



Lost Lake

Eastern Marathon County Lake Study

Final Study Results 2013

*University of Wisconsin-Stevens Point
and
Marathon County Staff and Citizens*

Healthy lakes add value to our communities. They provide a place to relax and recreate, and can stimulate tourism. Like any infrastructure, lakes require attention and good management practices to remain healthy in developed watersheds.

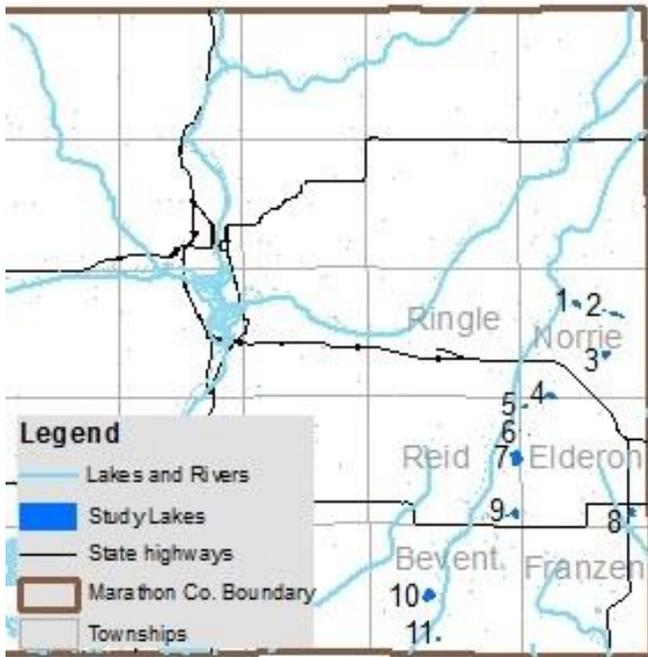
The purpose of this study is to learn about the current conditions of the fishery, habitat and aquatic ecosystems in order to help people make informed decisions to preserve what's good and correct any problems that exist.

To protect

the lake we must protect the “watershed,” the land that drains or sheds its water into the lake.



Lost Lake – Location



- 1: Mud
- 2: Mayflower
- 3: Norrie
- 4: Bass
- 5: Lost
- 6: Rice
- 7: Pike
- 8: Lilly
- 9: Mission
- 10: Big Bass
- 11: Wadley

Lost Lake
Township of Elderon
Hwy II
Surface Area: 42.6 acres
Maximum Depth: 25.1 feet

Lost Lake, Marathon Co.

Water Flow

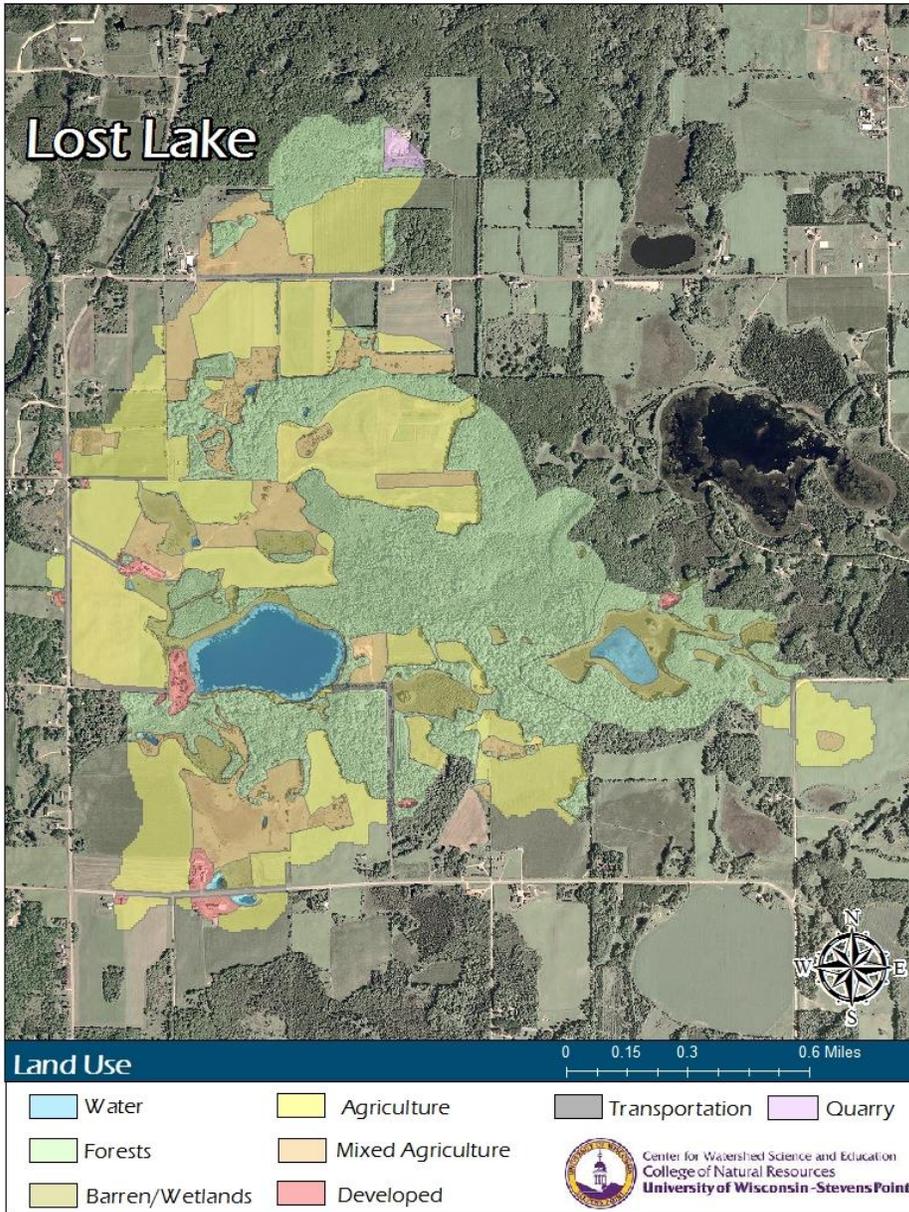
- 💧 Lost Lake is a seepage lake with most of the water entering the lake through groundwater.
- 💧 Surface water runoff and direct precipitation also contribute water, but to lesser extents.
- 💧 Water exits Lost Lake through groundwater.



Lost Lake – Surface Watershed

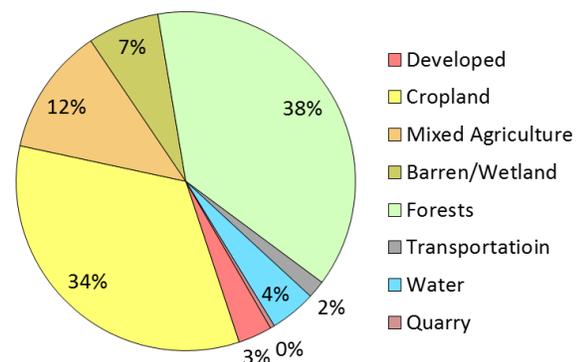


Surface Watershed: The area where water runs off the surface of the land and drains toward the lake.



- Land uses and land management practices occurring in the watershed affect the water quality in the lake.
- Land uses and land management also play major roles in how water moves across the landscape and how much water soaks into the ground (for long term-storage) or quickly runs off the land.
- The surface watershed of Lost Lake is 236 acres.
- The primary land uses in the Lost Lake watershed are agriculture and forests.
- In general, the lands closest to the lake have the greatest immediate impact on water quality. Much of the land adjacent to Lost Lake is wetlands and forests, but it does have residential development around some of its perimeter.

Land Use in the Lost Lake Watershed

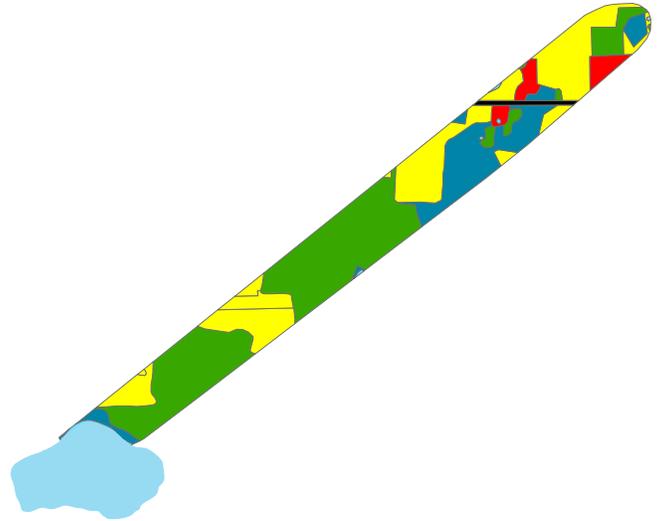


Lost Lake – Groundwater Watershed



Groundwater Watershed: The area where water soaks into the ground and travels below ground towards the lake.

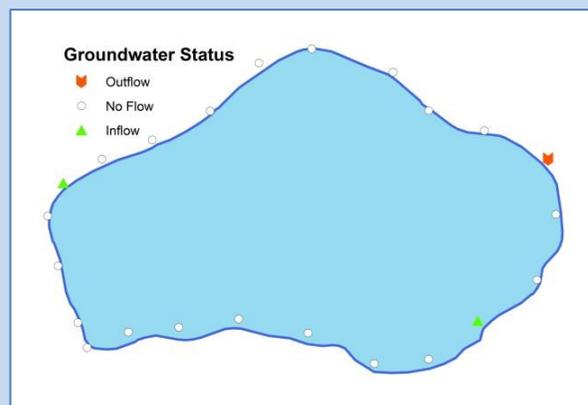
- ◆ **Groundwater** slowly contributes water to our lakes throughout the year. Hard surfaces on the landscape prevent water from soaking into the ground and becoming groundwater. This results in less water flowing to the lake during the winter and between rains.
- ◆ The quality of groundwater reflects what is happening on the land surface. Precipitation falling on forested land produces clean groundwater, whereas precipitation falling on lands that have chemical use can leach contaminants to groundwater. Groundwater contamination in central Wisconsin may include nitrogen, pesticides, herbicides and other soluble chemicals originating from septic systems, crops, barnyards, road maintenance, etc. Once in the groundwater, these chemicals slowly move towards a lake or river.
- ◆ The groundwater watershed for Lost Lake is 177 acres.
- ◆ The primary land uses in the Lost Lake groundwater watershed are agriculture and forests.
- ◆ In general, the land adjacent to the lake where groundwater is flowing into the lake has the greatest immediate impact on water quality. Wetlands and forest are adjacent to Lost Lake where most of the groundwater enters.



Land Use	Acres
Agriculture	57
Developed	7
Forested	77
Roads	2
Water	7
Wetland	27

Looking at Groundwater Up Close:

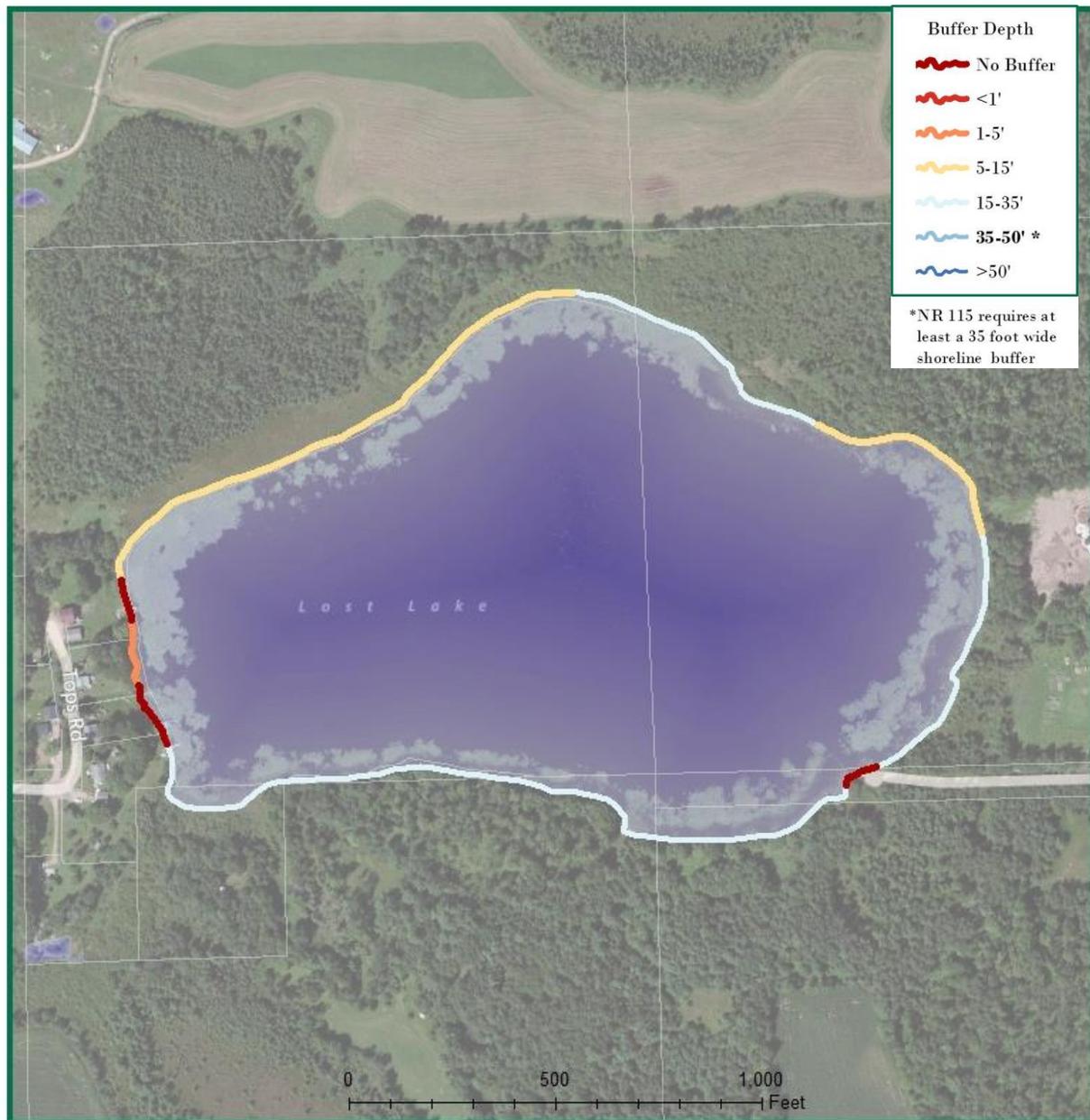
Groundwater enters Lost Lake from the northeast.



Lost Lake – Shoreland Vegetation

Shoreland vegetation is critical to a healthy lake’s ecosystem. It provides habitat for aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. It also helps to improve the quality of the runoff that is flowing across the landscape towards the lake. Healthy shoreland vegetation includes a mix of tall grasses/flowers, shrubs and trees.

The map below shows how far the 0.5 to 3 foot tall vegetation exists landward from the edge of Lost Lake. A greater vegetative buffer provides more habitat and better water quality.



Lost Lake – Lake Map

Lost Lake’s shape and depth play major roles in determining:

- 💧 Where aquatic plants can and cannot grow
- 💧 Types of fish and where they live
- 💧 How fast water in the lake warms up and cools down
- 💧 The water quality of the lake
- 💧 Abundance of habitat for species living in the water and on the land

MARATHON COUNTY, WISCONSIN

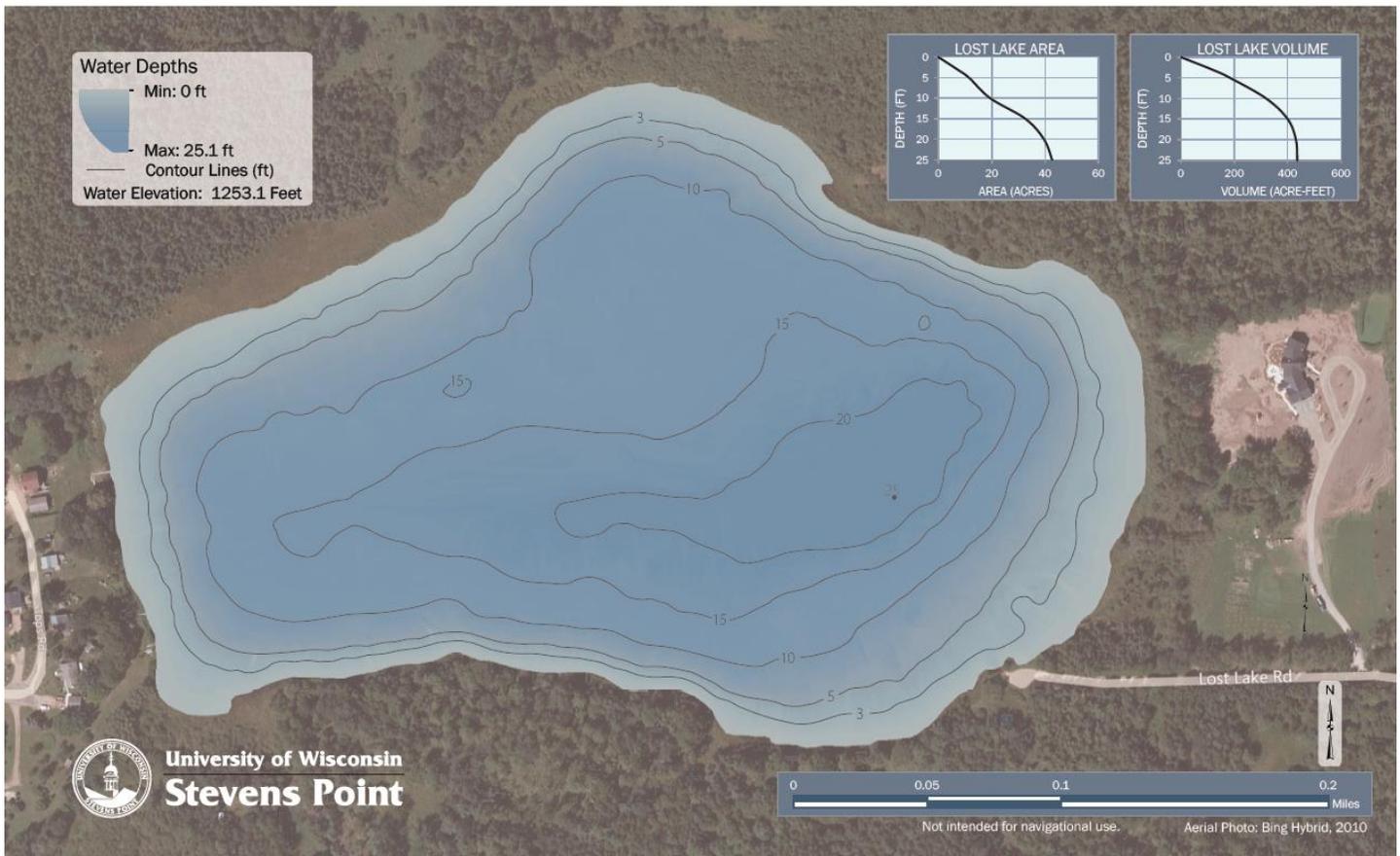
University of Wisconsin-Stevens Point
Center for Watershed Science and Education,
College of Natural Resources, and the GIS
Center, College of Letters and Science.

Map Cartography by Christine Koeller

LOST LAKE BATHYMETRIC MAP

Map funded by the Wisconsin
Department of Natural Resources Lake
Planning Grant Program, Marathon County,
Marathon County citizens, and
lake and fishing groups.

LAKE AREA	42.6 Acres
Under 3 Feet	7.2 Acres (16.7%)
Over 20 Feet	3 Acres (7.1%)
VOLUME	432 Acre-feet
SHORELINE	1.1 Miles
MAX DEPTH	25.1 Feet
GPS and Sonar Survey June, 2012	



Lost Lake – Fishery

Many factors determine which fish species thrive in a lake. Physical factors include the lake’s type, depth, surface area, geology and lake bed materials. Water quality in the lake also plays a role: water clouded with sediment or algae reduces the success of visual feeders, while low levels of dissolved oxygen will limit the fish population to those that can tolerate periods with low oxygen.

Species occurrence in Lost Lake in the 2011 survey and historical Wisconsin DNR records

Species	1949	1969	1984	2005	2011
Black Bullhead		x	x		
Black Crappie	x	x		x	x
Bluegill	x		x	x	x
Bullhead	x				
Common Shiner		x			
Golden Shiner	x	x		x	x
Iowa Darter					x
Largemouth Bass	x		x	x	x
Northern Pike		x	x		x
Yellow Perch	x		x	x	x
Pumpkinseed		x	x		x
Pumpkinseed x Bluegill hybrid		x			
Walleye		x			x
White Sucker	x			x	
Yellow Bullhead		x		x	x

◆ In 1982, Lost Lake’s dissolved oxygen concentrations fell below optimal conditions for fish survival and a temporary dip-netting permit was approved.

◆ According to Wisconsin DNR files, fish stocking records for Lost Lake date back to 1941. Historic stocking primarily consisted of adult northern pike and largemouth bass. Early efforts to stock bluegill and black crappie were abandoned prior to 1950.

Total catch and length of species in Lost Lake during the

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill	0.9	10.1	4.8	107
Yellow Bullhead	5.0	16.5	13.7	54
Golden Shiner	1.9	10.8	3.3	15
Largemouth Bass	3.1	17.9	7.0	6
Walleye	20.9	22.8	21.8	2
Black Crappie	6.5	6.5	6.5	1
Iowa Darter	2.4	2.4	2.4	1
Pumpkinseed	7.9	7.9	7.9	1
Yellow Perch	6.2	6.2	6.2	1
Northern Pike	12.1	12.1	12.1	1



- ◆ Lost Lake supports a warm water fish community.
- ◆ Iowa darter was newly documented in 2011.
- ◆ The presence of young bass and abundant sunfish indicates successful reproduction is occurring in Lost Lake.
- ◆ Reproductive success of walleye and northern pike could not be determined with the limited sampling data.



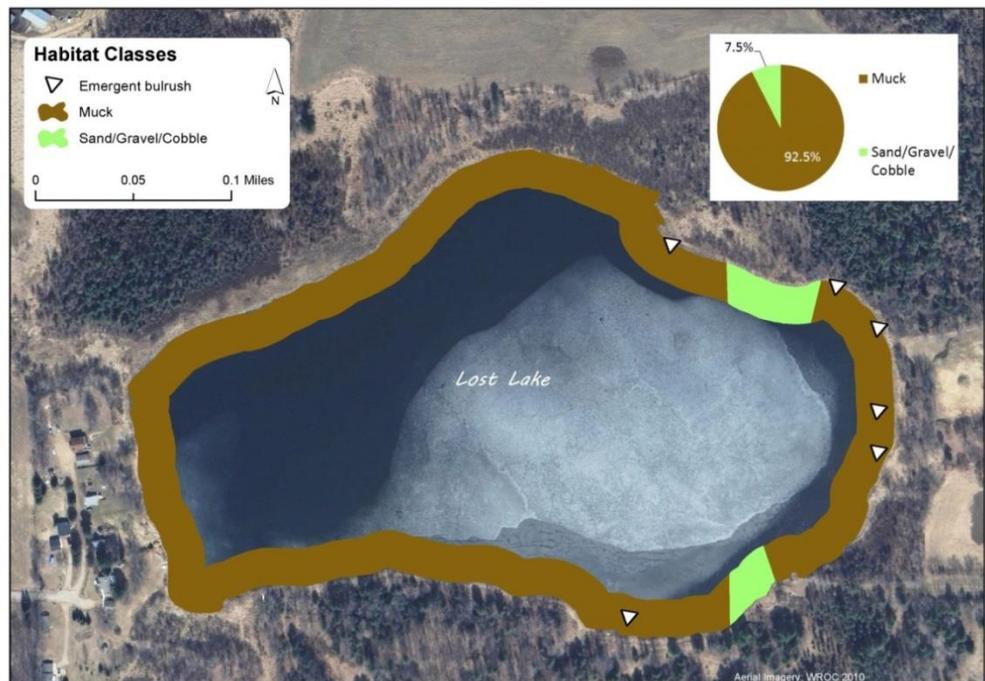
Lost Lake – Fishery

Habitat in and near the lake plays a major role in the composition of a fish community. Habitat is a combination of aquatic plants, woody structure and lake substrate. Near the shore is found some of the most important fishery habitat.

Coarse woody habitat (CWH) is an important component of a healthy and balanced fishery, playing a key role in the life histories of many fish species. Downed trees, logs and branches along with aquatic plants offer refuge from predators, a sheltered substrate for spawning, nurseries for young, and feeding grounds to forage for insects and algae. CWH is very important to other animals that live in or visit a lake including turtles, frogs, birds and mammals.

Coarse woody habitat (CWH) was not found to exist in abundance in Lost Lake – the fish community may benefit from the addition of CWH in areas where it is sparse.

Lost Lake Habitat
Marathon County, WI 2012

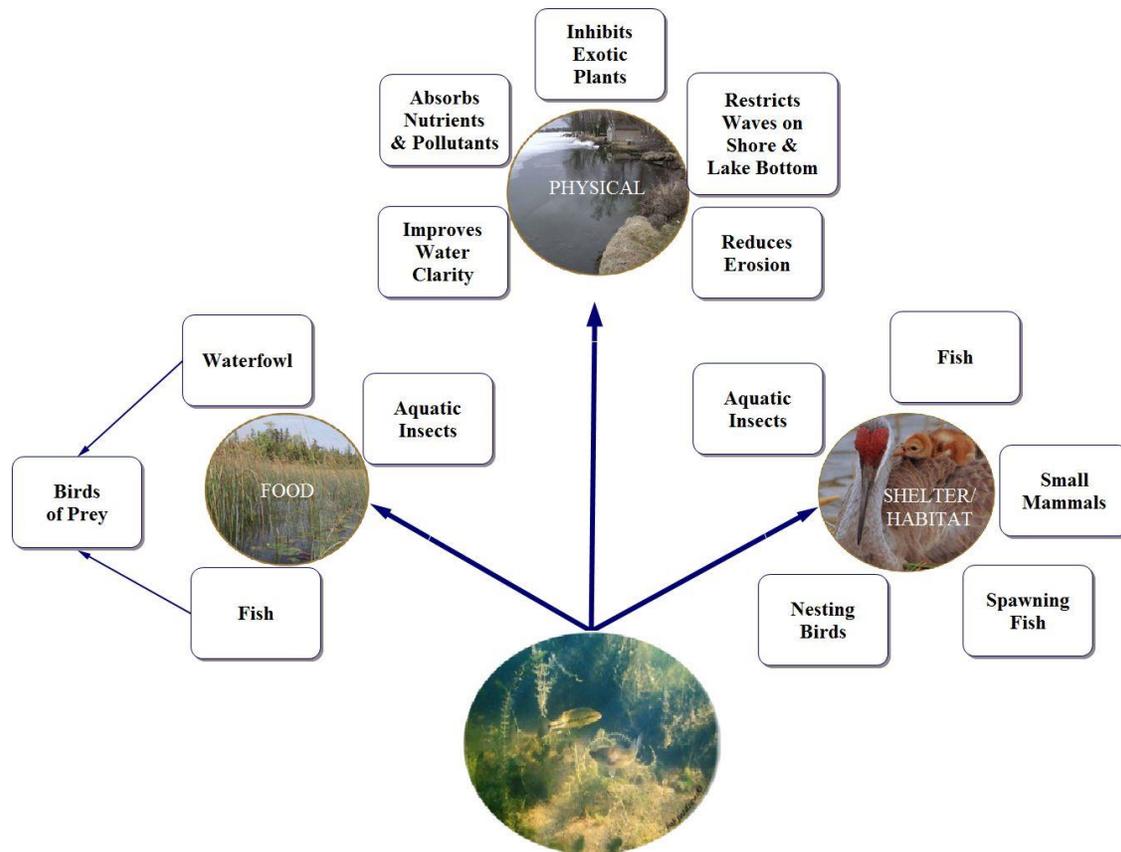


- ◆ Northern pike use areas with emergent and floating-leaf vegetation in shallow or flooded areas for spawning.
- ◆ Black crappie use bulrush habitat on gravel or sand substrates where they construct nests and guard young. Bulrush is present along areas of the eastern shoreline.
- ◆ Gravel areas are used as spawning habitat for many sunfish (bluegill, pumpkinseed, black bass), where males construct nests and guard their young.
- ◆ Yellow perch and walleye prefer near-shore cobble substrate.
- ◆ In the absence of sand and coarser substrates such as gravel, largemouth bass and sunfish may build nests on marl. Depressions are deepened until small amounts of coarser substrate, mostly fragments of snail shells, accumulate in the bottom of the nests.



Lost Lake – Aquatic Plants

Aquatic plants are the forest landscape within a lake. They provide food for some creatures including fish, ducks, and turtles, and habitat for fish, invertebrates and other aquatic animals. They create oxygen in the water and utilize nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species creating diversity that can help to prevent the establishment of aquatic invasive species.



AQUATIC PLANTS Food and Refuge for Aquatic Life

- ◆ The aquatic plant community in Lost Lake is characterized by an above average diversity when compared to other lakes in the Marathon County study. This included a number of relatively uncommon species for central Wisconsin. Lost Lake was one of only four lakes within the Eastern Marathon County Lake Study containing species of special concern.
- ◆ The 2012 aquatic plant survey of Lost Lake found no non-native species. This is a good indicator of overall aquatic health within the lake and demonstrates diligence by lake users in cleaning watercraft before entering the lake to prevent non-native species transfer.
- ◆ The habitat, food source, and water quality benefits of this diverse plant community should be the focal points in future decision-making concerning lake management strategies.



Lost Lake – Aquatic Plants

- During the 2012 aquatic plant survey of Lost Lake, 44 percent (68 of 153) of sites sampled had vegetative growth, with the greatest diversity located in the shallows on the eastern side of the lake.
- The survey identified eighteen species of aquatic plants, including spiny hornwort (*Ceratophyllum echinatum*), a species of special concern in Wisconsin and present at nearly half of the sampled sites.
- The dominant plant species in the survey was coontail, followed by common waterweed and spiny hornwort. The survey also documented the presence of small bladderwort, which like spiny hornwort is extremely sensitive to disturbance and is found only in healthy aquatic systems.

Species Richness is a count of the number of plant species found at a survey point. A greater number of species in a lake helps to make the aquatic plant community more resilient to year-to-year changes and aquatic invasive species. More plant species means more diverse habitat and food sources are available.

Bladderworts are carnivorous plants. They use special trigger hairs to sense an insect—which then is drawn into digestive “bladders” in the plant. Small bladderwort is very sensitive to disturbance, but is thriving in Lost Lake!

Lost Lake 2011 Aquatic Plant Survey:
Species Richness



Total Number of Species	
○ 0	○ 5
◆ 1	◆ 6
◆ 2	◆ 7
◆ 3	◆ 8
◆ 4	◆ 9



SMALL

Spiny hornwort resembles the more commonly occurring coontail. It is a food source to a wide range of waterfowl species and provides habitat for a number of aquatic insects. Spiny hornwort is a species of special concern in Wisconsin.



SPINY HORNWORT



Lost Lake – Aquatic Invasive Species

Aquatic Invasive Species are non-native plants or animals that may cause significant harm to a lake’s ecosystem. Typically, they are introduced to a lake by hitching a ride on clothing, boats, trailers and other water recreation equipment. Aquatic invasive species can be introduced to a lake accidentally or intentionally. Once in a lake, they may be impossible to completely remove and can be difficult and costly to control. Prevention and early detection are the best ways to keep aquatic invasive species from establishing in a lake.

Lakes With Aquatic Invasive Species in Marathon and Northern Portage County, 2012

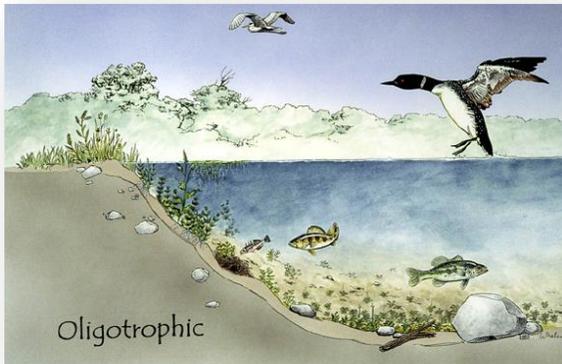
Lake Name	Banded Mystery Snail	Chinese Mystery Snail	Rusty Crayfish	Curly-Leaf Pondweed	Eurasian Water Milfoil	Purple Loosestrife
<i>Marathon County (Shaded lakes are part of Eastern Marathon Co. Lake Study)</i>						
Big Bass Lake	✓					
Big Rib River			✓		✓	
Eau Claire Flowage		✓			✓	
Flume Creek			✓			
Johnson Creek			✓			
Lake Wausau				✓		
Little Rib River			✓			
Little Trappe River			✓			
Lost Lake		✓				
Mayflower Lake		✓		✓		
Mission Lake	✓				✓	✓
Pike Lake	✓			✓		
Rice Lake	✓	✓		✓		
South Branch Embarrass River			✓			
Spring Brook			✓			
Trappe River			✓			
Wadley Lake	✓	✓		✓	✓	
Wausau Dam Lake					✓	
Wisconsin River			✓		✓	
<i>Northern Portage County</i>						
Tree Lake	✓	✓		✓		
Plover River			✓			
Lake Du Bay		✓	✓	✓	✓	

Learn to identify invasive species & look for them



Lost Lake – Water Quality

Lakes go through a natural aging process that results in increased aquatic plant growth, fish and wildlife over time. Within a lake's watershed, human activity on the land, in a wetland, or in the lake can dramatically accelerate this process. Depending on land management practices, changes in a lake that may have normally taken centuries to occur may take place in decades or even years. The amounts of nutrients, algal growth, and water clarity measures help to define the age of a lake. Based on these measures, lakes can be classified for comparison to one another.



Oligotrophic Lakes

Common uses:

- ✓ Swimming
- ✓ Skiing
- ✓ Boating

Vegetation of oligotrophic lakes:

- ✓ Very little vegetation



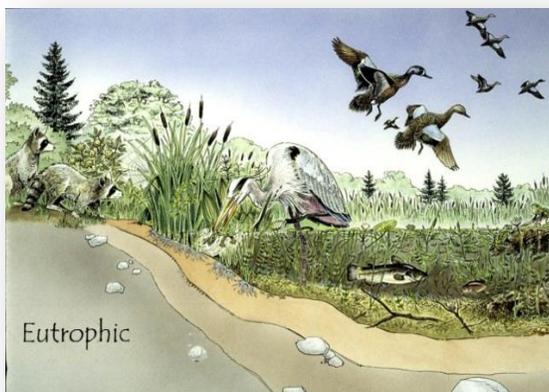
Mesotrophic Lakes

Common uses:

- ✓ Boating
- ✓ Fishing

Vegetation of mesotrophic lakes:

- ✓ Increased vegetation
- ✓ Occasional algal blooms



Eutrophic Lakes

Common uses:

- ✓ Fishing
- ✓ Wildlife watching

Vegetation of eutrophic lakes:

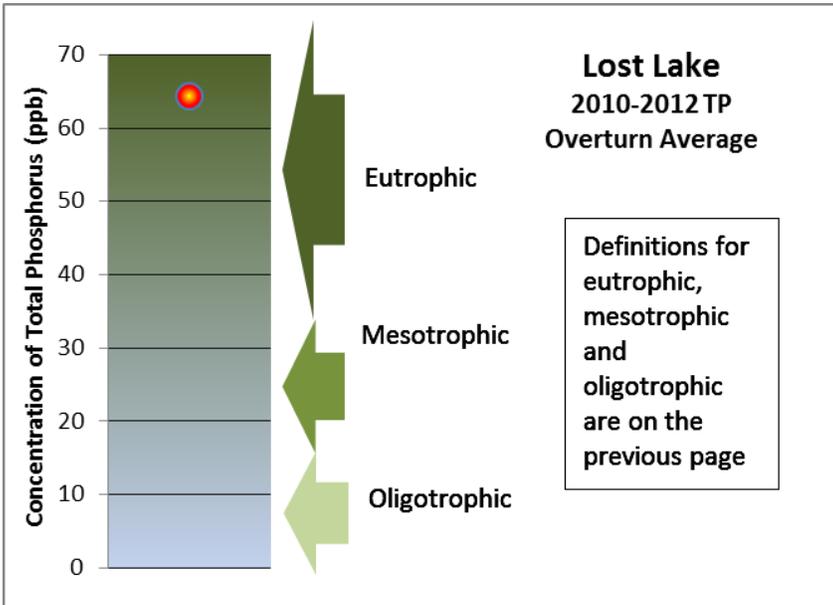
- ✓ Lots of aquatic plants
- ✓ Frequent algal blooms

Winter fish kills can occur in shallow lakes due to low oxygen levels.



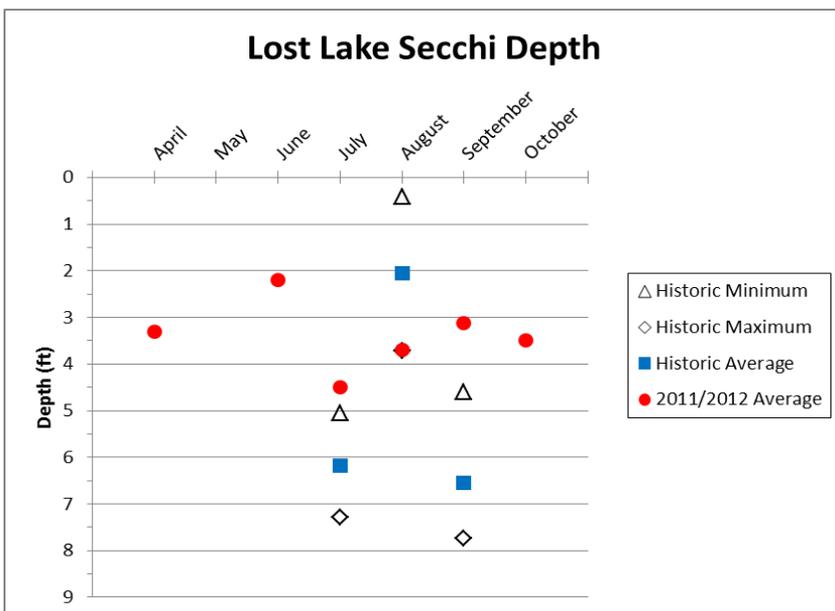
Lost Lake – Water Quality

Phosphorus is a major nutrient that can lead to excessive algae and rooted aquatic plant growth in lakes. In fact, one pound of phosphorus entering a lake can result 300 to 500 pounds of algal growth. All Marathon County lakes have either sufficient or excessive nutrients for aquatic plant growth, so these lakes will benefit from limiting the addition of more nutrients. Sources of phosphorus include septic systems, animal waste, storm water runoff, soil erosion, and fertilizers for lawns, gardens and agriculture.



- ◆ Total phosphorus levels measured when Lost Lake was well-mixed (overturn) are displayed in the graph to the left.
- ◆ Overturn sampling during the 2010-2012 monitoring period indicate that Lost Lake is a eutrophic lake with a high average total phosphorus level.

Water clarity is a measure of how deep light can penetrate (Secchi depth). Clarity is affected by water color, turbidity (suspended sediment), and algae. Water clarity helps determine where rooted aquatic plants can grow.



- ◆ The graph to the left shows water clarity data collected during the growing seasons in 2011 and 2012. It is typical for water clarity to vary throughout the year.
- ◆ The 2011/2012 average Secchi depth readings showed some variation from historic averages. Shallower average readings in July and September suggest a possible decline in water clarity during the monitoring period.

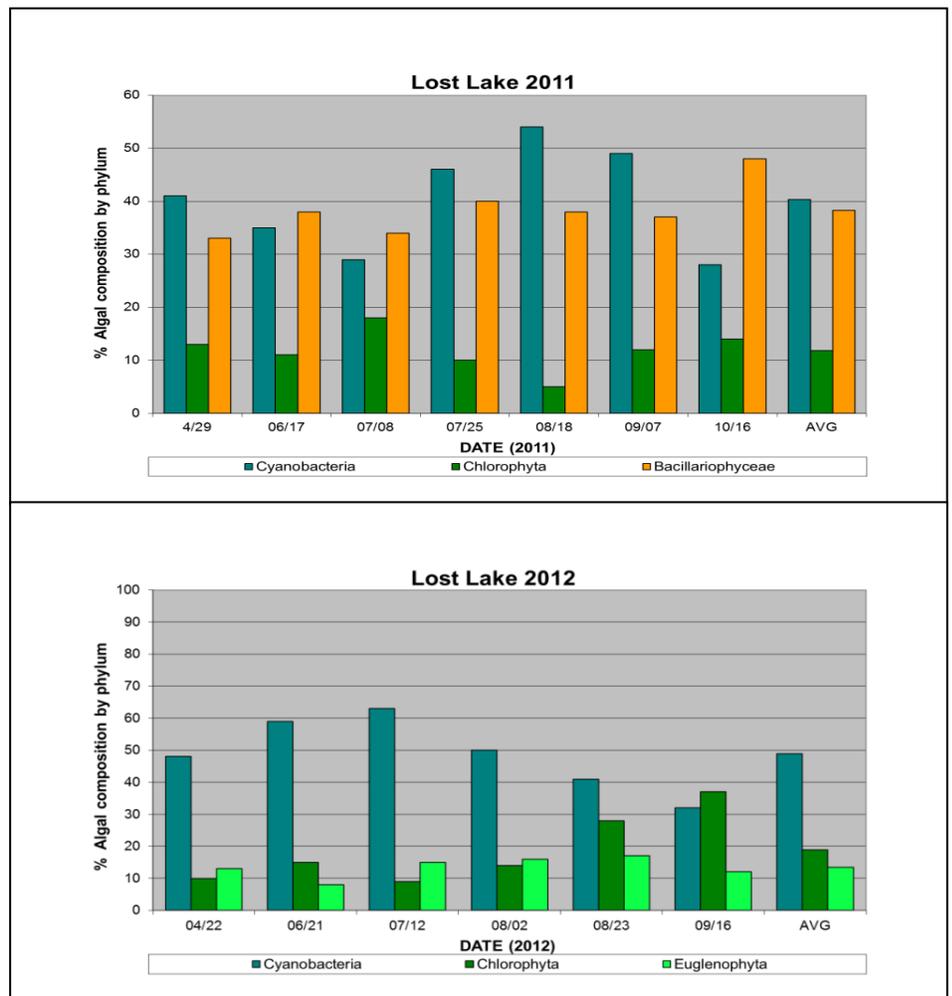


Lost Lake – Algae

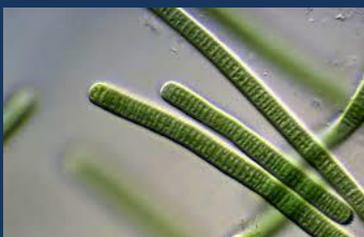
Algae are microscopic, photosynthetic organisms that are important food items in all aquatic ecosystems. Different algal groups increase or decrease during the year and they can be used to analyze a lake’s water quality because there are more varieties of algae than fish or aquatic plants. Conclusions can be drawn about water temperature, nutrient availability, and overall water quality of a lake using algal populations.

In Marathon County lakes, there are three dominant groups of algae: blue-green algae (Cyanobacteria), green algae (Chlorophyta), and diatoms (Bacillariophyceae).

- Lost Lake is very eutrophic and the algal community was dominated by blue-green algae. The only consistent pattern between 2011 and 2012 was the dominance of the blue-green algae.
- The large colonial and filamentous forms commonly found in Lost Lake are hard to eat and grow too thick to allow sunlight to penetrate the water and reach other submerged vegetation.
- The diatoms were very abundant during 2011 but nearly disappeared in 2012, with no obvious explanation.
- The green algae were only minor components of the community.



PERCENT ALGAL COMPOSITION FOR LOST LAKE IN 2011 AND 2012



Blue-green algae have the widest tolerance range for temperatures and nutrient concentrations. A few varieties of blue-greens can produce toxins that are potentially harmful to livestock, pets and humans.

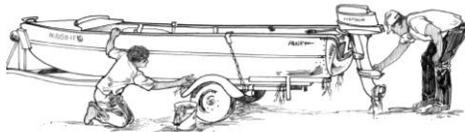


Lost Lake – What Can You Do?



Lake Users:

- ✓ Run boat engines efficiently
- ✓ Observe no/low wake zones
- ✓ Refuel away from water
- ✓ Dispose of trash properly
- ✓ Remove all aquatic plants from boats and trailers
- ✓ Respect wildlife and other lake users



Land Owners:

- ✓ Control soil erosion.
- ✓ Keep livestock out of lakes and streams
- ✓ Control manure runoff
- ✓ Carefully manage nutrients and pesticides
- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Learn to identify and look for invasive species



Home Owners:

- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Leave woody habitat for young fish, turtles and frogs
- ✓ Eliminate the use of fertilizer or use no phosphorus fertilizer
- ✓ Eliminate or minimize use of pesticides
- ✓ Control soil erosion
- ✓ Control runoff from rooftops and hard surfaces
- ✓ Clean up after pets
- ✓ Learn to identify and look for invasive species



Stop the Spread of Aquatic Invasive Species!

Wetlands and Shorelands:

- ◆ LEARN how to identify invasive plants and animals, and who to contact if found.
- ◆ DO NOT PURCHASE prohibited and restricted species! Whenever possible purchase native plants.
- ◆ NEVER transplant water garden plants or aquarium plants into lakes, streams, wetlands, or storm water ponds. Properly dispose of unwanted plants and animals!
- ◆ REMOVE invasive exotic plants from your landscape and replace them with native plants or non-invasive exotic plants. Scout annually for new invasive plants.
- ◆ AVOID using garden plants from other regions whose invasive potential is poorly understood.

Lakes and Rivers:

- ◆ LEARN what Wisconsin invasive plants and animals look like and who to contact if seen in a lake or river.
- ◆ INSPECT your boat, trailer and equipment when traveling to different water bodies and REMOVE any attached aquatic plants or animals (before launching, after loading, and before transporting on a public highway).
- ◆ DRAIN all water from boats, motors, and all equipment after use at a lake.
- ◆ NEVER release live fish, bait or pets into a wetland or water body.
- ◆ BUY minnows from a Wisconsin bait dealer. Only use leftover minnows at that same water body.



Lost Lake – Primary Researchers



Algae

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- *Wisconsin DNR Lake Protection grants*
- *UW-Stevens Point and UW-Stevens Point Faculty*
- *Marathon County*
- *Marathon County Citizens*



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<http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning/ConservationDivision/LakePrograms.aspx>



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