




## Choosing Management Strategies for Portage County Lakes

Once you've set goals for the condition of your lake through the lake management planning process, you'll want to choose the strategies most likely to help you achieve those goals. Each lake is unique in its physical characteristics, assemblage of living and non-living things, location on the landscape, and human uses. However, all lakes fall into certain categories or groups according to key characteristics. Choosing the proper management strategies for the type of lake you're trying to protect will mean the difference between the success or failure of your lake management efforts. Start with this list of "good housekeeping practices" that will benefit all lakes:

### Nutrients (including nitrogen and phosphorus) are a major source of lake water quality problems, so:

- ✔ Eliminate applications of fertilizer containing nitrogen or phosphorus, or limit them based on soil test results. (Beginning in 2010, application of lawn fertilizer containing phosphorus will be allowed only for new lawns or lawns shown to be phosphorus-poor.)
- ✔ Choose phosphorus-free automatic dishwasher detergent and other household cleaning products if your wastewater reenters the soil through a septic system.
- ✔ Don't wash your dog or yourself in the lake. Clean up and properly dispose of pet waste.
- ✔ Don't burn leaves near the lake or rake yard waste into the lake.
- ✔ Use natural vegetation, rain gardens, or landscaping to keep runoff out of the lake.
- ✔ If you are a farmer, request help from the Portage County Land Conservation Department to develop water quality-based best management practices for farmland that may impact the lake through surface runoff or groundwater inputs. These plans may include comprehensive farm planning, nutrient management planning, animal waste management planning, manure incorporation after spreading, and planting winter cover crops.
- ✔ Join other landowners and lake users to establish a water quality monitoring program for your lake.

### Fish and other aquatic life depend on natural vegetation near and on the lake's shore, so:

- ✔ Maintain a natural vegetation buffer, including grasses/forbs, shrubs, and trees, of at least 35 feet from the lake, as required by state and Portage County shoreland zoning ordinances. 
- ✔ Don't remove any more aquatic plants, logs, or brush than absolutely necessary for lake access and recreational activities in front of your property. Native aquatic plants help stop harmful aquatic invasive plants from becoming established. Follow state aquatic plant removal regulations and obtain permits when needed. 
- ✔ Learn to identify aquatic invasive plant species, watch for them near your property and public landings, and help stop their spread. Check with WDNR for aquatic invasive plant removal rules. 

### Septic systems do contribute nutrients and other chemicals to groundwater and lakes, even if they are working properly, so:

- ✔ Locate your drainfield as far from the lake shore as possible.
- ✔ Pump your septic tank at least once every three years.
- ✔ Consider installing an alternative or additional wastewater treatment system that can remove nitrogen and phosphorus, or explore community or other group wastewater treatment options.
- ✔ Use household chemicals sparingly, try to choose less harmful ("green") products, and be mindful

 Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

that chemicals put into a septic system could end up in the lake or your drinking water.

Lake water originates from precipitation, groundwater, runoff, and stream flow from the entire lake watershed, and each lake is different, so:

- ✓ Become familiar with your watershed and major water sources for your lake.
- ✓ Help educate and encourage others in the watershed to be good land managers to protect all sources of water to the lake. Create or join a lake district, homeowners' association, or other lake stewardship group.

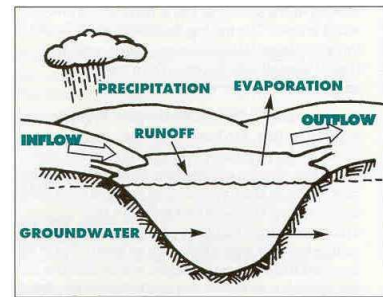
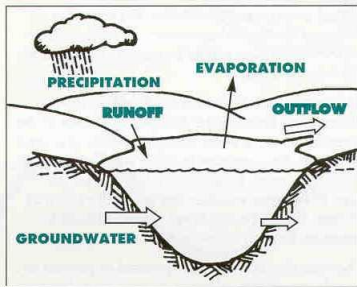
For more general lake protection practices, see the publication "Owning Waterfront Property – A Checklist" at [http://www.co.portage.wi.us/Planning&Zoning/PCL/Online\\_Informational\\_Materials/online\\_resources.htm](http://www.co.portage.wi.us/Planning&Zoning/PCL/Online_Informational_Materials/online_resources.htm).

## Portage County Lake Types

Lakes are divided into four main types – drainage lakes, groundwater drainage lakes, seepage lakes, and impoundments – depending on the sources of the water in them. Successful management strategies for each lake type need to target all the sources of the lake's water.

### Drainage lakes (Collins, Fountain, Spring, and Tree Lakes)

- receive much of their water from an inlet stream
- have a stream outlet that allows water to leave the lake
  - may have a dam to increase water depth

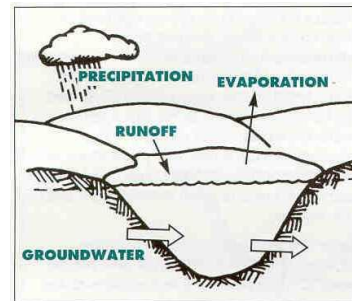


### Groundwater drainage lakes (Adams, Boelter, Ebert, Helen, Lions, and Rinehart Lakes)

- receive much of their water from groundwater
- have a stream outlet that allows water to leave the lake

### Seepage lakes (Bear, Becker, Emily, Jacqueline, Joanis, Lime, Onland, Pickerel, Severson, Skunk, South Twin, Sunset, Thomas, and Wolf Lakes)

- receive most of their water from groundwater, mainly at one end
- have an outlet only through groundwater, mainly at the opposite end
- retain water longer than other lake types.



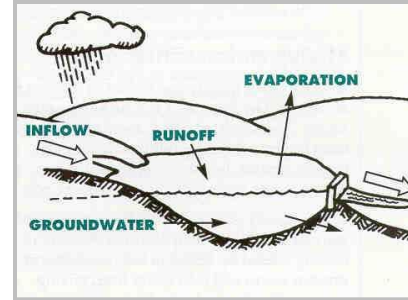
To protect and manage drainage, groundwater drainage, and seepage lakes, you must consider land uses in the surface water and groundwater watersheds and human activities on the water and shore.

Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

Each lake is unique in the proportion of water and contaminants it receives from these three sources. If you live in a groundwater inflow area on your lake, your personal practices that may affect groundwater are especially significant.

**Impoundments** (Amherst Millpond, Bently Pond, Jordan Pond, McDill Pond, Rosholt Millpond, and Springville Pond)

- are created by damming a stream
- receive most of their water from an inlet stream
- retain water for a shorter time than other lake types




To protect and manage an impoundment, you must consider land uses upstream. Shoreline activities are still important to water quality.

## Lake Morphometry

Some lakes are shallow and others are deep; some occur in flat terrain and others are nestled into hills; some are round “bowls” while others have complicated shorelines with many bays and wetlands. Deep lakes hold more water than shallow lakes of the same surface area, allowing more dilution of water contaminants and decreasing the chance of winter fish kills. Shallow lakes have more areas where sediment can be disturbed, but habitat is abundant in these fragile shallow water areas. All these factors are part of lake morphometry – the physical structure of a lake – and have effects on lake water quality and lake management strategies. Check which of these conditions apply to your lake.

Does your lake have areas less than 8 feet deep? These areas	
may have these problems	and may benefit from
sediment disturbance from boat motors	✔ no-wake speeds or electric motors only
wind disturbance of sediments	✔ moderate growth of aquatic plants to hold sediments in place
high density of aquatic plants	✔ strategies to improve recreational access ✔ tools from the phosphorus management toolbox
Shallow lakes may suffer from lack of dissolved oxygen in winter (see the Lake Water Chemistry section).	

Does your lake have a high percentage of its area more than 18 feet deep? Deep lakes	
may have these problems	and may benefit from
few aquatic plants; biomass dominated by algae; lack of oxygen at depth; release of phosphorus from sediments during low oxygen periods	✔ tools from the phosphorus management toolbox ✔ minimizing nearshore vegetation disturbance to provide habitat and protect water quality 
The two storied fisheries of deep lakes, which include trout and walleye in cool, deep waters as well as panfish and bass in shallow waters, require management to stay in balance.	

Is your lake a deep bowl protected from the wind? Lakes in deep bowls	
may have these problems	and may benefit from
runoff from steep shoreline areas	✔ houses being set back from steep slopes ✔ meandering, not direct, access to the lake ✔ vegetative buffers to prevent erosion along slopes

 Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

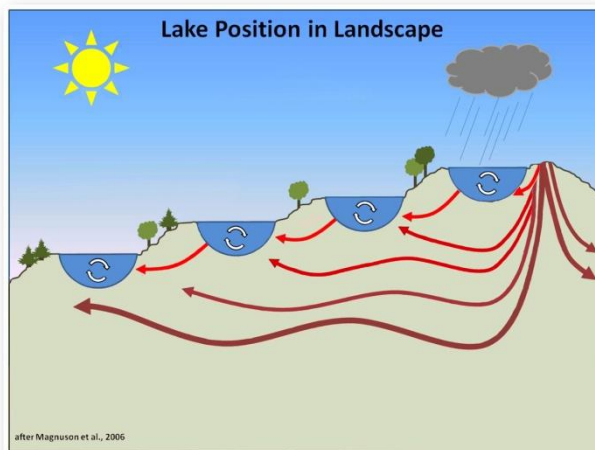
- ✓ shoreline buffers to intercept erosion and runoff
- ✓ additional tools from the runoff management toolbox

Is your lake a deep bowl protected from the wind (continued)? Lakes in deep bowls	
may have these problems	and may benefit from
lack of mixing and oxygenation	✓ monitoring dissolved oxygen concentrations and using mechanical aeration when necessary
Homes built on hills may have a greater depth of soil available to adsorb phosphorus from septic systems.	

Does your lake have wetlands along its shore? Lakes with adjacent wetlands	
may have these problems	and may benefit from
nutrient addition when water levels rise	✓ retaining natural wetland vegetation and minimizing nutrient flow to the wetlands
natural limit to residential growth and development	<ul style="list-style-type: none"> <li>✓ appropriate zoning ordinances to avoid developing wetland areas</li> <li>✓ maintaining vegetative buffers around wetlands</li> </ul>
wet soils and wetland vegetation in areas that people cross to access the lake	✓ avoiding wet areas or installing a boardwalk over them to reduce disturbance
Compared to lakes without wetlands, these lakes may have more water quality fluctuations and more diverse wildlife habitat.	

## Lake Water Levels and Lake Location in Watershed

Water levels are a very important subject to people who live on or use lakes. High water levels can flood property, septic systems, roads, and even homes. Low water levels can create smelly, unsightly strips of mud between the former shoreline and the new waterline, and can create difficulties in launching boats and doing other types of water recreation. Some lake fluctuations are natural, caused by seasonal changes in precipitation, evaporation, and groundwater discharge. Two Portage County lakes are home to an endangered plant (Fassett's locoweed) that has adapted to such water level fluctuations.




Natural lake level fluctuations are sometimes enhanced by human activities. Others are human-induced when water that would otherwise enter the lake is diverted to other uses. Still others are deliberately created by managing the flow of water through a dam.

Lake type plays a role in water levels; seepage lakes tend to experience large water level fluctuations. The closer your lake is to the watershed divide (the ridge that separates two watersheds), the more likely it is to naturally

Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication


experience large fluctuations in lake level. The illustration to the left shows that lakes farther from the top of the watershed receive more groundwater inputs; they may receive more surface water as well. Of lakes included in the 2003 Portage County study, those closest to, and most influenced by, the watershed divide are Bear, Boelter, Emily, Jacqueline, Pickerel, Skunk, South Twin, Sunset, Thomas, and Wolf Lakes. Check below for some actions you can take to manage lakes with water level fluctuations.


Does your lake experience natural water level fluctuations? Such lakes:	
may have these problems	and may benefit from
aquatic invasive plant species that become established on bare sediments or in shallower, warmer water	✔ looking for and removing aquatic invasive plants during low water periods. Check with WDNR for aquatic invasive plant removal rules 
damage to unique habitats by human use during low water periods	✔ establishing barriers to prevent vehicle access to the dry lake bed during low water periods
sensitivity to changes in groundwater recharge	✔ use of swales, rain gardens, and other management tools to encourage infiltration of rainwater and snowmelt
a large area less than 8 feet deep during some parts of the year	✔ no-wake speeds or electric-motor-only zoning
winter fish kills	✔ adding oxygen when necessary by mechanical aeration or by plowing snow off the lake surface to encourage plant growth
flooding of septic systems during high water periods	✔ as great a septic system setback from the lake as possible ✔ use of mound systems
shoreline erosion during high water periods	✔ maintaining native vegetation and unmowed/uncropped buffer strips near the water's edge
removal of woody material, leading to loss of potential habitat for fish during periods of high water	✔ leaving fallen trees, logs, or branches in place or adding them to the exposed lake bed during low water periods


Does your lake experience water level fluctuations because of water withdrawals in the watershed?
<b>In addition to the strategies above, such lakes may benefit from:</b>
✔ additional groundwater study to delineate groundwater inputs and outputs
✔ voluntary limitations on pumping or withdrawals by farmers, irrigators, municipalities, or other high-volume users
✔ introduction of suitably treated wastewater, clean snow, or clean water into the upper part of the watershed
✔ water conservation measures by users of the withdrawn water to minimize the amount withdrawn

## Lake Water Chemistry

Lake water chemistry affects the appearance of your lake as well as the types of plants and animals that survive and thrive in it. The natural water chemistry of your lake is influenced by its water source, soil and bedrock type, and location in its watershed. Some lakes in Portage County have hard water and experience marl formation, while others have soft water and are susceptible to acid rain. Lake water chemistry is also affected by human activities in the lake and land use practices on the shore and in the watershed. Check to see which water chemistry conditions occur on your lake.

 Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

 Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

Does your lake have hardness of more than 150 parts per million as CaCO <sub>3</sub> ? If so, marl may form. Marl lakes	
may have these problems	and may benefit from
high density of aquatic plants in shallow sediments	✔ strategies to improve recreational access
decreased water clarity caused by resuspension of marl by wind and boats	✔ slow no wake zones at water depths of less than 8 feet (Municipal rules may apply)
gradual filling with marl	✔ dredging to deepen parts of the lake. (Check with WDNR for permit requirements  )
These lakes usually have good water clarity because marl formation removes phosphorus that would otherwise be used by algae.	


Does your lake have water hardness of less than 90 parts per million as CaCO <sub>3</sub> ? These lakes	
may have these problems	and may benefit from
low calcium concentrations, leading to greater response by algae to phosphorus additions	✔ tools from the phosphorus management toolbox

Does your lake have water hardness of less than 25 parts per million as CaCO <sub>3</sub> ? Soft water lakes	
may have these problems	and may benefit from
higher mercury, aluminum, and zinc solubility when rainfall is acidic	✔ efforts at personal, regional, and national scales to reduce electricity use and fossil fuel consumption
These lakes usually are less productive than other lakes, but often have the most diverse aquatic macrophyte communities.	

Does your lake have dissolved oxygen concentrations less than 5 parts per million in the upper one-third of the water column during winter? These lakes	
may have these problems	and may benefit from
winter fish kills	✔ monitoring dissolved oxygen concentrations
	✔ adding oxygen when necessary by mechanical aeration or by plowing snow off the lake surface to encourage plant growth

Nitrogen and phosphorus, which are found in human and animal wastes and fertilizers, are the two major nutrients that can lead to excessive algae and rooted aquatic plant growth in Portage County lakes. All Portage County lakes have either sufficient or excessive nutrients for plant growth, so all lakes will benefit from limiting nutrient additions. However, when nitrogen and phosphorus reach certain concentrations, it is especially critical to act to prevent further water quality degradation.

To help lake residents, users, and planners understand the status of lakes relative to their phosphorus concentrations, WDNR has proposed a two-tiered set of numerical standards called “flag values” and “criteria values.” Reaching the “flag value” for phosphorus indicates that a lake needs attention to prevent phosphorus concentrations from rising further and degrading water quality. Reaching the “criteria value” means that phosphorus concentrations are likely to cause a variety of water quality problems and should be reduced. At this time, there are no “flag values” for nitrogen.

 Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication



**Do the inorganic forms of nitrogen in your lake exceed 0.3 parts per million (as N) in spring?  
Lakes with these high nitrogen loads**

<b>may have these problems</b>	<b>and will benefit from</b>
excessive nearshore aquatic plants and attached algae, and toxicity to some aquatic animals	<ul style="list-style-type: none"> <li>✔ eliminating nitrogen fertilizer applications by farmers and homeowners or limiting them based on soil test results</li> <li>✔ alternative or additional wastewater treatment systems designed to remove nitrogen</li> </ul>

**What is the total phosphorus (TP) concentration\* in your lake between June 1 and September 15?  
(\*defined as the average of at least three surface samples during the season)**

**Consult the following table**

**to compare this value to proposed flag and criteria values for your lake type:**

Lake Type	Total Phosphorus (parts per billion)	
	Flag Value	Criteria Value
Shallow – Drainage	28	40
Deep – Drainage	20	30
Deep – 2-Story Fishery	15	15
Shallow – Seepage	15	40
Deep – Seepage	15	20
Shallow – Impoundment	No flag value	40
Deep – Impoundment	No flag value	30

**Has your lake reached the proposed “flag value” for total phosphorus (TP)? Such lakes:**

**will benefit from**

- ✔ preventing phosphorus concentrations from increasing by implementing tools from the phosphorus toolbox
- ✔ establishing a water quality monitoring program

**Has your lake reached the proposed “criteria value” for total phosphorus (TP)? Such lakes:**

<b>may have these problems</b>	<b>and will benefit from</b>
excessive weeds and algae, including some algae that are toxic to animals winter fish kills, and poor aesthetics (green, turbid, smelly water)	<ul style="list-style-type: none"> <li>✔ reducing phosphorus concentrations by implementing tools from the phosphorus toolbox</li> <li>✔ conducting an in-depth study of lake management and rehabilitation alternatives to control internal and external nutrient loading.</li> <li>✔ establishing a water quality monitoring program</li> </ul>



### Phosphorus Management Toolbox

Implement one or more of the following tools to lower total phosphorus (TP) concentrations, or to keep concentrations from increasing:

- ✔ Eliminate phosphorus fertilizer use on your lawn or farm fields, or limit it based on soil test results. (Beginning in 2010, application of lawn fertilizer containing phosphorus will be allowed only for new lawns or lawns shown to be phosphorus-poor.)
- ✔ Don't burn leaves near the lake or rake yard waste into the lake.
- ✔ Implement agricultural best land management practices based on water quality.
- ✔ Install and maintain vegetative buffers, raingardens, and filter strips that cause stormwater to infiltrate and to limit runoff to the lake.
- ✔ Choose phosphorus-free automatic dishwasher detergent and other "green" household cleaning products if your wastewater reenters the soil through a septic system.
- ✔ Install alternative or additional wastewater treatment systems designed to remove phosphorus, or consider options for connection to a community or other group wastewater treatment system, especially in areas where groundwater discharges to the lake.
- ✔ Check the runoff management toolbox and protection tools in the lake management toolbox for more community-based actions and solutions.

### Aquatic Invasive Species

Aquatic invasive species are non-native plants, animals, and sometimes disease-causing organisms. They may displace native species, disrupt ecosystems, and harm recreational activities such as fishing and boating. Because they lack the predators and competitors they faced in their homelands, invasive species can spread rapidly and aggressively. Controlling invasive species is difficult, and getting rid of them is often impossible. People play a major role in spreading invasive species and can also help keep them from spreading.

#### Is your lake currently free of aquatic invasive species? Such lakes will benefit from:

- ✔ protecting and maintaining native plant and animal communities
- ✔ knowing how to identify invasive species and actively monitoring for them
- ✔ using signs, newsletters, or more active methods to educate boaters and anglers and to encourage them to clean boats and trailers before launch

#### Does your lake already have aquatic invasive species? Such lakes will benefit from:

- ✔ using the tools from the box above
- ✔ encouraging boaters and anglers to clean boats and trailers after use to prevent the spread of the invasive species to other lakes
- ✔ developing and following an aquatic plant management plan that contains and controls the invasive species



Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

## Lake and Watershed Management

Probably not surprisingly, the number of people who use a lake for recreation, live on a lake, or live in a lake's watershed has an influence on its water quality, as does the amount of agricultural land and types of land management practices in its watershed. Check which land use and development practices exist in your watershed.

Are there signs that your lake's ecosystem is out of its natural balance? Such lakes:	
may have these problems	and may benefit from
geese on shoreline	<ul style="list-style-type: none"> <li>✔ maintaining a natural vegetation buffer onshore; avoiding mowing or cropping to the water's edge</li> </ul>
eroding shorelines	<ul style="list-style-type: none"> <li>✔ vegetative buffers to prevent erosion on slopes</li> <li>✔ shoreline buffers to intercept erosion and runoff</li> <li>✔ other shoreline stabilization methods such as rock <sup>S</sup></li> <li>✔ maintaining in-lake aquatic plants to act as baffles and reduce the influence of waves</li> <li>✔ creating meanders rather than direct paths to the lake</li> </ul>
nuisance-level aquatic plant growth	<ul style="list-style-type: none"> <li>✔ creating an aquatic plant management plan</li> </ul>

Is your lake's fishery dependent on stocking? Such lakes:	
may have these problems	and may benefit from
lack of fish habitat	<ul style="list-style-type: none"> <li>✔ addition of woody material to the nearshore lake bottom</li> </ul>
lack of fish spawning areas or amphibian habitat	<ul style="list-style-type: none"> <li>✔ protection of native aquatic vegetation; avoid raking of the lake bottom or removal of vegetation</li> <li>✔ knowing critical habitat locations and actively protecting them from disturbance</li> </ul>
stunted fish, rough fish, dominance of non-game fish	<ul style="list-style-type: none"> <li>✔ catch and release fishing</li> <li>✔ consulting a WDNR or other professional fishery manager</li> </ul>

Are motorized watercraft used on your lake? Such lakes:	
may have these problems	and may benefit from
conflicts between uses	<ul style="list-style-type: none"> <li>✔ placing limits on motorized watercraft use by time of day, no-wake zones, and/or motor type</li> <li>✔ spatial/local boating ordinances to protect critical habitat</li> </ul>
lake sediment disturbances in shallow water during high-use periods, disturbance of plant beds and littoral vegetation, decreased water clarity	<ul style="list-style-type: none"> <li>✔ selecting a boat launch area and parking lot appropriate to the lake's carrying capacity and meeting WDNR standards for access</li> <li>✔ using no-wake speeds or zoning for electric motors only</li> <li>✔ protecting shallow water vegetation and natural materials that keep sediments in place</li> </ul>
increased risk of invasive species introduction	<ul style="list-style-type: none"> <li>✔ using signs or more active methods to educate boaters and anglers and to encourage them to clean boats and trailers before launch</li> <li>✔ monitoring areas near boat landings to identify and</li> </ul>

<sup>S</sup> Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

control aquatic invasive species that do get established	
Does your lake have a public park or boat landing? Such lakes:	
may have these problems	and may benefit from
increased nutrient runoff linked to vegetation disturbance	<ul style="list-style-type: none"> <li>✔ enhancing infiltration by use of native vegetation, including unmowed buffer strips</li> </ul>
water runoff from roofs, parking areas, and other paved, compacted, or impervious areas	<ul style="list-style-type: none"> <li>✔ directing runoff from these areas into a vegetated strip or rain garden away from the lake</li> </ul>
septic systems that experience heavy use	<ul style="list-style-type: none"> <li>✔ constructing these systems with as great a setback as feasible, on the soils that have the greatest capacity to adsorb nitrogen and phosphorus, and regularly inspecting, monitoring, and maintaining them</li> <li>✔ installing additional or alternative wastewater treatment systems that remove nitrogen and phosphorus, or exploring community or other group wastewater treatment options</li> <li>✔ installing water and energy-conserving plumbing fixtures and devices</li> </ul>

Does your lake currently have residential development on it, or is residential development likely in the future?, Such lakes:	
may have these problems	and will benefit from
nitrogen and phosphorus loading from fertilized lawns	<ul style="list-style-type: none"> <li>✔ eliminating fertilizer applications or limiting them based on soil test results</li> <li>✔ using natural buffers that include native vegetation between the lawn and the lake</li> <li>✔ minimizing amount of manicured lawn</li> <li>✔ using tools from the runoff toolbox</li> </ul>
nutrient loading from septic systems	<ul style="list-style-type: none"> <li>✔ using greater system setbacks from the lake whenever possible</li> <li>✔ encouraging or requiring the use of alternative or additional wastewater treatment systems that remove nutrients whenever systems are installed or replaced, or exploring community or other group wastewater treatment options</li> </ul>
destruction of shoreline vegetation and habitat	<ul style="list-style-type: none"> <li>✔ providing education for new landowners on keeping vegetated shorelines intact</li> <li>✔ restoring natural shoreline buffers and protecting critical habitat areas</li> </ul>
runoff that carries nutrients to the lake	<ul style="list-style-type: none"> <li>✔ using tools from the runoff toolbox</li> <li>✔ using protection tools from the lake management toolbox</li> </ul>

Does your lake's watershed have off-lake residential development, or is such development likely in the future? Such lakes may benefit from:
<ul style="list-style-type: none"> <li>✔ using tools from the runoff management tool box</li> </ul>



Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

- ✔ using protection tools from the lake management toolbox

Does your lake have agricultural land uses near the shore or in the watershed? Such lakes:	
may have these problems	and may benefit from
sediment and nutrient runoff inputs of nitrate or pesticides through groundwater increases in algae decreases in dissolved oxygen, and other water quality impacts	<ul style="list-style-type: none"> <li>✔ crops that require little nitrogen input</li> <li>✔ development and implementation of livestock grazing and manure spreading and storage plans and practices that protect water quality</li> <li>✔ vegetative filter strips along lakes, streams, and wetlands to limit runoff inputs and channelized flow to the lake</li> <li>✔ public support for county efforts to educate farmers and develop nutrient management plans based on water quality goals</li> <li>✔ public support for farmers who implement practices to protect water quality</li> </ul>

### Runoff Management Toolbox for Lake Watersheds

Implement one or more of the following tools to minimize the amount of surface runoff that carries nutrients and sediments to lakes:

- ✔ Implement road and building construction practices that meet Portage County erosion standards.
- ✔ Implement agricultural best land management practices to minimize runoff.
- ✔ Use the local zoning ordinance to limit impervious surfaces that create runoff.
- ✔ Install and maintain vegetative buffers and filter strips that cause stormwater to infiltrate and to limit runoff to the lake.
- ✔ Use stormwater management practices, which may include rain gardens, streets without curb and gutter, and retention basins.

### Protection Tools in the Lake Management Toolbox

Implement one or more of the following tools to manage land to protect lakes:

Use legal tools, including:

- ✔ Zoning that limits potentially damaging land uses and implements the overall density provided for in the land use plan.
- ✔ Overlay zoning that identifies special protections beyond those in the basic zoning ordinance, including shoreland setbacks, impervious surface limits, shoreland buffers, and mitigation measures.
- ✔ Zoning standards adjusted for specific lakes or groups of lakes with similar physical characteristics.
- ✔ Subdivision ordinances.

Use voluntary tools, including:

- ✔ Purchase of development rights that permanently protect landscapes while retaining private ownership.
- ✔ Conservation easements to restrict development or uses of land.
- ✔ Purchase of land by state and local governments or not-for-profit organizations.
- ✔ Conservation design which modifies subdivision ordinances to require protection of open space.



Check Wisconsin Department of Natural Resources (WDNR) regulations at

<http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

## For Additional Information

---

Many publications are available on the Portage County Lakes page of the Portage County website. Go to [www.co.portage.wi.us](http://www.co.portage.wi.us), choose Portage County Lakes from the County Information drop-down menu, and choose “Learn More about Lakes” from the Portage County Lakes main page.

Other information and resources are available at the Wisconsin Department of Natural Resources Lakes website ([www.dnr.state.wi.us/lakes/](http://www.dnr.state.wi.us/lakes/)) and the University of Wisconsin –Extension Lakes Partnership website ([www.uwsp.edu/cnr/uwexlakes/](http://www.uwsp.edu/cnr/uwexlakes/))

### Lake Management and State Lake Rules

Buzz (Patrick) Sorge, Program and Planning Analyst  
Wisconsin Department of Natural Resources  
1300 W Clairemont Avenue  
Eau Claire WI 54701  
Phone 715-839-3794, Fax 715-839-6076  
[patrick.sorge@wisconsin.gov](mailto:patrick.sorge@wisconsin.gov)

### Aquatic Plants and Aquatic Invasive Species

Scott Provost, Water Resources Management Specialist  
Wisconsin Department of Natural Resources  
473 Griffith Avenue  
Wisconsin Rapids WI 54494  
Phone 715-421-7881, Fax 920-787-2477  
[Scott.Provost@wisconsin.gov](mailto:Scott.Provost@wisconsin.gov)

### Fisheries

Tom Meronek, Fisheries Biologist  
Wisconsin Department of Natural Resources  
5301 Rib Mountain Drive  
Wausau WI 54401  
Phone 715-359-7582  
[thomas.meronek@wisconsin.gov](mailto:thomas.meronek@wisconsin.gov)

### Agricultural Best Management Practices

Steve Bradley, County Conservationist  
Portage County Land Conservation  
1462 Strongs Avenue  
Stevens Point, WI 54481  
Phone 715-346-1334, Fax 715-346-1677  
[Bradleys@co.portage.wi.us](mailto:Bradleys@co.portage.wi.us)

### Lake Management

Nancy Turyk, Water Resource Scientist  
Center for Watershed Science and Education  
University of Wisconsin-Stevens Point  
800 Reserve St, TNR 216  
Stevens Point WI 54481  
Phone 715-346-4155, Fax 715-346-3624  
[nturyk@uwsp.edu](mailto:nturyk@uwsp.edu)

### Shorelands and Land Use

Lynn Markham, Shoreland and Land Use Specialist  
Center for Land Use Education  
University of Wisconsin-Stevens Point  
800 Reserve Street  
Stevens Point, WI 54481  
Phone 715-346-3879, Fax 715-346-4038  
[lmarkham@uwsp.edu](mailto:lmarkham@uwsp.edu)

### Portage County Plants

Dr. Robert Freckmann  
Robert W. Freckmann Herbarium  
University of Wisconsin-Stevens Point  
800 Reserve Street, TNR 310  
Stevens Point, WI 54481  
Phone 715 346-2637  
[rfreckma@uwsp.edu](mailto:rfreckma@uwsp.edu)

### Portage County Shoreland Zoning

Steve Brazzale  
Portage County Planning and Zoning  
1462 Strongs Avenue  
Stevens Point, WI 54481  
Phone 715-346-1334, Fax 715-346-1677  
[Brazzals@co.portage.wi.us](mailto:Brazzals@co.portage.wi.us)

This publication was produced through a Wisconsin Department of Natural Resources Lake Management grant to Portage County, WI by the team of Dr. Byron Shaw, Nancy Turyk, Jen McNelly, Buzz Sorge, and Chris Mechenich  
Center for Watershed Science and Education  
College of Natural Resources  
University of Wisconsin-Stevens Point  
Stevens Point, WI 54481



Check Wisconsin Department of Natural Resources (WDNR) regulations at <http://dnr.wi.gov/org/water/fhp/waterway/>, or contact a resource person from page 12 of this publication

