



Yahara Watershed, Wisconsin

Madison Metropolitan Sewerage District Adaptive Management Plan

Overview

Wisconsin adopted revisions to its phosphorus water quality standards in 2010, which included maximum phosphorus thresholds for surface waters of the state. The Phosphorus Rule also included a provision for a new regulatory compliance strategy for phosphorus called the watershed adaptive management option in [section NR 217.18 of the Wisconsin Administrative Code](#). This option was intended to provide point and nonpoint sources a collaborative, watershed-based approach to reduce phosphorus loads to meet water quality criteria in an economical manner.

In 2011, EPA approved the Rock River Basin Total Maximum Daily Loads (TMDLs) for phosphorus and total suspended solids (TSS). The TMDLs established wasteload allocations for point source dischargers throughout the basin, including the Madison Metropolitan Sewerage District (MMSD), which operates a municipal wastewater treatment facility in the Yahara watershed within the Rock River Basin. After determining that the cost of installing traditional treatment technologies would be extremely expensive and benefit only a limited portion of the watershed, MMSD initiated an adaptive management pilot project to test on a small scale within the Six Mile Creek subwatershed an option that allows individual Wisconsin Pollutant Discharge Elimination System (WPDES) permittees to collaborate with nonpoint source and agricultural partners to achieve compliance with the TMDL wasteload allocations (see text box).

Watershed

Yahara watershed, Wisconsin

Key Water Quality Concerns

Total Phosphorus

Stakeholder Involvement Techniques

- Technical stakeholder involvement from beginning of the pilot project
- Watershed-scale stakeholder involvement for plan development and full-scale implementation
- Shared knowledge, data, and resources

Case Study Issues of Interest

Type of Point Sources



Publicly Owned Treatment Works Discharges



Industrial Process Wastewater Discharges

Type of Watershed-Based Permit or Approach



Coordinated Individual Permits

Highlighted Approach(es)



Implementation of Total Maximum Daily Loads or Other Watershed Pollutant Reduction Goals



Coordinated Watershed Monitoring

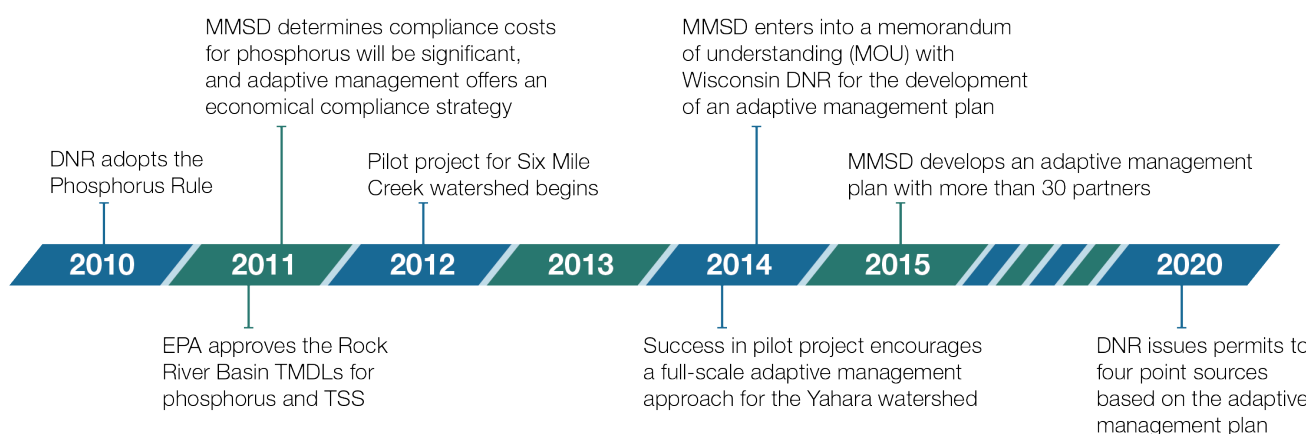
In 2017, MMSD developed an adaptive management plan and entered into an intergovernmental agreement with three other point source dischargers in the Yahara watershed: the City of Stoughton, the Village of Oregon, and the Wisconsin Department of Natural Resources' (DNR's) Nevin Fish Hatchery. See this [case study](#) for an overview of the Rock River Basin TMDL coordinated individual permits.

What is adaptive management?

Adaptive management is a collaborative, watershed-based approach that allows landowners, municipalities, and counties within a watershed to work together to meet phosphorus water quality criteria in the most economically efficient manner. Through this approach, the point sources monitor the watershed for water quality improvement and work with other phosphorus sources to adapt management practices as needed to reduce in-stream concentrations and achieve the water quality criteria.

This case study focuses on MMSD's adaptive management plan and coordinated watershed-approach to complying with the wasteload allocations in the TMDLs.

Milestones



Background

In December 2010, Wisconsin DNR adopted revisions to administrative rules to address water quality impairments related to phosphorus discharges to state waters. These revisions, collectively referred to as the Phosphorus Rule, 1) created maximum phosphorus thresholds for surface waters, 2) set procedures for implementing the new standards in WPDES permits, and 3) tightened agricultural performance standards.

For more information on Wisconsin's Phosphorus Rule, implementation strategies, and legislation, visit Wisconsin DNR's website: <https://dnr.wisconsin.gov/topic/Wastewater/Phosphorus>.

The Phosphorus Rule allows WPDES permittees to use multiple implementation strategies to achieve compliance with the phosphorus water quality standards, including:

- Treatment technology upgrades and optimization to phosphorus limits at end-of-pipe;
- Adaptive management;
- Water quality trading;
- Multi-discharger water quality standard variance for phosphorus;
- Individual water quality standard variance;
- Selecting the most appropriate compliance strategy during the planning phase; and
- Discontinued direct discharges of phosphorus.

In September 2011, EPA approved TMDLs for the Rock River Basin, including the Yahara watershed, to address water quality impairments caused by phosphorus and TSS. The TMDLs established wasteload allocations for phosphorus and TSS for all major source categories. After reviewing the approved TMDL requirements for phosphorus, MMSD determined that they would need filtration technology at their treatment facility to meet their wasteload allocations, with an estimated life cycle cost ranging from \$78 million to \$124 million. Instead of proceeding with the treatment upgrades, MMSD decided to pursue the adaptive management option to achieve the required reductions at a lower cost, while also maximizing environmental benefits in the watershed.

Permit Strategy

MMSD began a preliminary evaluation of the adaptive management compliance strategy for phosphorus in 2011. In 2012, more than 30 municipal partners and other stakeholders joined MMSD to begin a four-year adaptive management pilot project known as the Yahara Watershed Improvement Network (Yahara WINS). The goals of Yahara WINS were to evaluate the cost, performance, and ability to implement phosphorus control practices (with a primary focus on agricultural control practices); gauge the level of support for a full-scale adaptive management project; and establish a baseline water quality monitoring program while also evaluating water quality impacts.

In December 2014, MMSD and Wisconsin DNR entered an MOU outlining the standards and procedures for implementing the adaptive management project in the Yahara watershed. The MOU provided procedures for quantifying phosphorus and TSS reductions, measuring interim progress toward meeting reduction goals, providing reduction credits for state-funded nonpoint reductions, and determining compliance at the end of the adaptive management period. The pilot project participants operated under the MOU and provided approximately \$3 million in funding for the pilot project. Project participants ultimately determined the project was a success, and in 2014 implemented Yahara WINS as a full-scale adaptive management project for the entire Yahara watershed.

Yahara WINS is a network of community partners, led by MMSD, collaborating on a 20-year adaptive management strategy in which all sources of phosphorus in the Yahara watershed work together to reduce phosphorus. Partners in Yahara WINS include cities, villages, towns, county agencies, wastewater treatment plants, agricultural producers, and environmental groups. More information on Yahara WINS is available at: <https://yaharawins.org/>.

Permit Highlights

MMSD Adaptive Management Plan

MMSD began working with stakeholders, including the agricultural sector, to develop an adaptive management plan for the Yahara watershed in 2015. The plan was written to be consistent with the adaptive management eligibility requirements outlined in section NR 217.18 of the Wisconsin Administrative Code and Wisconsin DNR requirements, which include the nine elements listed below.

Required Element	Description
Identify partners	Potential partners can include other point sources, county land and water conservation departments, local municipalities, funding partners, Wisconsin DNR, and others.
Describe the watershed and set load reduction goals	Describe the adaptive management action area, including the counties in the watershed, available water quality data, number of reaches, hydraulic retention time, etc.
Conduct a watershed inventory	Gather current and historic land use and water quality data to identify potential opportunities for reductions in the watershed.
Identify where reductions will occur	Create an “action area” map with the location of the facility and locations where proposed reduction strategies and monitoring will occur.
Describe management measures	Identify strategies for reducing phosphorus with installation and maintenance activities.
Estimate load reductions expected from strategies	Employ models to estimate expected phosphorus load reductions.
Measure success	Collect effluent and in-stream samples. Using the monitoring results with modeling, show the expected water quality improvements and best management practice (BMP) effectiveness.
Demonstrate financial security	Show how project costs will be funded. Costs may include installation, maintenance, monitoring of BMPs, outreach, and education.
Provide an implementation schedule and milestones	Provide a detailed implementation schedule for the permit; annual reporting to Wisconsin DNR is required.

The final adaptive management plan, completed in January 2017, outlined a 20-year implementation period for participants to meet the phosphorus and TSS wasteload allocations specified in the TMDLs. Targeted phosphorus reductions were adjusted to account for entities that chose not to participate in the adaptive management strategy.

In 2016, MMSD entered into an intergovernmental agreement with three other point source dischargers—the City of Stoughton, the Village of Oregon, and Nevin Fish Hatchery—to implement the adaptive management approach to address phosphorus requirements in their WPDES permits. The intergovernmental agreement also includes the 22 satellite communities within the MMSD service area, which pay into Yahara WINS based on the amount of phosphorus they contribute.

Permit Components

Requirements of the adaptive management plan are incorporated into the individual WPDES permits for MMSD, the City of Stoughton, the Village of Oregon, and Nevin Fish Hatchery as required by section NR 217.18 of the Wisconsin Administrative Code. These requirements include interim effluent limits, compliance schedules, monitoring requirements, and annual reporting requirements.

Effluent Limitations

The Phosphorus Rule requires permits for facilities implementing adaptive management to include an adaptive management interim limit for phosphorus that is achievable through facility optimization or modest treatment technology upgrades. The interim limit may extend through up to four permit

cycles, after which a final limit becomes effective. The final limit may be set equal to the adaptive management interim limit if the receiving water has achieved the applicable water quality criteria.

The individual WPDES permits for MMSD, the City of Stoughton, the Village of Oregon, and Nevin Fish Hatchery each include a monthly average limit based on state technology standards and a six-month average interim limit based on section NR 217.18(3)(e) of the Wisconsin Administrative Code or past performance, whichever is lower.

Facility	Monthly Average Phosphorus Limit	6-Month Average Interim Phosphorus Limit
MMSD	1.0 mg/L	0.6 mg/L
City of Stoughton	1.0 mg/L	0.6 mg/L
Village of Oregon	1.0 mg/L	0.6 mg/L
Nevin Fish Hatchery	1.0 mg/L	0.076 mg/L

The interim limit established is based on the number of permit terms that have passed since implementation of the approved adaptive management plan, with the interim limit becoming more stringent in the second permit term. Compliance with the final limit is required by the third permit term unless the permittee submits either:

- A watershed adaptive management plan and a completed Watershed Adaptive Management Request Form 3200-139;
- An application for water quality trading;
- An application for a variance; or
- New information or additional data that supports a recalculation of the numeric limitation.

In addition, Wisconsin DNR must modify, revoke and reissue, or reissue the permit to incorporate a revised limitation before the expiration of the compliance schedule.

Load Reduction Requirements

The adaptive management plan identifies required annual phosphorus load reductions by TMDL stream reach. The percent reduction requirements by permit term are presented below:

Permit Term 1	Permit Term 2	Permit Term 3	Permit Term 4
40%	65%	90%	100%

Since the permits issued in 2020 are the first since implementation of the plan, they require a 40 percent total phosphorus load reduction within the Yahara River action area from the combination of all four point sources. The load reduction goal is identified as 5,329 pounds of phosphorus per year from the contributing point sources. Individual phosphorus load reduction goals are also included in each permit. If the load reduction goal is not met by March 31, 2025, the watershed adaptive management option may not be available to the participating permittees upon permit reissuance, or alternatively, Wisconsin DNR may request modifications to the adaptive management plan as a condition of permit reissuance.

Monitoring and Reporting Requirements

Each permittee is required to conduct effluent monitoring for phosphorus to determine compliance with their concentration-based effluent limitations. Individual permittees are also required to calculate

and report the daily mass discharge of phosphorus in pounds per day to determine compliance with the individual and combined phosphorus load reduction goals. As stated previously, if the individual or combined phosphorus load reduction goals are not reached by the end of the permit term, the permittee may no longer be allowed to use the adaptive management option, or Wisconsin DNR may request changes to the adaptive management plan.

The permittees must submit effluent monitoring results with their monthly discharge monitoring reports. MMSD is also required to submit surface water samples as identified in section 3.2.2 of the MMSD permit, and must submit the results as part of the annual reports on the implementation of the adaptive management plan. Watershed adaptive management option reports are due annually by July 31. Funding responsibilities related to monitoring efforts conducted through the adaptive management plan are determined based on permittees' individual phosphorus load reduction requirements. Cost allocations are calculated by multiplying the total adaptive management project cost by the fraction of total pounds of required project reduction needed for each permittee to meet its TMDL load allocation.

Special Conditions

Adaptive Management Reopener Clause

Wisconsin DNR may terminate the adaptive management option for any permittee through permit modification or at permit reissuance and require compliance with a phosphorus effluent limitation calculated under the Phosphorus Rule, or the TMDL wasteload allocation for any of the following reasons:

- Failure to implement the adaptive management actions in accordance with the approved adaptive management plan and compliance schedule established in the permit;
- New information becomes available that changes Wisconsin DNR's determinations;
- Circumstances beyond the permittee's control have made compliance with the applicable phosphorus criteria pursuant to the plan's goals and measures infeasible; and/or
- A determination by Wisconsin DNR that reductions have not been sufficient to timely reduce the amount of total phosphorus to meet the criteria.

Permit Effectiveness

Environmental Benefits

In its first year of full-scale implementation, Yahara WINS reduced the phosphorus load to surface waters in the watershed by 40,000 pounds. Completed or projected phosphorus reductions documented by Yahara WINS partners and landowners have increased each year since full-scale implementation of adaptive management. In 2020, the fourth year of full-scale implementation, more than 61,000 pounds of phosphorus were prevented from being discharged to surface waters. Wisconsin DNR also identified several benefits of implementing agricultural practices to achieve the phosphorus reductions, including:

- Keeping nitrogen and other pollutants out of waterways.
- Carbon sequestration.
- Avoiding energy-intensive filtration process.
- Improving habitat.

Benefits to the Permittee

The adaptive management strategy has allowed collaboration and cooperation among permittees and stakeholders in the Yahara watershed. This approach has also provided the permittees with a cost-effective alternative to achieving permit compliance as opposed to treatment upgrades. While 30-year compliance cost estimates projected that facility upgrades would cost \$224 million annually, the adaptive management approach was estimated to cost only \$24 million over the same time frame. As of 2021, a total of 23 cities, towns, villages, point sources, and others have entered into an intergovernmental agreement through Yahara WINS to collaboratively meet phosphorus numeric water quality criteria and TSS narrative standards.

Benefits to the Permitting Authority

The development and implementation of the MMSD adaptive management plan has allowed for a more streamlined and efficient permitting process for Wisconsin DNR. The Phosphorus Rule outlines the adaptive management option requirements, while the plan incorporates these requirements and informs the permitting process for participants with individual WPDES permits.

Lessons Learned

Matthew Claucherty of Wisconsin DNR shared his lessons learned from implementing the adaptive management approach to address phosphorus through the coordinated individual permits.

According to Mr. Claucherty, incorporating watershed work into a WPDES permit can be challenging because wastewater rules, at both the state and federal level, tend to assume brick and mortar upgrades will be used to comply with standards. The durational aspect for permitting a 20-year watershed effort exacerbated this challenge. While the challenges were unavoidable to some degree, he found that close coordination between permittees, Wisconsin DNR, and EPA helped Wisconsin DNR avoid any major pitfalls. However, he acknowledged that additional communication could have smoothed the process even more.

Mr. Claucherty believes that watersheds dominated by agricultural land use would lend themselves well to the watershed-based permitting approach used in the Yahara watershed. It is helpful if local stakeholder groups are available to form partnerships. Yahara WINS is an excellent example of this, because many stakeholder groups are interested in improving the quality of Madison-area lakes. Other adaptive management projects in Wisconsin may look different for a number of reasons. The presence or absence of a TMDL for phosphorus or TSS is a big factor that leads to differences in adaptive management plan content and scope of implementation.

Resources

Clean Wisconsin. 2013. *A Guide to the Adaptive Management Option for Phosphorus in Wisconsin*.

Madison Metropolitan Sewerage District (MMSD). January 2017. *Madison Metropolitan Sewerage District Adaptive Management Plan*.

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Wisconsin Administrative Code. WAC NR 217.18: Watershed Adaptive Management Option. Amended November 2010. https://docs.legis.wisconsin.gov/code/admin_code/nr/200/217/iii/18.

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Wisconsin DNR. June 2020. *Adaptive Management Technical Handbook: A Guidance Document for Stakeholders* (Guidance Number: 3400-2020-11).

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Wisconsin DNR. No date. *Rock River TMDL*.

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Yahara WINS. No date. Official website. <https://yaharawins.org/>.

Permitting Authority Point of Contact:

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Pollutants of Concern in Watershed:

Total phosphorus and total suspended solids (TSS)

Permit Issued:

May 1, 2020