



Devil's Lake

Lake Management Plan Update 2017

Submitted By:

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Lake Management Plan Update

Introduction

Purpose of the Update

This management plan updates and documents management activities during 2017, examines current conditions in the lake, and provides management recommendations for 2017. The plan will detail an integrated approach to lake management including but not limited to exotic weed control, water quality monitoring and aquatic vegetation surveying. Management activities were conducted, and relate only to areas of Devils Lake within the Rollin Township jurisdiction.

Characteristics of the lake

Devil's Lake is a 1330-acre lake located in Woodstock and Rollin Townships, Lenawee County, Michigan. Public access to the lake is provided by a Michigan Department of Natural Resources boat launch, located at the northwest corner of the southern basin. Much of the shoreline has been developed for single family, seasonal and year-round homes.

The lake drains into Bean Creek on the southwest, just north of Manitou Beach. Bean Creek flows into the village of Addison about two miles (3 km) to the west and continuing south, ultimately turns into the Tiffin River after crossing the Ohio state line.

Rooted vegetation is sparse in a majority of the shoreline areas although some pockets of near shore vegetation exist. The majority of the aquatic vegetation is located along drop off areas and shallow flats. The lake has a history of aquatic plant problems, especially since the introduction of the exotic invasive species, Eurasian watermilfoil. A formal lake-use survey was not included in this study, but observations made while working on the lake indicate that the lake is used for fishing, boating (power & non-power), and swimming.

Management Goals for Devil's Lake

- The primary goal of aquatic plant management in Devil's Lake is the control of exotic aquatic plants. The exotic plant species, Eurasian watermilfoil and curly leaf pondweed, should be controlled throughout Devil's Lake. The abundance of these species should be reduced to the maximum extent possible, and efforts should be made to reduce their recovery after treatment.
- Aquatic plant management should preserve species diversity and cover of native plants sufficient to provide habitat for fish and other aquatic organisms. Native plants should be managed to encourage the growth of plants that support the Devil's Lake fishery (by creating structure and habitat) provided that they do not excessively interfere with recreational uses of the lake (e.g., swimming and fishing) in high-use areas. Where they must be managed, management techniques that reduce the stature of native plants without killing them (e.g., harvesting, contact herbicides) should be used whenever possible. Specific areas should be set aside where native plants will not be managed, to provide habitat for fish and other aquatic organisms. Muskgrass (*Chara*) should be allowed to grow throughout the lake, except in where it grows so tall as to interfere with boating and swimming.
- The species Starry stonewort, if found on the Devil's Lake should be actively controlled and managed. Starry stonewort is in the same family as Muskgrass (*Chara*) but is considered to be an exotic invasive species. Starry stonewort,



Starry stonewort

which looks very similar to the beneficial species Chara, is appearing in more and more lakes. Chara is a highly desired plant because it is typically low growing, keeps the water clear and can slow down the invasion of exotic weed species. Starry stonewort also forms dense mats, but unlike chara, it can grow from 5 to 7 feet tall. Starry stonewort can be very detrimental to a lake's ecosystem and has the ability to kill off native plants and have a negative impact on a lake's fisheries.

- The invasive terrestrial plants, Purple loosestrife and Phragmites should be controlled along the shoreline and adjacent wetlands where present. Both species are exotic and have the ability to displace beneficial native vegetation. Purple loosestrife grows 2 -4 feet tall and is a vibrant magenta color. It is very aggressive and can quickly become the dominant wetland vegetation. Phragmites (common reed) is a wetland grass that ranges in height from 6 to 15 feet tall. "Phrag" quickly becomes the dominant feature in aquatic ecosystems, aggressively invading shorelines, wetlands, and ditches. This plant creates dense "strands" - walls of weeds crowding out beneficial native wetland vegetation and indigenous waterfowl habitats. Spreading by fragmentation and an extensive root system, Phragmites ultimately out-competes native plant life for sun, water and nutrients.



Phragmites

- Conditions in Devil's Lake should not be allowed to deteriorate below present levels. Expansion of aquatic plant problems should trigger an adjustment in the aquatic vegetation management strategy. To support such responses, an annual record of vegetation and management should be maintained.
- Preventative measures that protect the lake from further nutrient enrichment should be identified and implemented.

Lake Management Activities Conducted in 2017

Water Quality

Water quality in the lake was evaluated in the spring and fall of 2017. On each occasion, a depth profile of water temperature and dissolved oxygen concentrations was measured at one-meter (approximately three foot) intervals and the Secchi disk depth was measured in the deepest part of the lake (Deep Hole Site). LakeCheck™ analysis was collected from the deep part of the lake. LakeCheck measures conductivity, total dissolved solids, pH, alkalinity, total phosphorus, soluble reactive phosphorus, nitrates and ammonia.

Planning/Evaluation

Complete surveys of the aquatic vegetation of the lake were conducted in May and September, 2017. Brief checks of the lake were made throughout the summer months.

Vegetation surveys determine the locations of target and non-target plant species. The results of the surveys are used to determine the most appropriate management strategy. The vegetation surveys also document the success of the prescribed management program. An AVAS survey is the State of Michigan's method for conducting a complete aquatic vegetation survey. The Aquatic Vegetation Assessment Site (AVAS) survey divides the parts of the lake capable of growing plants (littoral zone) into subareas and records the cover of each aquatic plant found in each "site". This method of surveying takes into account not only the types of plant species present in the lake but also the densities of those species. AVAS surveys are also an excellent way to track plant species trends over time. A goal of invasive plant

management is to have native plants increase while exotic plants decrease over time. The success of this goal can be illustrated through the use of the AVAS data collected over several years.

Since different native plants grow at varying times throughout the season it is important to evaluate the lake multiple times to account for *all* species in the lake. The first evaluation is conducted in the spring and is used to determine areas that will require treatment or management. The second survey is conducted in late summer or fall and is used to determine management success.

Table 1: Common Plant Species Found in Devil's Lake – September 2017

AVAS Code	Common Name	Scientific Name	% Cumulative Cover Devil's Lake
<i>Submerged- Exotic</i>			
1	Eurasian watermilfoil	Myriophyllum spicatum	0.70
<i>Submerged- Native</i>			
3	Muskgrass	Chara	2.59
5	Flatstem pondweed		0.02
7	Variable pondweed	Potomageton spp.	0.02
9	Richardson's pondweed	Potomageton spp.	1.06
10	Illinois pondweed	Potomageton illinoensis	2.05
11	Largeleaf pondweed	Potomageton spp.	0.16
17	Native Milfoil	Mryiophyllum spp.	1.22
15	Wild Celery	Vallisneria Americana	0.40
22	Bladderwort		0.02
27	Sago pondweed	Stukenia pectinata	0.02
<i>Emergent- Native</i>			
30	Water lily	Nymphaea odorata	0.35
31	Pickerel weed		0.16

Current Conditions in the Lake

Aquatic Vegetation

Devil's Lake supports a diverse community of aquatic plants. Twelve native species of aquatic plants were encountered in the September 2017 survey of the lake (Table 1). Rooted plant growth is low in most shoreline areas as the survey results show.

All of the plants listed in Table 1 are native North American species except Eurasian watermilfoil. Eurasian watermilfoil is a non-indigenous aquatic nuisance species, i.e., plants from other places. These exotic plants cause considerably more problems than most native species. Eurasian watermilfoil can attain nuisance levels of growth at almost any time of year, whereas curly leaf pondweed completes its lifecycle and drops out of the water column by approximately the Fourth of July.

The native plant species in Devil's Lake benefit the lake, performing such functions as stabilizing sediments and providing habitat for fish and other aquatic organisms. In general, native species cause few problems, compared with those caused by exotic plants. Three species commonly found in higher densities on Devil's Lake are Chara, Illinois pondweed and Wild celery.



Chara

Illinois pondweed

Wild celery

Aquatic Plant Control

The initial treatment for Eurasian watermilfoil was conducted on June 8th, 2017. The initial treatment included 15 acres of Eurasian watermilfoil that was mapped using GPS coordinates. The milfoil was treated with the granular systemic herbicide, Sculpin (2,4-D). The Eurasian watermilfoil was closely monitored following treatment and results appeared to be positive as the majority of the milfoil was gone within 3 weeks following treatment. Further lake monitoring indicated additional areas of milfoil and regrowth in some of the initial treatment areas. A follow up treatment was completed on July 26th encompassing 24.5 acres of Eurasian watermilfoil. The September vegetation survey found only small amounts of Eurasian watermilfoil Lake wide. The management strategy for the control of Eurasian watermilfoil has worked well. Native plants did not pose a significant issue this season and harvesting was not needed.

Water Quality Monitoring

Water quality monitoring is a critical part of lake management. Water quality monitoring provides an ongoing record of conditions in a waterbody. Changes in water quality can indicate threats from sources such as failed or inadequate septic systems, agricultural and lawn runoff, burgeoning development and erosion from construction site. Prompt identification of threats to water quality makes it possible to remedy them before irreversible harm has been done. Riparian's enjoyment of the water resource and the value of their property depend on maintaining water quality.

Temperature and Dissolved Oxygen Profiles

Depth profiles of temperature and dissolved oxygen indicate that on June 8th the lake was thermally stratified at 7 meters. The lake was well oxygenated, with an oxygen concentration in the Deep Hole Site of 9.0 mg/L (100% saturation) at the surface and 1.5 mg/L (14% saturation at 10 meters).

On September 9th, the lake was no longer thermally stratified. Dissolved oxygen was moderate from the surface to bottom waters. September dissolved oxygen concentrations at the surface were 7.2 mg/L (82 % saturation), and the concentration at 10 meters depth was only 5.3 mg/L (59 % saturation).

Conductivity Total Dissolved Solids, pH and Alkalinity

Conductivity and Total Dissolved Solids (TDS) measure the total concentration of dissolved salts in the water. Values for Devils Lake indicate low concentrations of dissolved materials. Alkalinity and pH measure the amount of dissolved bases and the balance of acids and bases in the water. Alkalinity and pH values were within normal ranges for a hard water lake.

Secchi Disk Depths

The Secchi disk depth is a measure of water clarity, determined by measuring the depth to which a black and white disk can be seen from the surface. (Larger numbers represent greater water clarity.) In June, the Secchi disk depth was 4 meters. The September Secchi disk depth was constant at 4 meters.



Total Phosphorus

Total phosphorus measures the total amount of phosphorus in the water. Phosphorus is an important plant nutrient (i.e., fertilizer) and the nutrient most likely to limit algal growth. Elevated phosphorus inputs to lakes caused by human activities are a major cause of cultural eutrophication. The total phosphorus concentration at the surface in the Deep Hole in June was 15 µg P/L. By September, the lake was not stratified and concentrations were still similar to those found in June. The deep hole had a concentration of 10 µg P/L.

The concentration of phosphorus encountered in Devils Lake during 2017 indicates low to moderate phosphorus concentration of the lake. Overall, the phosphorus concentrations observed during the 2017 season are similar to other lakes in the area with similar physical characteristics.

Nitrates

Nitrates measure the total amount of in-organic nitrogen in the water. Nitrogen is an important plant nutrient (i.e., fertilizer) and the nutrient most likely to limit the growth of rooted plants. Overall, nitrate concentrations in the lake were moderate to low. In June, nitrate concentrations in the deep hole site was 230 µg N/L at the surface. By September, nitrate concentrations remained the same at 230 µg N/L. Nitrates values observed during the 2017 season continue to indicate low to moderate levels in the lake.

Evaluation of Trophic Status

Carlson's Trophic State Index (TSI) calculated from Secchi disk depth total phosphorus and chlorophyll measurements made in June and September yielded values between 40 and 33 (see Table 2). These values overall rate Devils Lake as meso-oligotrophic to mesotrophic.

Table 2. Trophic State Index (TSI) Values

Site: Deep Hole	TSI from Secchi Disk	TSI from Total Phosphorus	TSI from Chlorophyll
June	40	39	NA
September	40	33	NA

Management Recommendations for 2018

Management options are dependent on many factors, including but not limited to, species abundance (density), species richness, species location and many lake characteristics. Whenever an exotic species is found within an aquatic environment, action needs to be taken to prevent long term ecological damage as well as recreational and aesthetic loss that will take place.

Submersed Aquatic Plants

Conventional Herbicide treatments

The 2018 aquatic plant management program should detect and treat any areas where Eurasian watermilfoil is detected. If native plants become sufficiently dense to interfere with recreation, harvesting may be recommended.

Areas of Eurasian watermilfoil should be promptly treated using herbicides. Treatments with the herbicides, Triclopyr and/or 2,4-D, in localized treatment areas to slow the spread of Eurasian watermilfoil, when found should be conducted. The herbicides Triclopyr and 2,4-D, control Eurasian watermilfoil with little or no impact on most native plant species. Since they are selective, systemic herbicides can actually kill the entire Eurasian watermilfoil plant. Under ideal conditions, several consecutive annual applications of Renovate or 2,4-D can reduce Eurasian watermilfoil to a maintenance (low) abundance. For this strategy to succeed, it is necessary to treat all the Eurasian watermilfoil in the lake each time they are applied.

Triclopyr is a systemic herbicide with selectivity very similar to 2,4-D. Triclopyr is not subject to the well setback restrictions that currently affect 2,4-D. Therefore, triclopyr can be used to control Eurasian watermilfoil in near shore areas. A combination of both systemic herbicides in Devil's Lake could greatly reduce the growing Eurasian watermilfoil problem.

Several contact herbicides, including diquat, can also provide short-term control of Eurasian watermilfoil. These herbicides kill only the shoots of the plant, and plants regrow relatively rapidly from their unaffected belowground parts.

Nuisance native plant management can also be incorporated into a lake management program with conventional herbicide treatments or mechanical harvesting if needed. Native plant treatments are completed using only contact herbicides in shoreline residential areas.

Monitoring

Aquatic vegetation and water quality will be monitored to document the condition of the lake and to provide warning of any changes in the condition of the lake that need to be addressed by additional lake management activities.

The Recommended Management Schedule for 2018:

- A spring vegetation survey (to evaluate conditions in the lake and direct management efforts)
- Water quality evaluation should continue
- Early summer herbicide treatment (to control any Eurasian watermilfoil and/or curly leaf pondweed areas that are found)
- Mid summer herbicide treatment, if required
- Mid summer mechanical harvest for native plant control, if required
- Mid-summer water quality sampling
- Late summer herbicide treatment, if required
- A fall vegetation survey
- Fall water quality sampling