LPL-1053-06

Bear Lake Report

BARRON COUNTY, WISCONSIN

Summary of the Lake Management Study

Field Work: 2006 **Report: Spring 2007**

Bear Lake Management Program Formulated

Lake Appears to Be in Good Shape

PROTECTION PROJECTS WILL SUSTAIN GOOD WATER QUALITY

Bear Lake is located in Barron County, Wisconsin. Bear Lake is 1,358 acres in size, has an average depth of 20 feet and a maximum depth of 87 feet.

A lake study was conducted in 2006 with two primary objectives.

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

Results found that lake summer water clarity conditions of about 7.9 feet were slightly better than expected compared to reference lakes in the area (see page 3 for more information).

Typically, phosphorus is the nutrient that has the biggest influence on algae growth. Phosphorus levels on Bear Lake were on the low side at 23 parts per billion. This accounts for the low algae growth and relatively good water clarity that is found in Bear Lake.

Bear Lake, Barron County, Wisconsin

Aquatic plants were also studied in 2006. When the plant survey results of 2006 are combined with other plant data collected in years past, an aquatic plant picture emerges.

Bear Lake was found to have a good diversity of plants with 18 plant species. The most common plant was flatstem pondweed, a native species.

Results of lake and watershed data collection indicate Bear Lake's water quality is about where it should be compared to reference lakes in this area (or ecoregion).

This means less expensive protection projects rather than expensive restoration projects are the preferred approach as long as Bear Lake maintains good quality.

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

Bear Lake Statistics

Bear Lake

Lake size (acre):	1,358
Mean depth (feet):	20
Maximum depth (feet):	87
Volume (acre-feet):	27,160
Watershed area (acre): (including the lake)	30,464
Watershed : Lake surface ratio	7
Clarity in 2006 (feet):	7.9
Lake phosphorus in 2006 (parts per billion)	23

Summary of Lake and Watershed Conditions

Geology and Soils
Bear Lake is a glacial lake formed during the last retreat of the Superior 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 Bear (including the lake) is 30,464 acres (based on USGS data). 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 Bear is from Boyer Creek, Sucker Creek, and Bear Creek. The outflow is through Bear Creek and into Rice Lake.

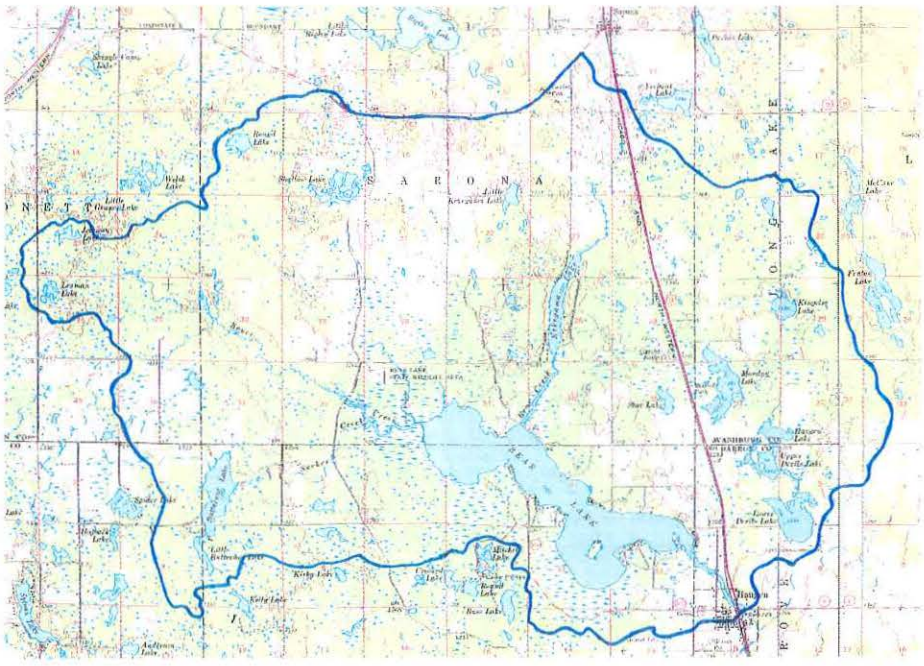
Lake Dissolved Oxygen & Temperature
Bear Lake thermally stratifies during the summer. This means that wind action will mix the warmer upper lake water which sits on top on the denser cold water in the bottom of the lake. Oxygen concentrations may fall in the bottom water and become temporarily depleted during the summer. The lake is reaerated during spring and fall overturn, when the whole lake mixes.

Lake Clarity
Lake water clarity in Bear Lake is good with a summer average around 8 feet.

Lake Nutrients
Phosphorus concentrations in Bear Lake are better then predicted when compared to other lakes in the North Central Hardwood Forest ecoregion with an equivalent watershed area. A growing season phosphorus average for 2006 for Bear Lake was 23 ppb. A predicted phosphorus concentration using ecoregion values is higher at about 45 ppb.

Lake Algae
Bear Lake has algae species that are common to lakes in this part of the state with green algal species present in early summer and some blue-green species present in late summer..

Lake Aquatic Plants
There is good coverage of submerged aquatic plants covering about 45% of the lake bottom (611 acres). Plants are beneficial as a filter for nutrients and as fish and wildlife habitat. Aquatic plant diversity is good with 18 submerged or floatingleaf plant species identified in Bear Lake in 2006. While aquatic plant coverage remains stable, several aquatic plant species appear to have declined in abundance since the last plant survey in 1992. The species that declined include coontail and naiads. Largeleaf pondweed increased in occurrence.



The watershed drainage area to Bear Lake is about 30,464 acres and is outlined in blue.

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.

Lake Assessment

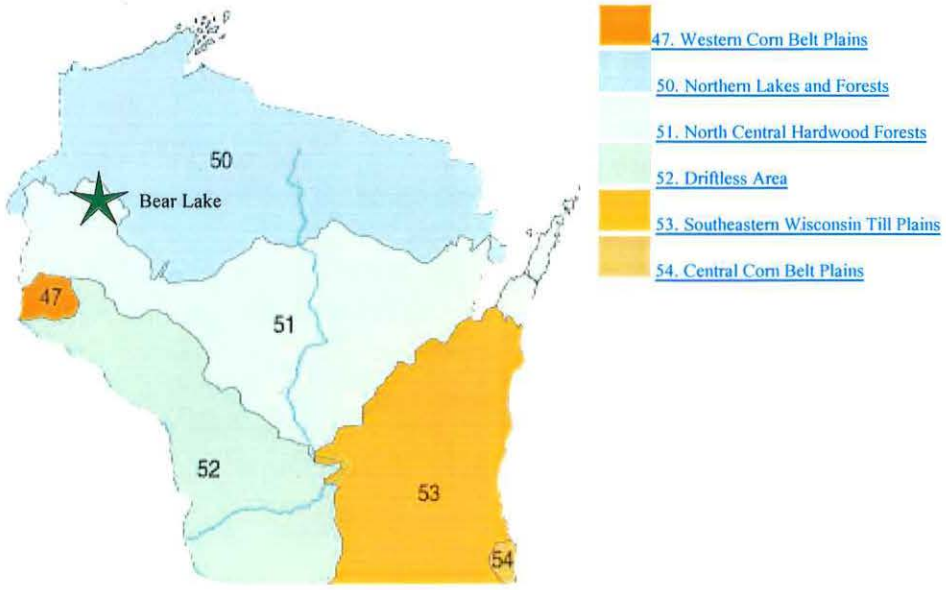
Water quality of Bear is within range of lakes found in the North Central Hardwood Forest Ecoregion. Water quality parameters consisted of transparency, phosphorus, and chlorophyll measurements.

Lake water quality in Bear is about what would be expected based on it's watershed size and the ecoregion setting. Although Bear Lake resides in the North Central Hardwood Forest ecoregion, most of it's watershed is in the Northern Lakes and Forests Ecoregion. This ecoregion typically has low concentrations of phosphorus in runoff. Therefore long term prospects for ongoing good water quality are high.

Lake management efforts should be directed to protect the existing good water quality.

Ecoregions of Wisconsin

Revised April 2000
National Health and Environmental Effects Research Laboratory
U.S. Environmental Protection Agency

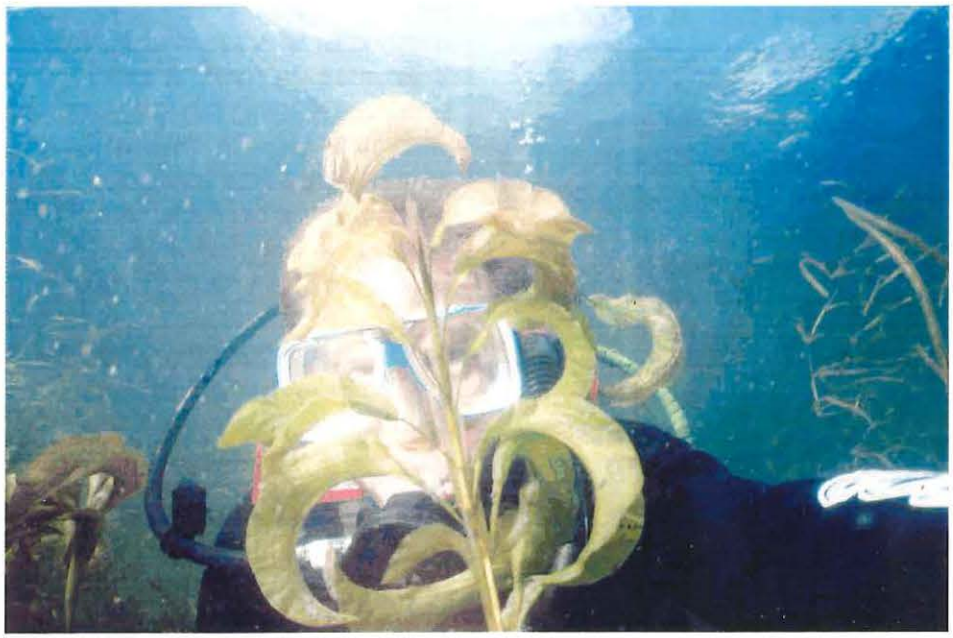


Bear Lake is located in the North Central Hardwood Forest Ecoregion. However, much of its watershed is located in Northern Lakes and Forest Ecoregion.

Aquatic Plants Are Key to Good Water Quality

Aquatic plants are very important to lakes. They act as nurseries for small fish, refuges for larger fish, and they help to keep the water clear. Currently Bear Lake has a high diversity (number of species) of aquatic plants with a total of 18 species identified in 2006. Common plants found in the Bear Lake include: flatstem pondweed, northern watermilfoil, and water celery, all native plants.

In August of 2006, aquatic plant distribution was estimated to be at 611 acres. If this coverage can by maintained, the odds are good that clear water conditions will be sustained as well.



Here is a picture of largeleaf pondweed from Bear Lake. This is a desirable aquatic plant species. Bear Lake has relatively good aquatic plant diversity and should promote good water clarity.

Recommended Lake Management Projects

1. Watershed projects - forests, wetlands, and new construction

Maintain some type of surveillance on watershed conditions. For example, stream sampling will give some insight to potential water quality problems and serves as a benchmark for future reference. Also, alert the County if excessive erosion is observed at construction sites.

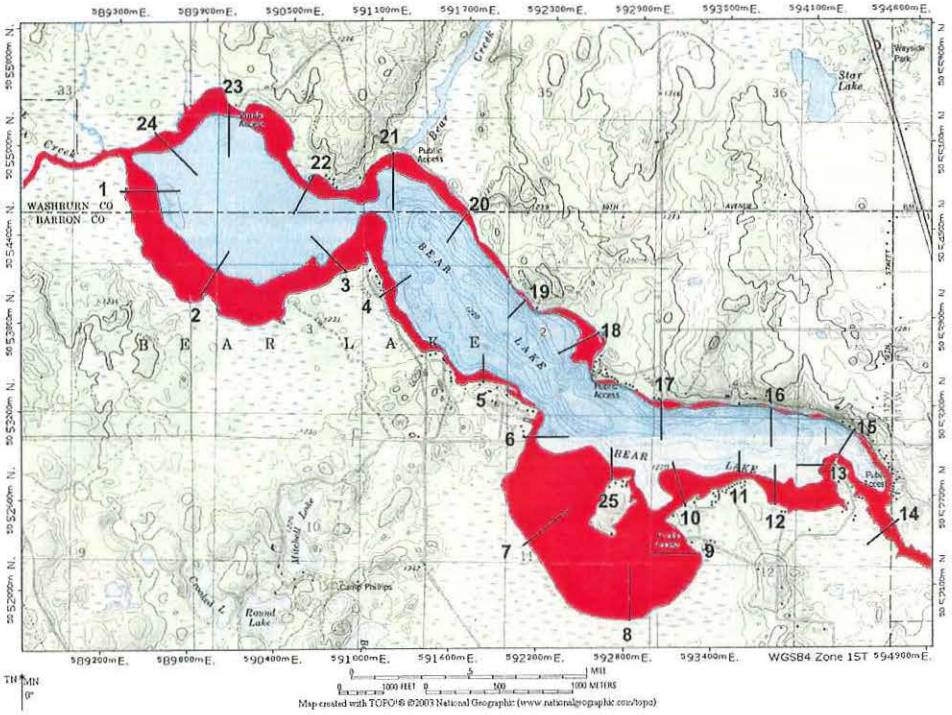
2. On-site system maintenance

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 good water quality of the lakes. 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. Aquascaping projects

Bear 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. Set up a Bear Lake Shoreland model describing how to design, install, and maintain a natural shoreland. Publish it in the lake's newsletter.



Plant coverage for Bear Lake for August 2006. The red shaded area represents coverage by submerged, floatingleaf, and emergent aquatic plants.

4. Aquatic plant projects

Based on the aquatic plant survey results from 2006, non-native aquatic plants are not a problem. The question is: what would milfoil do if it got into Bear Lake. A new technique of using lake sediment analysis to gage the potential for nuisance growth of Eurasian watermilfoil is available. A sediment survey could be conducted for the Bear Lake for a cost of $3,000.

5. 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.

6. 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. Sampling twice per month would be better. An aquatic plant survey should be conducted every three to four years. The level of effort for a monitoring program depends on the availability of volunteers and funding levels.

In addition, stream sampling should be considered as well with monitoring occurring over the growing season. Monitoring every two years would be sufficient.