



Manistee Lake

A GUIDEBOOK FOR HOMEOWNERS

Preface

In 2005, the Manistee Lake Improvement Board was established in accordance with Michigan's Natural Resources and Environmental Protection Act. The Lake Board is working with several partners including the Manistee Lake Association, the Au Sable Institute, and the Michigan Department of Natural Resources to improve and protect Manistee Lake.

As property owners around Manistee Lake, we all have an investment in the lake. Whether we use it for swimming, boating, fishing, or simply enjoying the view, preserving the quality of the lake is important to all of us. This guidebook has been prepared by the Manistee Lake Improvement Board to provide homeowners with information about how to protect Manistee Lake.

Manistee Lake Improvement Board
Norm LaCroix, Manistee Lake Property Owner
Mike Neubecker, Coldsprings Township Supervisor
Norm Groner, Excelsior Township Supervisor
Francis Kelly, Kalkaska County Drain Commissioner
Lou Nemeth, Kalkaska County Commissioner

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The background of the page features a soft-focus photograph of autumn leaves in shades of brown and orange, with a single white feather floating in the upper right quadrant. The overall tone is natural and serene.

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Lake Facts

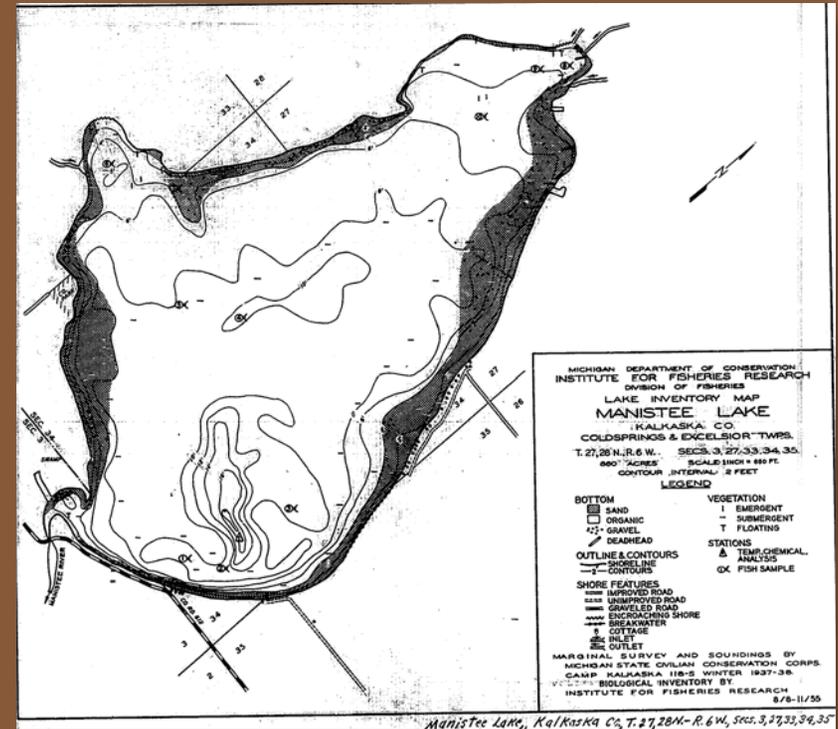
With a surface area of 876 acres, Manistee Lake is a relatively large lake. However, despite its size, the lake is shallow with a maximum recorded depth of 18 feet, and a mean or average depth of about 7 feet. Much of the lake is shallow enough to support aquatic plant growth.

The shoreline of Manistee Lake is over 7 miles long. Shoreline development factor is a calculation of the irregularity in the shape of the lake shoreline. A lake that is perfectly round would have a shoreline development factor of 1.0. Manistee Lake has a shoreline development factor of 1.8, which indicates the shoreline of Manistee Lake is nearly twice as long than if the lake were perfectly round. Because of its irregular shape, Manistee Lake supports about twice the amount of shoreline development than a perfectly round lake of equal size. Currently, over 300 homes and cottages border the lake.

Manistee Lake contains about 6,132 acre-feet of water, which equates to about 2 billion gallons. This volume of water would cover over 9 square miles to a depth of 1 foot. One small stream flows into the lake from the cedar swamp on the north shore. Groundwater appears to be a significant source of water to Manistee Lake.

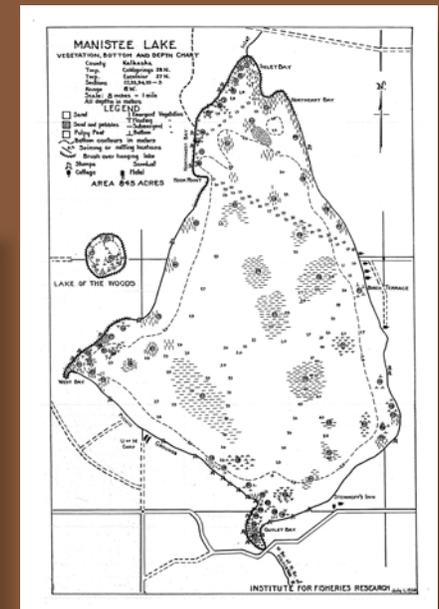
Manistee Lake forms the headwaters of the North Branch of the Manistee River. Water flows from the outlet at the south end of the lake in a southwest direction into the main branch of the Manistee River and on to Lake Michigan at the city of Manistee. The elevation of Manistee Lake is over 600 feet higher than Lake Michigan.

Manistee Lake provides fishing, boating, swimming, and other recreational opportunities to lake residents and the general public.



Manistee Lake, Kalkaska Co., T. 27, 28 N. - R. 6 W., Secs. 3, 27, 33, 34, 35

The bottom of Manistee Lake was first mapped in the 1930's by the Institute for Fisheries Research





Manistee Lake Physical Characteristics

Lake Surface Area 876 Acres

Maximum Depth 18 Feet

Mean (Average) Depth 7 Feet

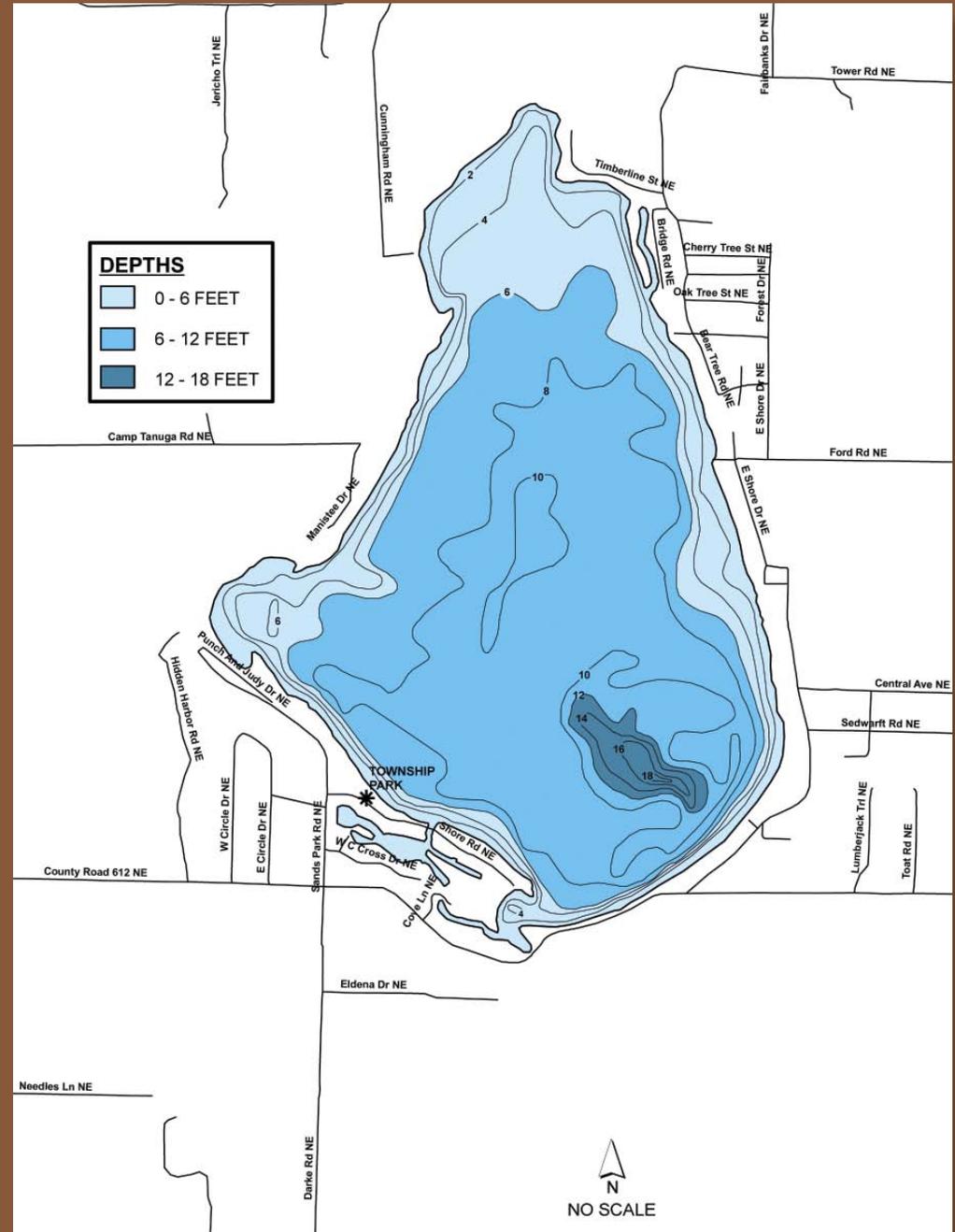
Lake Volume 6,132 Acre-Feet

Shoreline Length 7.6 Miles

Shoreline Development Factor 1.8

Lake Elevation 812.5 Feet

Manistee Lake Depth Map



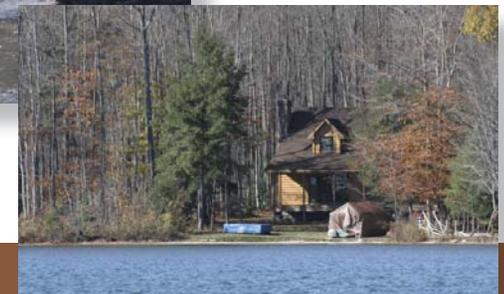
Watershed Facts

The land area surrounding a lake that drains to the lake is called a watershed or drainage basin. A watershed boundary is determined by examining a topographical map that shows the “lay of the land” around the lake. The Manistee Lake watershed is approximately 6,600 acres in area, a land area about 7.5 times larger than the lake itself. Much of the watershed is forest or wetland. However, most of the land immediately adjacent to the lake has been developed (see Watershed Land Cover Map on page 4).

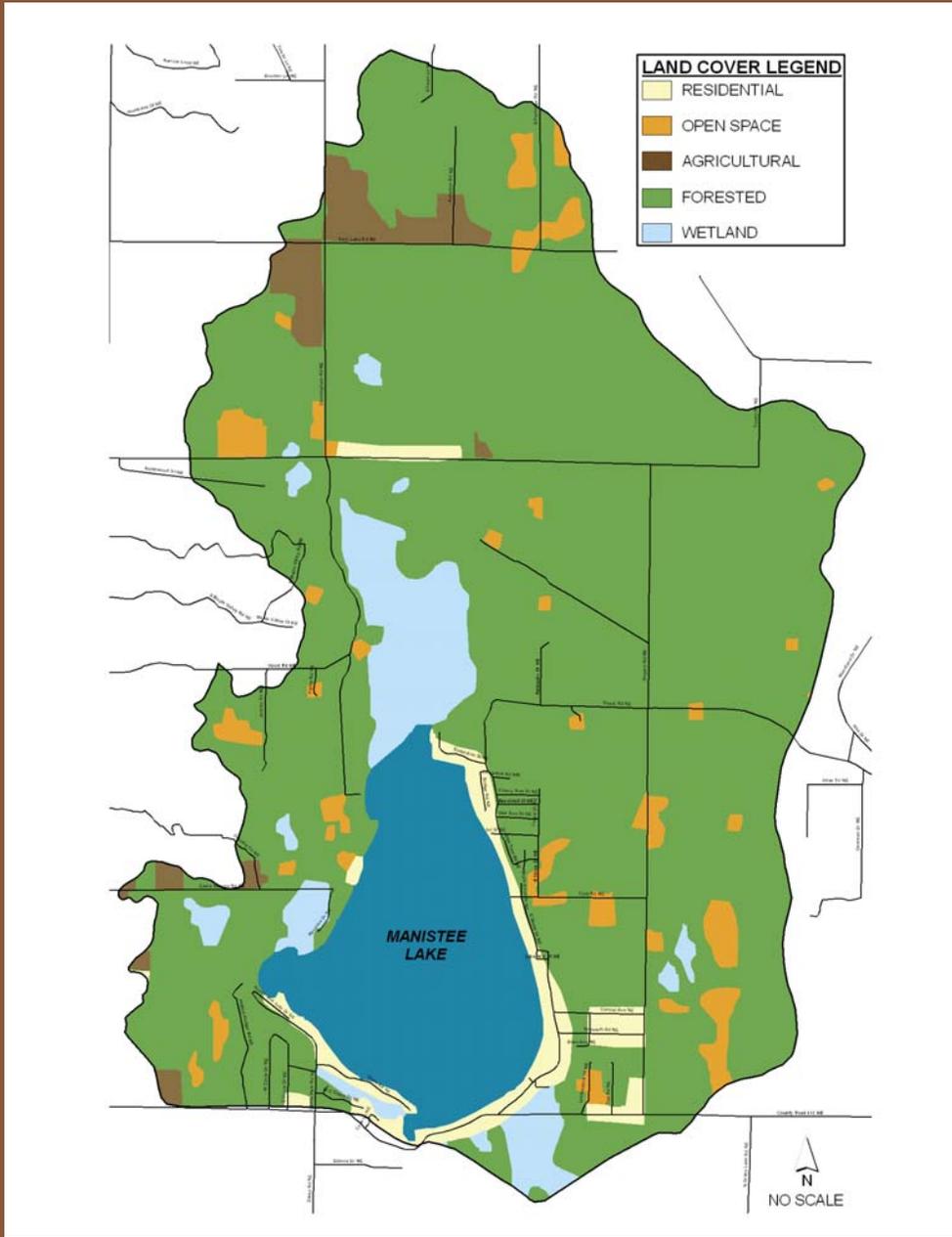
Forest land and wetland in the watershed are beneficial in that they contribute very little runoff to the lake. Wetlands in particular perform several important ecological functions. They store floodwaters, provide habitat for fish and wildlife, and help to filter storm water. Preservation of wetlands in the Manistee Lake watershed is vital to the protection of the lake.

Currently, the homes and cottages around Manistee Lake are served by on-site septic systems. Soils mapping conducted by the U.S. Department of Agriculture Soil Conservation Service indicates that the soils surrounding Manistee Lake are composed largely of Island Lake and Au Gres sands. These soils generally have a substantial limitation for on-site septic systems due to either poor filtering capacities or a high water table. Problems associated with malfunctioning septic systems can be expected to increase as more homes around Manistee Lake are converted from seasonal to year-round use. Eventually, the limited ability of area soils to retain pollutants will be exceeded. Until community sewer service is available, proper operation and maintenance of septic systems will be required to protect the lake.

Most of the development in the Manistee Lake watershed is concentrated near the lake. As a result, the shorelands around Manistee Lake have changed. Natural areas that allowed rain waters to infiltrate have been replaced by roof tops, roads, driveways, and other hard surfaces. Now, rather than infiltrating, storm water runs off these hard surfaces, often carrying fertilizer, oil, and other pollutants to the lake. Shoreland runoff can directly impact areas near shore and cause unsightly algae growth. Reducing pollution inputs from the watershed is essential to protecting the quality of Manistee Lake over the long term.



Primary controllable sources of pollution in the Manistee Lake watershed include lawn fertilizer and septic system seepage.



Manistee Lake Watershed Land Cover Map

Base map: Michigan Resource Information System



Manistee Lake Watershed Boundary Map

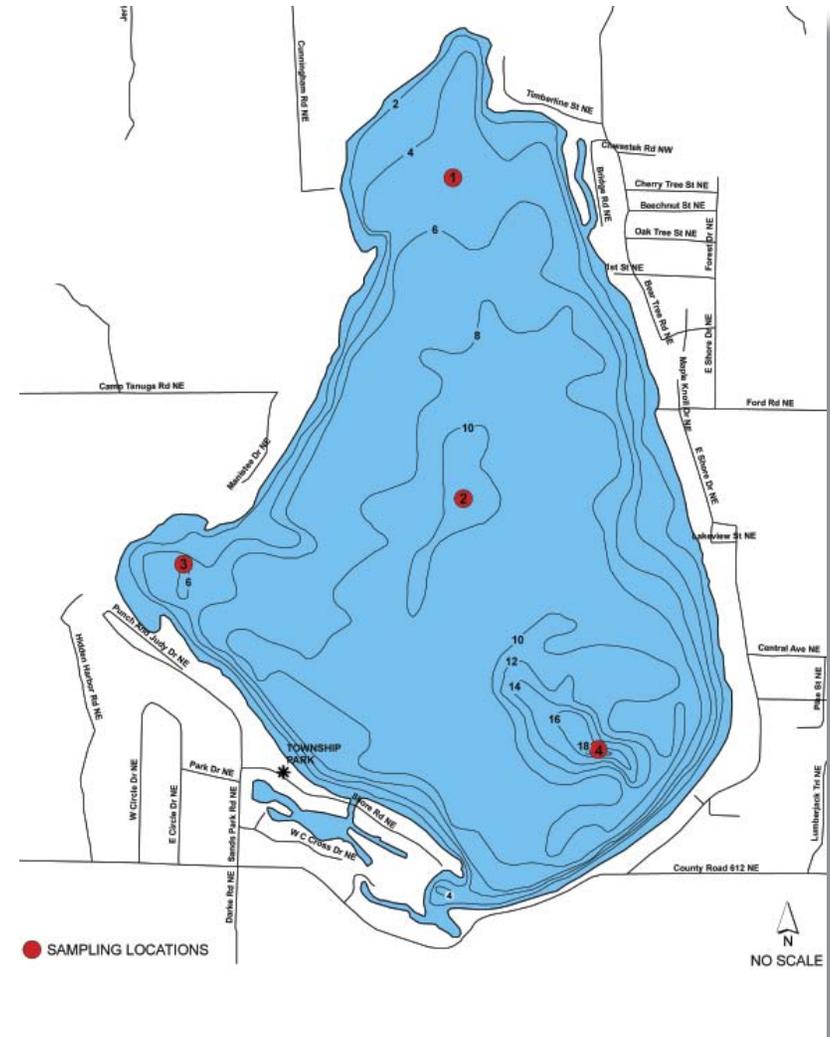
Base Map: U.S. Geological Survey

Water Quality

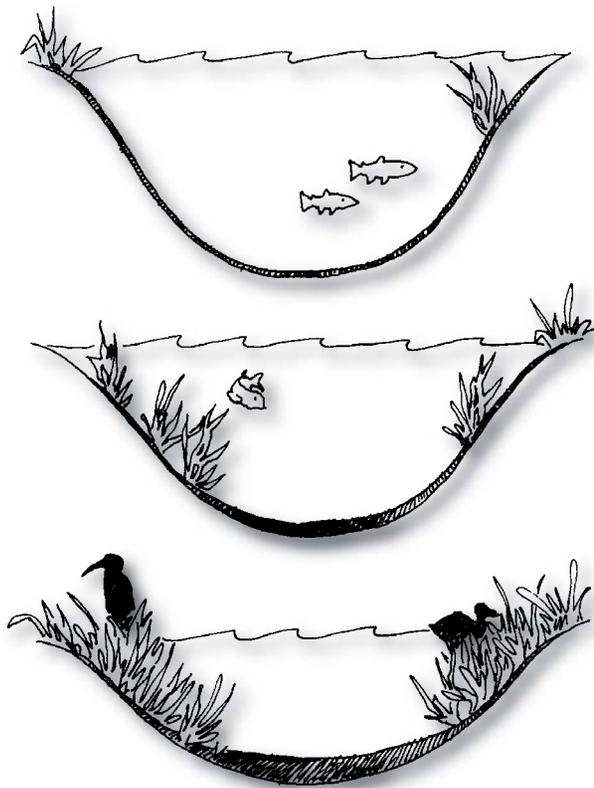
Phosphorus is the nutrient that most often stimulates excessive growth of aquatic plants and algae, leading to a number of problems collectively known as eutrophication. By measuring phosphorus levels, it is possible to gauge the overall health of the lake. Lakes with a phosphorus concentration of 20 parts per billion or greater are considered to be eutrophic. Phosphorus levels in Manistee Lake are generally below the eutrophic threshold level.

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in the water column can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 parts per billion is considered characteristic of a eutrophic condition. Chlorophyll-*a* levels measured in Manistee Lake are consistently below the eutrophic threshold concentration indicating algae growth in the open waters of the lake is moderate.

A Secchi disk is a round, black and white, 8-inch disk that is used to estimate water clarity. Eutrophic lakes have a Secchi transparency of less than 7.5 feet. Generally, it has been found that plants can grow to a depth of about twice the Secchi disk transparency. In Manistee Lake, Secchi readings have averaged about 8 feet indicating that sunlight penetration is sufficient to support aquatic plant growth over much of the bottom of Manistee Lake.



Manistee Lake Sampling Location Map



OLIGOTROPHIC lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish such as trout and whitefish.

Lakes that fall between the two extremes of oligotrophic and eutrophic are called MESOTROPHIC lakes.

EUTROPHIC lakes have poor clarity, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike.

Manistee Lake is borderline between a mesotrophic and a eutrophic state.

Lakes can be classified based on their ability to support plant and animal life. When classifying lakes, scientists use the broad categories oligotrophic, mesotrophic, or eutrophic. Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as cultural eutrophication. Manistee Lake is beginning to show signs of cultural eutrophication.



Aquatic Plants

Plants are important to lakes because they produce oxygen during photosynthesis, help stabilize shoreline and bottom sediments, and provide habitat and cover for fish and other aquatic inhabitants.

The distribution and abundance of aquatic plants are dependent on several variables including light penetration, bottom type, temperature, water levels, and the availability of plant nutrients. Due to its shallow depth and rich bottom sediments, Manistee Lake naturally supports abundant plant growth.

There are several types of aquatic plants including emergent, floating-leaved, submersed, and free-floating. Each of these plant types provides important ecological functions. Given their importance in the lake ecosystem, control efforts should only focus on removing nuisance, non-native plant types such as Eurasian milfoil.

Eurasian milfoil (*Myriophyllum spicatum*) is an invasive aquatic plant that was first introduced to the United States in the 1940's. Thus, it is not native to Michigan but is currently widespread in the state. Eurasian milfoil is problematic in that it becomes established early in the growing season and can grow at greater depths than most native plants. Eurasian milfoil often forms a thick canopy at the lake surface that can degrade fish habitat and seriously hinder recreational activity. Eurasian milfoil can spread rapidly by "vegetative propagation" whereby small pieces break off, take root, and grow into new plants. Once introduced into a lake, Eurasian milfoil may out-compete and displace more desirable plants and become the dominant species. Controlling the spread of Eurasian milfoil is the primary focus of the plant control effort in Manistee Lake.



Manistee Lake Vegetation Survey Grid Map

Manistee Lake supports a diverse population of aquatic plants. Fourteen different species of plants have been observed in the lake.

Common Name	Plant Type
Elodea	Submersed
Eurasian milfoil	Submersed
Flat-stem pondweed	Submersed
Variable pondweed	Submersed
Large-leaf pondweed	Submersed
Chara (Muskgrass)	Submersed
Naiad	Submersed
Thin-leaf pondweed	Submersed
Richardson's pondweed	Submersed
White-stem pondweed	Submersed
White water lily	Floating-leaved
Yellow water lily	Floating-leaved
Water shield	Floating-leaved
Arrowhead	Emergent





Eurasian Milfoil *Myriophyllum spicatum*

Eurasian milfoil can spread rapidly by a process called “vegetative propagation” or “fragmentation” in which pieces of the plant break off, take root, and grow.



Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission.

Weevils are about the size of a sesame seed, barely visible to the naked eye. Weevils pose no harm to humans or fish.



Milfoil weevil
(Euhrychiopsis lecontei)

To help control the spread of Eurasian milfoil in Manistee Lake, nearly 70,000 milfoil weevils (*Euhrychiopsis lecontei*) have been stocked and additional stocking is planned. The weevil has been found to feed almost exclusively on milfoil species, especially Eurasian milfoil. Researchers have documented declines in Eurasian milfoil populations as the result of weevil feeding. These declines have been attributed largely to the burrowing and tunneling action of weevil larvae that cause the milfoil plant to lose buoyancy and fall from the water column. Weevil stocking and public education are the only methods of Eurasian milfoil control used in Manistee Lake over the past ten years.

Biologists are conducting annual vegetation surveys in Manistee Lake to evaluate the type and distribution of plants throughout the lake and to gauge the effectiveness of the weevil-stocking program.



Milfoil weevil photography courtesy of Tom Alwin and Michigan State University Department of Fisheries and Wildlife.

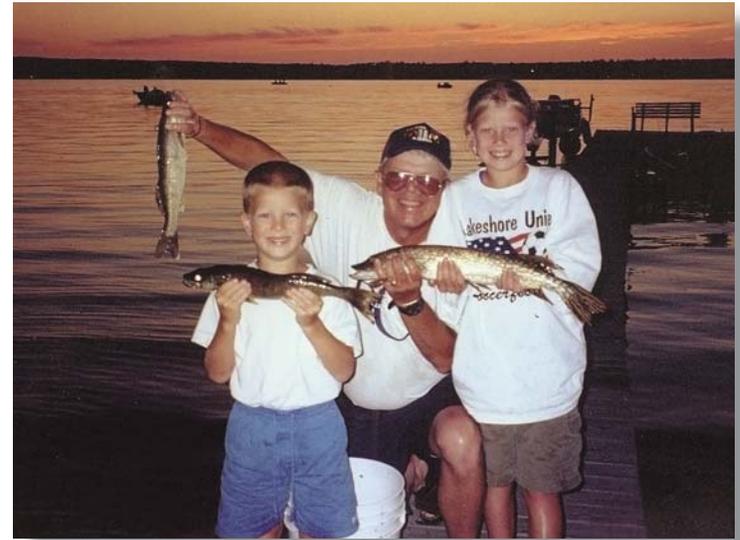


Fisheries

Manistee Lake maintains a prized fishery. In a survey performed in 2004 by the Michigan Department of Natural Resources (MDNR), 21 different fish species were found in the lake. Game fish in the lake include walleye, largemouth bass, smallmouth bass, bluegill, black crappie, pumpkinseed sunfish, northern pike, and yellow perch. Over the years, many fish caught in Manistee Lake have been of sufficient size to be entered into the MDNR Fisheries Division Master Angler Program.

Manistee Lake supports a healthy warm-water and cool-water fishery. However, the lake is too shallow to support cold-water fish species like trout. MDNR surveys indicate an increase in warm-water species such as largemouth bass and crappie in recent years.

Fishing is a popular pastime in Manistee Lake and walleye are one of the most sought-after game fish. Manistee Lake has been stocked with walleye on a periodic basis since the early 1900s. The most extensive walleye stocking was performed in 1969, 1971, and 1972 when one million fry were stocked each year resulting in excellent walleye fishing from 1973 to 1983. MDNR's current walleye stocking plan is 44,000 fingerlings every third year, but stocking is on hold due to concerns about spreading a fish disease called viral hemorrhagic septicemia (VHS). Work is being done to re-institute the walleye stocking program as soon as possible.



A complete copy of the 2004 MDNR Status of the Fishery Report for Manistee Lake can be obtained at www.manisteelake.org

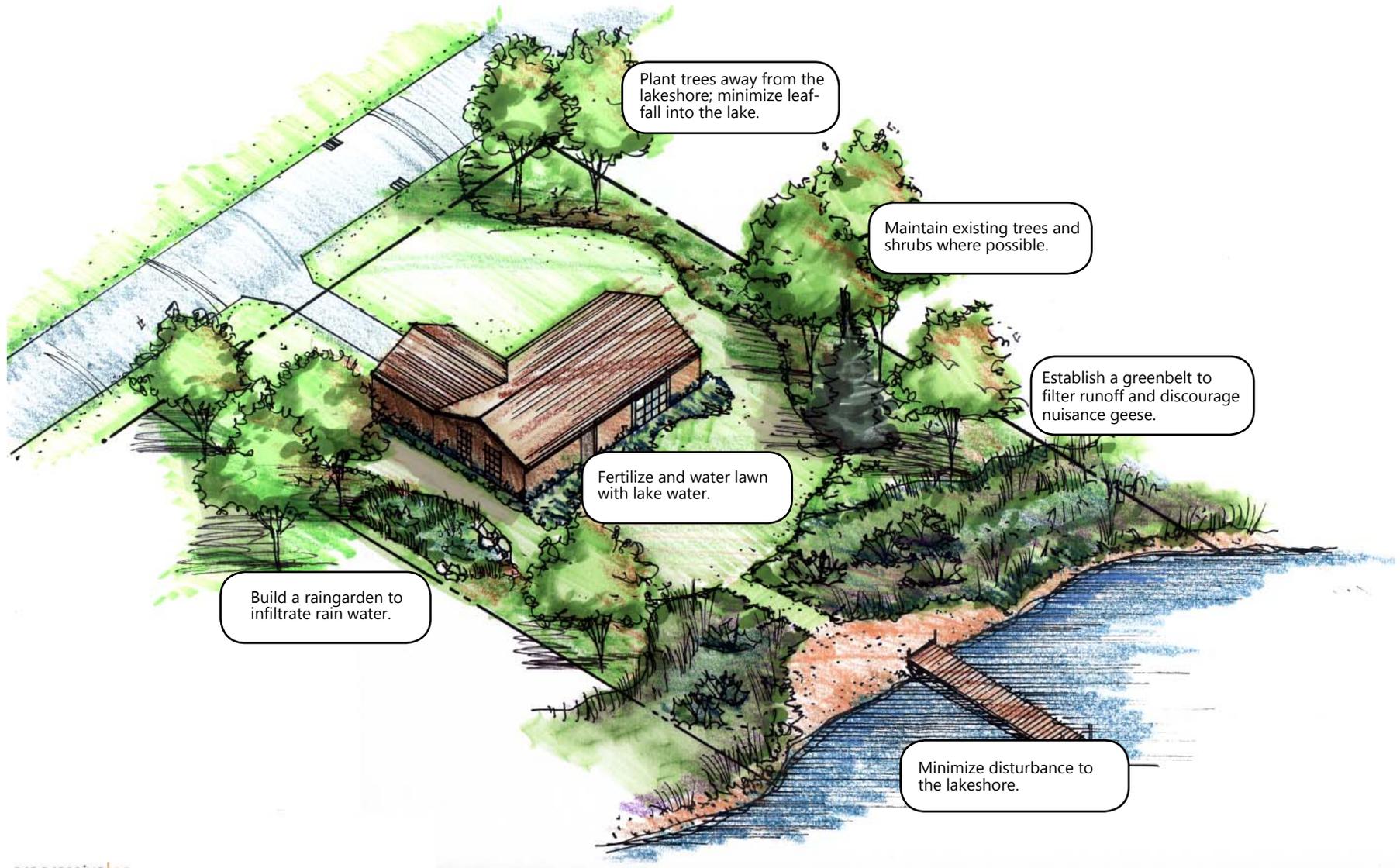


In addition to stocking, some natural reproduction of walleye occurs in Manistee Lake. However, stocking of walleye is required to sustain the walleye fishery. The Manistee Lake Improvement Board and the Manistee Lake Association are exploring methods to enhance natural walleye reproduction in the lake.

Recent MDNR survey results indicate that about 50% of the total fish biomass in Manistee Lake is white suckers. White suckers often compete with perch and other fish for food. In an attempt to reduce the number of white suckers, the Manistee Lake Improvement Board and the Manistee Lake Association collaborated with the MDNR to conduct a white sucker netting program. In the spring of 2007, over 1,000 white suckers weighing a total of about 1.5 tons were removed from the lake. MDNR will repeat the sucker removal process on a periodic basis. The MDNR is planning future surveys of Manistee Lake to evaluate the overall health of the fishery and the effects of the white sucker removal program.



What You Can Do



Septic System Maintenance Lawn Care

- Have your septic tank pumped every two to three years.
- To avoid overburdening your septic system, do not use a kitchen garbage disposal unit.
- Do not put harmful materials such as fats, solvents, oils, paints, coffee grounds, or paper towels into your septic system.
- Know the location of your drainfield, and do not park automobiles or heavy vehicles on your drainfield.
- Do not stockpile snow or allow your downspouts to drain onto your drainfield.
- Avoid planting deep-rooted trees or shrubs over your drainfield.
- Conserve water! The less water you use, the better your septic system will function.
- Be wary of putting additives into your septic system.
- Effective April 1, 2009, Kalkaska County requires that septic systems be inspected at the time property is sold or transferred.

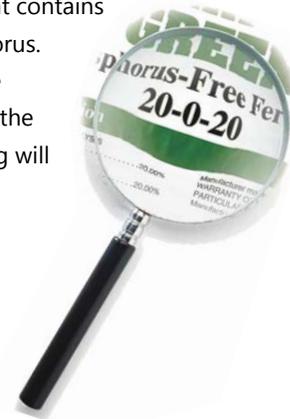
In General

- Where possible, promote infiltration of stormwater into the ground. Build a rain garden in low areas to capture runoff from driveways and downspouts. For more on rain gardens visit www.raingardens.org
- To reduce runoff, maintain trees, shrubs, and ground cover.
- Don't use soap, shampoo, or other cleaning products in the lake.

- Don't cut the grass too short! Near lakes, a mowing height of 3 to 3.5 inches or higher is recommended.
- Return grass clippings back to the lawn. You can reduce the nitrogen needs of your lawn significantly by doing so. If possible, use a mulching lawn mower to aid in this process.
- Rake and dispose of leaves away from the lake. Compost if possible. Do not burn leaves near shore. Nutrients concentrate in the ash and are easily washed into the lake.
- Avoid using pesticides near the lake, many are toxic to aquatic life.

Fertilizer

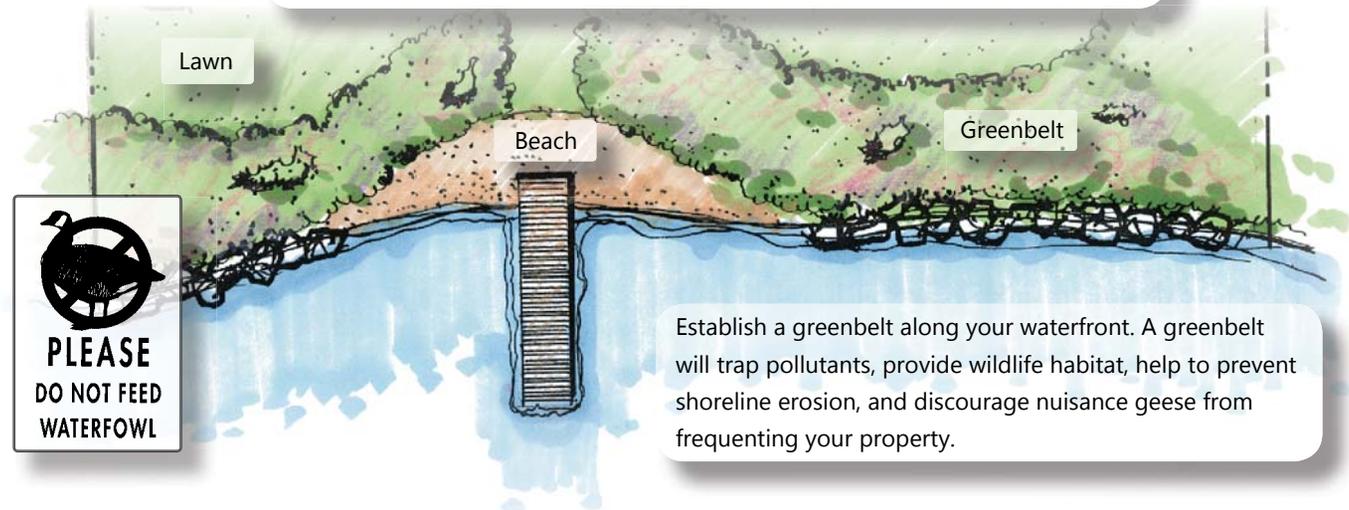
- Water lawn with lake water which contains nutrients that are good for the lawn. Water will seep through the soil back to the lake which is good for the lake.
- If you must use fertilizer, insist upon a fertilizer that contains no phosphorus. (The middle number on the fertilizer bag will be zero.)



Minimize lawn area. Less turf means less fertilizer, less pesticides—and less mowing! It's better for the lake and easier on you.

Greenbelt

- A greenbelt is a strip of land along the lakeshore that contains plants to trap pollutants that would otherwise wash into the lake.
- A greenbelt should be at least 10 feet wide, but more than 30 feet wide is best.
- Don't fertilize the greenbelt.
- For a natural look, don't mow the greenbelt. Allow natural grasses and wildflowers to grow.
- For a landscaped look, plant groundcovers, ferns, perennials, and shrubs.
- Remember: Canada geese will often avoid properties with greenbelts.





10 Ways to Protect Manistee Lake

1. Don't use lawn fertilizer.
2. Help prevent the spread of invasive species! If you trailer your boat from lake to lake, wash your boat and trailer before launching back into Manistee Lake.
3. Water the lawn sparingly to avoid washing nutrients and sediments into the lake.
4. Don't feed ducks and geese near the lake. Waterfowl droppings are high in nutrients and may cause swimmer's itch.
5. Don't burn leaves and grass clippings near the shoreline. Nutrients concentrate in the ash and can easily wash into the lake.
6. Don't mow to the water's edge. Instead, allow a strip of natural vegetation (i.e., a greenbelt) to become established along your waterfront. A greenbelt will trap pollutants and discourage nuisance geese from frequenting your property.
7. Infiltrate drainage from your downspouts rather than letting it flow overland to the lake.
8. Don't dump anything in area wetlands. Wetlands are natural purifiers.
9. Have your septic tank pumped every 2 to 3 years.
10. Don't be complacent—our collective actions will make or break the lake!