

A scenic view of Pentwater Lake. In the foreground, a large white sailboat with a tall mast and a blue cover is on the left. Another similar sailboat is on the right. The water is calm, reflecting the sky and the boats. In the background, a dense line of green trees borders the lake under a clear blue sky.

Pentwater Lake

A Guidebook for Homeowners

Preface

The Pentwater Lake Improvement Board was established in 1999 in accordance with Michigan's Natural Resources and Environmental Protection Act. With input from lake residents, the lake board has implemented several programs to help improve the quality of Pentwater Lake.

As property owners around Pentwater 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 Pentwater Lake Improvement Board to provide homeowners with information about how to protect Pentwater Lake.

Pentwater Lake Improvement Board

Ron Steiner, Pentwater Lake Property Owner

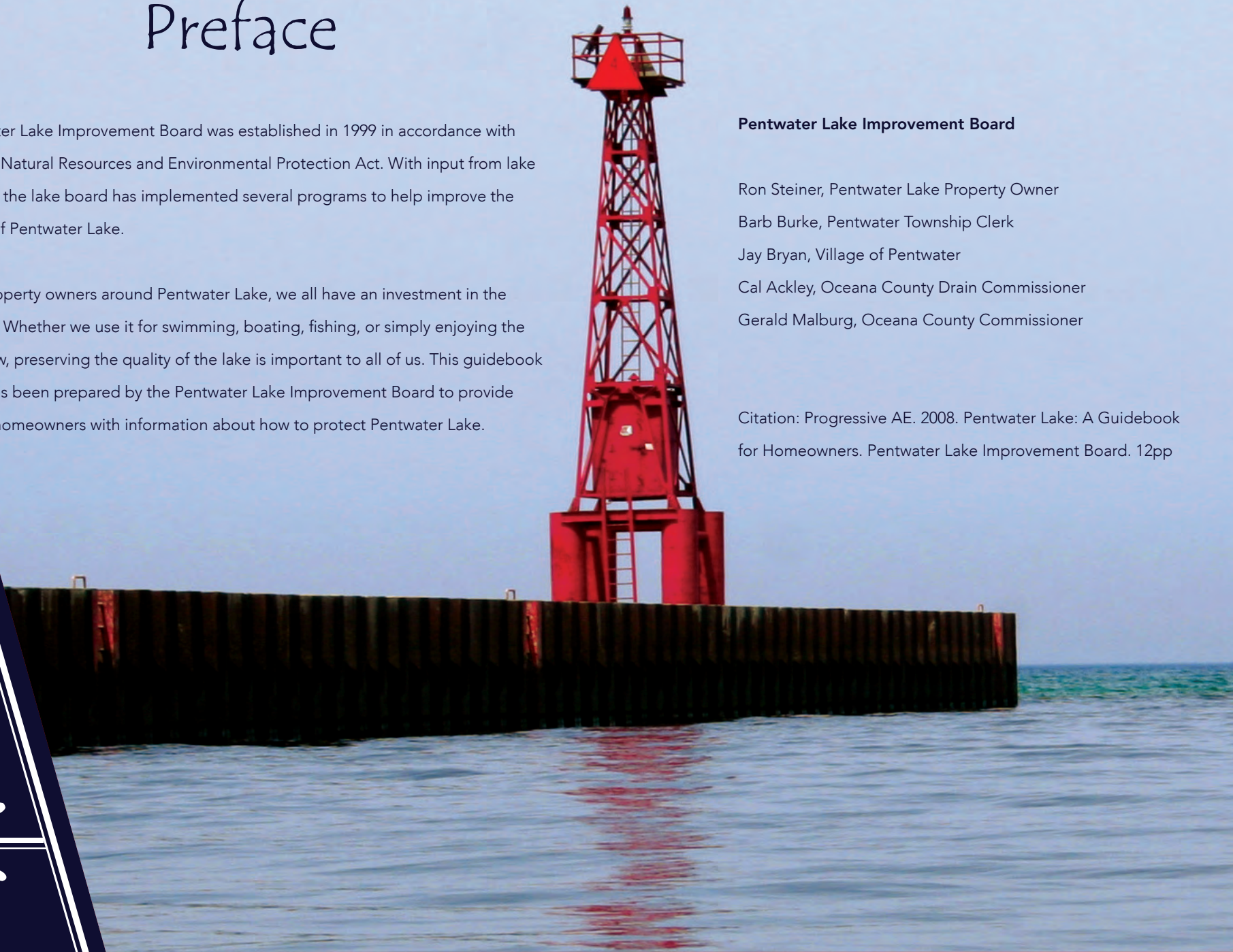
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An Historical Perspective

The earliest known inhabitants of Pentwater were the Ottawa, Chippewa, and Pottawatamie Indians. Prior to settlement, the Pentwater area was heavily forested and fish and wildlife were bountiful. However, the advent of the logging era changed Pentwater dramatically. By the mid-1800's, saw mills became established around the lake and vast stands of lumber were harvested and shipped to Chicago, Milwaukee, and other port cities.

The village of Pentwater was founded in 1867. An article in the Oceana Times around that time noted:

Pentwater is the only village in the county; it is delightfully situated on the banks of a lake of the same name, and has three stores, two steam saw mills, one printing press, several extensive fisheries, two lawyers, one clergyman and about 300 inhabitants. The largest store is 40 x 60 feet with a hall 30 x 40 feet in the second story, and is owned by Charles Mears, who is largely engaged in the lumber and mercantile business at five different points on the shore. He has also an extensive lumber, shingle and wood depot in Chicago, Illinois.

The dredging of the channel between Pentwater Lake and Lake Michigan in the 1850's enabled navigation and provided safe refuge to ships from storms on the "big lake." An article from the Oceana Times in the late 1800's noted:

Lake Pentwater is so protected by high banks and bluffs, that when a vessel is once inside, no storm can hurt her.

From the late 1850's until the 1920's, a ferry was operated on wire cables that had been stretched across the

channel. Eventually, a bridge replaced the ferry and remained functional until it was removed in the early 1950's.

During the logging area, Pentwater was indeed a wilderness. An excerpt from a book entitled "Pentwater 1853 – 1942" by Florence R. Schrupf reads:

The wolves were very troublesome. They would gnaw the handles of axes and saws if left out at night. The salt from sweaty hands attracted them. They were especially fierce that winter. Quoting again from Mrs. Barber, "As winter advanced, they became even dangerous. One time in particular we few settlers were somewhat frightened by them. It was night time and we were awakened by the howling of wolves in the distance. The howling became almost deafening as they drew nearer and looking from the windows we saw a great pack of them halted in front of the house as if about to attack it; but upon placing lights in the windows they fled. You can hardly imagine the feeling of relief I experienced when I saw them disappearing across the lake.

With the decline of the lumbering trade, a furniture factory, a brick factory, and a number of other businesses were established in Pentwater. By the mid-1900's, Pentwater was known as a prime resort and vacation community. Today, several marinas exist on the lake and more than two hundred homes and cottages border its shores. Pentwater Lake provides fishing, boating, skiing, and other recreational activities to area residents and the public at large. Protecting the quality of Pentwater Lake is essential to our quality of life.

Photography compliments of the Pentwater Historical Society





Pentwater Harbor



Lake Facts

Pentwater Lake has a surface area of 483 acres and a maximum recorded depth of 50 feet. Based on depth soundings conducted by the National Oceanic and Atmospheric Administration, Pentwater Lake has an average depth of about 22 feet. While shallow shoals exist near shore, the lake tends to drop-off quickly. Thus, large boats can be moored close to shore.

The shoreline of Pentwater Lake is nearly nine miles long. Shoreline development factor is a calculation of the irregularity in the shape of the lake shoreline. With a shoreline development factor of 2.8, the shoreline of Pentwater Lake is nearly three times longer than if the lake were perfectly round.

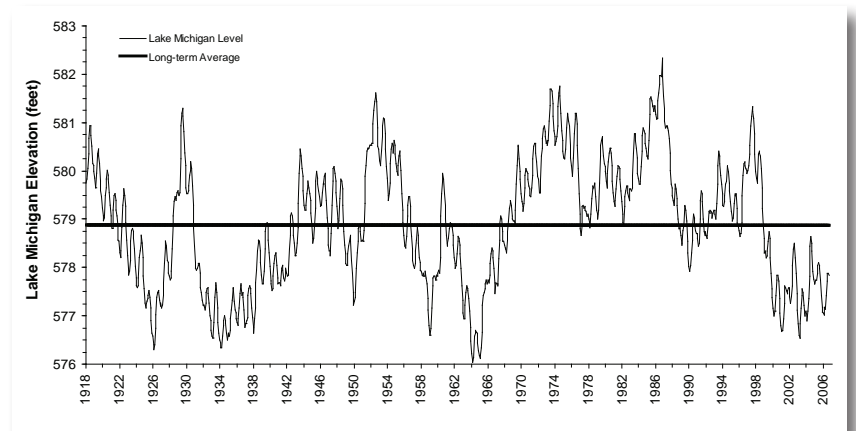
Pentwater Lake has a volume of about 10,600 acre-feet which equates to about three and one-half billion gallons of water.

The navigation channel between Pentwater Lake and Lake Michigan has been re-constructed several times. Periodic dredging of the channel is required to facilitate navigation to and from Lake Michigan. During periods of low water, as have been experienced in recent years, the need for maintenance dredging increases.

The level of Pentwater Lake fluctuates with Lake Michigan. Lake level records maintained by the U.S. Army Corps of Engineers indicate Lake Michigan has fluctuated from a low of about 576 feet above sea level in the mid

1960's to a high of about 582 feet above sea level in the mid 1980's, a difference of about 6 feet. In recent years, the levels of Pentwater Lake and Lake Michigan have been close to the historic low. However, if history is any indication, the level of the lakes can be expected to eventually rise.

The Pentwater River discharges to the east end of Pentwater Lake. Sediment deposition over the years has contributed to the formation of a large, shallow delta at the mouth of the Pentwater River in an area known as the Pentwater Marsh. This area is generally demarcated by Long Bridge Road which is the north-south causeway with Pentwater Marsh to the east and Pentwater Lake to the west. During periods of low water levels, the delta can be seen extending into Pentwater Lake under Long Bridge Road.





Pentwater Lake Physical Characteristics

Lake Surface Area 483 Acres

Maximum Recorded Depth 50 Feet

Approximate Average Depth 22 Feet

Estimated Volume 10,600 Acre-Feet

Shoreline Length 8.6 Miles

Shoreline Development Factor 2.8



Watershed Facts

A watershed is the land area that drains to a lake. A watershed boundary is determined by examining a topographical map that shows the “lay of the land” around the lake. The Pentwater Lake watershed is approximately 166 square miles—a land area over 200 times larger than the lake itself. Most of the watershed is drained by the Pentwater River that flows into the west end of Pentwater Lake. The watershed includes portions of Oceana and Mason counties, and portions of 13 townships, the City of Hart, and the Village of Pentwater.

The predominant land uses in the watershed are forestland and agriculture, with very little urban land. While agriculture is common in the watershed, most of the watershed does not have soil types conducive to conventional crops. Instead, orchards and specialty crops such as asparagus and Christmas tree farms are common. About 22 square miles or thirteen percent of the watershed is composed of wetlands. Many of these wetlands are adjacent to the Pentwater River and its tributary streams. These wetland areas provide several vital functions including flood control, wildlife habit, groundwater recharge, and water purification.

Much of the north branch of the Pentwater River drains forested or undeveloped land within the Manistee National Forest. Agricultural activity is more prevalent in the portion of the watershed drained by the south branch of the Pentwater River. Urbanized land in the watershed is concentrated near Pentwater Lake and in the City of Hart about mid-way up the south branch of the Pentwater River. A discussion of the Pentwater Lake watershed would not be complete

without mention of the 1986 flood. In September of 1986, an estimated 10 to 12 inches of rain fell in the watershed in a 48-hour period. The resulting torrent of water swelled area rivers above flood stage, washed out roads and bridges, and washed away the dam upstream on Hart Lake. Literally tons of sediment has since washed downstream. The delta observed in the Pentwater Marsh and in Pentwater Lake west of Long Bridge Road is due, in part, to the flood of 1986.

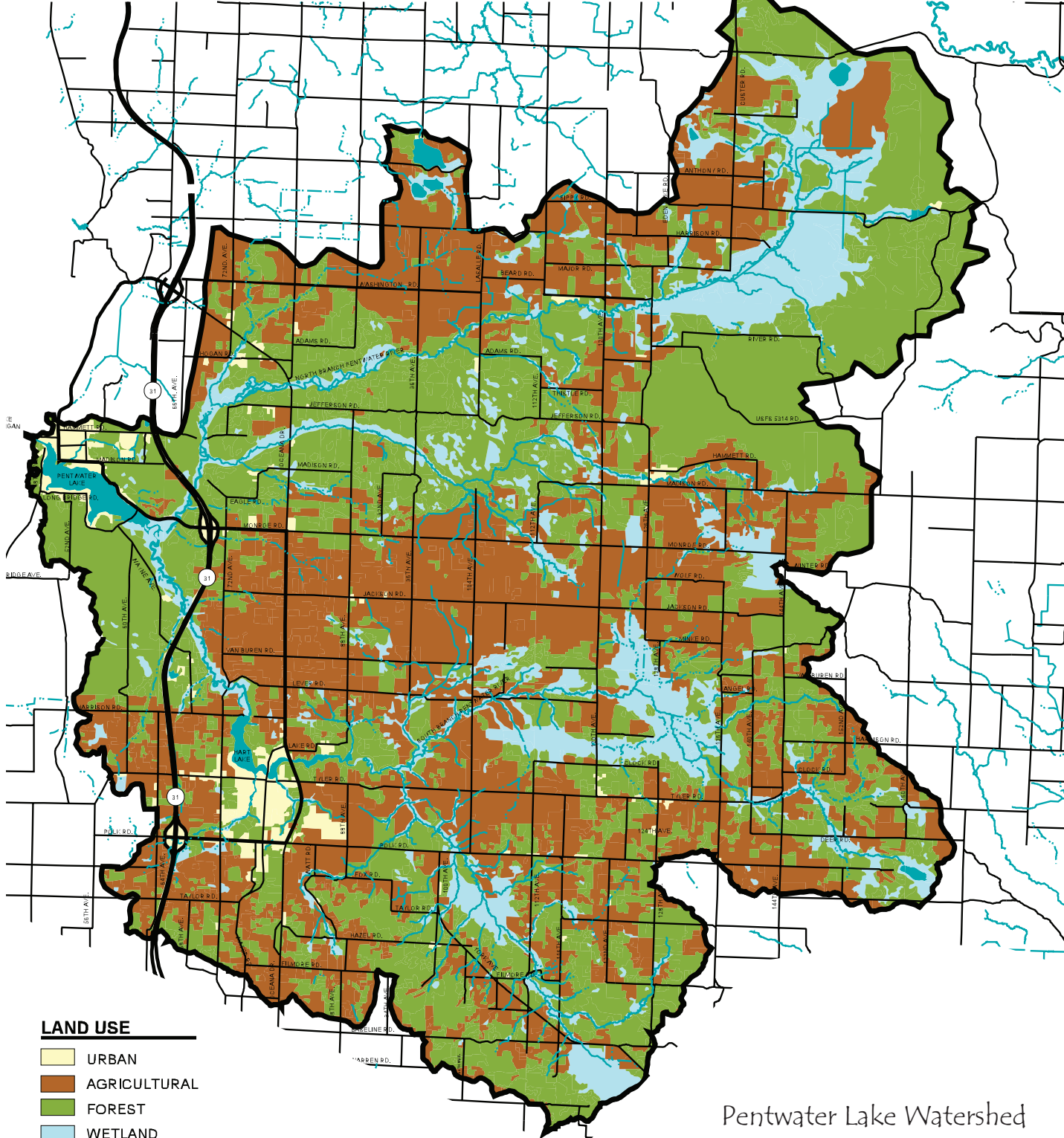
To address watershed management issues, a federal grant was awarded to the Oceana Conservation District to develop a comprehensive management plan for the South Branch of the Pentwater River. In developing the plan, extensive field surveys were conducted, problem areas were identified, and corrective actions proposed. The failure of the Hart Lake dam in 1986 was cited as a source of excessive sediment in the river and many sites were identified where erosion and sedimentation are occurring.



Most of the shoreland areas bordering Pentwater Lake have been developed. Natural areas have been replaced by roof tops, roads, driveways, and lawns—all of which have the potential to increase pollution inputs to the lake. Shoreland runoff directly impacts localized areas near shore, often causing increased aquatic plant growth which can quickly diminish the recreational and aesthetic appeal of the lake. Reducing pollution inputs from the watershed is essential to protecting the quality of Pentwater Lake over the long term.

Protection of Pentwater Lake over the long term will require that watershed pollution sources be limited as much as possible.





Pentwater Lake Watershed



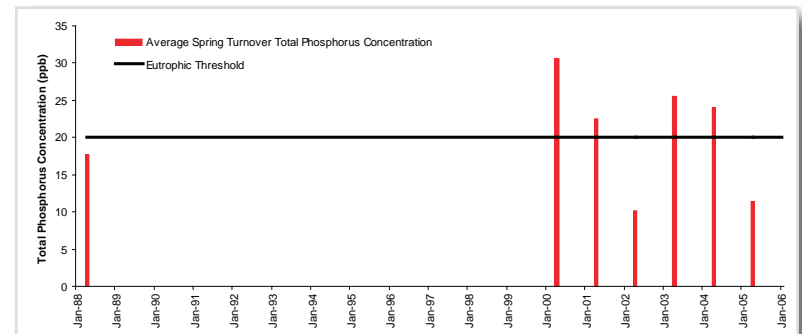
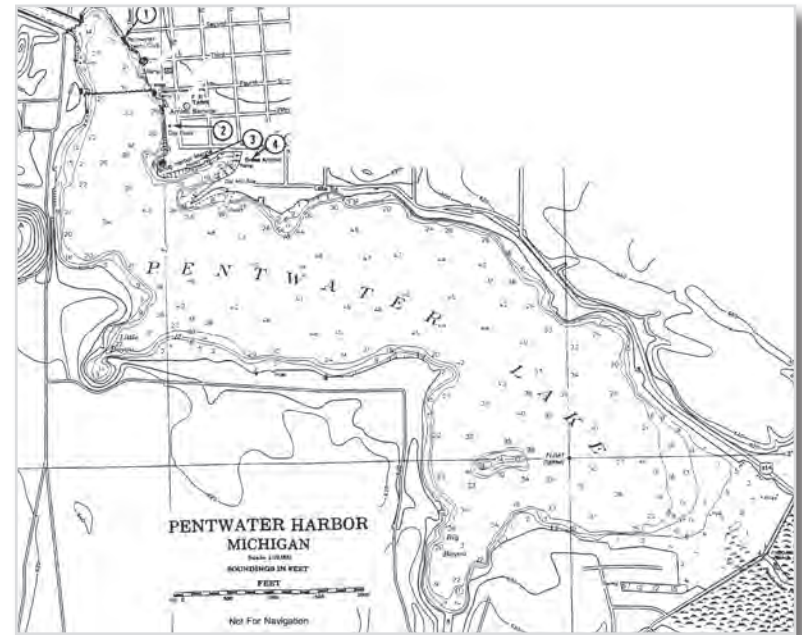
Water Quality

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.

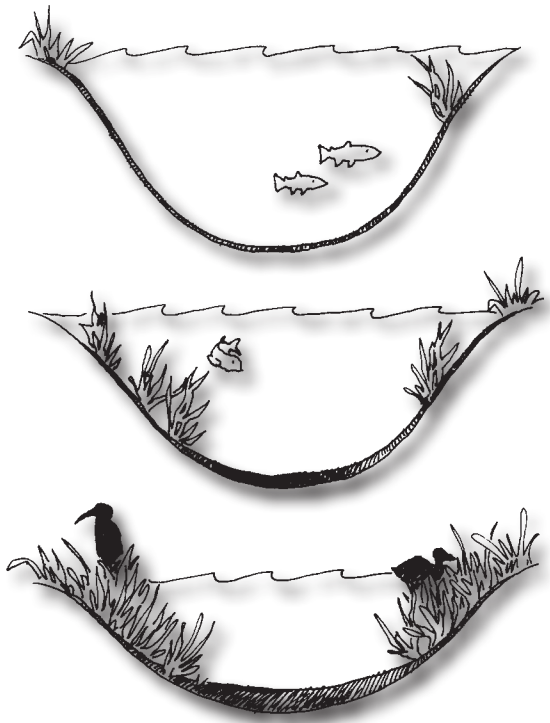
For the past several years, samples have been collected each spring and summer from the surface to the bottom over the deepest portion of Pentwater Lake. Phosphorus levels in Pentwater Lake occasionally exceed the eutrophic threshold level. Another source of phosphorus is the deep-water sediments in Pentwater Lake that release phosphorus under certain conditions.

Water clarity in the lake measured with a Secchi disk is generally about seven to eight feet. Aquatic plants can grow to a depth of about twice the Secchi transparency. Nuisance algae growth periodically occurs along the shoreline of Pentwater Lake, but algae growth in the open waters of the lake is generally moderate.

While cold-water trout and salmon species migrate from Lake Michigan on occasion, Pentwater Lake maintains a warm-water fishery. This is because the cool, deep waters in Pentwater Lake contain too little dissolved oxygen during the summer months to support cold-water fish species. However, perch, pike, bass, and sunfish are commonly caught in the lake. The Department of Natural Resources periodically stocks the Pentwater River with brown trout and occasionally steelhead.



Once in the lake, a single pound of phosphorus can generate hundreds of pounds of aquatic plants. The primary controllable source of phosphorus in the Pentwater Lake watershed is the runoff of lawn fertilizers.



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.

Pentwater 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. Pentwater Lake is beginning to show signs of cultural eutrophication.



Aquatic Plants

Aquatic plants are an essential component of the lake environment. Plants in lakes 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.

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, control efforts should only focus on removing nuisance or exotic, non-native plant types such as Eurasian milfoil.

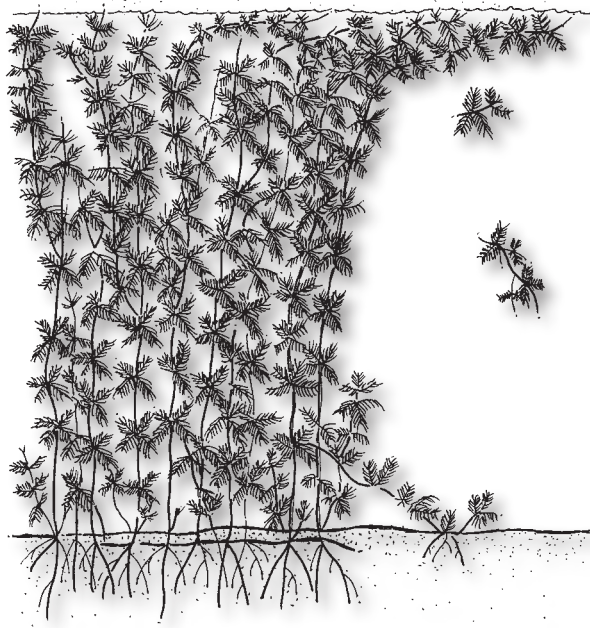


Pentwater Lake supports a diverse population of aquatic plants. 18 species of aquatic plants have been observed in the lake.

Common Name	Plant Type
Coontail	Submersed
Curly-leaf pondweed	Submersed
Elodea	Submersed
Eurasian milfoil	Submersed
Northern milfoil	Submersed
Muskgrass	Submersed
Naiad	Submersed
Variable pondweed	Submersed
Richardson's pondweed	Submersed
Flatstem pondweed	Submersed
Thinleaf pondweed	Submersed
Wild celery	Submersed
Water stargrass	Submersed
White water lily	Floating-leaved
Yellow water lily	Floating-leaved
Bulrush	Emergent
Cattail	Emergent
Purple loosestrife	Emergent



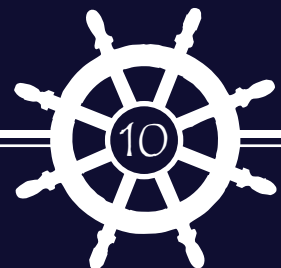
Eurasian Milfoil *Myriophyllum spicatum*



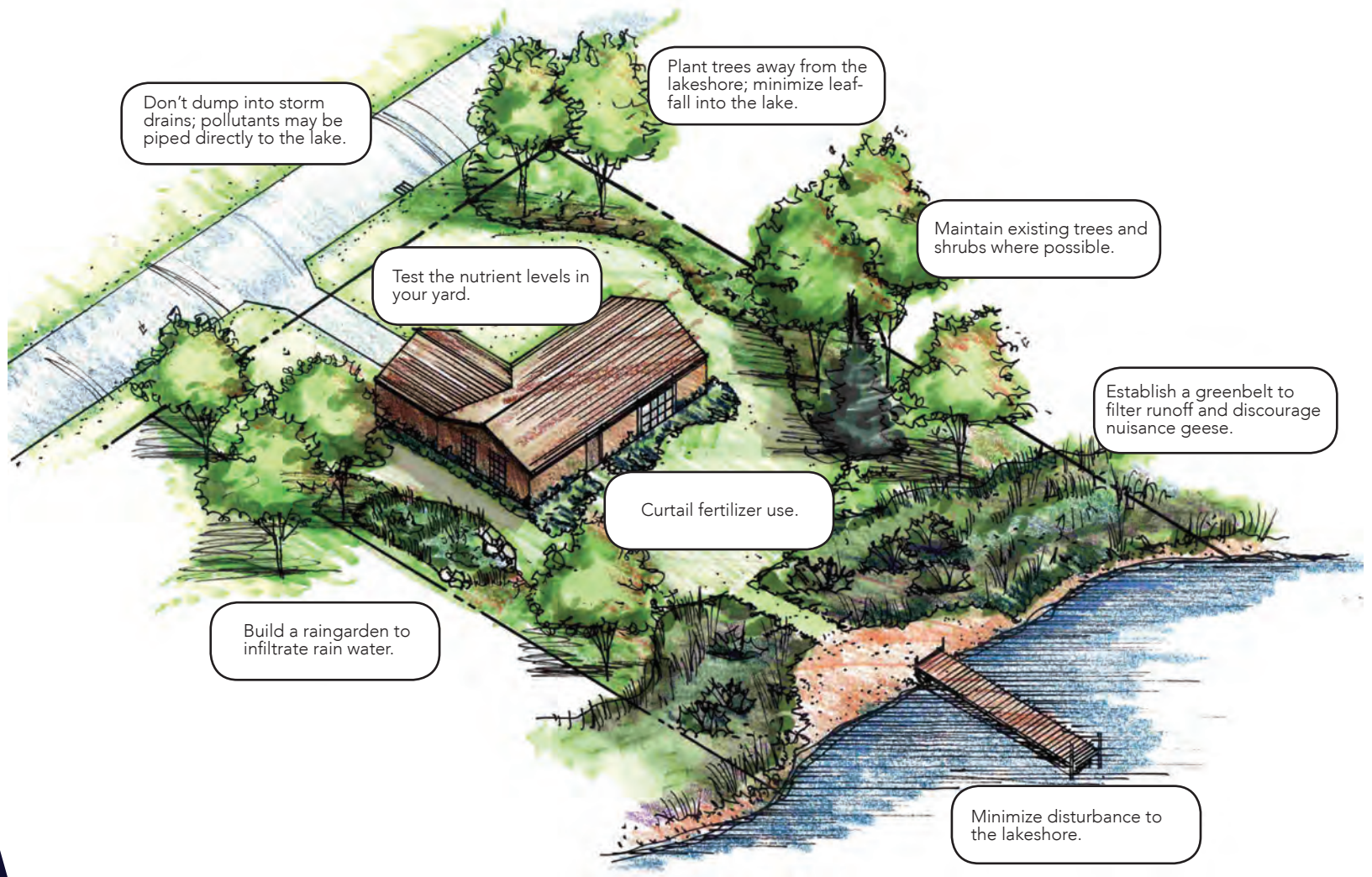
Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville).
Used with permission.

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 system, 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 Pentwater Lake. For the past several years, biologists have conducted surveys of the lake to identify the location of Eurasian milfoil, and herbicides have been applied to control the spread of the plant. The annual monitoring surveys and treatments help to ensure Eurasian milfoil and other invasive species do not gain dominance in Pentwater Lake.

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.



What You Can Do



IN GENERAL

- 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.
- Where possible, promote infiltration of stormwater into the ground. Build a rain garden in low areas to capture runoff from driveways and downspouts.
- To reduce runoff, maintain trees, shrubs, and ground cover.

GUIDELINES ARE
BASED ON MICHIGAN
STATE UNIVERSITY
RESEARCH.

FERTILIZER

- If you don't use fertilizer, don't start now. If you do...
- Don't use fertilizer that contains phosphorus unless a soil test shows a need for it.
- Fertilizers are labeled with a 3-number system that indicates the percentage of the bag that contains nitrogen (first number), phosphorus (second number) and potassium (third number). Example: a 50-pound bag of 20-0-10 fertilizer contains 20% nitrogen (or 10 pounds), 0% phosphorus, and 10% potassium (5 pounds).
- When spreading fertilizer, don't allow fertilizer to fall directly in the water.
- Lightly water after fertilizer is applied. Too much water will cause the fertilizer to leach right past the lawn and into the lake; the turf roots will never get a chance to use it.

LAWN CARE

- 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.
- If you use a professional lawn care service, be sure to request a fertilizer that does not contain phosphorus.



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.

If you want to know more about lake water quality, watershed management, invasive species, and other topics, visit www.michiganlakeinfo.com





10 Ways to Protect Pentwater Lake

1. Don't use lawn fertilizer that contains phosphorus.
2. Use the minimum amount of fertilizer recommended on the label—more is not necessarily better!
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. If you have a septic system, have your septic tank pumped every 2 to 3 years.
10. Don't be complacent—our collective actions will make or break the lake!

