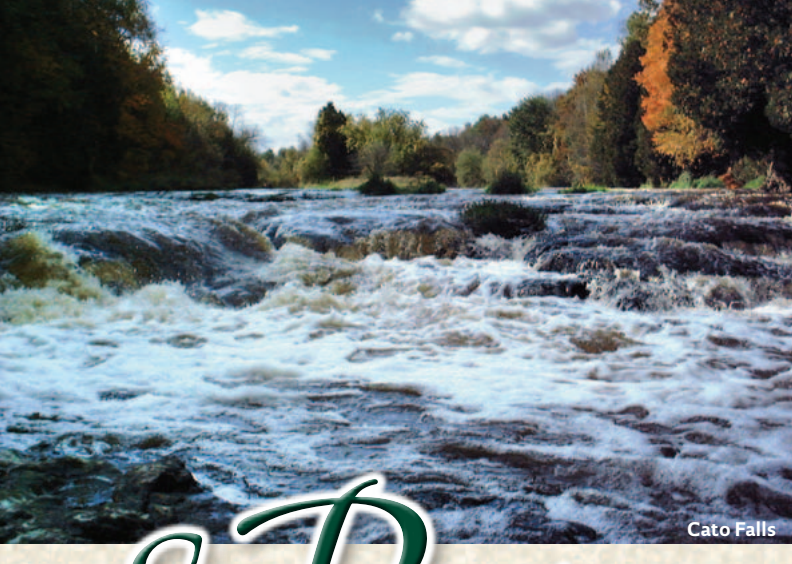


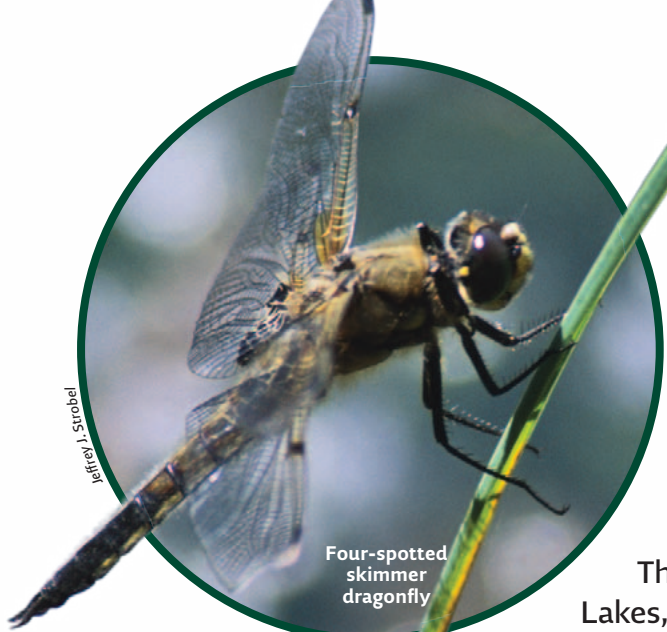
A clean water guide for people living and working in the Manitowoc River watershed, including the Branch River, North Branch Manitowoc, South Branch Manitowoc and Killsnake Rivers, and Mud and Pine Creeks



# Explore & Restore



## What do you value about your river?



Read on to learn more about the Manitowoc River. Take time to explore and restore this amazing water resource!

The Branch, North Branch Manitowoc, South Branch Manitowoc and Killsnake Rivers, and Mud and Pine Creeks are all major tributaries of the Manitowoc River. Although you may see one of these rivers everyday, you may not stop to really think about them or the Manitowoc River system. As you peer out your window or step outside, what do you see? Is the river scenic, or unsightly? What do you hear? What do you smell? Does the river add to or decrease the economic value of your property? Have you thought about how these rivers connect you to the rest of the world?

### The Manitowoc River system is in the Great Lakes basin

The Manitowoc River system feeds water to the Great Lakes, which have played a major role in the history of the United States and Canada. The Great Lakes are immensely important still today for food, drinking water, transportation, industry, recreation and energy production.

The Great Lakes make up the largest system of fresh surface water on earth and contain about 18% of the total world supply. The Great Lakes basin, the land area that drains into the Great Lakes, is home to more than 10% of the United States population and 25% of Canada's population. The Great Lakes basin harbors some of the world's greatest industrial capacity and almost 25% of

About this brochure: This brochure is part of the 2009 "Explore and Restore" river education project. "Explore and Restore" is a collaborative effort of Woodland Dunes Nature Center, Wisconsin Maritime Museum, the Lakeshore Natural Resource Partnership, and the UW-Extension Basin Education Initiative, and supported with funding through a 2008-09 Wisconsin Department of Natural Resources river protection grant. Through this partnership, programs and educational brochures are offered to citizens regarding four rivers (East Twin River, West Twin River, Manitowoc River and Silver Creek) that are especially in need of restoration action from citizens.

agricultural production in Canada and 7% of agricultural production in the United States.

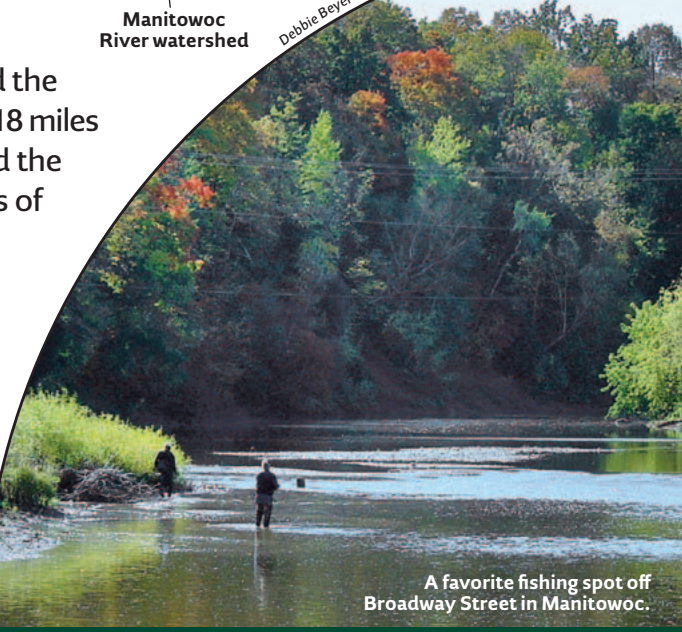
### The Manitowoc River system supplies water to Lake Michigan

The Manitowoc River flows directly into Lake Michigan. Lake Michigan is where 43% of all Great Lakes fishing happens; it cradles the world's largest collection of freshwater sand dunes and recreational beaches; and it supplies drinking water to 11 million people, including residents of Manitowoc, Two Rivers and Green Bay.

By volume, Lake Michigan is the second largest Great Lake and the fifth largest freshwater lake in the world! It is 307 miles long and 118 miles wide, with an average depth of 279 feet. But Lake Michigan and the Great Lakes system have limits. They are showing serious signs of stress from more than 100 years of intense human activity.

Water in Lake Michigan has a retention time of about 100 years. Polluted water entering the lake about 100 years ago is likely to affect it yet today. Water entering Lake Michigan today may be felt by you, your grandchildren and your great-great grandchildren. Activities that support healthy rivers support a healthy Lake Michigan.

Sources: The Great Lakes - An Environmental Atlas and Resource Book, U.S. Environmental Protection Agency (EPA) and the Government of Canada, 1995; and the Lake Michigan Lakewide Area Management Plan (LaMP), Michigan Department of Environmental Quality and U.S. EPA, 2007.



## What threatens the health of the Manitowoc River system?

The main threats to the river system and thus, also to Lake Michigan and the rest of the Great Lakes system, include polluted runoff, toxic chemicals, habitat loss and fragmentation, and invasion by alien species.

### Industrial waste

Under federal policy, many stretches of the Manitowoc River are classified as "impaired waters." This means that, due to pollutants, the Manitowoc River is not meeting its potential for supporting activities such as fishing and swimming. Although the river is impacted by a variety of pollutants, it is contamination from polychlorinated biphenyls (PCBs) that puts it on the list of Wisconsin's impaired waters.

Historic contamination from PCBs in industrial waste (now banned in the U.S.) restricts the amount of fish that is safe to eat throughout most of the Manitowoc River system, except for the North Branch Manitowoc, which has no advisory. If you are planning to fish, you are advised to check and follow consumption guidelines found on the DNR website at: <http://dnr.wi.gov/fish/consumption>

### Runoff from agricultural and urban areas

Scientists report that in the past 100 years, 50% of our topsoil has eroded from Wisconsin farmlands. Agriculture makes up 85% of land use in the Manitowoc River watershed. Runoff from agricultural lands may contain fertilizers, pesticides, herbicides, manure, land-spread industrial waste, and sediment from soil erosion. Monitoring shows that the rural portion of the Manitowoc River watershed delivers 21,065 tons of sediment (1,000 dump truck loads!) from soil erosion and 74 tons of phosphorus annually. This is the ninth-highest load of phosphorus and sediment of all the rivers flowing into Lake Michigan.



In urban and residential areas, soil erosion at construction sites and chemicals that run off from pavement and lawns, or are poured into storm sewers can be toxic to fish and other animals. Small amounts of pollutants can have big impacts. Just one quart of motor oil poured down a storm drain can create a 2-acre oil slick harming waterfowl, fish and other aquatic organisms.

### Loss of forests and wetlands

Prior to European settlement, the Manitowoc River watershed was covered with forests and wetlands that provided rich wildlife habitat and also protected soil and water resources. Forests held the soil in place during rainstorms and spring thaws, keeping soil from eroding into rivers and streams. Forests also shaded rivers and streams, keeping waters cool.

Historically, wetlands large and small dotted the watershed, absorbing floodwaters and releasing them slowly

into surrounding rivers, lakes, streams and groundwater. Biologists estimate that 50% of historic wetlands have been lost in this region. Wetlands and their flood-control benefits are greatly diminished in today's Manitowoc River watershed. Flash floods are becoming the norm when rainstorms rage or snow thaws.

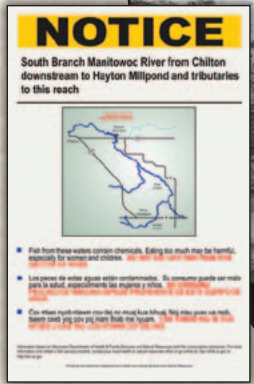
If you own woodland or wetland, learn more and do what you can to care for it and protect it - you have a special feature that is important to the water quality above and below ground.

### Dams

Dams have impacted water quality and habitat in the Manitowoc River. Today there are still three dams on the Manitowoc River and several more dams and other barriers, like improperly installed culverts, on its tributaries.

Dams and other barriers slow the flow of water and often result in a lake or pond upstream. The water in the lake or pond warms, raising the temperature of the water downstream and promoting algae growth.

Dams and other barriers confine fish and other aquatic organisms to limited stretches of river or stream. These barriers may keep fish from historic spawning areas, winter or summer habitat, or Lake Michigan. Loss of this critical habitat can reduce or eliminate populations such as northern pike, smallmouth bass, or lake sturgeon that depend on flowing waters.



### Invasion by alien species

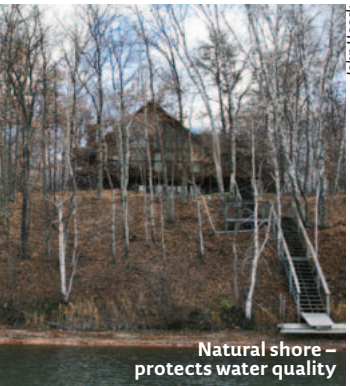
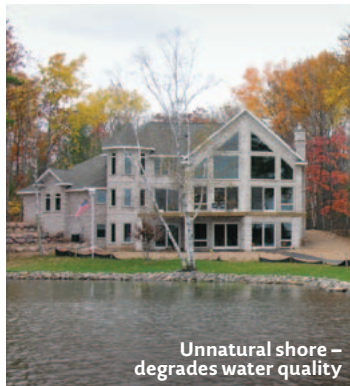
Today, carp and rusty crayfish are the only aquatic aliens known to be present in the entire river system. Other aliens like zebra mussels, sea lamprey and round goby coming from Lake Michigan have been limited to the lower river by the Clarks Mills dam. These aliens replace native species like emerald shiners, sculpin and northern clearwater crayfish.

Purple loosestrife, Eurasian water milfoil, phragmites and bush honeysuckle are alien plants that displace native plants important for food and cover for fish and wildlife.

## Take action in the watershed to help restore the Manitowoc River system

### Volunteer...

- Observe and record changes in a portion of a river or stream.
- Stencil "Dump No Waste - Drains to River" on city storm drains.
- Restore habitat and beauty to a portion of degraded riverbank by replacing invasive plants with native trees, shrubs, wildflowers and grasses. (You will need to follow county ordinances and may need a shoreline permit.)



### At home...

- Use lawn care practices that minimize the use of chemicals, especially phosphorus.
- Use lawn care practices that minimize runoff and maximize rainfall and snowmelt infiltration into the soil.
- Maintain or establish a buffer of natural vegetation, rather than mowed lawn, along the riverbank.
- Have your septic system inspected and pumped every three years by a certified septic installer to be sure it functions properly.
- Properly dispose of household hazardous waste (paint, drained oil, old herbicides, cleaning solutions, etc.). Watch for annual "Clean Sweep" announcements.

### On your farm...

- Reduce erosion with buffers, crop rotations, conservation tillage, no-till planting, cover crops and grassed waterways.
- Optimize yields and lower the phosphorus content in your soil to 25-40ppm with a soil test and nutrient management plan.
- Incorporate manure into the soil immediately upon application.
- Avoid applying manure during frozen or snow-covered conditions.
- Do not apply manure or chemicals near ditches, lakes, rivers, streams, sinkholes, bedrock fractures and wells.
- Build berms to divert water away from sinkholes, bedrock fractures and wells.
- Restore wetlands and woodlands.



### In town...

- Avoid dropping or pouring anything into storm drains.
- Encourage city officials to create stormwater management ordinances, programs and incentives.
- Encourage city, county and state officials to press for clean-up of contaminated sediments in the Manitowoc River.



**FOR MORE INFORMATION**

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

General information: 7 am-10pm, 7 days per week; 1-888-936-7463

Spill Hotline: 24 hours/day, 7 days/week; 1-800-943-0003

www.dnr.state.wi.us

Keywords: Wisconsin waters, rivers, Great Lakes, beach health, impaired waters, fish consumption advisories, runoff, forests, wetlands, dams, aquatic invasive species, natural areas, fish

COUNTY CONSERVATION DEPARTMENTS

Brown County: 920-391-4620 www.co.brown.wi.us

Calumet County: 920-849-1444 www.co.calumet.wi.us

Fond du Lac County: 920-923-3033 x 3 www.fdlco.wi.gov

Manitowoc County: 920-683-4183 www.manitowoc.wi.us

Soil erosion control and water protection information, technical assistance and cost sharing opportunities for farmers, rural landowners and homeowners with private wells

UNIVERSITY OF WISCONSIN - EXTENSION COUNTY OFFICES www.uwex.edu/ces

Brown County: 920-391-4610 Fond du Lac County: 920-929-3170

Calumet County: 920-849-1450 Manitowoc County: 920-683-4169

Information on drinking water and private wells, water resources, forestry, and earth-friendly yard care. Information and training for farmers, crop advisors and manure haulers.

WISCONSIN MARITIME MUSEUM 920-684-0218 X115 www.wisconsinmaritime.org (focus on Manitowoc River and Silver Creek)

WOODLAND DUNES NATURE CENTER 920-793-4007 www.woodlanddunes.com (focus on East and West Twin rivers)

BRILLION NATURE CENTER 920-756-3591 (e-mail) bnc@brillion.k12.wi.us (focus on groundwater and North Branch Manitowoc River)

LEDGE VIEW NATURE CENTER 920-849-7094 www.co.calumet.wi.us (focus on caves and groundwater)

Volunteer opportunities and educational programs.

# Explore the Manitowoc River System

## ► Seven rivers, one river system

The Manitowoc River gathers its momentum from the Branch River, North Branch Manitowoc River, South Branch Manitowoc River, Killsnake River, Mud Creek and Pine Creek, which drain lands in Brown, Calumet, Fond du Lac and Manitowoc counties. We refer to these rivers collectively as the Manitowoc River system. The Manitowoc River forms at the confluence of the North Branch Manitowoc River and South Branch Manitowoc River, near the Manitowoc/Calumet county line, and flows for 36 miles before entering Lake Michigan.



Manitowoc River

### Two sources of river water

Water in the Manitowoc River system is a mix of groundwater and surface runoff. During dry periods when river levels are low, water you see remaining in most rivers and streams is groundwater. Groundwater is rain or snowmelt that soaks into the ground and is stored between soil particles. It may seep into lakes, rivers and streams.

Rain and snowmelt that does not soak into the ground, but runs off the surface of the land, also contributes to the river system. **Surface runoff** results in increased water depths and flows after rainstorms and winter or spring thaws.

Some streams, like Mud Creek, are fed primarily by surface runoff. Others, like the Branch River, are fed by groundwater and surface runoff. Both sources can deliver pollutants to lakes, rivers and streams.



Branch River

### What is your watershed address?

The watershed, land that drains into the Manitowoc River system, covers 542 square miles or 346,880 acres. Check the map at left to see where you live or work within the watershed. If our addresses were based on watersheds rather than city and state, what would be your address?\*



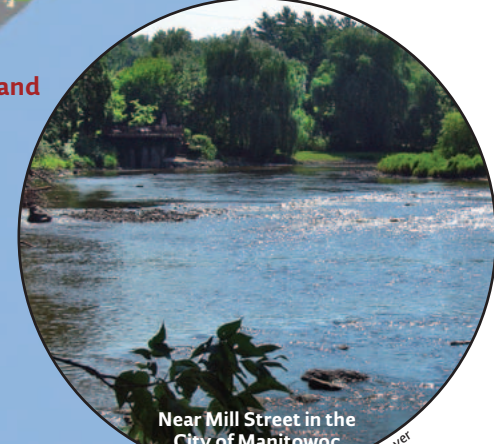
8th Street drawbridge in Manitowoc

### Boating and canoeing

The character of the river changes, depending on where you are:

**The urban stretch in the City of Manitowoc** is deep enough for large boats to access from Lake Michigan. Near the lake, you can motor under a drawbridge!

**From Clarks Mills to the City of Manitowoc**, the river is rocky, sometimes shallow and quick flowing, with a drop of 12 feet/mile. This stretch is floatable seasonally with a canoe or kayak in spring and sometimes during autumn.

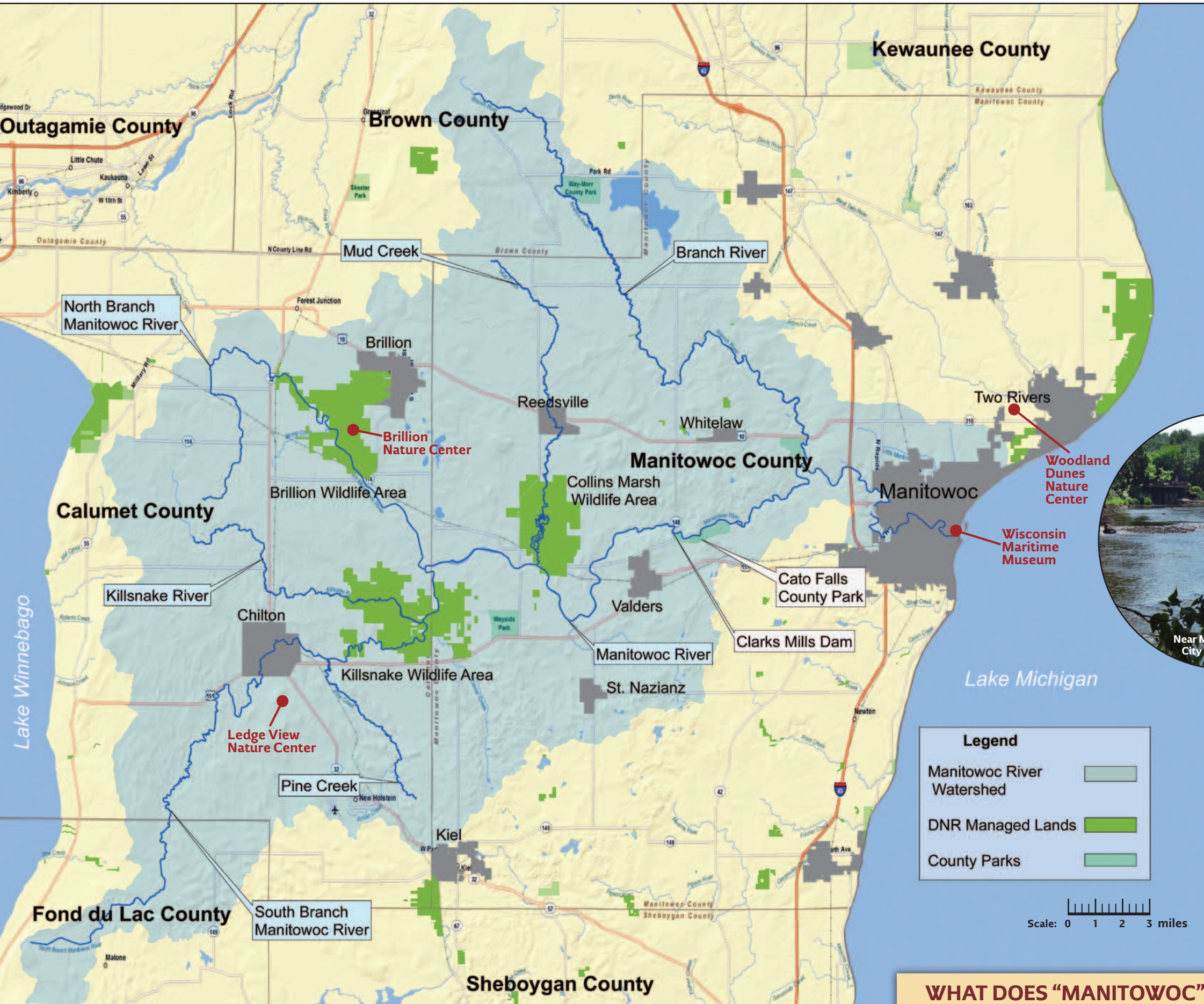


Near Mill Street in the City of Manitowoc

**Upstream from the dam at Clarks Mills**, the Manitowoc River is wide, sluggish, and marshy. It drops only 1 foot/mile in elevation, but can be paddled by canoe or kayak spring, summer, and fall most years. As you travel further up the watershed, the tributary rivers and streams get narrower and shallower, but most of them have sections that can be paddled in spring and during wet autumns.



Collins Marsh



**Legend**

- Manitowoc River Watershed
- DNR Managed Lands
- County Parks

Scale: 0 1 2 3 miles

\*Answer: [Your local river or stream], Manitowoc River System, Lake Michigan, Great Lakes, St. Lawrence River, Atlantic Ocean.

### WHAT DOES "MANITOWOC" MEAN?

Wisconsin Historical Society records show that "Manito" is a word native people here used for "spirit," or "mysterious influence." Hence this area may have been referred to as "spirit land," "spirit woods," "devil's den," etc. Manitowoc County takes its name from the river.

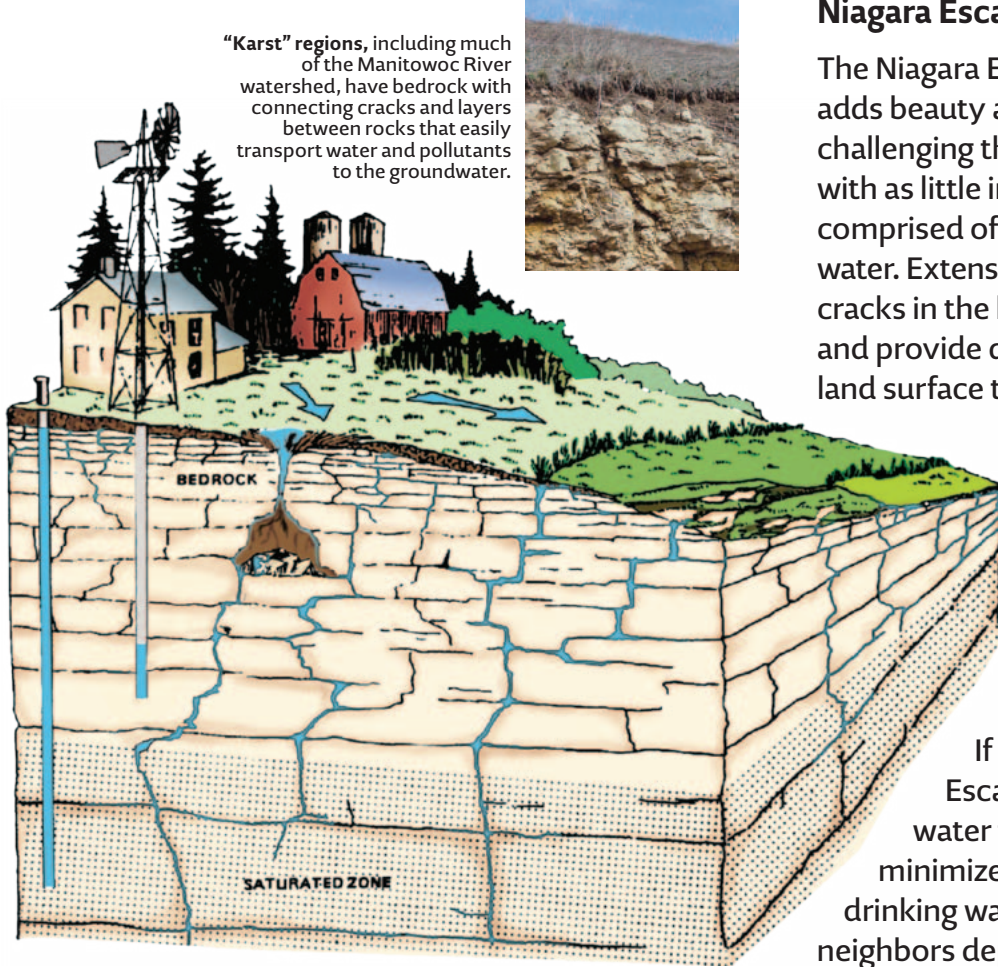
### Niagara Escarpment

The Niagara Escarpment is a limestone ridge that adds beauty and variety to the landscape, while challenging those who live and work here to do so with as little impact as possible. The escarpment is comprised of a limestone that can be dissolved by water. Extensive networks of vertical and horizontal cracks in the limestone are continuously forming and provide direct conduits for pollutants from the land surface to groundwater.

Water pumped by wells is groundwater. Residents in this watershed use groundwater for drinking, except those living in the City of Manitowoc.

### Protect the water you drink!

If you own property along the Niagara Escarpment, learn more about groundwater threats. Work with your neighbors to minimize impacts on groundwater – your drinking water. Your health and that of your neighbors depends on it!



"Karst" regions, including much of the Manitowoc River watershed, have bedrock with connecting cracks and layers between rocks that easily transport water and pollutants to the groundwater.



### Natural areas

Since the forest and wetland habitat in the Manitowoc River watershed has been dramatically altered through the years, natural areas like the Brillion Marsh, Collins Marsh, Killsnake Wildlife Area, VanderBloemen Bog, Cato Falls County Park, Schuette Park and Manitowoc City Park serve as important refuges for wildlife. Wildlife conservation efforts in the Manitowoc River watershed focus on restoring wetland, forest and grassland habitat on both public and private lands.



Wild turkey

### People and the river

Imagine the rich hunting and fishing opportunities that drew native people to this area prior to the 1800s... Imagine the Manitowoc River system as a transportation route before roads were built... Imagine life here in the mid-1800s and early 1900s when the forests were cut for building cities and

railroads, and farms were chiseled from the remaining barren land.

A sawmill built in 1837 by the Conroe family in Manitowoc Rapids and a ship-building company started by Joseph Edwards near the mouth of the Manitowoc River, were two of the first industries



Launching of passenger steamer Petoskey, Burger Boat Company.

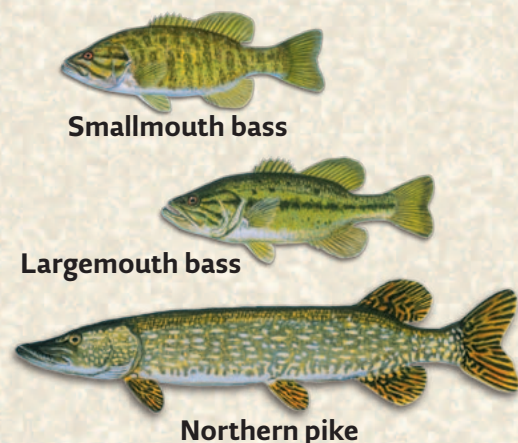
on the lower river. Over time, more than 23 shipyards would come and go in Manitowoc, with one, the Burger Boat Company, still working today. Schooners, yachts, minesweepers, self-unloading bulk freighters, tugboats, and diesel submarines are just a few of the ships whose crews navigated the lower Manitowoc River.

## ► The "fish story"

Fishing can improve with actions in the watershed that improve water quality and river habitat. The variety of fish species is declining in the Manitowoc River. A survey conducted in the 1980s documented the presence of 58 species. The survey catch was dominated by white sucker, central mudminnow and common shiners, but also included a variety of game fish, panfish and greater redhorse, a Wisconsin special concern fish.

Recently, only 35 species were captured in a survey. Smallmouth bass, largemouth bass and northern pike were not nearly as abundant as found in previous surveys. The lack of game fish

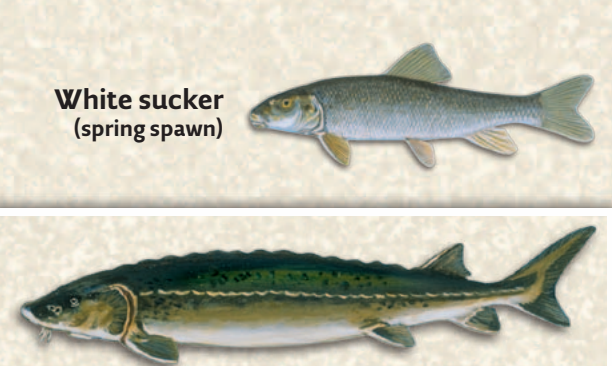
was very noticeable and is likely caused by low dissolved oxygen levels, the lack of pool and riffle habitat, low water levels, and episodes of poor water quality.



Although they are still the dominant game fish found in the Manitowoc River system, surveys indicate that populations of bass and pike are declining from poor water quality and loss of habitat.



The Manitowoc River and Branch River may have seasonal runs of trout and salmon. These fish were stocked in Lake Michigan for controlling alewives and for sport fishing.



### Will lake sturgeon return?

There is citizen interest in re-establishing native lake sturgeon to the lower stretch of the Manitowoc River, but water quality needs to improve. Too much sediment in the water smothers sturgeon eggs and reduces survival of young fish.