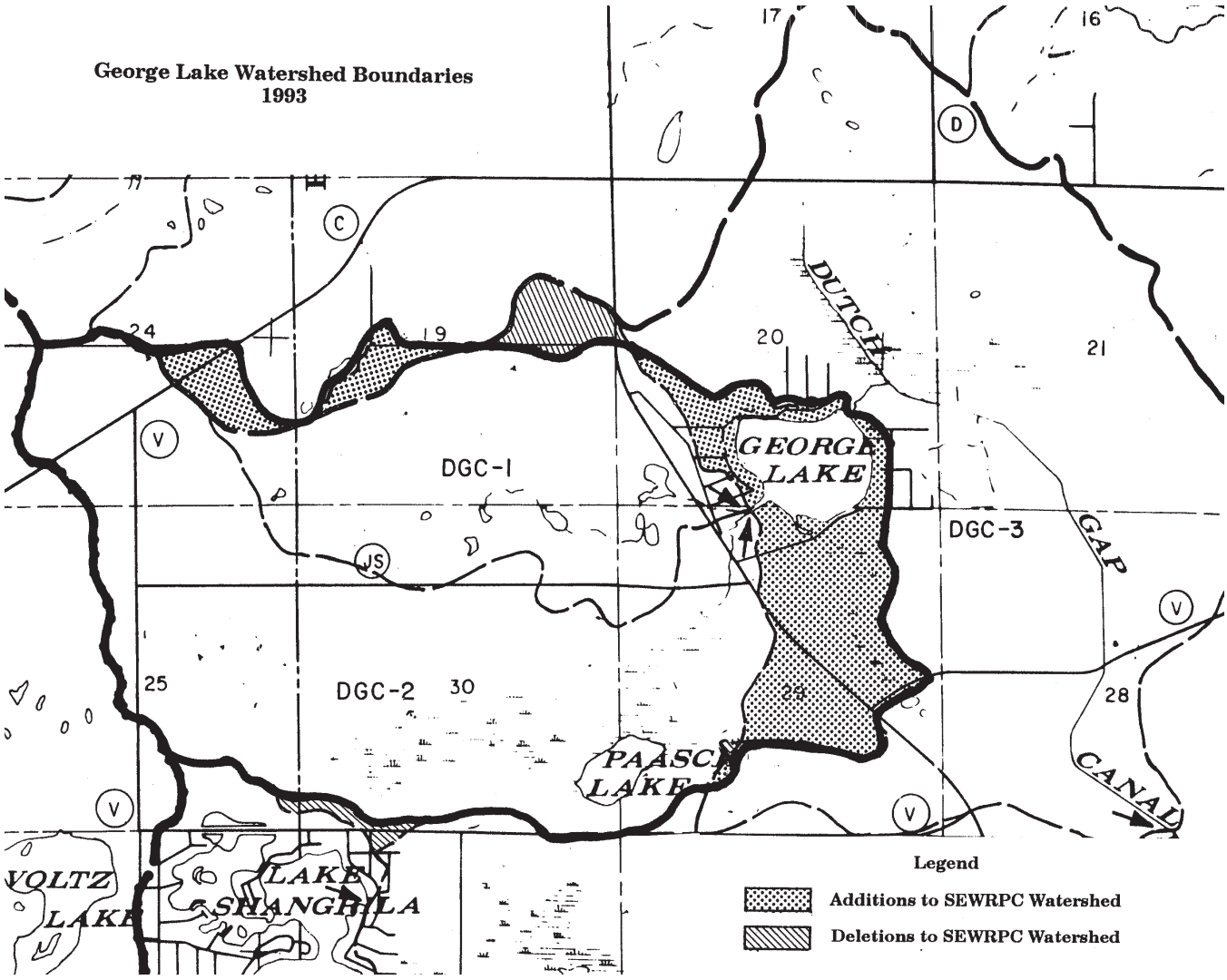


Table 1 Hydrography and Morphology of George Lake
Kenosha County, Wisconsin, 2003

Area = 59 acres
Shore length = 1.18 miles
Shore development factor* = 1.16
Watershed area = 2108 acres
Maximum depth = 16 feet
Mean depth = 6.4. feet
Ratio of watershed area to lake area = 30:1
Lake volume = 389.4 acre feet

Sources: WDNR

LAKE USE

Lake use levels vary significantly from lake to lake, and region to region. Lakes near urban settings are often inundated with users, especially on weekends and holidays. Rural lakes may see sporadic levels of increased lake use. George Lake is located between the populated Milwaukee and Chicago metropolitan areas. The immediate area surrounding the lake is more rural in character. The lack of parking at the boat launch also restricts the level of lake use, although efforts are now underway to resolve the parking situation. George Lake is frequently used by area residents. The majority of summer recreational uses are scenic viewing, swimming, fishing, and boating. Winter lake uses include scenic viewing, fishing, and snowmobiling.

ACCESS LOCATIONS

Until the parking situation is improved, George Lake does not meet the Wisconsin Department of Natural Resources (WDNR) standards for public access to an inland lake. There is a public access site on the south shore of George Lake, however, the road approaching the access site is posted no parking. The WDNR defines public access as one with adequate parking.

BOATING ORDINANCE

State Boating Statutes apply on George Lake. A local ordinance allows: all water sports (water skiing, tubing, jet skiing, etc) are allowed between the hours of 12:00 noon and 6:00 pm and is prohibited at all other times.

WATER QUALITY

George Lake has limited data on water quality. A volunteer participates in the volunteer monitoring program with DNR, monitoring Secchi disk readings, temperature, phosphorus and chlorophyll A. The Self-Help Monitoring Data can be viewed on the DNR website at www.dnr.state.wi.us/LakeSelfHelp/ViewData.

Water clarity on George Lake has varied over the years, from a low of 1 foot on November 1, 1993 to a high of 8 feet on June 25, 1995.

Phosphorus has ranged from a low of 15 ug/l on August 16, 1995 to high of 122 ug/l on October 4, 1993. Phosphorus samples averaged 45 ug/l.

George Lake is considered eutrophic with high levels of nutrients, decreased clarity, algae glooms, and excessive aquatic plants. This means that the lake is highly productive with poor water quality and supports large amounts of vegetation and fish.

Water quality may change over time. The lake may experience fluctuations in its trophic status. Monitoring the water quality over many years will provide the information necessary to determine rehabilitation activities that should be a priority and to gage the effectiveness of activities that are undertaken.

A long term, ongoing program of water quality monitoring should be a priority of the District. The information is crucial to developing and evaluating any lake management activity. Continued monitoring through USGS or the expanded Self-Help Monitoring program with DNR should be a priority.

Funds are available through the Wisconsin Planning Grant for such a program. Additional cost share funds are often available for lakes that take part in the U.S. Geological Survey (USGS) lake water quality sampling program.

FISH AND WILDLIFE

George Lake maintains a warm water fishery. The lake has northern pike, largemouth bass, and panfish. A recent fish survey conducted by WDNR also found grass pickerel and carp. The fisheries in a lake is impacted by aquatic plant growth. Native plants provide higher quality habitat for macro-invertebrates and spawning fish, than do exotic plant species. Dense Eurasian watermilfoil stands increase the stunted fish populations when small fish can hide from their predators. Native plants have a more “open” structure that allows predator fish to graze on small fish. Efforts to improve the native plant community will improve the habitat for the fisheries.

Detailed surveys of the fisheries are valuable tools for assessing the health of the George 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 natural shoreline on the south and west is valuable to fish and wildlife, although the density of Eurasian watermilfoil reduces its quality. The large wetland complexes adjacent to the lake increase the value of the lake 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.

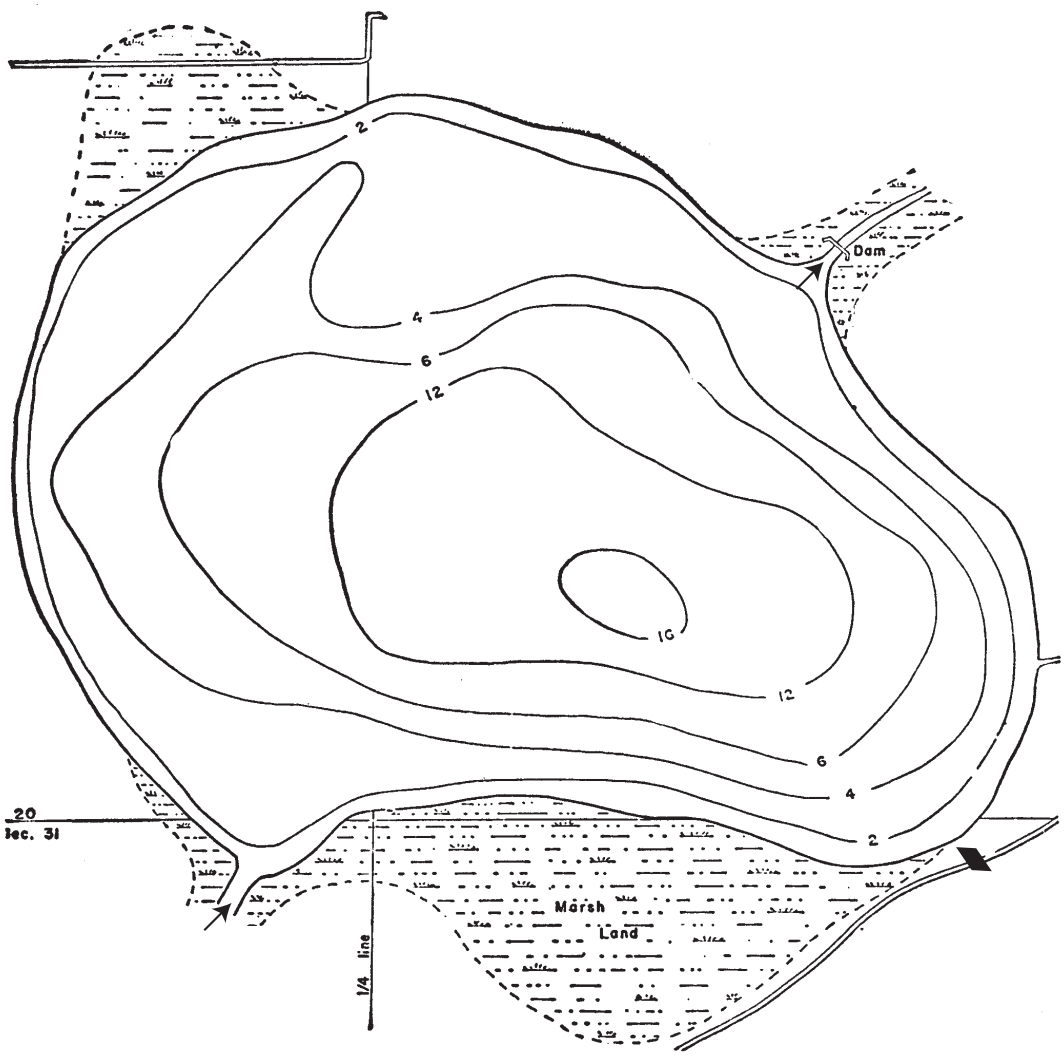
A problem facing many lakes in Southeast Wisconsin is the non-migratory Canada goose. These geese are an entirely different species than the migratory goose and cause significant problems. The non-migratory geese remain in an area year-round. They especially like mowed lawns and open water, making lakeshore 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.

Another problem for some lakes are the proliferation of seagulls. This is especially true when the lake is in close proximity to a landfill.

SHORELINE DEVELOPMENT AND AESTHETIC FEATURES

The George Lake watershed area is not highly developed because most of the watershed is wetland. 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 large wetland complex on the south side of the lake provides a natural vista. The large wetland and undeveloped areas in the watershed provide a degree of water quality protection for the lake.

Map 3 - George Lake



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HISTORICAL CONDITIONS

There is limited, detailed historical information available on many lakes in Wisconsin. A study conducted by Environmental Resource Assessments of Madison in 1978, found Eurasian watermilfoil, a native milfoil, white and yellow water lilies, curly-leaf pondweed, and sago pondweed as present in the system. Eurasian watermilfoil was the most dominant plant at the time. Maximum rooting depth in 1977 was only 5 feet in June and 2 feet in August. The shallow rooting depth was attributed to severe algal blooms.

SENSITIVE AREAS

The level of development around lakes and the amount of recreational use lakes receive often diminish the value of the resources to fish and wildlife. Often, people tend to underestimate the affect they have on the rest of their environment. 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 reintroductions, etc.

The WDNR has not conducted a Sensitive Area designation on George Lake. Map 4 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 high 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 George Lake and should be protected. Native species such as *Potamogeton Illinoensis* , *Stuckenia pectinata*., *Potamogeton foliosis*., *P. gramineus*, and *Utricularia vulgaris*. should not be target species of a chemical treatments. Harvesting areas with the native species should focus on topping the Eurasian watermilfoil.

George Lake has very limited areas of natural shoreline, most of which is confined to the wetland edge. 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. Shallow areas near shore with native aquatic plants should be protected.

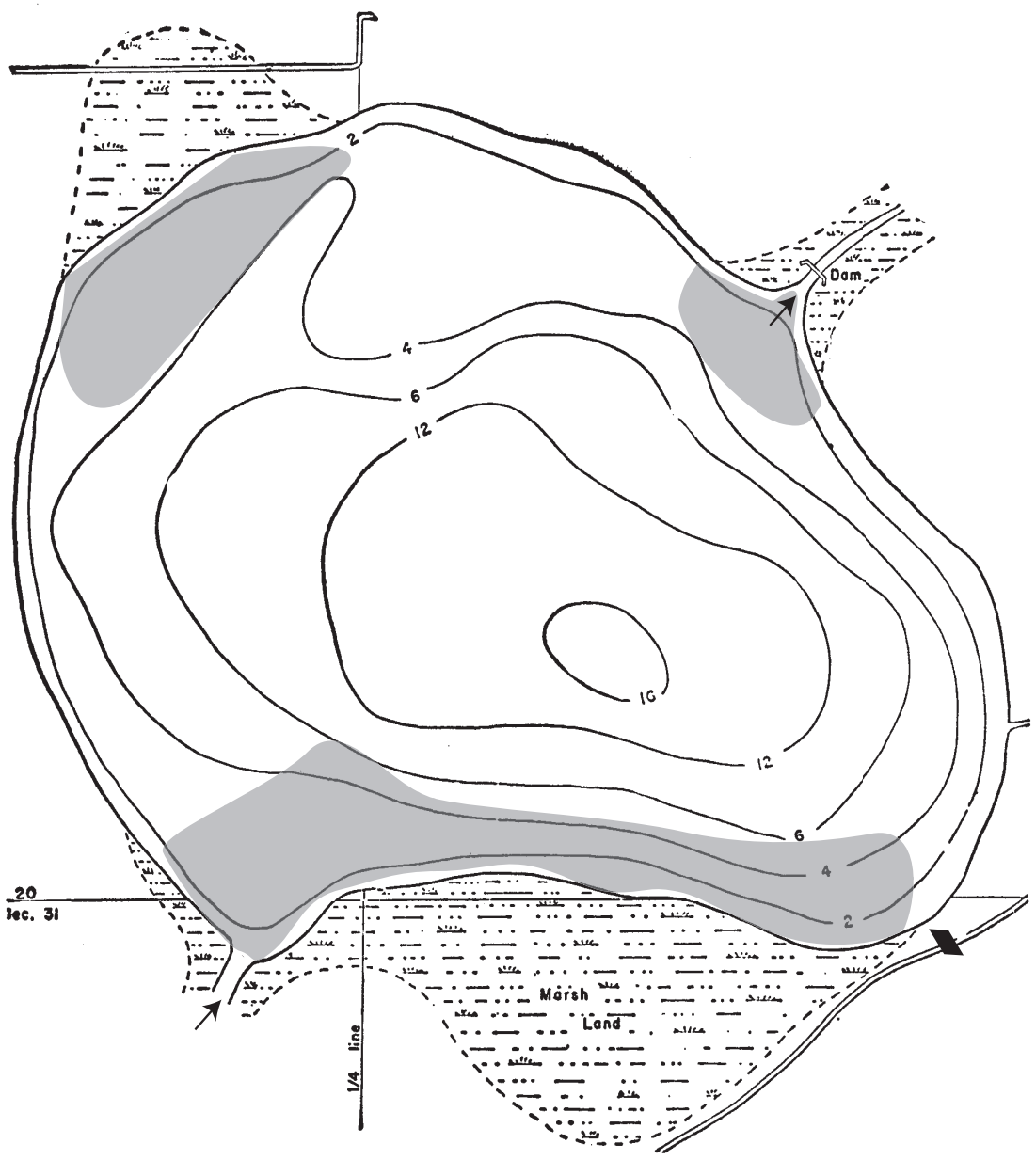
WDNR would consider conducting a Sensitive Area designation on George Lake at the request of the District.

EXOTIC SPECIES

During the aquatic plant survey, George Lake was evaluated for exotic species. Eurasian watermilfoil and curly-leaf pondweed are exotic plant species present in George Lake. Purple loosestrife is a wetland exotic species present in the immediate area. The District may consider participating in efforts to control purple loosestrife using beetles. Information on bio-control program is provided in the Appendix.

No zebra mussels have been found in George Lake to date. Educational activities should focus on the preventative actions that can be taken by lake users to prevent the introduction of invasive, exotic species. This can include newsletters and boat launch signage and programs that explain how exotics are transfered from lake to lake and what actions that can be undertaken by individuals to prevent the transfer.

Map 4 - George Lake Areas of Diverse Native Vegetation



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CHAPTER 3

AQUATIC PLANTS

BACKGROUND

Aquatic plants are very important to the health of the 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 also provide an early warning signal that the lake is reacting to negative impacts from the watershed.

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 takes 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 lakebed areas support. Soft sediments usually support more plants than hard sand or gravel areas. Exotic plants tend to favor soft sediments. Wind and wave action impacts plant growth.

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

PLANT DESCRIPTIONS

Pondweeds

Pondweeds are important species of plants for a lake. Pondweeds do not grow as dense and 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 tend 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. George Lake has three native pondweeds: variable pondweed, Illinois pondweed, and leafy pondweed. A fourth pondweed found on George Lake is the exotic, curly-leaf pondweed and is discussed further below.

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 George Lake are *Potamogeton Illinoensis* and *Stuckenia pectinata*. Other high value plant species include *Potamogeton foliosis*. *P. gramineus*, and *Utricularia vulgaris*.

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 George Lake, but unlike Eurasian watermilfoil, does not dominate the plant community. The most effective means of control of curly-leaf pondweed is to protect the native

plants and secondly, to prevent turion production. This can be done by conducting plant management activities prior to time the plant forms the turions. Early, mid-May, chemical treatment is effective but may also impact native pondweeds. Chemical control of curly-leaf pondweed should only be done if areas do not have native pondweeds. Havesting the tops of the plant early will help minimize the formation of turions. Exercise caution when determining which plant management technique is to be used because some of the techniques will control native pondweeds as well as the curly-leaf pondweed.

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 George Lake. Because it is unknown how long the plant has been in George 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 George Lake. The plant dominates much of the littoral zone of the lake. Very dense areas such as that adjacent to the wetland complex on the South shoreline are very likely crowding out native plant species.

Muskgrass (Chara **sp.)**

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

Muskgrass is present in George Lake, but at this time, not at nuisance levels. No treatment of muskgrass should be done unless boating access is prevented by growths of muskgrass.

Coontail

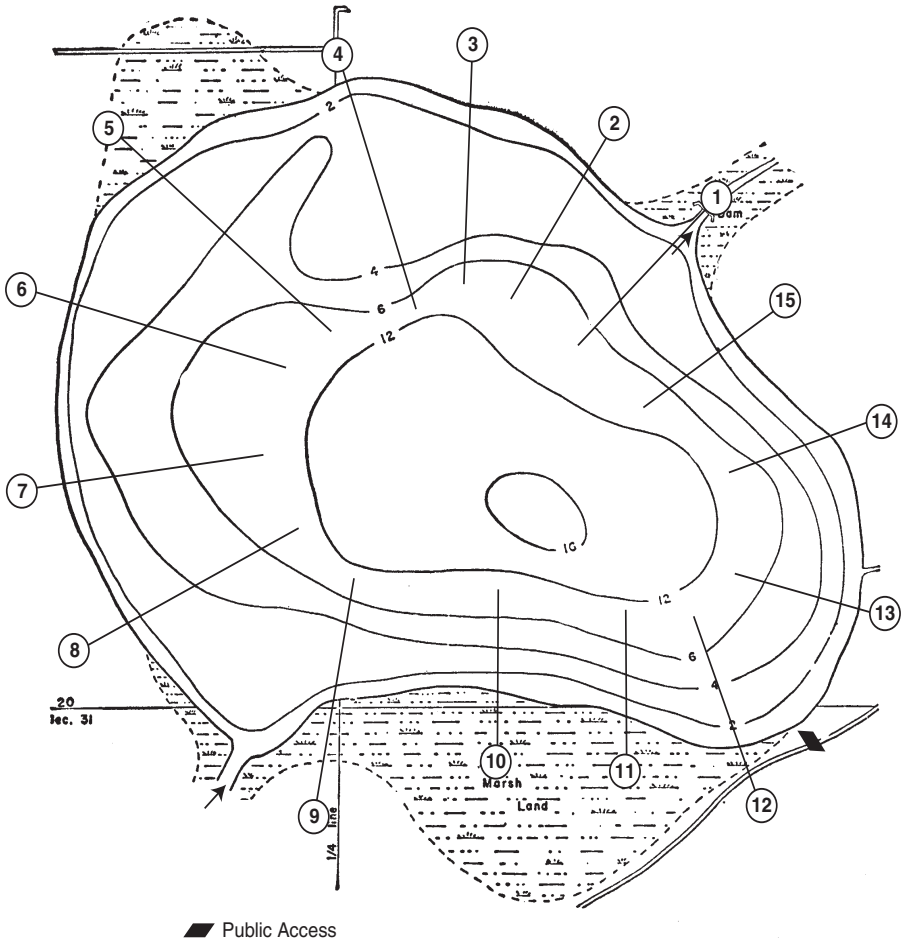
Coontail (Ceratophyllum demersum) is a plant that has no roots. The plant is similar in appearance to watermilfoil. Coontail is tolerant of low light conditions and will drift around a lake. It grows year-round. The plant can reach densities that impair recreational use. The plant is good habitat for invertebrates. The foliage and fruit are a source of food for waterfowl. Coontail is a dominant plant in George Lake but does not warrant specific management activities at this time.

GEORGE LAKE AQUATIC PLANTS

An aquatic plant survey was conducted by Aron & Associates in July 2002 and in June 2003. The field work was conducted in accordance with DNR approved methods for aquatic plant surveys. Fifteen transects were established around the lake. Four depths were sampled along the transects at the 1.5, 3, 6, and 8 foot depths. In addition to the transect survey, a general survey of the lake was conducted. The general survey consisted of using a boat and traversing the littoral zone, visually identifying plant species present. Rake casts were done randomly around the lake to verify the visual observations in shallow depths and to identify species present in deeper depths.

Because ongoing plant management was effective at reducing the nuisance, the July 2002 survey was not able to document the density of the Eurasian watermilfoil. The survey was repeated in June 2003, this time to document the extent of Eurasian watermilfoil. Map 5 shows the locations of the survey transects. The maximum rooting depth in both 2002 and 2003 was determined to be nine feet (Map 6).

Map 5 - George Lake Transects



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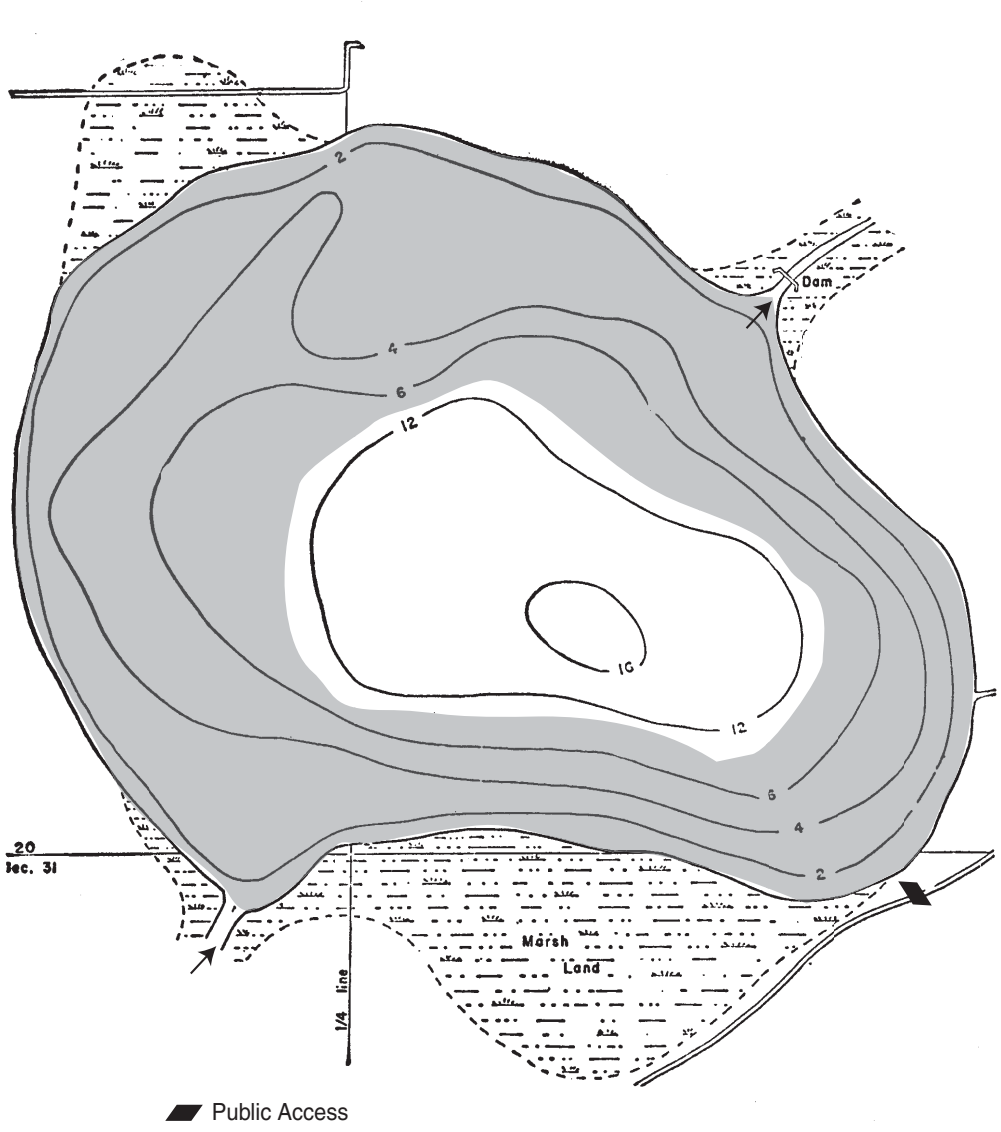
Map 6 - George Lake - Area Available for Aquatic Plant Growth



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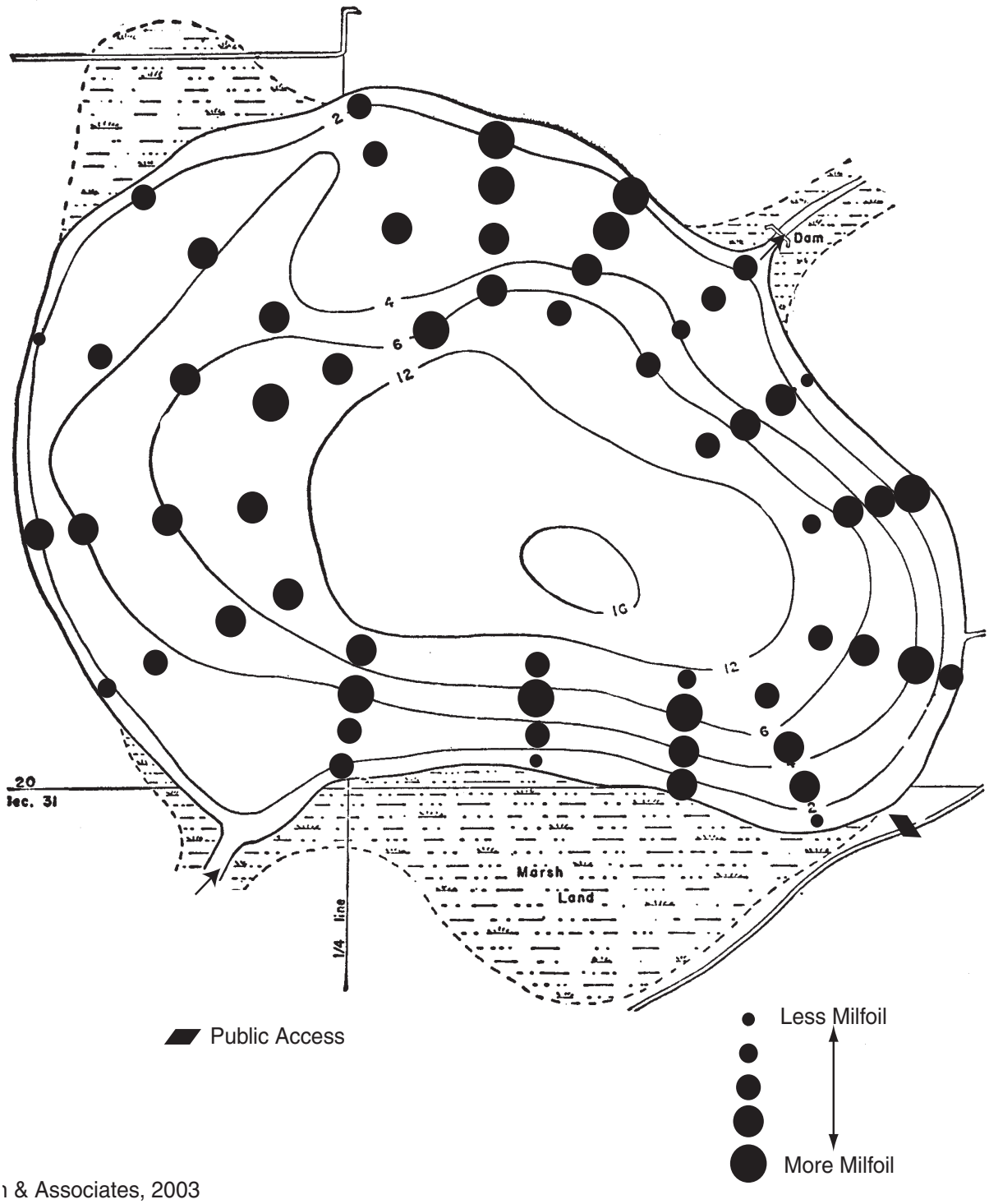
Map 7 - George Lake Eurasian Watermilfoil



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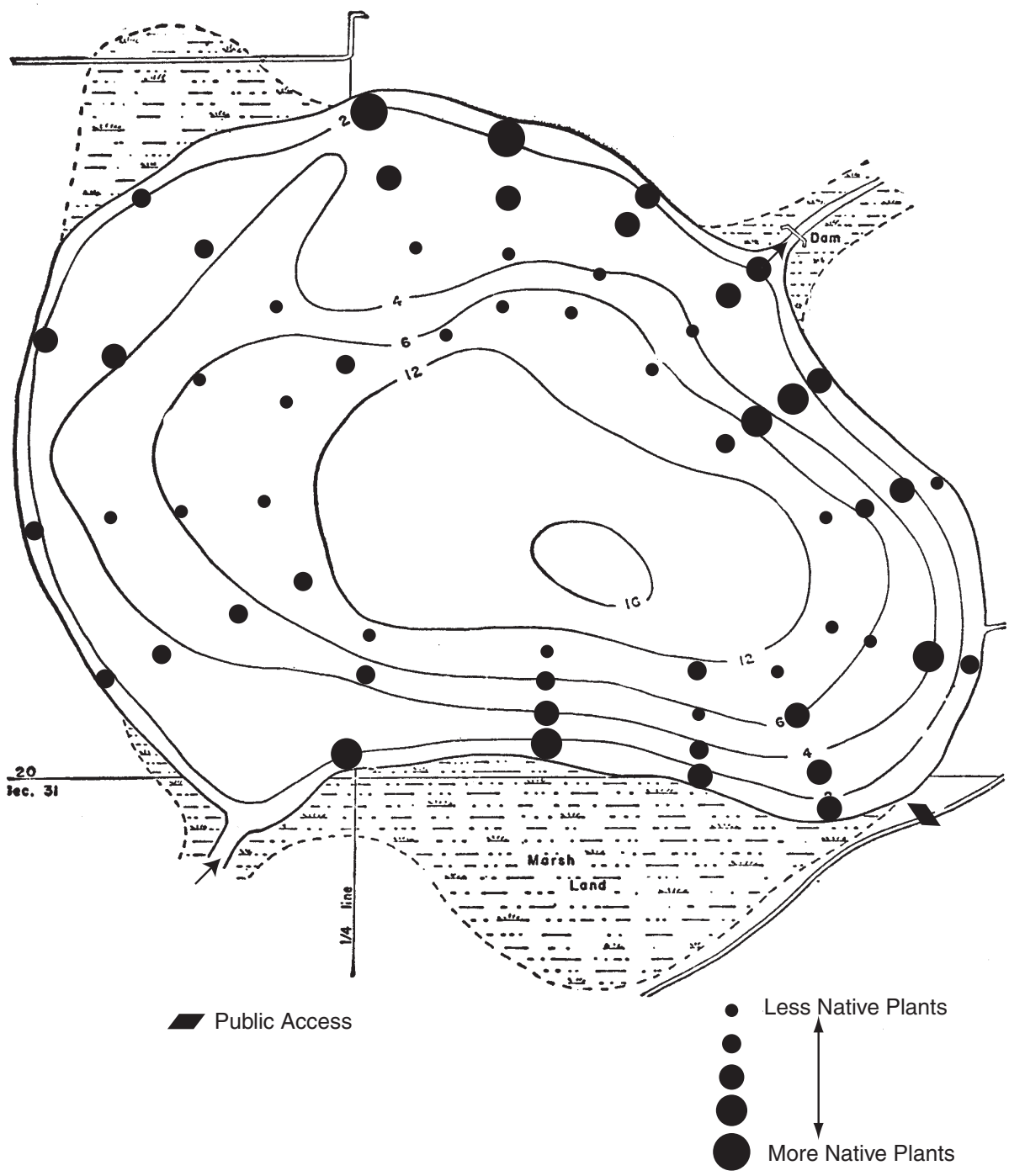
Map 8 - George Lake Native Plants



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The aquatic macrophytes observed in George Lake during the survey are listed in Table 2. A total of 14 submersed and floating aquatic plant species were observed. In general, the aquatic macrophyte population of George Lake is dominated by Eurasian watermilfoil (*Myriophyllum spicatum*) and coontail (*Ceratophyllum demersum*). The maximum rooting depth was determined to be 9 feet. Eurasian watermilfoil was most commonly found in depths of 3 to 8 feet.

Maps 7 and 8 show the relationship between Eurasian watermilfoil, the native plants, and water depth. Eurasian watermilfoil is able to grow throughout the littoral zone, while the native plants do not do as well in the deeper waters. In shallow waters, the native plants are able to compete and do relatively well. Decreased light levels, further diminished by the density of Eurasian watermilfoil, limit the growth of the natives in the deep water zones.

Sandy, firm bottom shoreline areas have primarily native plant species, interspersed with Eurasian watermilfoil and curly-leaf pondweed. Softer, mucky bottom areas are dominated by Eurasian watermilfoil with a few native plants.

The lack of identification of specific plants during a survey does not mean that additional plants are not present, it only means they were not located in this survey. Unfortunately there is little historical data on plants identified in George Lake. Lack of resources, the small size of the lake and the large number of lakes in Wisconsin are just a few of the reasons surveys have not been done previously. Without the historical information it is impossible to know whether more plants existed in George Lake. Based on the aforementioned report from 1977, George Lake has a deeper maximum rooting depth and a greater variety of aquatic plants now than was present in 1977.

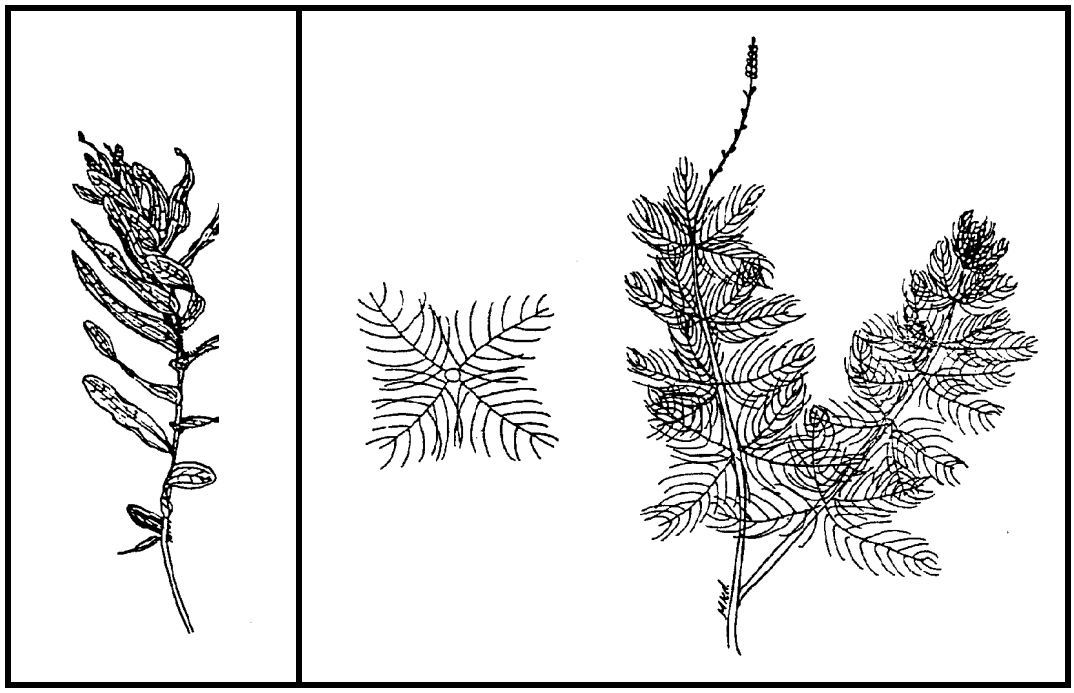


Figure 1. Curly-leaf Pondweed and Eurasian Watermilfoil.

The greatest diversity of aquatic plants in George Lake was found in the 1.5 and 3 foot depths. Eurasian watermilfoil dominated plant growth at all depths (Map 7). Eurasian watermilfoil, slender naiad, and coontail were dominant at the 1.5 foot depths.The fewest species, (3) were found in the 8 foot depths. Eurasian watermilfoil and coontail dominated the 8 foot depths. Sago pondweed was the only other plant found in the 8 foot depth . Eurasian watermilfoil appears to have significantly expanded its range since the 1977 survey when only 58% of sample points had the plants.

Of the native plants, coontail, sago pondweed, and muskgrass were the most common in the lake.

Table 2

List of Plant Species in George Lake, 2002		
Scientific Name	**Common Name**	**Value**
Chara sp.	Muskgrass	Provides harbor to algae, invertebrates, and insects which in turn provides grazing areas for fish. Provides cover and is excellent producer of food for fish.
Ceratophyllum demersum	Coontail	Provides food and spawning habitat for fish, and food and cover for waterfowl.
Lemna minor	Duckweed	Provides good food for waterfowl.
Myriophyllum spicatum	Eurasian Watermilfoil	A non-native, exotic plant species. No ecological significance known.
Najas flexilis	Slender Naiad	Stems, leaves and seeds are eaten by waterfowl. Important to marsh birds, muskrats, and fish.
Nuphar sp.	Yellow Water Lily	Leaves, stems, and flowers are eaten by deer. Roots eaten by beavers. Seeds eaten by waterfowl. Leaves provide harbor to insects, and shade and shelter for fish.
Nymphaea sp.	White Water Lily	Leaves, stems, and flowers are eaten by deer. Roots eaten by beavers. Seeds eaten by waterfowl. Leaves provide harbor to insects, and shade and shelter for fish.
Potamogeton crispus	Curly-leaf Pondweed	A non-native, exotic plant species. Provides food, shelter, and shade for some fish and waterfowl.
P. foliosis		Fruits and tubers are used by waterfowl. Foliage and fruit provides food for muskrat, beaver, deer and moose. The branching of leaves provides habitat for invertebrates and foraging opportunity for fish.
*P. gramineus**	Variable-leaf Pondweed	Provides some food for waterfowl and shelter for fish.
P. illinoensis	Illinois Pondweed	Provides some food for waterfowl and shelter for fish.
Ranunculus longirostris	Water Crowfoot	The seeds and foliage provide food for waterfowl. Provides food for fish.
Stuckenia pectinata	Sago Pondweed	Fruits and tubers are used by waterfowl. Foliage and fruit provides food for muskrat, beaver, deer and moose. The branching of leaves provides habitat for invertebrates and foraging opportunity for fish.
Utricularia vulgaris	Bladderwort	Stems provide food and cover for fish.

*Found only in the general survey.

Aquatic Plant Species in George Lake, 2002 and 2003					
Scientific Name	**Common Name**	**No. of Sites Found[1]**	**% Frequency**	**Density Where Found[2]**	**Whole Lake Density**
Chara sp.	Muskgrass	20	33	2.95	.098
Ceratophyllum demersum	Coontail	44	73	2.37	2.37
Lemna minor	Duckweed	1	2	0.02	0.02
Myriophyllum spicatum - 2002	Eurasian Watermilfoil	39	65	2.64	1.72
Myriophyllum spicatum - 2003	Eurasian Watermilfoil	60	100	3.57	14.27
Najas flexilis	Slender Naiad	18	30	2.83	.85
Nuphar sp.	Yellow Water Lily	1	2	1.00	0.02
Nymphaea sp.	White Water Lily	4	7	1.0	0.07
Potamogeton crispus	Curly-leaf Pondweed	4	7	2.0	0.13
P. foliosis	Leafy Pondweed	1	2	1.0	0.02
P. illinoensis	Illinois Pondweed	5	8	2.8	0.23
Ranunculus longirostris	Water Crowfoot	1	2	1.0	0.02
Stuckenia pectinata	Sago Pondweed	30	50	1.5	0.75
Utricularia vulgaris	Bladderwort	3	5	2.33	0.12

1 - Maximum is 60
2 - Maximum is 5

CHAPTER 4

PROBLEMS

George Lake is considered a quality water resource even though its waters and sediments contain sufficient amounts of nutrients to promote nuisance aquatic plant and algae growth. Phosphorus and nitrogen have been determined to be the most critical components that drive aquatic plant growth. Phosphorus is the limiting nutrient that affects aquatic plant growth in George Lake.

The water clarity contributes to plants thriving in depths of up to 9 feet. The fertile soils in the region contribute to the excessive plant problems in George Lake. Carp can also present a problem, disrupting game fish spawning areas, suspending sediments, reducing water clarity, and negatively impact the aquatic plant conditions.

Although the George 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 was common in 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 is the plant species creating the nuisance conditions in George 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 5

HISTORICAL PLANT MANAGEMENT

There has been a range of aquatic plant management on George Lake over the years. From chemical treatment to aquatic plant harvesting, the community continues to work to resolve the issues associated with Eurasian watermilfoil.

There has been mechanical harvesting on George Lake since 1993. The program has been following a plant management plan developed by the District in 1992.

Personnel

The District has 2 hourly employees. The hours per week varies. The Weed Control Committee of the District oversees the weed harvesting operation.

Budget

The harvesting operation is funded through the District's budget levied on the landowners. The District treasurer oversees the accounts. Accounts are audited annually.

Training

Training was initially provided by Aquarius Systems when the equipment was purchased.

Equipment List

1 - EH-220 Aquatic Plant Harvester

1 - dump truck

1 - conveyor

Equipment Storage

The harvester is stored on private property. The dump truck and conveyor are stored on Town property.

Equipment Maintenance

A routine maintenance check is performed at the end of each operational day, and the end of the season.

Insurance

The District has a full range of insurance coverages on the equipment, personnel, etc. The actual equipment is insured, as well as Workers Compensation and Employee Liability insurance.

Transfer Sites

The harvested plant material is off-loaded on the South shoreline.

Disposal Site

The harvested vegetation is transported to Bristol Farms.

CHAPTER 6

PLANT MANAGEMENT ALTERNATIVES

The nature of aquatic plant species survival provides the means to spread. For instance, wild celery can spread by releasing from the sediments and floating to new areas in late summer and fall. The spread of aquatic plants is even more prolific with exotic species because of the speed with which they spread. Control of exotic or nuisance plant species is an uphill battle. Fragmentation is important for Eurasian watermilfoil. 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 George Lake. While the firm, sandy shorelines will not see as much Eurasian watermilfoil growth, the soft sediment portions of the lake will likely see expanded areas of Eurasian watermilfoil. The downside of this expansion 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 George Lake, it should not be considered for the best, long term interest of the water resource.

DRAWDOWN

Drawdown can be used to control some plant growth. Use of this method entails dropping the lake X number of feet for a period of time. This exposes the plants to extreme temperatures, drying, and freezing. Some plants respond very favorably to drawdown, while other plants react negatively, or unpredictably. Eurasian watermIlfoil and coontail react unpredictably (Nichols, 1991), and muskgrass reaction is not known. An adequate outlet control structure and a source of clean water to refill the lake 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 at least 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, or killed, by a drawdown. Costs associated with a drawdown depend on the outlet control structure. Pumping to lower the lake raises the cost for equipment, electricity, and staff. Costs can be minimal if the lake can be lowered by opening a gate.

Conclusion—Drawdown is not considered a viable alternative for plant management on George Lake.

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 flock 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.

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.

Conclusion—Water quality sampling beyond that conducted now, similar to the program offered by the USGS, would need to identify internal nutrient release from sediments as a problem before this could be considered a viable alternative for plant management on George Lake.

DREDGING FOR AQUATIC PLANT CONTROL

Dredging is most often used to increase depths for navigation in shallow waters, especially for channels, rivers, and harbors. Developing a project involves sediment analysis, disposal location identification, plan development and permit acquisition. This frequently involves many hours of planning and permit acquisition, and usually takes anywhere from 6 months to 2 years, depending on the scope of the project.

Dredging for the sole purpose of plant control has met with mixed success. To be considered successful for the purpose of aquatic plant control, dredging would need to bring the lake bed to depths beyond 9 feet deep, the maximum rooting depth in the lake. Dredging is the most costly form of plant management control. Costs range from $5 to $20 or more per cubic yard depending upon site conditions, method used, and disposal costs. A WDNR permit is required.

Conclusion—Dredging simply for aquatic plant control is not a viable alternative for plant management on George Lake. The cost would be prohibitive and the impact to the quality of the resource would be significant.

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. Water quality problems may result from improperly sized aeration systems, so initial planning and engineering must be done carefully to prevent creating even greater problems. Annual maintenance and operational problems and costs are difficult for smaller lake organization budgets and staff. There has been no documented effect of aeration on plant growth. WDNR approval is required.

Conclusion—George Lake has good water clarity. Aeration is not considered a viable alternative for plant management on George Lake.

SCREENS

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

Screens create little environmental disturbance if confined to small areas that are not important fish or wildlife habitat. Although they are relatively easy to install over small areas, installation in deep water may require SCUBA. Screens must be removed each fall and reinstalled in spring. Care must be taken to use screens where sufficient water depth 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. A negative impact of screens is that all plant species are affected, even natives. WDNR approval is required.

Conclusion—Screens are a viable alternative for the limited applications by individuals on some lakes, however, they are contradictory to the WDNRs goal of protecting native plants. They are not viable for the management of plants on George 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 have limited application.

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 George 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 George Lake. No signs of the weevil were identified in George Lake in 2002 or 2003.

HAND CONTROLS

A method of aquatic plant control on a small scale is use of hand or manual controls. These 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 could 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 minimize the area impacted and to be selective in their clearing, again

focusing on Eurasian watermilfoil or curly-leaf pondweed. Landowners should maintain a natural area of vegetation both on the upland shoreline area and in the water. The District may wish to acquire some rakes and cutters to loan or sell to property owners. Landowners should be sure to collect all plant fragments to prevent spreading a nuisance problem.

Riparian landowners may remove Eurasian watermilfoil plants within their “riparian zone” without permit. Residents may apply for a permit to remove native plants in a single area that is not more than 30 feet wide 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.

NATIVE PLANT SPECIES RE-INTRODUCTION

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 of aquatic plants in George Lake, native species re-introduction 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 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 George 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.

CHEMICAL TREATMENT

Chemical treatment for the control of aquatic plants is a controversial method 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. Even if no chemical treatment is conducted, the plants will still die off and contribute to the sediment accumulation.

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 herbicies do not 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 applications. 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, or 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.

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, 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 reinfestation 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.

Concerns over the use of herbicides continues. Some of the more widely stated issues are addressed below.

"The lake is not safe to use following the use of herbicides" The extensive testing of herbicides prior to approval includes monitoring the affects of the active ingredients on people, fish, wildlife, groundwater, upland vegetation, etc. The toxicity levels used in the tests are far greater than that used in aquatic plant control.

"Removing the plant material by harvesting keeps the material from filling in the lake like it does with chemical treatment" Decaying plant material, whether from aquatic plants, or from upland trees, or from decaying cattails, all contribute to the sediment on the lake bed. This infilling occurs whether there is chemical treatment, harvesting, or no management at all. Chemical treatment creates some material when the plant dies, however, larger amounts of plant material are prevented from growing. Harvesting only removes that portion of the plant that it cuts off. The rest of the plants continue to grow, and then decay. The efforts to provide conditions which favor native plants minimizes long term the amount of decaying material on the lake bed.

"The lake will be clearer because we are harvesting instead of chemically treating." Many things affect the clarity of the lake. Vegetation on the lake bed protects the sediments from being disturbed by wind, waves, and human activity. Reducing the vegetation overall allows sediments to be suspended. Carp resuspend sediments, causing very noticeable impacts on clarity. Muskrats grazing on water lily roots can affect clarity. And harvesting can resuspend a lot of sediment if operated in water less than 3 feet deep. An increase in aquatic vegetation usually means clearer water as the nutrients in the system are used for plant production. Since the 1970s the decline in algal blooms has coincided with the increase in aquatic plants and the increase in water clarity.

"All we have to do is stop the incoming nutrients and our lake will be fine and we won't have weeds to treat or cut." Unfortunately, that is not the case. Although every little bit helps, the improvement is seen only in the long term life of the lake. There are sufficient nutrients in the lakebed to drive aquatic plant and algae growth for very many years. Those nutrients have entered the lake from current activities (passive or active, such as tree leaves, plant decay, or erosion) and from past activities (pollution and/or runoff over the entire life of the lake). The removal of the aquatic plant material by harvesting is insufficient to counteract the new input.

"The shoreline was chemically treated, and now the lake is pea soup green". Conducting shoreline treatment will not produce pea green conditions. The algae conditions increase when the nutrients in the lake exceed the level that can be used by aquatic plants. Small, shoreline treatments are usually not enough to cause the shift to an algal-dominated lake.

The following paragraphs 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 can also impact 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 treat-

ment 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 — Native aquatic plants may be safely treated using herbicides, taking care to properly match the herbicide with the targeted nuisance. Chemical treatment should be complimentary with the harvesting program. Areas which are treated should not be harvested to ensure the active ingredient has the proper time to work.

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 George Lake should only target the nuisance species.

- There may be consideration given to treating Eurasian watermilfoil and curly-leaf pondweed with the appropriate herbicide. In most situations this will be a 2,4-D herbicide. Chemical treatment of the remaining native plant communities would not be advised on George 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. Early season application of a 2-4,D product will ensure Eurasian watermilfoil control while treating the least amount of biomass, without harming native species.
- George Lake may be a candidate for a Fluridone on a whole lake basis, however, further analysis should be done. Volume of flow through the lake in the proposed treatment season would need to be considered. Any proposed treatment should be done during very low flows. Removal of Eurasian watermilfoil lakewide would allow native plant species to thrive and spread into the areas currently dominated by Eurasian watermilfoil. 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 George Lake, should be developed as discussed earlier.
- Beach areas on George Lake may be treated with contact herbicides such as Reward (active ingredient Diquat) to remove the plants in the areas for public safety.
- Based on existing conditions targets species for chemical treatment include: Eurasian watermilfoil and curly-leaf pondweed.

HARVESTING

Selective harvesting is another lake management tool that is frequently used to control aquatic plants. Plants are cut off up to 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).

Harvesting must be done in waters deeper than three feet. Harvesting in shallower areas 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. 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.

Harvesting of fish lanes can open up areas so game fish can feed upon panfish, increasing 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.

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 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. However, cutting the entire plant bed will negatively impact the native plants which cannot regrow as quickly as Eurasian watermilfoil. Harvesting also removes fish, turtles and invertebrates.

Because of the increasing concern of the role seeds play in the spread of Eurasian watermilfoil, areas that are harvested and dominated by Eurasian watermilfoid should be harvested 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 making George Lake ineligible for a grant. Only two contract harvesters are known to operate in Wisconsin, charging approximately $125 per hour with a 40 hour minimum.

Conclusion—Harvesting is a viable alternative for aquatic plant management on George Lake. Harvesting should not be done in areas where chemical treatment has been used. Harvesting should be done only in water depths greater than 3 feet. Landowners should be encouraged to remove floaters from their shorelines. Material can be mulched or used in plant beds. Harvester operators should be trained in all safety aspects of the program. The operators should also be trained in aqautic plant identification.

CARP REMOVAL

Carp control has been included in this section because of the impact carp have on aquatic plants. As discussed earlier, carp disrupt the bottom sediments, dislodge native plants, and reduce water clarity. An important way to protect the native plant population is to remove carp whenever possible. This may be done by spearing, bow and arrow, or hook and line. Larger scale removal requires a permit from WDNR.

Conclusion—Carp removal is a viable management tool for George Lake. George Lake should develop a program to encourage landowners and lake users to remove carp. This might entail something as large as a Carp Tournament with a prize for the most removed, or individual removals by volunteers, i.e. a Carp Patrol.

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 George Lake if a specific need is identified, 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. WDNR and UWEX may be consulted for assistance with the development of ordinances.

CHAPTER 7

PLANT MANAGEMENT PLAN

GOALS AND OBJECTIVES

The District's goal is to optimize the preservation and enhancement of aquatic resources, including water quality, fisheries, and wildlife, while minimizing the conditions resulting from aquatic nuisances and to preserve and maintain recreational uses of George Lake.

The District desires to:

- Preserve native species within George Lake and its watershed.
- Protect sensitive areas.
- Control exotic and nuisance plant species.
- Protect and improve fish and wildlife habitat.
- Improve recreational opportunities.
- Lessen the negative ecological impacts of aquatic plant management while providing nuisance relief.
- Identify local educational efforts that the District may undertake to improve the public's understanding of lake issues.
- Research potential sources of pollutants in the watershed.
- Eliminate the use of fertilizers on the shoreland.

To achieve the goals, the development of this plan is one component of an effort that has included water quality monitoring, wetland inventories, and the development of a Lake Plan.

RECOMMENDATIONS

Management efforts should be directed toward protection and maintenance of the resource with a primary focus on controlling Eurasian watermilfoil. Control of native plants is not an objective of the plan and will not be conducted. Chemical treatment, mechanical harvesting, hand removal, carp removal, native plantings, and educational projects may be used to control Eurasian watermilfoil and curly-leaf pondweed.

Chemical Treatment

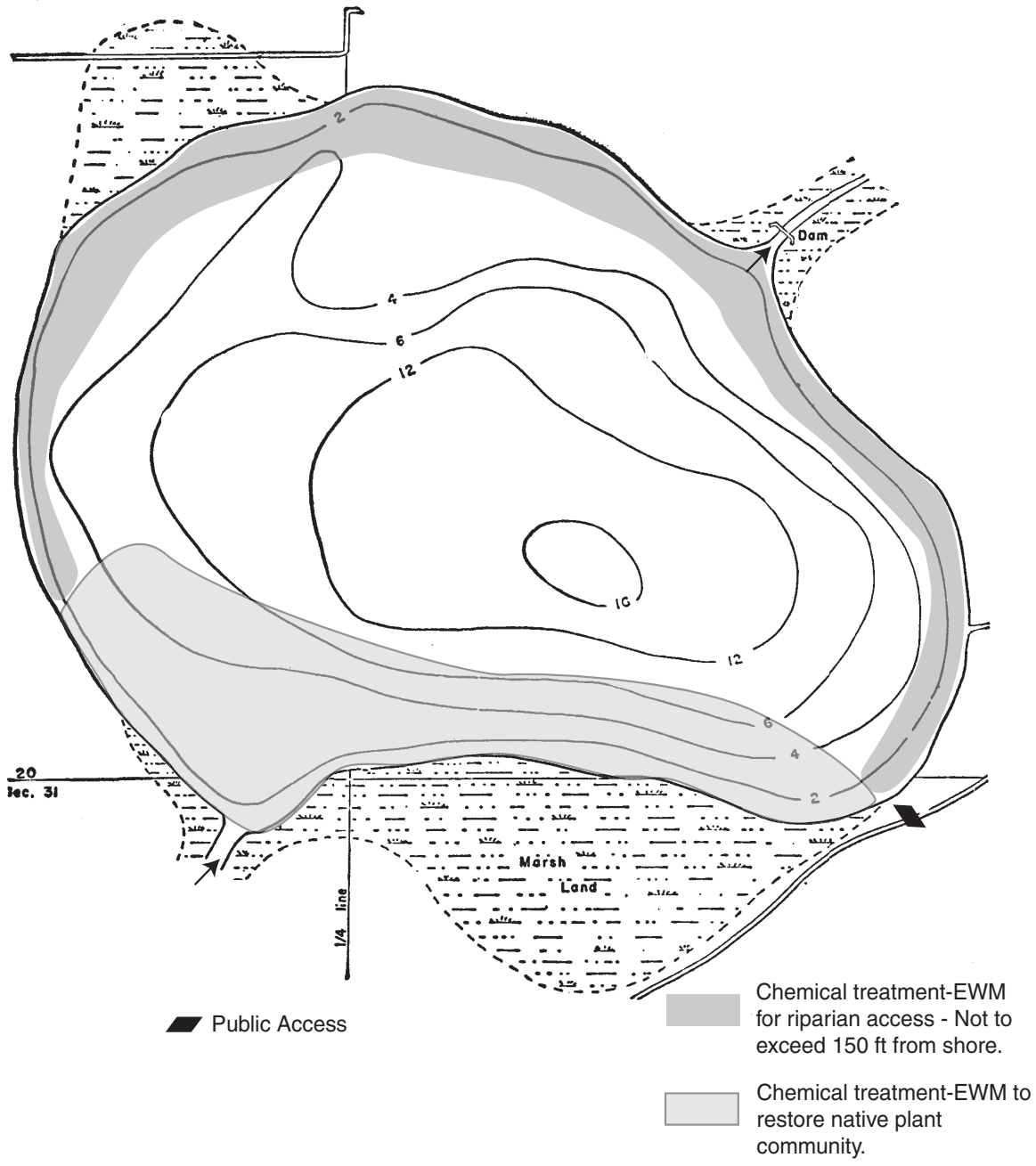
- The District may continue to use chemicals to control nuisance plants. Treatments should minimize the effects on non-target plants. Care should be taken to avoid treating too much plant material at a time. Earlier, rather than later season treatments will accomplish this. Waiting until there are high densities to treat could place undue stress on the fish community by reducing oxygen concentrations after treatment.
- In the most diverse areas of the lake, treatment should focus on Eurasian watermilfoil. That should be done as early as possible in the season to allow native plants the opportunity to grow without the shading and crowding from the early, very dense, nuisance plants.

- Areas with only curly-leaf pondweed may be treated using Aquathol K. Chemical treatment of areas with diverse mix of pondweeds along with curly-leaf pondweeds should be avoided to protect the native pondweeds.
- When other susceptible plants such as bladderwort and waterlilies are in the treatment area, the product may only be used at a rate low enough to avoid impacting the native plants. If budget constraints limit the amount of treatments that can be done, chemical treatment should focus on the larger, monotypic stands (areas with few or no native plants) of Eurasian watermilfoil.
- Products that impact pondweeds (Reward and Aquathol K) should not be used except in swimming areas.
- The swimming beaches may be treated with non-selective contact herbicides such as Reward (active ingredient Diquat) to provide safe swimming conditions. There should not be concern about the diversity of plants in the beaches since the diverse communities will likely return year after year, in spite of the treatments. Map 9 shows the areas that may be chemically treated.
- Based on existing conditions, target species for plant management are Eurasian watermilfoil and curly-leaf pondweed.

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 the general public 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 - George Lake Plant Management Plan
Chemical Treatment Areas



Aron & Associates, 2003

Map 10 - George Lake Plant Management Plan
Mechanical Harvesting Areas

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Harvesting

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.

There has been mechanical harvesting on George Lake since 1993. The program has a plant management plan developed by District in 1992.

- The District may continue to harvest the deep water areas of the lake (Map 10).
- The District may use contract harvesting to provide relief from extreme nuisance conditions.
- Any harvesting done should be carefully planned to avoid native plants as much as possible.
- No harvesting should be done in shallow waters, less than three feet deep.
- Native plants may be harvested only when 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.
- Lily pads should not be harvested.

Personnel

The harvester should be operated by trained personnel, familiar with the complexity and requirements of the equipment.

Budget

The harvesting operation should continue to be funded through the District’s budget levied on the landowners. The District treasurer oversees the accounts. Accounts should be audited annually.

Training

Training was initially provided by Aquarius Systems when the equipment was purchased. Yearly training should be conducted to familiarize staff with the equipment and maintenance requirements. Training should also include safety and aquatic resources issues such as plant identification.

Equipment List

1 - EH-220 Aquatic Plant Harvester

1 - dump truck

1 - conveyor

Equipment Storage

Inside storage is preferable. Outside storage may be used if equipment is properly protected.

Equipment Maintenance

Daily: All fluids should be checked. Fittings should be greased. Conveyors, cutting

heads, and hoses should be checked for wear.

Engine oil should be changed at least twice a year, or according to the manufacturers requirements. A maintenance log should be kept documenting all major repairs. Equipment should be properly winterized for storage.

Insurance

The District should continue to maintain a full range of insurance coverages on the equipment, personnel, etc. Coverages should include Errors and Omissions, Bodily Injury and Property Damage, Personal Injury, Workers Compensation, and Employee Liability insurance.

Daily Log

A daily log should be maintained. The log should include areas harvested, loads removed, hours worked, maintenance conducted, any remaining problems.

Transfer Sites

The current offload site on the South shore may continue to be used. Daily removal of floating plant debris in the vicinity should be part of normal operations.

Disposal Site

The harvested vegetation may continue to be transported to Bristol Farms. Vegetation should only be placed on upland sites and cannot be placed in wetlands or floodplains.

Safety

The District should require staff to wear lifevests when operating the harvester. Additional safety training on the specific equipment should also be provided. Emergency phone numbers should be included on board the harvester. Operator should be provided with two-way radios or cell phones to use in the event of an emergency.

Hand Removal

Riparians should be encouraged to use the least intensive method to remove nuisance vegetation in their shoreline areas. This could include minimal raking and pulling. 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. If screens are considered by individuals, a WDNR permit will be required.

Riparians should be encouraged to allow native plants to remain. This will help prevent infestation of the areas by 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.

Carp Removal

The District may consider developing a voluntary carp removal incentive program. Any carp removed will be of benefit to the resource.

Protect Native Habitat And Shorelines

Consideration should be given to protecting native aquatic plant species along undeveloped shorelines. Developed shorelines should be restored to more natural conditions. This will accomplish a number of management goals including but not limited to:

- Shoreline protection from wave action
- Provide valuable fish and wildlife habitat
- Improve the aesthetic value of George Lake
- Prevent the spread of exotic plant species

The District may conduct plants or transplantings to encourage the spread of native plant species. The District should work with WDNR, or the LCC to develop projects and acquire any necessary permits. Projects may include:

—Planting of water lilies. This may be done by transplanting small plants into new shallow areas, or by purchasing roots from an aquatic nursery. When purchased, the small tubers are weighted and can be tossed from shore or from a boat. These should be planted in shallow, near-shore areas.

—Transplanting sedges. Small plants may be removed from areas with many plants and placed into areas without them. The goal here is to encourage the spread of the plants without disrupting or harming existing plants.

—Planting Chara. Chara is actually an algae, but it is usually included in discussions of aquatic plant management. Chara has no roots but is very effective at stabilizing bottom sediments and reducing the opportunity for invasion from Eurasian watermilfoil. Chara can be purchased from an aquatic nursery. It comes in bushel-sizes, shipped in plastic bags. Chunks of Chara are pulled out, dropped into the lake (usually from a boat), and pushed down into the bottom sediments with a rake. The success of this type of planting may not be seen for a couple of years.

Transplanting should only be done if a well-populated host area is available. This will prevent damage to or loss of the existing plants. Consult with a professional and WDNR to develop a plan and acquire a permit.

Information and Education

The Town of Bristol maintains a website (www.town.bristol.wi.us) that includes information on George Lake. District contact information, agendas, minutes, etc are available on the site. This Plant Management Plan will be provided in electronic form to include on the website.

The District should continue to educate property owners regarding the plant management activities and how people's activities may affect the plant community as well as water quality in George Lake. Informational material should be distributed regularly to district residents, landown-

ers and lake users and local government officials. Topics should include information relating to lake use impacts, importance and value of aquatic plants, land use impacts, etc.

Other issues that should be addressed include landscape practices, fertilizer use, and erosion control. Materials are available for distribution from WDNR and UWEX. Existing materials should be distributed as much as possible. Continued distribution of materials may seem redundant, but the District should remember that it takes multiple "hits" for information to be recognized and understood. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

Another important educational effort should be developed to inform the public about the benefits of protecting native aquatic plants, giving equal consideration to fish and wildlife, while reducing recreational nuisances.

A watershed watch program should be considered. This group would serve as the local partner, along with WDNR and the County Land Conservationist to prevent problems, react quickly to new threats, and provide local feedback.

The District should also enlist the participation of the local schools. The schools could use George Lake as the base for their environmental education programs. For example, Burlington Schools have a mandatory community service requirement that assists with lake management activities in their community. Regular communication with residents will improve their understanding of the lake ecosystem and should lead to long term protection.

Another valuable educational tool is the community survey. Communities surveys that are unbiased and well-done, provide vital information on the thoughts, concerns, and desires of the lake community. Changes in philosophies that occur in reaction to changes in the resource (positive or negative) can be identified through community surveys. Assistance with the development and conduct of a survey is available from Aron & Associates and the University of Wisconsin Extension.

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.

Ordinances

The District may consider the development of ordinances. These may include lake use ordinances to address specific lake use conflicts, phosphorus reduction ordinances, or working with the local municipalities to improve storm water planning. 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.

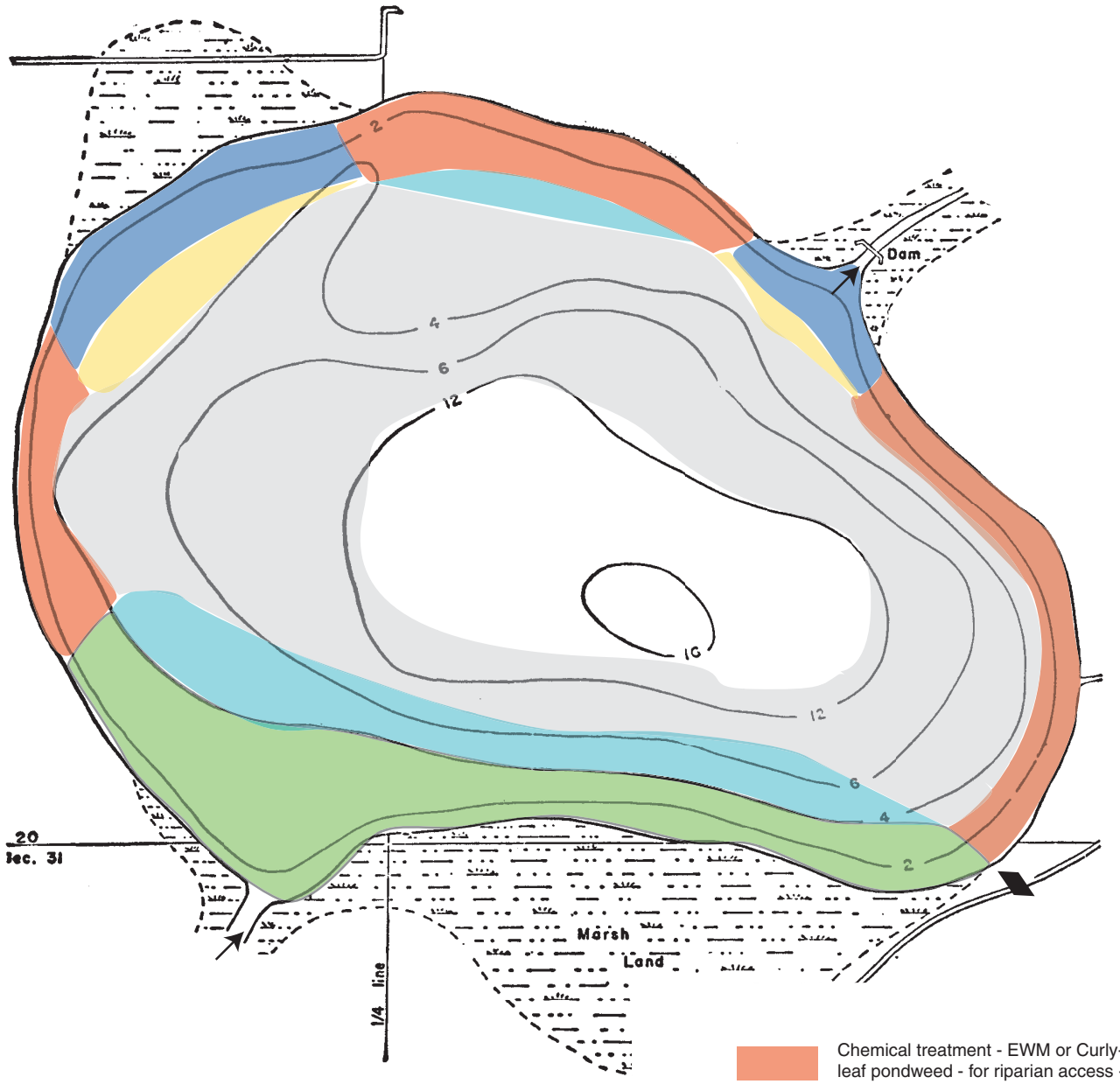
- Is the situation creating unsafe condition?
  Dense, stringy weeds in a beach area, for instance, could create dangerous conditions for young swimmers.

- 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.

Map 11 - George Lake Plant Management Plan



Public Access

Chemical treatment - EWM or Curly-leaf pondweed - for riparian access - Do not exceed 150 ft from shore.

Chemical treatment - EWM - to restore native plant community.

Chemical treatment - EWM - Diverse Plant area.

Mechanical Harvesting - EWM or curly-leaf ponweed - no lily pads

Harvest EWM- Diverse Plant area.

Harvest or Chemical treatment - EWM/Curly-leaf

Aron & Associates, 2003

CHAPTER 8

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 an aquatic plant nuisance situation:

- Have native aquatic plants increased in densities and diversity;
- Have nuisance species decreased in densities and coverage;
- Has water quality improved;
- Does the general public, and more specifically, 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, web sites, public meetings, etc; and are they being used by the public.

The District should re-survey the aquatic plant population at least every three to five years. This will provide necessary historical data, and will provide information on the success of the management activities that are undertaken. The District should then review the Plant Management Plan every three to five years to ensure its appropriateness to the changing conditions.

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APPENDIX

LOCAL CONTACTS

KENOSHA COUNTY

County Web Site co.kenosha.wi.us

County Executive — Phone: 262-653-2600

Office of the County Clerk — Phone: 262-653-2552
1010 56th St
Kenosha, WI 53140

Clerk of Circuit Court — Phone: 262-653-2664

County Sheriff — Phone: 608-297-2115

Health Department — Phone: 262-605-6700

Highway Department — Phone: 262-857-1870

Division of Parks and Recreation — Phone: 262-857-1869
19600 75th St.
Bristol, WI 53104-9772

Birth & Death Certificates, Marriage Records
Register of Deeds — Phone: 262-653-2444

Racine/Kenosha UW Extension Service
14200 Washington Ave
Sturtevant, WI 53177 — Phone: 262-886-8460

Kenosha Area Chamber of Commerce
715 56th St
Kenosha, WI 53140 — Phone: 262-654-1234

Kenosha County Historical Society
220 51st Place
Kenosha, WI 53140

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

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

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 or 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 zone

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.