Updates on the Wisconsin River TMDL and water quality improvement efforts.

Water quality efforts underway

There is a major effort underway to improve water quality in the Wisconsin River Basin. The framework for this effort is a Total Maximum Daily Load (TMDL), which is the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. A waterway that exceeds water quality standards is often no longer suitable for its designated uses, such as wildlife habitat, fishing, or other recreational activities.

A TMDL requires several years of monitoring data to determine where the pollutants are coming from. This data is then combined with computer models to determine how reductions can be made fairly and in the most cost-effective way possible. Wisconsin has a number of TMDLs that are either in the development phase or have already been completed and are in the process of being implemented. The Wisconsin River TMDL is currently under development and scheduled to be finalized in 2017.

Through this newsletter, the Wisconsin River TMDL team is working to communicate progress on the different stages of TMDL development and invite public feedback. This quarterly newsletter also highlights information, tools and resources available to help with conservation efforts in the state.


Photo credit: Jean Unmuth

Subscribe to receive email updates about the Wisconsin River TMDL.

Created by Susan Sandford - Wisconsin Department of Natural Resources Bureau of Water Quality

IN THIS ISSUE

5th Annual Wisconsin River Symposium

Join us on March 19 for the fifth Annual Wisconsin River Water Quality Improvement Symposium: *Making Connections for Clean Water*

Page 2

Monitoring water quality in the Wisconsin River Basin

One of the most comprehensive watershed monitoring efforts ever undertaken in the state of Wisconsin!

Page 3

Forming watershed partnerships to achieve water quality goals

DNR is providing opportunities for technical stakeholder input and fostering partnerships with agricultural groups within the watershed.

Page 9

Tools and Resources

Tools and resources available to help with conservation efforts.

Page 10

5th Annual Wisconsin River Water Quality Improvement Symposium

Making Connections for Clean Water

March 19, 2015
University of Wisconsin – Stevens Point
Dreyfus University Center

The Wisconsin River Symposium provides updates on the Wisconsin River Basin Clean Waterways Project, a water quality monitoring effort designed to improve conditions in the Wisconsin River, and is a collaborative effort between many partners including UW-Stevens Point and Wisconsin Department of Natural Resources. This year's symposium, themed ***Making Connections for Clean Water***, will bring together representatives from municipalities, industry, agriculture, government, nonprofits, academia and citizen organizations to discuss water quality improvement efforts in the Wisconsin River basin, talk about overcoming challenges by building partnerships, present creative solutions that inspire action and allow for attendees to learn from and network with one another.

2015 Sessions:

- Keynote: Finding Common Ground: 25th Anniversary of the Lower Wisconsin Riverway. Mark Cupp, Director, Lower Wisconsin Riverway Board
- Wisconsin River Total Maximum Daily Load (TMDL) Updates and Timeline
- Understanding Wisconsin River Basin Reservoirs: An overview of phosphorus, habitat, algae, fish and AIS
- Wisconsin River Basin Modeling: Status Update and Technological Innovations used in Water Quality Modeling
- Adaptive Management and Phosphorus Trading: partnerships and compliance options
- Understanding our next step - TMDL implementation: Learning from successes in the Red Cedar River watershed

> "This event brings together agriculture, industry, citizens and government. It presents an opportunity to discuss possible solutions that will improve water quality in the Wisconsin River. Working together, sharing ideas, will result in improved water quality for future generations."
>
> **Rick Georgeson**
> President
> Petenwell and Castle Rock Stewards

Register Now! [exit DNR]

$30 early bird registration before February 27

For more information about the symposium or sponsorship opportunities, visit the **2015 Symposium webpage**. [exit DNR]

Symposium organizers:

Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

UW Extension
University of Wisconsin-Extension

Wisconsin Dept. of Natural Resources

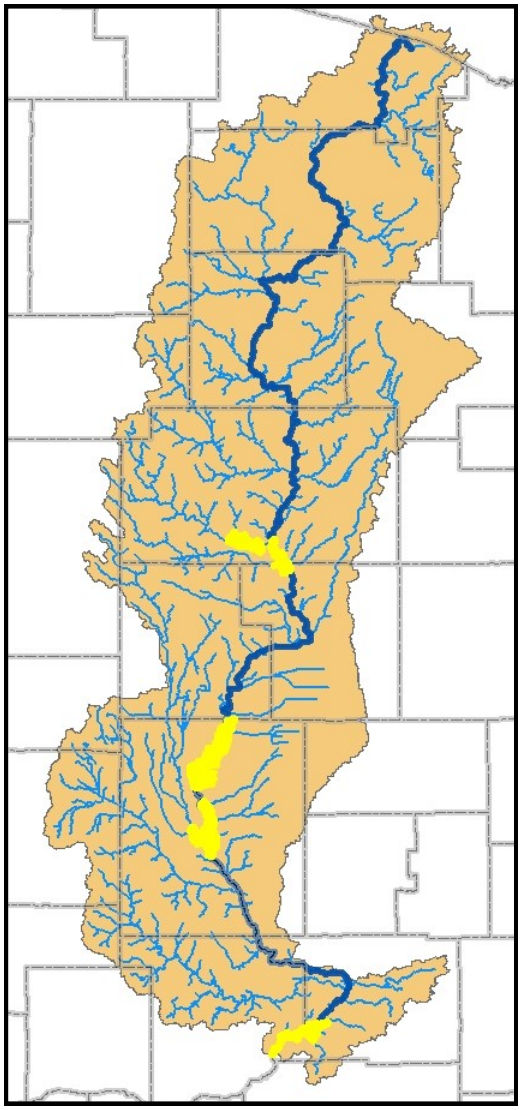
River Alliance of Wisconsin

PACRS

Monitoring Water Quality in the Wisconsin River Basin

In December of 2013, DNR wrapped up work on one of the most comprehensive watershed monitoring efforts ever undertaken in the state - four years of flow and water quality monitoring in the rivers, streams and lakes of the Wisconsin River basin. The purpose of this comprehensive, long-term, large-scale monitoring effort was to gain a better understanding of water quality conditions within the basin. This monitoring was the first step in an ongoing, basin-wide effort to reduce the amount of phosphorus in Wisconsin River basin waterways, thereby reducing the frequency and severity of toxic blue green algae blooms and improving aquatic habitat and recreational opportunities.

The framework for this basin-wide water quality improvement effort is the development of a *Total Maximum Daily Load* (TMDL). A TMDL is the maximum amount of a pollutant that a body of water can receive and still achieve water quality standards. Through monitoring and computer modeling, we can use the TMDL process to determine how much phosphorus needs to be reduced in order to achieve water quality standards, and how to achieve the needed phosphorus reductions.



The Wisconsin River TMDL study area

The Wisconsin River TMDL study area spans Wisconsin's central corridor from the headwaters in Vilas County to Lake Wisconsin in Columbia County, covering 9,156 square miles - approximately 15 percent of the state. The hydrologic network within the basin (or watershed) includes the *main stem* of the river, smaller rivers and streams called *tributaries* that flow into the main stem of the river and impounded waters, called *reservoirs*.

Tributary	The rivers and streams that flow into the Wisconsin River are called **tributaries**.
River Main Stem	The **main stem** of the Wisconsin River is the large river channel that originates in the forests of Vilas County in northern Wisconsin, flows south across the glacial plain of central Wisconsin, then west starting near Portage, until it joins the Mississippi just south of Prairie du Chien.
Reservoir	A **reservoir** is a man-made impounded lake, created by damming a flowing river or stream. There are many reservoirs in the Wisconsin River basin. Five major reservoirs were monitored as part of the Wisconsin River TMDL project, including Big Eau Pleine, Lake DuBay, Petenwell, Castle Rock and Lake Wisconsin.
Watershed	A **watershed** is the area of land that drains to a specific stream, river or lake. Watersheds exist at different scales. For example, each Wisconsin River tributary stream has its own smaller watershed. These tributary watersheds, together with the lands that drain directly to the Wisconsin River, collectively comprise the Wisconsin River watershed.

What type of data was collected?

In addition to measuring the amount of phosphorus, there are other constituents that help us understand the dynamics and states of water. These measurements are described in detail below:

Data collected	How the data was collected	What the data is used for
Water Chemistry: Suspended solids Phosphorus Nitrogen Chlorophyll	• Semi-monthly water samples at or near stream flow stations throughout the year. • Semi-monthly samples at reservoir stations mid-April through September.	• Calculate concentrations in the water and the loads coming into the main stem from tributaries.
Stream flow	• USGS gaging stations, storage reservoir outlets and hydropower dams.	• Determine the water flow into the reservoir and the associated nutrient loads. • Understand how reservoirs respond to nutrient loads under various flow conditions.
Field Parameters: Dissolved oxygen Temperature Transparency Conductivity pH	• Field measurements taken in conjunction with water chemistry sample. • Vertical profiles in reservoirs. • Continuous monitoring at selected sites.	• Document the prevailing conditions under which the samples were collected. • Determination of hydrodynamic mixing patterns (the movement of water) in reservoirs.
Algae (species identification and bio-volume)	• Semi-monthly samples at reservoir stations mid-April through September.	• Understand the relationship between algae growth and nutrient loads in reservoirs. • Understand the composition of blue green algae blooms.

Sampling in all seasons

Water quality monitoring is not a fair-weather endeavor! Throughout the four years of data collection, monitoring was conducted regardless of conditions - rain or shine, ice or snow, flood or drought. As a result, monitoring staff frequently had to use specialized equipment and procedures to complete the necessary work. This constant dedication and effort over the four year monitoring period has provided DNR with one of the most robust and comprehensive datasets ever collected in support of TMDL development.

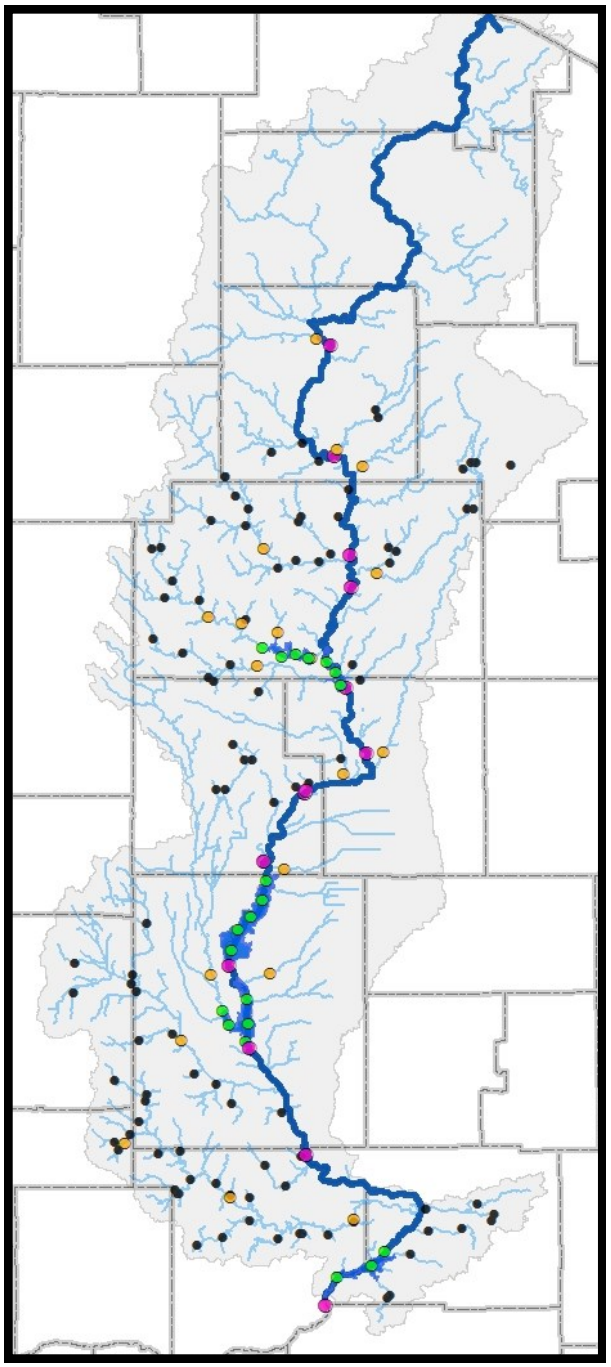
Photo credits: James Brodzeller

Drilling through ice

Sampling during flooding

The **Wisconsin River TMDL monitoring strategy** design was developed by Pat Oldenburg, WDNR Eau Claire. The majority of the monitoring was completed by James Brodzeller (UW Stevens Point) through a contract with WDNR.

Monitoring Locations



The four years (2009-2013) of Wisconsin River basin monitoring data included main stem, tributary and reservoir monitoring sites, as described below and shown on the map to the right.

● ***Main stem of the river:*** Water flow, phosphorus concentration and other water quality constituents, such as nitrogen and suspended solids, were measured year round at thirteen sites along the main stem of the river, providing information about how much phosphorus is carried from north to south by the main stem. Water flow was measured either at 15 minute intervals or hourly, and water quality constituents were measured every 2 weeks. Field parameters such as temperature, dissolved oxygen, pH, transparency and conductivity were similarly measured concurrently with other water quality constituents. Continuous temperature data was collected at the Nekoosa, Petenwell, and Castle Rock dams and on Tenmile Creek, Big Roche a Cri Creek, and the Yellow River.

● ***Tributaries:*** As on the main stem sites, water flow, phosphorus, other water quality constituents and field parameters were measured year round at 19 sites on tributaries flowing into the main stem of the river, providing information about how much phosphorus each tributary watershed contributes to the main stem of the river.

● ***Reservoirs:*** Chlorophyll, phosphorus, other water quality constituents and field parameters were measured twice a month from April – October at 20 sites on the five major reservoirs. Additionally, hourly flow data at the Petenwell and Castle Rock dams was provided by the Wisconsin River Power Company. At the reservoir sites, field parameters were measured in profile, at one-meter depth intervals from the waters surface to the bottom of the lake. Thermistor strings were placed at multiple sites on Castle Rock and Petenwell to continuously monitor changes in thermal mixing of the reservoirs over the course of the summer. Algae samples were collected at multiple sites to identify the major algal species present as well as estimate the amount of algae present.

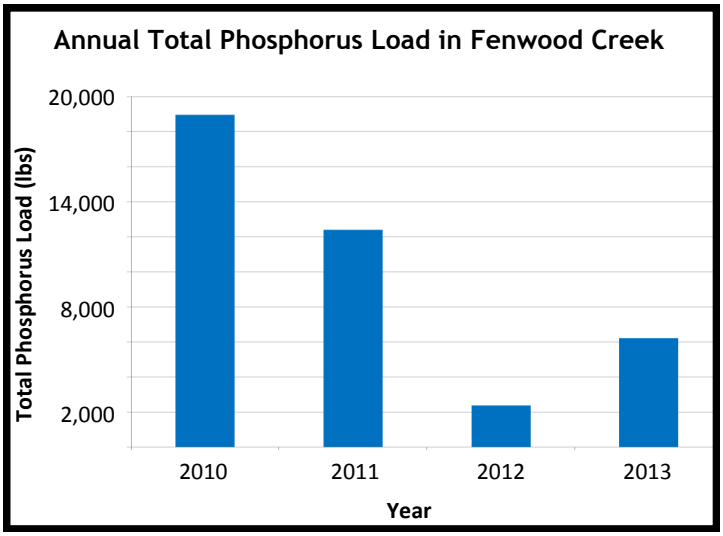
● ***Additional Phosphorus Evaluation Sites:*** Phosphorus concentrations were measured monthly at 98 additional sites between May and October 2012, in order to provide an additional validation dataset independent from the main stem, tributary and reservoir monitoring sites described above.

Sediment P Release: The phosphorus concentration in sediment, and phosphorus release rates from sediment under various conditions, was measured in multiple locations on four of the five major reservoirs. These same measurements will be made at the fifth reservoir, Lake DuBay, in 2015.

How is monitoring data used?

Monitoring data helps create a picture of what is happening in the basin waterways, which in turn helps us understand what is happening in each of watersheds draining to these waterways and how much pollution is washing off the land . The data also helps us understand how our waterways respond to pollution, in particular the frequency and severity of blue green algae blooms. Through this understanding of the system, we can then create a replication of the system with computer models, use the models to tell us how much pollution needs to be reduced for waterways to be healthy and develop an effective strategy for improving them and keeping them healthy. Within the context of the TMDL, computer models use monitoring data to predict how changes within the watershed impact water quality. This information is then used in the TMDL to develop strategies for achieving water quality improvements.

Why was it necessary to monitor for four years?



Annual and seasonal variation in rainfall and other climate variables have a huge impact on the amount of water flow in streams and rivers, as well as the amount of phosphorus carried in runoff from land into waterways. The graph on the right shows the annual amount of phosphorus that flowed into Fenwood Creek, a tributary to the Big Eau Pleine Reservoir, during the four year monitoring period. This figure shows there was a significant difference between amount of phosphorus in the creek during an extremely wet year (2010) and an extremely dry year (2012). Short-term monitoring would not have captured this natural variability, and would have provided a limited understanding of waterway conditions, skewed towards the dry represented during the monitoring period. Collecting four years of monitoring expands our understanding of the system to encompass the natural range of seasonal and annual climate variation. From this expanded understanding we can determine an average and typical range of water quality conditions.

What do the monitoring results tell us?

The monitoring results (shown on page 7 and 8) allow us to see the average total phosphorus concentration at each monitoring location. Phosphorus is essential to plant growth, which is why people apply it to their gardens and agricultural fields. However, if too much phosphorus washes off the land and into water bodies, it can cause nuisance aquatic plant and algae growth which can harm fish and aquatic life, decrease recreational opportunities and create health risks for people and pets. Wisconsin has a state wide phosphorus criteria that sets the maximum allowable phosphorus concentration in Wisconsin waters. A water body that exceeds the maximum allowable concentration is referred to as "impaired" and is no longer suitable for its designated uses, such as wildlife habitat, fishing or other recreational activities.


Algae on Lake Petenwell
Photo credit: James Brodzeller

Each type of water body has a different amount of phosphorus allowed under the criteria before it is considered "impaired." These amounts are:

- Rivers 100 µg/L
- Streams 75 µg/L
- Reservoirs 30 -40 µg/L

Calculating an average total phosphorus concentration indicates which sites are exceeding their phosphorus criteria and helps DNR determine how much phosphorus needs to be reduced upstream in order to meet water quality goals at each monitoring site.

What does 100 µg/L of phosphorus look like?

At its maximum capacity, Lake Petenwell can hold around 161 billion gallons of water. If a lake of that volume had a concentration of 100 µg/L of phosphorus, it would be equal to about 6.7 dump trucks of phosphorus in the water.

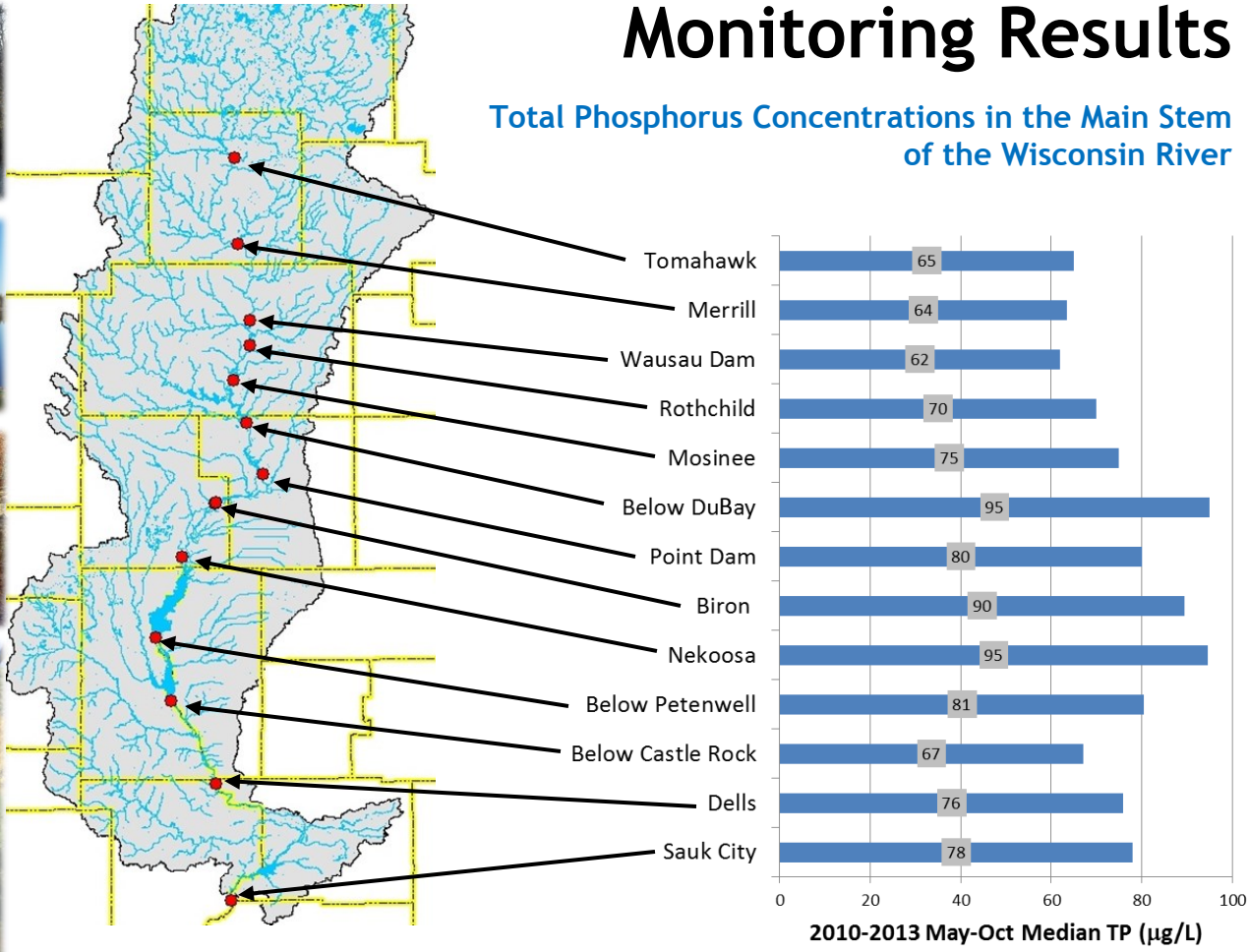
How much algae could that produce?

One pound of phosphorus can produce up to 300 to 500 pounds of algae.* This means that 6.7 dump trucks (134,600 pounds) of phosphorus could potentially produce up to 67 million pounds of algae.

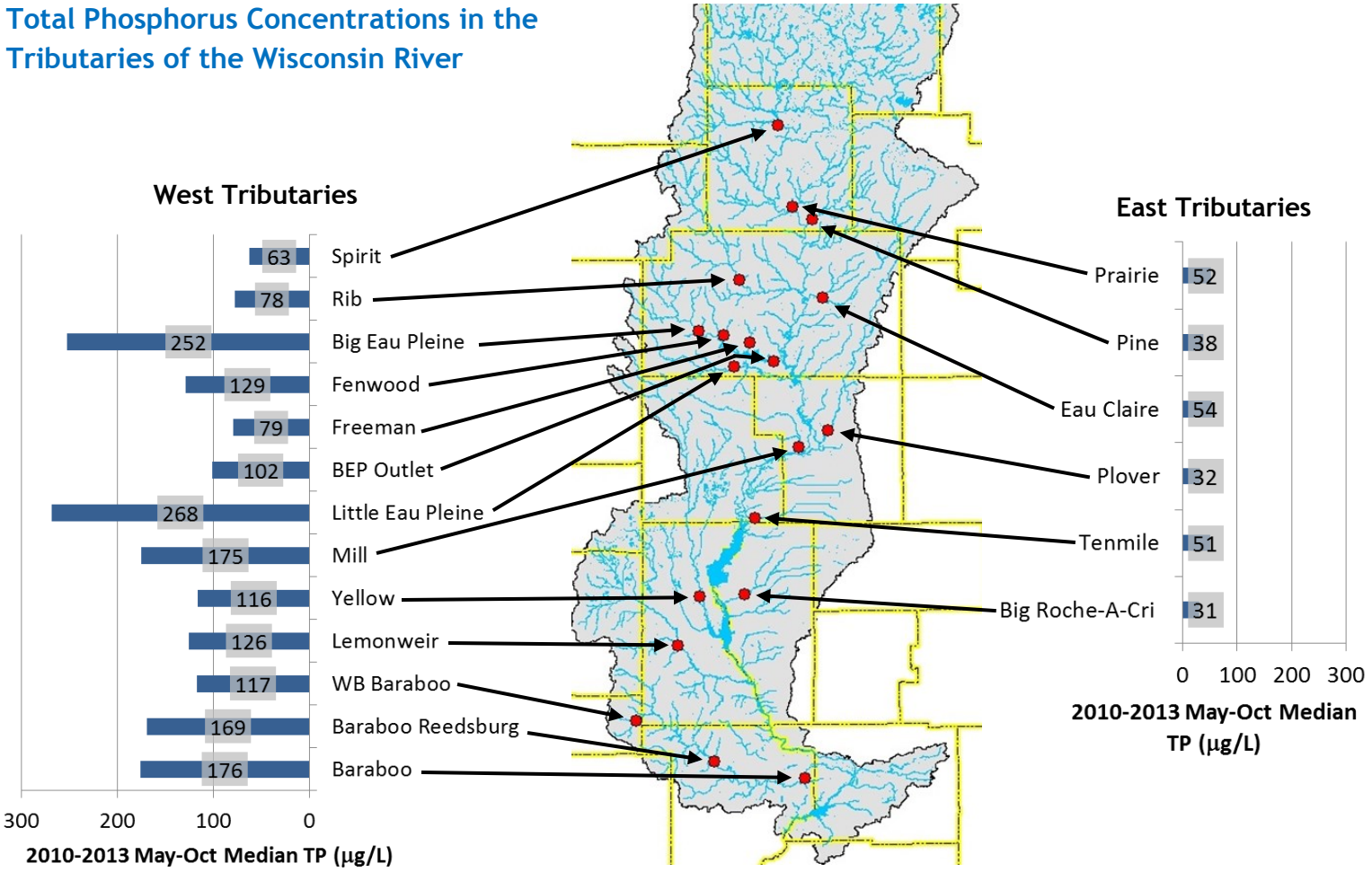
*http://www.cleanwatermn.org/app_themes/cleanwater/pdfs/forTeachers/Algae.pdf [exit DNR]

Monitoring Results

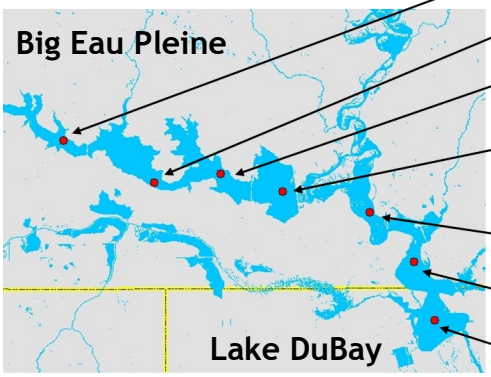
Total Phosphorus Concentrations in the Main Stem of the Wisconsin River

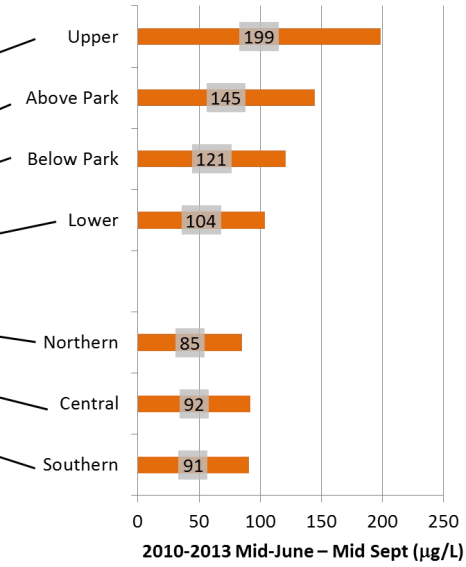


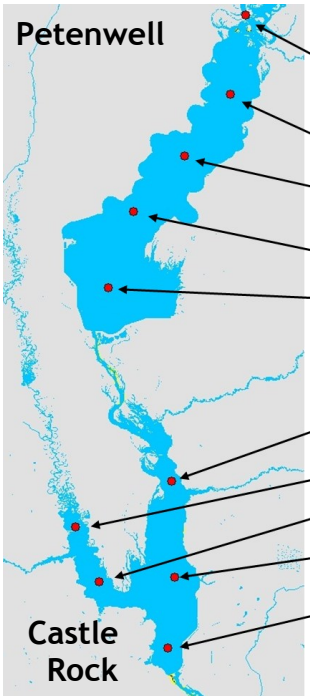
Total Phosphorus Concentrations in the Tributaries of the Wisconsin River

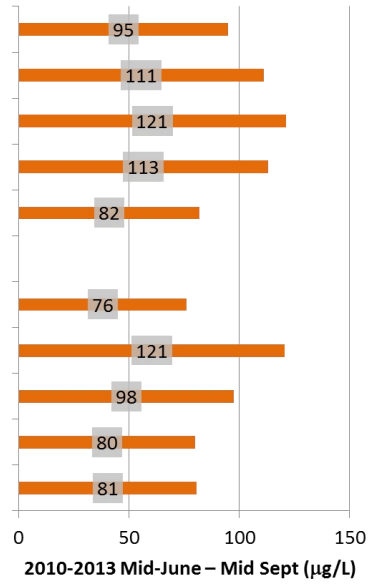


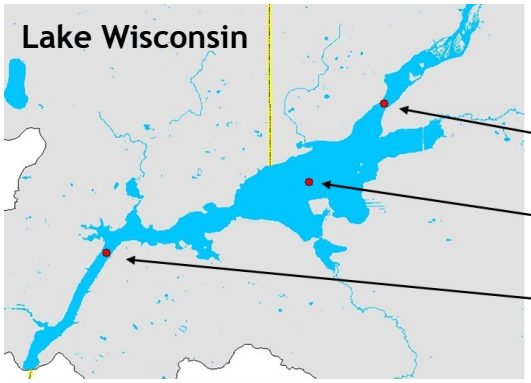
Total Phosphorus Concentrations in the Major Reservoirs

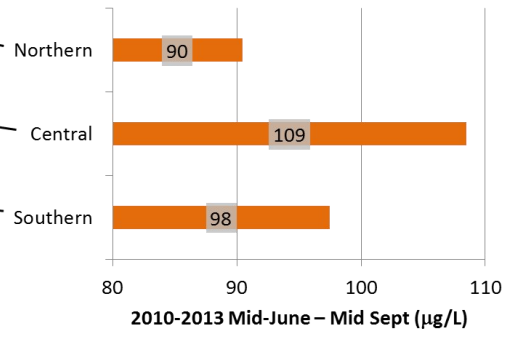












The phosphorus criteria for reservoirs (30-40 µg/L) is much lower than for rivers and streams because water stays in a reservoir much longer than it does in a river or a stream. This longer **residence time** means that water quality impairments and algae blooms can occur at much lower phosphorus concentrations than in faster moving water.

Forming Watershed Partnerships to Achieve Water Quality Goals

Fostering agricultural partnerships in the Wisconsin River basin

On January 21, representatives from county land conservation departments, University of Wisconsin Extension, certified crop advisors, and other local organizations met with DNR staff to discuss the important role of agricultural partnerships in efforts to improve water quality in the Wisconsin River basin. Workshop participants learned how TMDLs in other watersheds have shifted conservation priorities, heard about phosphorus control efforts that are already in progress in the Wisconsin River Basin, and shared ideas about how to continue collaborating within the watershed to achieve water quality goals.

Workshop participants included representatives from 14 counties, three crop consulting firms, Wisconsin Land and Water Conservation Association, River Alliance of Wisconsin, Golden Sands RC&D, North Central Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources.

As a result of this basin wide collaborative workshop, future regional workshops will be organized that will engage a wider variety of citizens and groups to discuss conservation priorities, training needs, and ways to partner together to ensure effective TMDL implementation and achieve water quality goals.

Providing opportunities for technical stakeholder input into TMDL model development

DNR is currently providing opportunities for technical stakeholder input into the development of Wisconsin River TMDL models. A number of stakeholders in the basin have requested the opportunity to access and comment on TMDL models concurrently with their development. In response to these requests, DNR has developed a process for technical input intended to provide equal access to all interested technical stakeholders. For information on how to access these models, contact dnrwisconsinrivertmdl@wisconsin.gov.

An outline of the plan and estimated schedule for technical stakeholder input is available on the Wisconsin River TMDL website (click on "Opportunities for technical input (11/14) [PDF]" near the bottom left of the page).

Tools and Resources

This section highlights tools and resources available to help with conservation efforts

DNR Grant Opportunities

The Wisconsin DNR has a number of grant opportunities throughout the year to help achieve water quality improvements.

Lake Protection Grants

Deadline: February 1

Lake protection grants assist local governments, lake associations, nonprofit conservation associations and other qualified applicants with the implementation of lake protection and restoration projects that protect or improve water quality, habitat or the elements of lake ecosystems. **Find out more!**

Targeted Runoff Management (TRM) Grants

Deadline: April 15

These grants provide funding to help control nonpoint source pollution by reimbursing costs for agriculture or urban runoff management practices in targeted, critical geographic areas with surface water or groundwater quality concerns. Check out **page 11** [exit DNR] of the 2012 Land and Water Conservation Report to read about how TRM grant funds were used in Pierce County to improve manure management and protect water quality and fish habitat. **Find out more!**

Urban Nonpoint Source and Storm Water Management Grants

Deadline: April 15

These grants provide funding for local governments to help control nonpoint source pollution by reimbursing costs from planning or construction projects that control urban nonpoint source and storm water runoff pollution . **Find out more!**

DNR Grants Reducing Nutrient Loads in the Wisconsin River Basin

Golden Sands Resource Conservation and Development Council, a nonprofit organization that works to enhance Central Wisconsin's economy and natural resources, received a lake protection grant to improve the Mill Creek watershed (a tributary to the Wisconsin River). Under the grant, the group is working with a variety of farmers in the area that want to explore rotational grazing. Rotational grazing divides a pasture into different paddocks where animals graze in controlled rotations, using some paddocks for grazing and allowing others to rest and regrow. Spreading out the impact of grazing and allowing fields to regenerate helps keep soil in place. Switching from conventional farming to a managed grazing system also means that fields normally planted in row crops are converted to permanent pasture. This makes the fields much less vulnerable to sediment runoff, reducing the soil loss rate from 3-6 tons/acre/year to around 0.5 tons/acre/year.

Photo credits: Golden Sands RC&D

Using the grant funding, the council has hired Bob Brant as a grazing consultant. Bob has been a dairy farmer for 40 years and a certified grazing planner since 2006. He has helped over 250 farmers incorporate managed grazing into their operations and, through the council, is currently providing one-on-one farm visits, grazing system planning, educational opportunities and technical assistance in the Mill Creek watershed. Dairy farmers and livestock producers in Central Wisconsin are showing increasing interest in managed grazing practices, partially due to the potential increases in farm profitability from this type of system. Having free access to a grazing specialist can help them get the information and technical assistance they need in order to make the switch to a managed grazing system. The result is less sediment and nutrient runoff from farmland, resulting in healthier soils for farmers, lower nutrient loads in the Wisconsin River basin and better water quality for all water users.

Marathon County Awarded Grant for Nine Key Element Plan Development

The EPA has identified nine key elements of watershed plans that are critical for achieving improvements in water quality. They recommend that these nine key elements be included in watershed plans that intend to address water quality and require that all nine elements be included in watershed plans that receive Clean Water Act section 319 funding. Marathon County recently received funding from the DNR to develop a nine-key element plan for the Fenwood Creek watershed located in the west central part of the county. Fenwook Creek feeds into Big Eau Pleine River, a tributary to the Wisconsin River with one of the highest nutrient loads. Once Marathon county has an approved nine-key element plan, they can use it to apply for funding for water quality improvement projects.

Find out more about the Nine Key Elements from the EPA [exit DNR]

Training Sessions: Modeling and Analysis Tools for Nonpoint Source Implementation

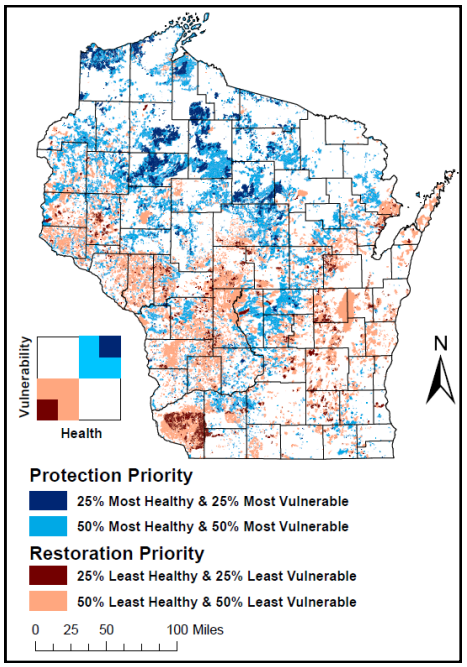
The Wisconsin Department of Natural Resources is currently in the process of offering training sessions on Modeling & Analysis Tools for Nonpoint Source Implementation. Seven sessions will be held around the state between January 20 and February 25, 2015. During the sessions, participants will learn about the various models that are available to assist with nonpoint source implementation planning, evaluation, and reporting. Sessions give in depth details about DNR's EVAAL model, EPA's STEPL [exit DNR] model, DNR's Healthy Watersheds Assessment tool and use of DNR's online spatial data viewers. During the day, participants will learn what is needed for input to those models, where to get it and model parameter selection. Learning to use these models and analysis tools will help them in their work to prioritize conservation efforts throughout the state of Wisconsin.

Remaining training dates and locations:

- February 11—West Bend, WI
- February 18—Stevens Point, WI
- February 19—Ashland, WI
- February 25—Richland Center, WI

If you would like more information about these sessions or would like to attend, email theresa.nelson@wisconsin.gov

> We are seeing an incredible level of interest in these training sessions. The feedback we have received so far has been very positive – even folks skeptical of modeling have come out with a greater understanding of how models can be useful and how they can be applied to aid in conservation planning.
>
> **Theresa Nelson**
> Modeling Engineer—WDNR



Healthy Watersheds Assessment

Wisconsin River Basin Clean Waterways Project
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