Alfred Thompson Bricher: *Drifting*, 1886

Lake Management Plan for Muskellunge Lake, Vilas County, Wisconsin

July 2005

Prepared by Steve McComas, Blue Water Science
with contributions from Wisconsin Department of Natural Resources and the Muskellunge Lake Association

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Muskellunge Lake Report

VILAS COUNTY, WISCONSIN

Summary of the Lake Management Study

Field Work: 2004 **Report: Summer 2005**

Muskellunge Lake Management Program Formulated

Natural Conditions Rated as Good

AQUATIC PLANT PROJECTS COULD BE CONSIDERED

Muskellunge Lake, located in Vilas County, Wisconsin, is 272 acres in size, and has an average depth of 9 feet with a maximum depth of 19 feet.

A lake study was conducted in 2004 with two primary objectives.

* to characterize existing lake conditions.
* to develop a lake management plan that protects, maintains, and enhances Muskellunge Lake' water quality.

Results found that lake summer water clarity conditions of about 5 feet were slightly less than expected compared to reference lakes in the area (see page 3 for more information on reference or ecoregion lakes). A goal for Muskellunge Lake is clarity averaging about 7 feet over the summer.

Phosphorus is the typical nutrient that has the biggest influence in algae growth. Phosphorus levels in Muskellunge Lake were on the moderately high side at 34 parts per billion (ppb). This accounts for the algae growth that results in water clarity of around 5 feet.

Volunteers helped with aquatic plant surveys on Muskellunge Lake, Vilas County, Wisconsin in 2004.

Aquatic plants were also studied in 2004. Muskellunge Lake was found to have a good diversity of plants with at least 13 plant species. No exotic plant species were found.

Based on these findings and from previous work by others, a lake management plan was formulated.

Aquatic plant management is one management area and fish manipulation is a potential future project.

Muskellunge Lake Statistics

Muskellunge Lake

Lake size (acre):	272
Mean depth (feet):	9.3
Maximum depth (feet):	19
Volume (acre-feet):	2,530
Watershed area(surface) (acre): (not including the lake)	2,602
Watershed : Lake surface ratio	10:1
Clarity in 2004 (feet):	4.7
Lake phosphorus in 2004 (parts per billion)	34

This special newsletter was prepared by Blue Water Science, St. Paul, Minnesota and is part of a lake management program conducted on Muskellunge Lake. The program was funded by a grant from the Wisconsin DNR with volunteer assistance from the Muskellunge Lake Association.

Summary of Lake and Watershed Conditions

Geology and Soils
Muskellunge Lake is a glacial lake formed during the last retreat of the Wisconsin Valley glacial lobe starting about 10,000 years ago. The soils deposited by the glacier are primarily sands and loamy sands.

Watershed Characteristics
The watershed area draining to Muskellunge (not including the lake) is 2,602 acres (based on USGS records). Land use is primarily forests and wetlands, with residential use accounting for a small percent of the total watershed area.

Water Inflows and Outflows
The water inflow to Muskellunge is from temporary streams and groundwater springs. The outflow is by way of Muskellunge Creek.

Lake Dissolved Oxygen & Temperature
Muskellunge Lake thermally stratifies during the summer but weakly. This means that wind action will occasionally mix the upper lake water during the summer. In-between mixing events, oxygen concentrations in the bottom water become temporarily depleted.

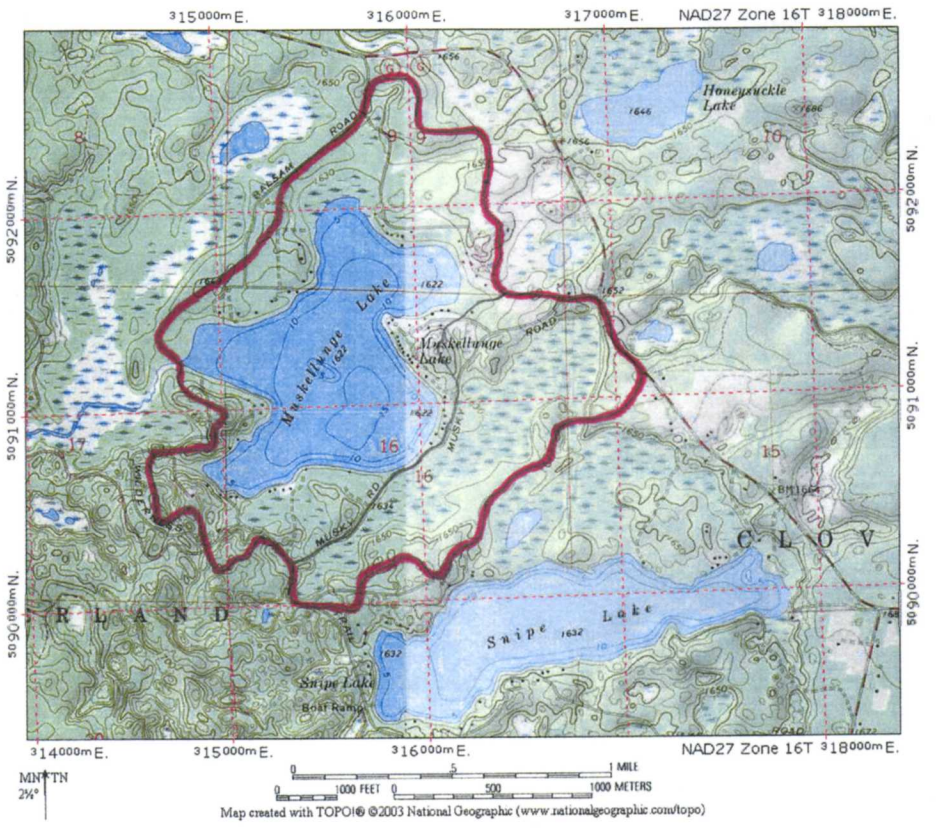
Lake Clarity
Lake water clarity in Muskellunge Lake is fair with a summer average around 5 feet.

Lake Nutrients
Phosphorus concentrations in Muskellunge Lake are slightly elevated when compared to other lakes in the Northern Lakes and Forest ecoregion. A growing season phosphorus average for 2004 for Muskellunge Lake is 34 ppb. A predicted phosphorus concentration using ecoregion values is lower at about 24 ppb.

Lake Algae
Muskellunge Lake has algae species that are common to lakes in this part of the state.

Lake Aquatic Plants
There is good coverage of submerged aquatic plants covering about 73% of the lake bottom (160 acres). Plants are beneficial as a filter for removing nutrients from the water and serve as fish and wildlife habitat. Aquatic plant diversity is good with 17 submerged or floatingleaf plant species identified in Muskellunge Lake.

Fish
Muskellunge Lake is stocked with walleyes and muskies. Numbers are about average. Bass and panfish are also present and bluegills are abundant.

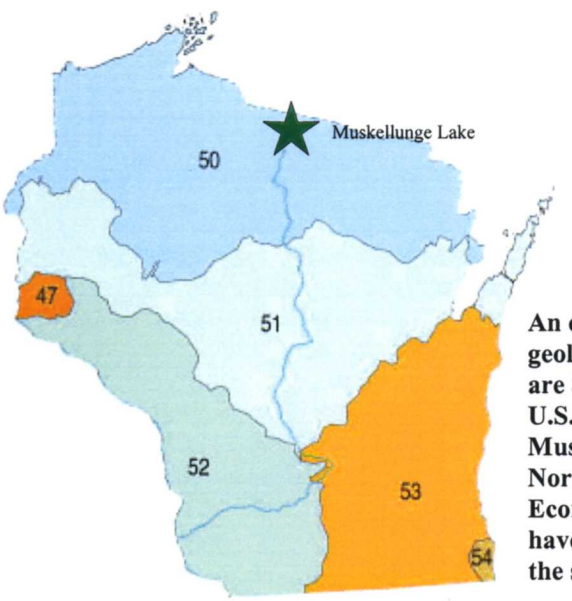


The watershed drainage area directly to Muskellunge Lake is about 550 acres and is outlined in red. However, the US Geological Survey also includes drainage from Snipe Lake and this increases the overall watershed area to 2,602 acres.

What is a watershed?

A watershed is the land area around the lake that captures rainfall and where all the drainage and runoff goes into the lake. It is also called a drainage basin. If the watershed has pollution sources, then the pollution will be carried into the lake with runoff. It is important to reduce the source of pollution in the watershed because this in turn will reduce the amount of pollution that gets into the lake.

Ecoregions of Wisconsin



47. Western Corn Belt Plains
50. Northern Lakes and Forests
51. North Central Hardwood Forests
52. Driftless Area
53. Southeastern Wisconsin Till Plains
54. Central Corn Belt Plains

An ecoregion is delineated based on geology, soils, and vegetation. There are 84 delineated eocregions in the U.S. and six are in Wisconsin. Muskellunge Lake is located in the Northern Lakes and Forest Ecoregion. Lakes in this ecoergion have some of the best water quality in the state.

Significant Findings of This Study

- Water quality of Muskellunge is not within range of other lakes in the Lakes and Forests Ecoregion. Water quality parameters consisted of transparency readings, phosphorus, and chlorophyll. There is the potential for better water quality in Muskellunge.
- The watershed is in relatively good shape and does not appear to contribute excessive amounts of phosphorus to Muskellunge Lake at this time.
- The primary factors affecting water quality in Muskellunge Lake are nutrients from groundwater inputs and from phosphorus release from lake sediments. It may very well be that phosphorus was delivered to Muskellunge Lake by way of groundwater and this occurred over a lengthy time period (at least over the last 100 years and probably longer).
- As phosphorus was delivered to the lake, not all of it left the lake. Much of the phosphorus was retained and settled and accumulated in the lake sediments. Some of this phosphorus is released from lake sediments every year and contributes to algae blooms.
- Water clarity can be improved, but it would be costly. A lake sediment alum treatment traps phosphorus in the sediments and could improve water quality for 5 to 10 years but the cost would be approximately $240,000.
- Native aquatic plants are diverse and no exotic aquatic plants were found in the two surveys conducted in 2004.
- Coontail, a native plant, and a floatingleaf plant grow abundantly in the bays and shallow water. If control is considered, only remove the minimum amount of plants necessary to improve navigation.
- A fish manipulation project is a potential future project in an attempt to improve water clarity.

Recommended Lake Management Projects

1. Watershed projects - forests and wetlands

Although majority of the watershed is forested, the surrounding wetlands probably contribute phosphorus, by way of groundwater, to Muskellunge Lake. However, this is a natural pathway. Watershed project areas to monitor in the future involve erosion control for new development as well as with forest harvesting activities.

2. On-site system maintenance

On-site wastewater treatment systems operate satisfactorily when they are properly installed and maintained. Several activities can be implemented to assist in proper operation of the system. These activities include workshops, septic tank pumping campaigns, and ordinance implementation. However, much of the education can be conveyed through Lake Association newsletters.

There is little evidence of failing onsite systems based on shoreland setback distances and the questionnaire responses. An option would be to contract with the County to randomly select 10% of the systems around the lake and conduct an onsite inspection and publish the results in a newsletter.

3. Shoreland protection and enhancement (landscaping projects)

Muskellunge Lake has stretches of natural shoreline conditions but vegetative buffers and natural conditions could be improved along some of the developed parcels. The challenge is to protect the existing natural conditions and to enhance shorelands that lack native vegetative buffers. A volunteer lakescaping program should be implemented.

Recommended Lake Management Projects-concluded

Initially work with the UW Extension or a Planning Grant consultant to set up a Muskellunge Lake Shoreland model describing how to design, install, and maintain a natural shoreland. Publish it in the lake's newsletter.

4. Aquatic plant projects
The primary aquatic plant goal is to maintain and/or protect submerged aquatic plants in Muskellunge Lake. Two plant management ideas are given below:

- Maintaining good shoreland conditions can sustain long-term shallow water plant communities. Ongoing shoreland maintenance and improvement will be important.

- Aquatic plant removal using manual methods is an option for maintaining an open area in front of your property. Mechanical harvesting is another option if channels out to open water are deemed necessary. However, only the minimum amount of plants needed to reduce navigational hindrances should be removed.

5. Fish Management Options
Winter aeration probably needs to continue indefinitely, unless winter sampling indicate oxygen levels can be maintained without it. A future project involves a fish and an aquatic plant manipulation in an attempt to improve water clarity. Increasing gamefish stocking and decreasing bluegill density by netting could restructure the fish community and result in better water clarity through a biomanipulation pathway. Maintaining channels through thick vegetation would give gamefish access to panfish and sustain bluegill control.

6. Sediment Alum Treatment for Water Clarity Improvement
An expensive option to improve lake water quality addresses the groundwater and lake sediment phosphorus release. These two sources represent over 70% of the nutrient input into the water column. The use of an alum sediment treatment would address both phosphorus release from lake sediments and phosphorus associated with groundwater inflow.

It is assumed that 80% of the lake surface would be treated with alum and this is about 220 acres. Until more information is acquired, an assumed cost is $1,100/ac. The total cost for the alum project would be approximately $242,000.

7. Ongoing education program
The Lake Association's newsletter should be an ongoing instrument to provide lake protection information. Abundant material is available from the WDNR on the internet and from a variety of books, including the book "Lake and Pond Management Guidebook" written by Steve McComas. This material can be inserted into newsletters.

A variety of educational opportunities are available that go beyond newsletter articles. Lake fairs and demonstration projects could be useful for advancing lake information. A good time for special events is in conjunction with the annual meeting.

8. Watershed and lake monitoring program
Ongoing lake testing should include: Secchi disk, total phosphorus, and chlorophyll a. Testing once per month from May through September is adequate to characterize lake conditions.

Winter dissolved oxygen levels should be collected to check the performance of the aeration system and the potential for winterkill conditions caused by a lack of dissolved oxygen. In addition, an aquatic plant survey should be conducted every three to four years.

A special project would be to monitor lake sediment pH over the summer to check for potential phosphorus release from lake sediments. Zooplankton sampling could indicate the potential need for a fish manipulation project.

The level of effort for a monitoring program depends on the availability of volunteers and funding levels.

A mechanical harvester could be used to create cruising lanes through several areas of dense growth in Muskellunge Lake.