



Wisconsin's Nutrient Reduction Strategy 2015 — 2016

Implementation Progress

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The original Nutrient Reduction Strategy (2013) was developed by the Department of Natural Resources with contractual assistance from the University of Wisconsin – Extension. This Implementation Progress document follows the original with detailed information on progress achieved since the publication of the original work. Substantial input from DNR staff and individuals in federal, state and local agencies was provided both for the original and this Implementation Progress Report. To keep the document to a reasonable size, programs and activities are not described in detail. For more information, the reader is encouraged to go to websites identified in the text.

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Wisconsin's Nutrient Reduction Strategy 2015-16

Implementation Progress

June 2017

Introduction

In November 2013, Wisconsin Department of Natural Resources issued “Wisconsin’s Nutrient Reduction Strategy” on behalf of state, federal and local agencies in Wisconsin that are involved in managing phosphorus and nitrogen losses to water. Wisconsin, like all states in the Mississippi River basin, had agreed to develop and implement a nutrient reduction strategy to address its contribution to Gulf of Mexico hypoxia (consistent with the ***Gulf of Mexico Hypoxia Action Plan 2008***). However, Wisconsin’s main objective in minimizing nutrient losses to water is to improve lakes, rivers, streams and groundwater within the state. Like other states in the Mississippi River basin,

implementation of the Nutrient Reduction Strategy is occurring mainly through existing programs that have catalyzed municipalities, farmers, landowners, technical assistance providers and concerned citizens to collaborate in addressing water quality problems in their own watersheds. The actions implemented to address local nutrient-related water quality impairments are also effective in reducing nutrient losses to the Mississippi River.

This report is a compendium of nutrient reduction activities in 2015 and 2016 that represent progress in implementing Wisconsin’s Nutrient Reduction Strategy.

Executive Summary

There is substantial statewide implementation of actions to reduce nutrient losses to water. Implementation is occurring at the programmatic level (statewide programs

that target phosphorus and/or nitrogen reduction) and at the watershed level (e.g., implementation of Total Maximum Daily Load plans).

Background:

The Wisconsin Nutrient Reduction Strategy was developed with partners and finalized in 2013, partly in response to the 2008 Gulf of Mexico Hypoxia Action Plan. This national plan set a national goal of 45% reduction in nitrogen (N) and phosphorus (P) loading to the Mississippi River to address the size of the hypoxic zone in the Gulf of Mexico. In Wisconsin, the main focus of nutrient reduction efforts is to address water quality problems caused by nutrients affecting state rivers, lakes and streams. Wisconsin's strategy follows the 2011 U.S. Environmental Protection Agency

framework, which established elements for state nutrient reduction strategies: target watersheds with highest loading; address all sources; and track, measure and report progress. Implementation of the Wisconsin Nutrient Reduction Strategy is occurring through existing state, federal and local programs.

Current water quality conditions:

In-state and Gulf of Mexico water quality issues persist, as these ecosystems slowly respond to restoration efforts.

Programmatic Implementation

There have been significant reductions in phosphorus discharges from **point sources**. For point sources, the main implementation action is Wisconsin Pollutant Discharge Elimination System (WPDES) permit limits for phosphorus, which has been included in 85% of the permits reissued since January 1, 2011. Many permittees with new phosphorus limits are optimizing existing operations as a first step. Compliance options of adaptive management or water quality trading, which allow point sources to work with nonpoint sources to achieve phosphorus load reductions, have been selected by 13 permittees, with many more exploring these options. Tracking

of annual point source discharges by DNR indicates **phosphorus loading in the Mississippi River Basin decreased 11.4% between 2013–2015**.

There are many programs for **agricultural nonpoint sources** at the federal, state, and county level which are providing incentives to farmers to implement nutrient reduction best management practices. County land and water resource management plans and Nine Key Element watershed plans are effective tools for assessing the contributing causes/sources of nonpoint source pollution, setting goals and identifying actions to address them.

In addition, Wisconsin DNR and Department of Agriculture, Trade and Consumer Protection (DATCP) continue to implement (in partnership with county land and water conservation departments) the state's nonpoint source performance standards and prohibitions found in [Chapter NR 151, Wisconsin Administrative Code](#) and [Chapter ATCP 50, Wisconsin Administrative Code](#). These include the cropland phosphorus index and requirements for nutrient management planning. According

to DATCP, nutrient management plans are in place for 32% of cropland acres. Farmer-led watershed groups have emerged as an important vehicle for implementation in which farmers lead planning, education and best management practice innovation with their neighbors. As a result, conservation practices implemented in critical locations have resulted in measurable (by model estimation) phosphorus reductions. There are currently 15 groups and more are being organized.

Watershed Level Implementation

Nutrient reduction actions are occurring in many watersheds through total maximum daily load or TMDL implementation, WPDES permit compliance options (whether control, adaptive management or water quality trading) and voluntary conservation to improve water quality. At the watershed level, many different groups are partnering for effective implementation; USDA Natural Resources Conservation Service, county land and water conservation departments, municipal wastewater agencies, University of Wisconsin Extension, farmers, local

environmental/watershed groups, U.S. Geological Survey and state agencies. Planning and/or implementation is occurring in all watersheds identified as the "top group" of watersheds targeted for phosphorus reduction because of their high load contribution, many of which have approved TMDLs or are developing TMDLs. Phosphorus TMDLs and watershed or county land/water resource plans are driving nutrient reduction implementation in "non-targeted" watersheds as well. Initiatives to address nitrates in groundwater are underway.

Future Focus

Over the next biennium, work by DNR and partners will include developing better ways to measure and track nutrient reduction progress (particularly for nonpoint sources).

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Chapter 1. Water Quality Status and Trends

The following excerpts from “Wisconsin’s 2016 Water Quality Report to Congress” provide an overview of how nutrients are affecting water quality.

Long-Term Trend Water Quality Monitoring

Lake Long-Term Trend Network

Anthropogenic nutrient loading is a major stressor of lakes in Wisconsin and elsewhere. DNR has been collecting total phosphorus (TP) on 62 lakes for up to 45 years, providing an opportunity to test whether phosphorus concentrations have changed over time. These lakes occur throughout the state in agricultural, urbanized and forested watersheds and range in size, trophic status and hydrology. Linear models were used to test for change in annual mean TP over time.

Total phosphorus decreased in eight lakes, increased in six lakes and did not change in 44 lakes (See Figure 1). Lakes with a decreasing trend were located in southern Wisconsin watersheds with significantly more developed land. These lakes were also shallower (mean maximum depth of 29 feet), more eutrophic (median total phosphorus of 56 $\mu\text{g/L}$) and had an earlier period of record dating back to the mid-1970’s. In contrast, most lakes with an increasing TP trend were deeper (mean maximum depth of 67 feet), oligotrophic or mesotrophic (median TP of 12 $\mu\text{g/L}$) and had a more recent period of record dating to the late 1980’s. Lakes with increasing TP trends were in forested, northern watersheds.

Long-term data sets such as this one elucidate trends in time and space and

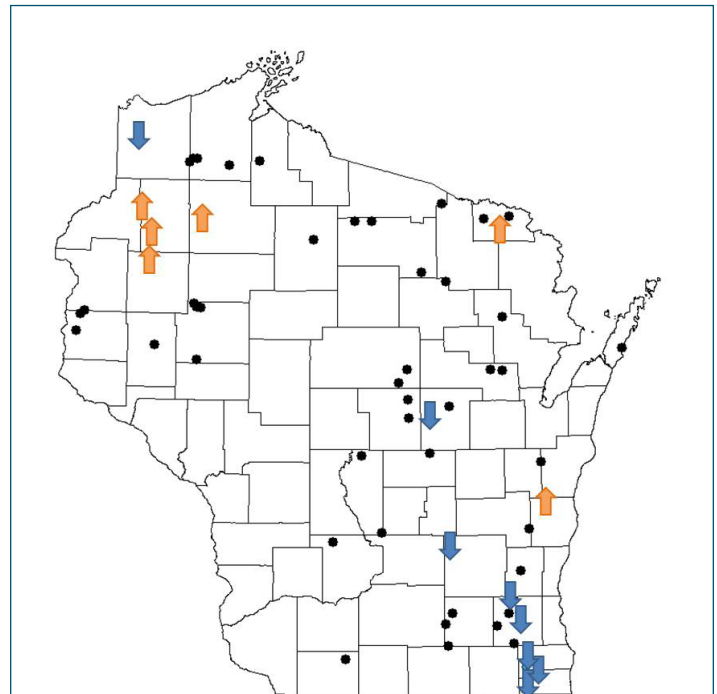
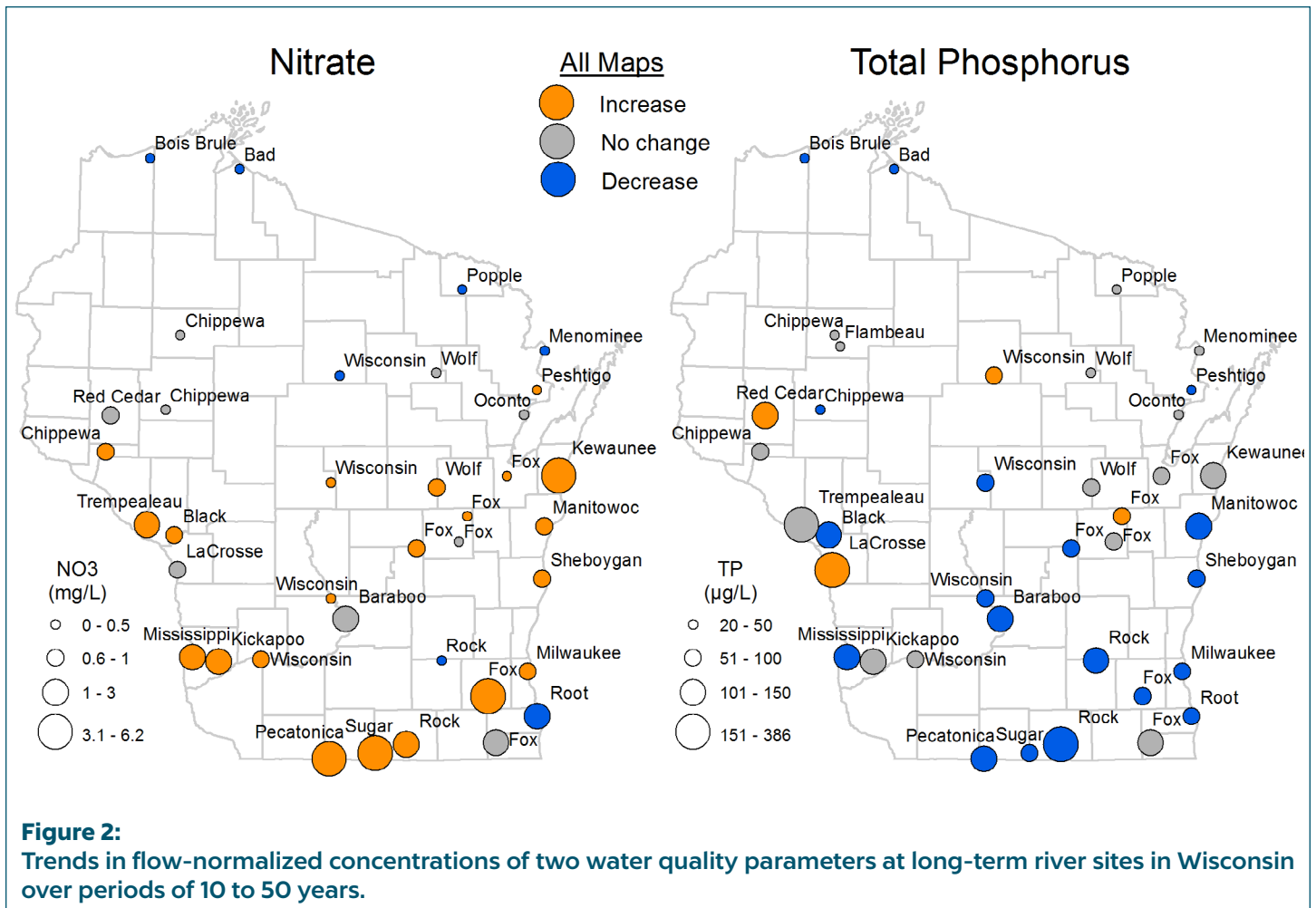


Figure 1: Wisconsin lakes that exhibit a significant increasing (upward orange arrow), significant decreasing (downward blue arrow), or no trend (black circle) in total phosphorus over the past 10 to 45 years.

provide opportunity to understand causes of change, be they environmental drivers or the result of direct management actions. Future analyses will examine potential drivers of changes in TP over time and will also test for trends in other parameters such as: surface water temperature, hypolimnetic dissolved oxygen, water clarity, chlorophyll- α , nitrogen, pH, alkalinity, color, calcium and magnesium.

River Long-Term Trend Network

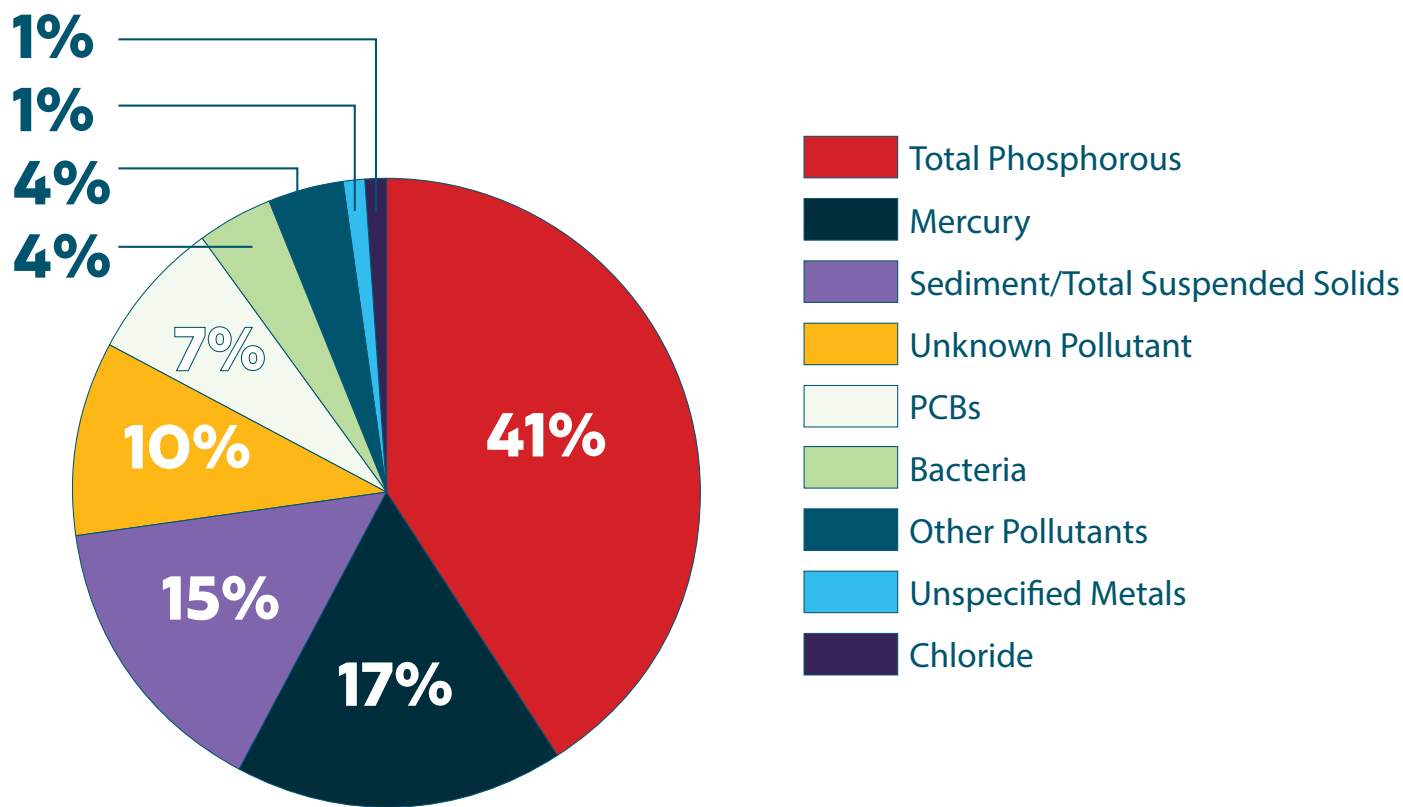
DNR has been monitoring water quality at 38 river stations for periods of 15 to 55 years. Long-term trends in these datasets were analyzed with the Fluxmaster model, which estimates linear trends while controlling for the effects of discharge and season on water quality. River water quality trends



were highly variable among parameters and regions of the state. Concentrations of total phosphorus and total suspended solids have decreased in most rivers over the last several decades. In contrast, concentrations of chloride and nitrate have increased in most rivers over this period. The largest reductions in total phosphorus occurred in southern Wisconsin and many of the rivers with large phosphorus reductions also had large suspended solids reductions. Nitrate concentrations increased in most rivers in agricultural basins in Wisconsin.

The reasons for these trends are likely a combination of changes in land management practices, including agricultural production systems, erosion control, nutrient management and improvements in wastewater treatment. Further analyses will evaluate non-linear trends to identify periods where the most significant changes occurred and will determine whether trends vary among seasons. These more detailed analyses will provide more certainty about the causes of improvements and declines and will help target where and when further work is needed.

Figure 3: Impairment Pollutants



CWA Section 303(D) List (Impaired Waters)

Assessing waterbodies against water quality standards and identifying impaired waters that do not meet standards is part of the overarching federal Clean Water Act framework for restoring impaired waters. Waters that do not meet their designated uses because of water quality standard violations are impaired. Waterbodies are removed from the list

when new data indicates that water quality standards are attained.

The 2016 impaired waters list contains more than 1,700 pollutant/water listing combinations. The primary pollutant listings are total phosphorus, mercury and total suspended solids (sediment), representing 73 percent of the current listings ([See Figure 3](#)).

Monitoring Studies of Nutrients in Lake Superior

In Lake Superior, long term monitoring of the offshore waters indicates low phosphorus levels (generally $< 5 \mu\text{g/L}$). Existing state administrative code (s. NR 102.06(5) (a), Wis. Adm. Code) sets total phosphorus criteria at $5 \mu\text{g/L}$ for both offshore and near-shore waters (note that $5 \mu\text{g/L}$ is echoed in Annex 4 of the 2012 Great Lakes Water Quality Agreement as the substance objective for Lake Superior). However, some embayments have experienced elevated levels of both total and dissolved forms of phosphorus. Tributary inputs are the primary source of phosphorus to the lake. High phosphorus loads are associated with high sediment loading, which is substantial in some of Wisconsin's Lake Superior watersheds due to soil type (easily erodible clay soils) as well as historic and present day land uses. Nitrogen levels in Lake Superior are high and have been increasing over the past 100 years (Sterner et al 2007), with nitrate as the dominant form. The nitrogen:phosphorus ratio in lake proper habitat is strongly weighted towards nitrogen, indicating that phosphorus is the limiting nutrient for algal growth.

Lake Superior has not experienced significant issues with algal blooms largely due to low phosphorus and cold water temperatures. However, with observations

of rising water temperatures in Lake Superior (Austin 2008) and direct observations of algal blooms, the potential for eutrophication of shallow water nearshore habitats is of increasing interest. The Lake Superior LAMP Cooperative Science and Monitoring Initiative for 2016 includes monitoring work to evaluate the vulnerability of embayments and nearshore habitats to eutrophication, focused around the Chequamegon Bay region. Following major storm events in 2012 and 2016, algal blooms were observed on the western arm of the Bayfield peninsula. These heavy precipitation events, followed by warm weather and calm/onshore winds are hypothesized to be the cause of blooms. Long shore and wind driven currents can move nutrients a long distance from river mouth pour points, and conditions for algal blooms can occur when sediments settle and light penetration increases following major storm events. Information on lake temperatures, nutrient levels and hydrodynamics will be important to observing and understanding algae blooms as an emerging concern in Lake Superior. Support for watershed practices to reduce runoff remains critically important to mitigate sediment loads and concurrent phosphorus loads.

Chapter 2. Nutrient Reduction Through Point Source Programs

WPDES Program

Nutrients discharged to water from point sources are under state and federal regulation. Through the use of Wisconsin Pollutant Discharge Elimination System (WPDES) permits, phosphorus levels in the discharge from a point source are limited under the permit according to the applicable water quality standard for phosphorus and/or by the Waste Load Allocation established by a Total Maximum Daily Load (TMDL) for the receiving waterbody. Before 2010, most wastewater dischargers had a technology-based phosphorus limit of 1 mg/L. New permit limits (whether a Water Quality Based Effluent Limit or WQBEL, or TMDL load limit) are incorporated as WPDES permits expire and are renewed every five years. Wisconsin DNR estimates that about 500/589 (85 percent) of the surface water discharge permits that have been reissued since Jan. 1, 2011, include phosphorus WQBELs – either TMDL-based WQBELs, non-TMDL WQBELs, or both.

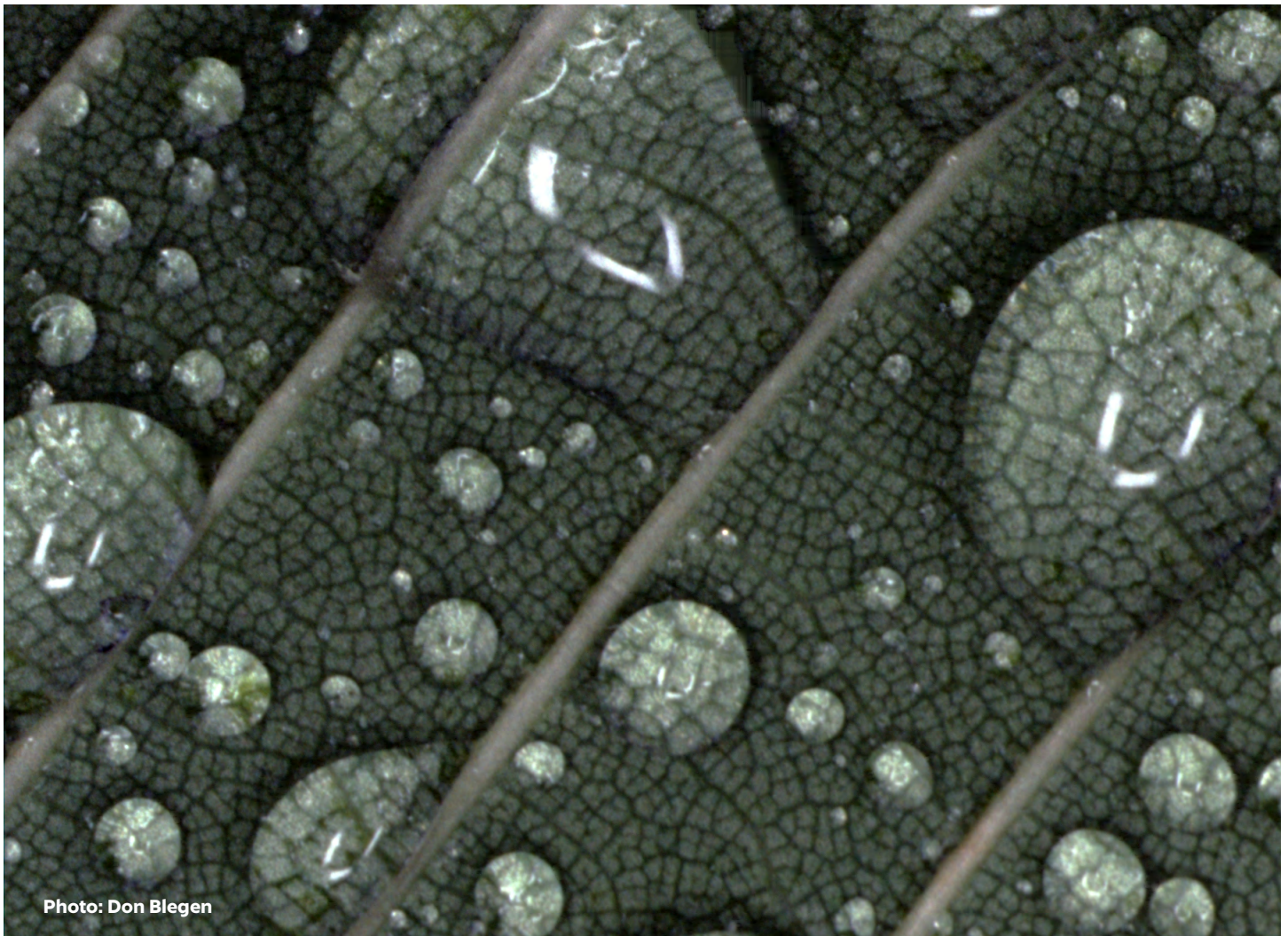
Although Wisconsin does not currently have a water quality standard for nitrogen, WPDES permits for municipal majors in the Mississippi River Basin issued since November 2012 contain a requirement for quarterly effluent monitoring for total nitrogen.

A first step that most point sources are taking to reduce phosphorus is to optimize existing equipment for phosphorus removal. An example of optimization is described in the inset below.

Wisconsin permittees have the option of complying with new phosphorus permit limits through improved controls or through adaptive management or water quality trading. Regardless of the compliance option chosen, most point sources have compliance schedules that extend beyond one permit cycle.

Janesville has an advanced secondary treatment 19.8 million gallons per day (MGD) plant with enhanced biological phosphorus removal and biological nitrogen removal in the activated sludge process. The facility discharges to the Lower Rock River. New phosphorus wasteload allocations were established in an approved TMDL for the Rock River basin. Janesville's Operations Evaluation Report determined that current operations would need to be revised to consistently meet the wasteload allocation.

Janesville conducted monitoring and reduced industrial phosphorus inputs over the last three years through its pretreatment program. The pretreatment program includes a database of annual industrial contributions from individual users. A list of the top 15 industrial users and their average mass discharge of phosphorus from 2013 to 2015 was established. Prior to this work, Janesville conducted a phosphorus minimization study in 2004. The study surveyed all industrial and commercial customers and asked for information on phosphorus containing products and cleaners. Customers were asked to research substitute items that could reduce their phosphorus discharge. These programs have been instrumental in minimizing the phosphorus in the treatment plant's influent. One optimization action item identified in Janesville's plan is further evaluation of a particular industrial source with high phosphorus contribution and associated optimization activities. In addition to optimization actions already taken, Janesville plans to further study the phosphorus chemistry of its influent and effluent to support future optimization planning and to reconfigure its EBPR process for maximum performance.



Adaptive Management

Adaptive management is a phosphorus compliance option that allows point and nonpoint sources (e.g. agricultural producers, storm water utilities, developers) to work together to improve water quality in those waters not meeting phosphorus water quality standards. This option recognizes that the excess phosphorus accumulating in our lakes and rivers comes from a variety of sources, and that reductions in both point and nonpoint sources are frequently needed to achieve water quality goals.

By working in their watershed with landowners, municipalities and counties to target sources of phosphorus runoff, point sources can minimize their overall investment while helping achieve compliance with water quality-based criteria and improve water quality. The [*Adaptive Management Technical Handbook*](#) is available to help describe adaptive management and how to develop a successful adaptive management strategy <http://dnr.wi.gov/topic/surfacewater/documents/adaptivemanagementhandbooksigned.pdf>

Figure 4: Adaptive Management and Water Quality Trading project locations



Water Quality Trading

Water Quality Trading (WQT) may be used by Wisconsin Pollutant Discharge Elimination System (WPDES) permit holders to demonstrate compliance with water quality-based effluent limitations (WQBELs). Generally, water quality trading involves a point source facing relatively high pollutant reduction costs compensating another party to achieve less costly pollutant reduction with the same or greater water quality benefit. In other words, water quality trading provides point sources with the flexibility to acquire pollutant reductions from other sources in the watershed to offset their point source load so that they will comply with

their own permit requirements. The Water Quality Trading How-To Manual is available http://dnr.wi.gov/topic/surfacewater/documents/WQT_howto_9_9_2013signed.pdf to help describe water quality trading and how to develop a successful trading strategy. Additional technical information as well as permitting information is available in the Guidance for Implementing Water Quality Trading in WPDES Permits http://dnr.wi.gov/topic/surfacewater/documents/WQT_guidance_Aug_21_2013signed.pdf. Further information can also be found in the description of the Fox P Trade project, in Chapter 4 of this document.

Changes in Point Source Phosphorus Loads to Wisconsin Waters, 2013-2015

The DNR Water Quality Bureau has been tracking point source phosphorus loads over the years, as summarized below. The annual load estimates are based on the average daily discharge rate and average daily effluent phosphorus concentration reported over a calendar year by each WPDES permittee required to monitor. The annual loading has been decreasing over the period of record (1995-2015). Of note, the total loadings in the Mississippi basin are estimated at 646.9 thousand pounds in 2013 (646,900 after rounding), 618.8 in 2014, and 573.7 in 2015. Over that time, the annual point source loadings will therefore have decreased by about 11.4 percent or about 73,200 pounds per year.

Table 1. POINT SOURCE PHOSPHORUS LOADING SUMMARY – 2015
TOTAL DISCHARGES
(all values in units of thousand pounds per year)

BASIN	1 ST YEAR LOADING	2000 ANNUAL LOADING	2004 ANNUAL LOADING	2008 ANNUAL LOADING	2012 ANNUAL LOADING	2013 ANNUAL LOADING	2014 ANNUAL LOADING	2015 ANNUAL LOADING	CHANGE FROM 1 ST YEAR	% CHG. FROM 1 ST YEAR
OUTSIDE GREAT LAKES										
ST. CROIX	47.1	30.1	18.6	19.3	15.1	13.7	14.1	12.0	- 35.1	- 75
UPPER CHIPPEWA	50.2	43.4	40.6	30.6	18.9	20.6	25.4	17.1	- 33.1	- 66
LOWER CHIPPEWA	112.9	75.5	66.0	59.9	52.2	54.4	59.7	46.3	- 66.5	- 59
BLACK - BUFF. - TREMPEA-LEAU	124.9	56.3	55.1	27.6	21.0	23.4	25.5	24.2	- 100.7	- 81
LA CROSSE - BAD AXE	430.0	36.9	40.2	43.6	36.2	33.4	30.8	27.4	- 402.5	- 94
UPPER WISCONSIN	702.9	506.6	377.8	278.9	191.9	186.1	185.8	160.8	- 542.1	- 77
LOWER WISCONSIN	145.5	107.8	49.6	58.0	40.8	48.3	40.2	35.9	- 109.6	- 75
SUGAR	27.7	17.7	24.8	13.4	8.5	9.4	9.0	9.7	- 18.0	- 65
PECATONICA	19.4	17.3	14.1	18.7	11.8	22.6	10.5	7.5	- 11.9	- 61
GRANT-PLATTE	34.7	32.1	16.2	24.5	16.3	17.1	17.7	19.9	- 14.8	- 43
UPPER ROCK	364.9	334.9	94.6	70.7	48.6	62.1	56.0	51.8	- 313.1	- 86
LOWER ROCK	332.2	300.1	169.1	155.4	103.1	105.7	100.0	106.7	- 225.5	- 68
FOX (ILLINOIS)	77.9	64.5	47.5	56.7	45.4	51.1	44.2	44.4	- 33.6	- 43
TOTALS:										
OUTSIDE GR. LAKES BASINS	2470.5	1623.3	1014.2	859.3	606.8	646.9	618.9	573.7	- 1896.8	- 77

Table 2. POINT SOURCE PHOSPHORUS LOADING SUMMARY – 2015

TOTAL DISCHARGES
(all values in units of thousand pounds per year)

BASIN	1ST YEAR LOADING	2000 ANNUAL-LOADING	2004 ANNUAL LOADING	2008 ANNUAL LOADING	2012 ANNUAL LOADING	2013 ANNUAL LOADING	2014 ANNUAL LOADING	2015 ANNUAL LOADING	CHANGE FROM 1ST YEAR	% CHG. FROM 1ST YEAR
GREAT LAKES										
LAKE SUPERIOR	22.4	14.3	18.5	18.7	14.2	18.8	20.2	17.0	- 5.4	- 24
WOLF	60.9	38.5	35.8	31.4	25.0	26.3	26.7	25.0	- 36.0	- 59
UPPER FOX (WI)	54.3	57.6	61.4	63.9	59.0	61.8	48.4	40.7	- 13.6	- 25
LOWER FOX (WI)	294.6	173.7	191.8	193.7	132.5	130.5	152.4	120.4	- 174.1	- 59
UPPER GREEN BAY	67.9	40.2	46.8	28.1	16.5	18.7	20.2	20.3	- 47.7	- 70
DOOR - TWIN - MANI-TOWOC	63.0	52.0	48.8	45.9	31.5	31.4	29.0	27.6	- 35.3	- 56
SHEBOYGAN	46.5	37.4	40.1	43.4	26.0	32.9	32.8	31.2	- 15.3	- 33
MILWAUKEE	707.7	405.4	339.1	339.9	233.1	243.9	264.8	254.7	- 453.0	- 64
ROOT - PIKE	178.6	87.8	113.1	105.9	79.8	96.5	88.4	87.7	- 91.0	- 51
TOTALS:										
GREAT LAKES BASINS	1495.9	907.6	895.4	870.9	617.6	660.8	682.9	604.6	- 891.3	- 60
OUTSIDE GR. LAKES BASINS	2470.5	1623.3	1014.2	859.3	606.8	646.9	618.9	573.7	- 1896.8	- 77
ALL FACILITIES	3966.4	2530.9	1909.6	1730.2	1224.4	1307.7	1301.8	1178.3	- 2788.1	- 70

Concentrated Animal Feeding Operations (CAFO)

With the increase in CAFO facilities (currently at 280 permitted with another 35 in the queue), it means that more acres in the state are under nutrient management plans and following stricter requirements for spreading of manure. Properly operated CAFO production areas are meeting zero discharge from

the production area up to the 25 year, 24 hour storm if they are dairies and zero discharge for all storm events for pork, chickens and turkeys. An increase of four CAFO staff in 2016 will improve the ability of the department to conduct compliance inspections and head off problems before they become a discharge.

Rain Gardens are an infiltration technique — water is captured in a garden that features native plantings, and the water has a chance to slowly filter into the ground rather than run off into the storm sewer. DNR Photo



Storm Water Management

Storm water discharges from certain municipal separate storm sewer systems (MS4s), industrial facilities, and construction sites are regulated as point sources, typically under WPDES general permits.

An industrial facility covered under a storm water general permit is not given a specific wasteload allocation under a TMDL unless DNR identifies the facility as a significant source of a pollutant of concern. However, an industrial facility is required to develop a site-specific storm water pollution prevention plan that addresses pollutants associated with the facility. Accordingly, if a facility has outdoor exposure of equipment, industrial processes or activities, feedstock, final product, waste materials, etc., that are sources of nutrients as a pollutant of concern, its storm water pollution prevention plan is to address those sources through source area pollution prevention controls and storm water best management practices to reduce, with the goal of eliminating, the storm water discharge of a pollutant of concern.

In addition to receiving WPDES storm permit coverage, permitted MS4s and construction sites are required to meet certain DNR-established performance standards for storm water runoff that aid the goal of reducing the discharge of nutrients. Like an industrial facility, a construction site covered under a storm water general permit is not given a specific wasteload allocation under a TMDL unless DNR identifies the site as a significant source of a pollutant of concern. However, the construction site and post-construction performance standards require the design

and implementation of best management practices that reduce the discharge of sediment during construction and the discharge of total suspended solids after construction is complete. Meeting these performance standards reduces the discharge of nutrients associated with and binding to sediment and total suspended solids by preventing mobilization and/or capturing these particles prior to discharge.

Developed urban area performance standards apply to all permitted MS4s and are implemented through the MS4 storm water permit program. In addition to meeting these performance standards, permitted MS4s discharging to an impaired waterbody with an approved TMDL are assigned wasteloads allocations. The developed urban area performance standards require all permitted MS4s to achieve a reduction in total suspended solids in runoff that enters waters of the state as compared to no controls. A permitted MS4 demonstrates compliance with this performance standard through water quality statistical modeling. By comparing the situation with controls versus no controls, the MS4 can determine if it is meeting the standard or if it needs to implement additional best management practices. While there is no performance standard specifically for nutrients, some nutrient reduction is realized by reducing the discharge of total suspended solids.

Approved TMDLs with an urban component typically address sediment, total suspended solids, and phosphorus as the pollutants of concern. Permitted MS4s that are assigned wasteloads allocations for these pollutants under an approved



TMDL need to assess their level of compliance by determining if existing controls are adequate. If not in compliance based on existing controls, the permitted MS4 develops a written plan that describes how the permittee will make progress toward achieving compliance. Elements of the plan include recommendations and options for storm water control measures that will be considered to reduce the discharge of each pollutant of concern; a proposed schedule for implementation of the recommendations and options; and a cost effectiveness analysis. The proposed schedule for implementation may extend beyond the five year term of the permit DNR anticipates that subsequent reissued storm water permits will incorporate requirements to facilitate additional progress toward TMDL compliance.

Chapter 3. Nutrient Reduction Through Agricultural Nonpoint Source Programs

Wisconsin Agricultural Performance Standards and Prohibitions

Wisconsin's agricultural performance standards and prohibitions (NR 151, etc.) identify requirements to control runoff from agricultural fields, pastures and livestock facilities <http://dnr.wi.gov/topic/nonpoint/documents/farmersneed.pdf>. All farmers in Wisconsin must comply with the requirements if cost-sharing is made available (not required for new agricultural facilities). CAFOs must also follow additional requirements as stated in WPDES permits and performance standard (NR 243). Farmers must demonstrate compliance to participate in some state and local programs (such as Wisconsin's Farmland Preservation Tax Credit) or to obtain local and state permits (e.g., for livestock siting and manure storage facilities).

Nutrient Management Plans

(excerpted from Wisconsin Nutrient Management Update, DATCP, November 2016)—Nutrient management planning (NMP) is a key practice farmers can use to reduce excess nutrient applications to their cropland and the water quality problems that result from nutrient runoff to lakes, streams and groundwater. The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) tracks farms that develop and update their NMPs in accordance with the U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) Technical Standard 590. Each year DATCP collects NMP Checklist forms submitted by farmers, agronomists and public agency staff to update the number of cropland acres covered by NMPs. In 2016, Wisconsin farmers made impressive strides toward implementing soil and water conservation through the development of 7,128 NMPs on 2,960,872 acres, a 14 percent increase from 2014, covering 32 percent of Wisconsin's 9 million cropland acres.

Through 2017, DATCP requires that NMPs meet the Wisconsin NRCS 590 Nutrient

Management Standard (2005) and be prepared by a qualified planner, which may be the farmer or a certified crop adviser. In 2018, DATCP will revise its rules to require compliance with the Wisconsin NRCS 590 standard dated December 2015. In addition to accounting for all N-P-K nutrients applied, and planned to be applied, to fields over the crop rotation, the 2015 nutrient management standard includes winter manure spreading requirements and increased water quality protections (see below in this Chapter for more details regarding the changes in NRCS 590 Standard). With the upgrade in the NM standard, DATCP will change its rules to increase the flat rate for cost-sharing from \$7 per acre for four years (or \$28 per acre) to \$10 per acre for four years (\$40 per acre).

Farms can be required to implement nutrient management without cost-sharing if they are: a) causing a significant discharge; b) regulated by local manure storage or livestock siting ordinances or by a DNR WPDES permit; c) accepting NMP or manure storage cost share funds; or d) participating in the Farmland Preservation Program.

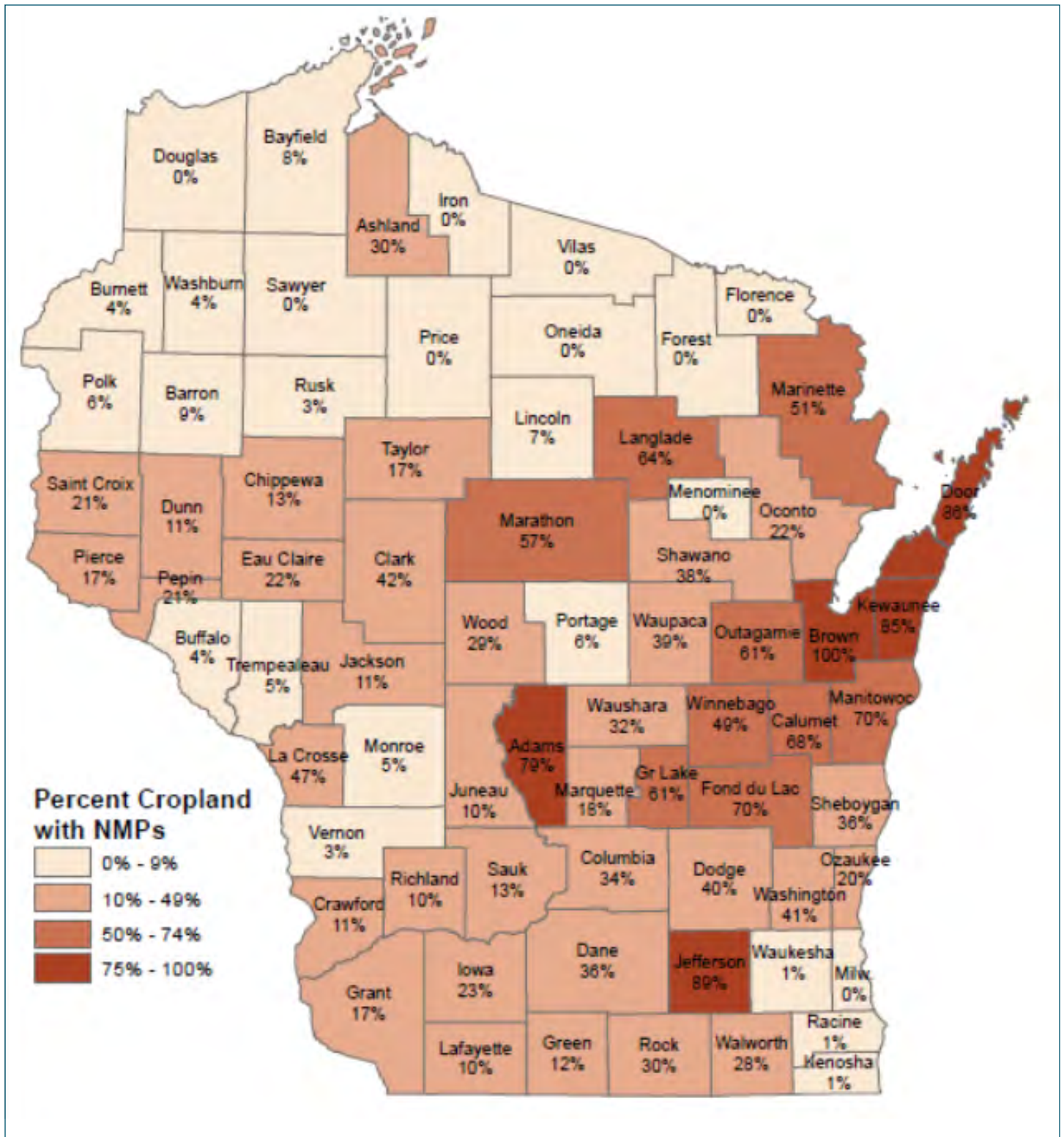


Figure 5: Percent of County's Cropland with 2016 NM Plans (Calculated from county reported acres and 2012 National Agriculture Statistics Service of WI county cropland).

Nutrient Management Farmer Education Grants

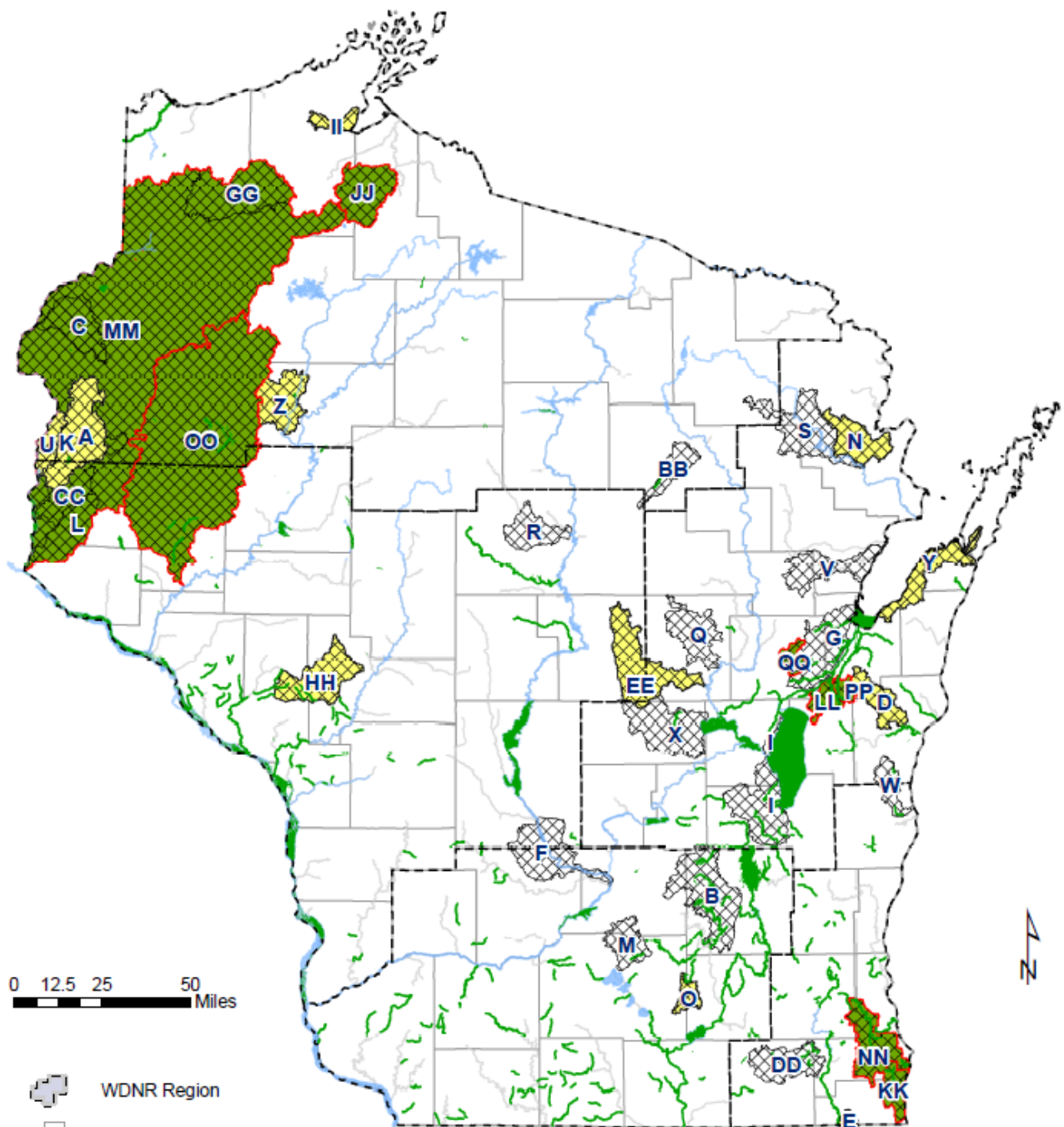
Each year DATCP awards funding to groups or entities who sponsor a training course in which farmers learn how to write their own nutrient management plans that are compliant with the NRCS 590 NM Standard. The program allows applications in one of two funding tiers. Tier 1 projects enable farmers to become qualified to write and update their NMPs for four years, after which the farmer must come back through a training course to update their skills and knowledge of nutrient management. Tier 2 projects allow applicants to provide training on general nutrient management principles, water quality issues associated with improper nutrient management, soil health, etc. Tier 2 projects do not necessarily result in development of 590 compliant nutrient management plans.

For 2017, DATCP raised the minimum awards in each category and received 11 requests for funding under Tier 1 and six requests for Tier 2 funding, totaling \$175,814 in requests. DATCP will fully fund all requests. All grant recipients must sign a contract with DATCP which commits the project to developing nutrient management plans meeting the NRCS 590 Standard.

Although NR 151 implementation is a basic element of water quality protection related to agricultural runoff, implementation success in a particular watershed requires **outreach/education** to farmers on water quality best management practices, building **partnerships** to effectively address water quality issues and **financial assistance**. The following efforts represent one or more of these elements.



Figure 6: Nine Key Element Watershed Plan Areas



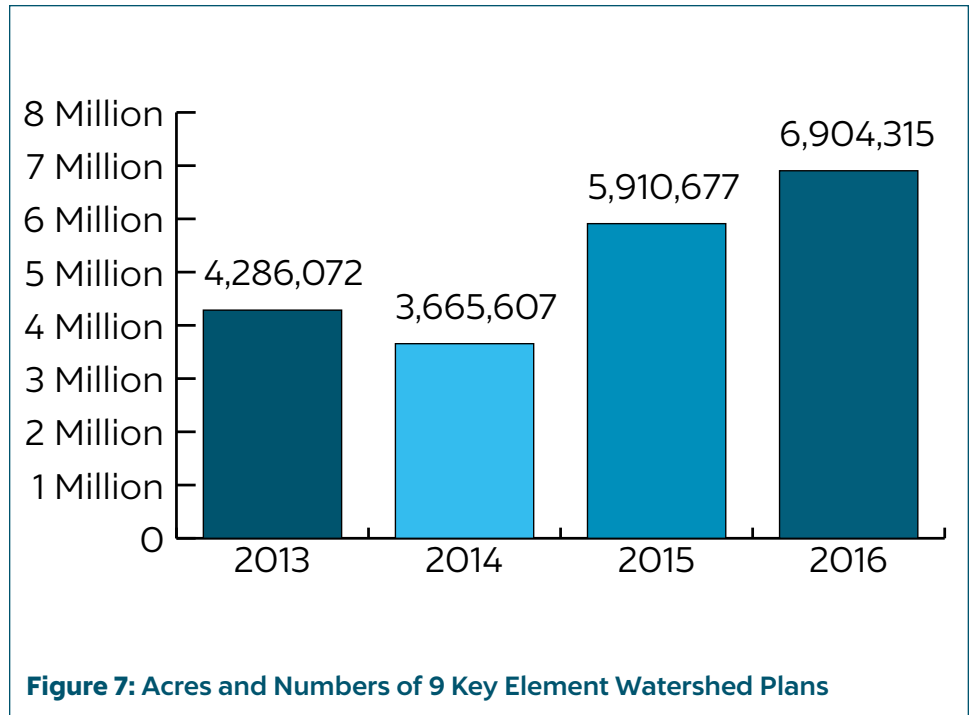
Notes:
 1.) Project areas represent the HUC-8, HUC-10 or HUC-12 equivalents of previous WDNR Priority Watersheds.

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 Runoff Management
 Section
 May 2016

County Land and Water Conservation Departments

In every watershed where nutrient water quality issues are being addressed, the county conservation departments are providing leadership, outreach/education and assistance to farmers in locating cost-share dollars for implementation. Annually, DATCP provides base funding for County staff and landowner cost-sharing as long as counties have DATCP-approved Land and Water Resource Management (LWRM) Plans. In 2017, DATCP allocated \$8.7 million dollars to support staff in 72 counties who are responsible for signing contracts to commit \$5.4 million allocated for landowner cost-sharing. LWRM plans must be revised every 10 years, and are subject to a five year review to evaluate county progress regarding plan implementation. DATCP

has recently adopted annual work plan requirements that include county targets for reducing annual sediment and nutrient loads. Changes in LWRM planning requirements in 2014, combined with the new annual planning activities, address many of the nine key elements that DNR and U.S. EPA look for in a high-quality watershed-based water quality management plan.



Development/Approval of Nine Key Element Watershed Plans

Watershed plans consistent with EPA's nine key elements provide an important framework for improving water quality in a holistic manner within a geographic watershed, and are a typical pre-cursor to implementation activities to reduce agricultural losses of nutrients to water. The nine elements help assess the contributing causes and sources of nonpoint source pollution, involve key stakeholders and prioritize restoration and protection strategies to address water quality problems. The first three elements characterize and set goals to address pollution sources. The remaining six elements determine specific resources and criteria to implement and evaluate the plan. For agriculture NPS contribution to nutrient impairments, a typical piece of the watershed planning process is to use modeling tools such as SNAP+ or STEPL to assess critical areas within the watershed where phosphorus losses to water are projected to be the highest. These become areas of focus for BMP promotion and implementation under the plan. Having an approved nine key element watershed plan is a prerequisite to accessing state funding for BMP implementation.

The watersheds shown in [Figure 6 on page 22](#) have DNR and EPA-approved "Nine Key Element" watershed plans. [Figure 7 on page 23](#) shows the number of plans and the total acres covered by plans as of May 2016.



View of the Stonefeild Historic Site on the bank of the Mississippi River, near Cassville, Wis.

Wisconsin Discovery Farms

UW Discovery Farms, part of UW-Extension, is working with farmers across Wisconsin on phosphorus and nitrogen management. Research from edge-of-field sites, evaluations like nitrogen use efficiency, and information sharing strategies like the farmer network are tools that the UW Discovery Farms Program uses in its educational programming.

Specifically, the program's 2015 annual winter conference brought together more than 180 farmers, crop consultants and nitrogen and phosphorus experts. Conference presenters included farmers and renowned nutrient management experts from Wisconsin, Minnesota and Pennsylvania. Attendees had the opportunity to learn more about nitrogen use efficiency, phosphorus challenges with manure in no-till systems, manure application strategies and ways to effectively minimize nutrient loss. The conference included two farmer panels to increase farmer-to-farmer information sharing. Visit the [conference page](#) to find presentations and handouts from the conference.

In addition, the UW Discovery Farms [Nitrogen Use Efficiency Project](#) has the potential to improve soil and water resources, while preserving farm productivity and profitability. The project is currently working with 43 farmers on over 100 fields in 11 counties around Wisconsin. The project has five main objectives: (1) evaluate nitrogen use

efficiency (NUE) on farms at the field level; (2) train farmers to conduct their own on-farm evaluations of NUE; (3) allow farmers to test their own management practices for improvements in NUE; (4) enhance farmer understanding of the connection between NUE and water quality; (5) develop an online farmer network with NUE results, water quality information, and a forum for information exchange among participants. This project was made possible by a USDA Conservation Innovation Grant.

UW Discovery Farms continues to work within the Jersey Valley watershed (Monroe and Vernon Counties) and the Dry Run watershed (St. Croix County), presents at numerous events, hosts more than eight events annually and conducts water quality research on farms to increase understanding of water quality challenges and develop farm-specific solutions that make both economic and environmental sense. As the watershed projects begin to wrap up, Discovery Farms is evaluating the effectiveness of its programming. Program leaders are in the process of reviewing 50 returned surveys and 10 key informant interviews. It is clear that farmers in the watersheds value the local data provided by the program and use it as well as guidance from Discovery Farms staff when making nutrient management decisions. A journal article about the results will be completed in the fall of 2016.

Figure 8: 2016/17 Farmer-Led Grant Participants

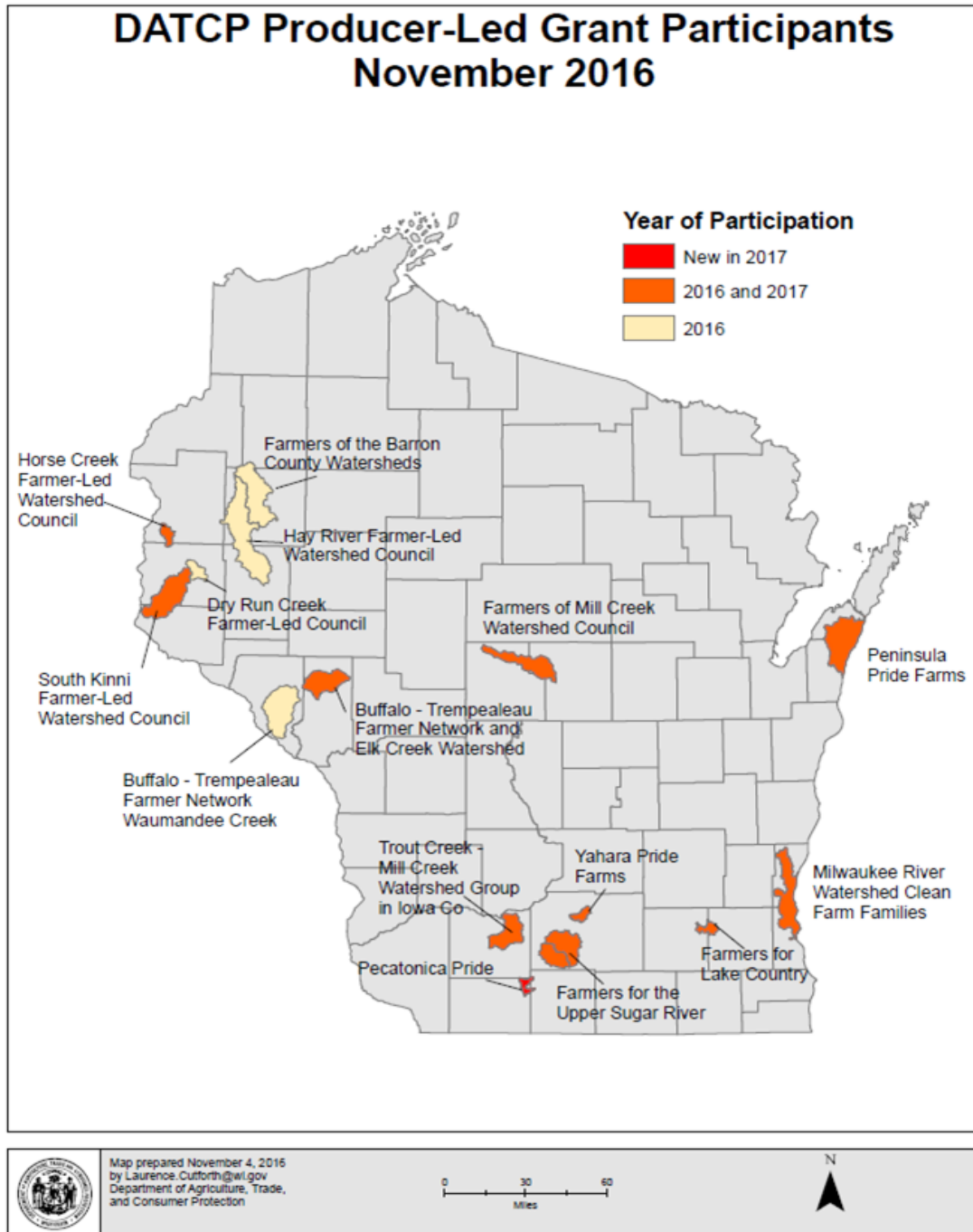


Figure 9: Practices installed using Soil and Water Resources Management funds in 2015, WI DATCP.

Conservation Practices			
Conservation Practices		Acres	Feet/Number Installed
Soil Erosion Control	CREP Equivalent	9.13	
	Animal trails and walkways		13,529 ft
	Cover and green manure crop	1,181.00	
	Critical area stabilization		39.7
	Diversions		11,445 ft
	Field windbreaks		33,818 ft
	Grade stabilization structures		44
	Riparian buffers	14.99	
	Sinkhole treatment		1
	Stream bank crossing		3,631 ft
	Streambank and shoreline protection		21,037 ft
	Subsurface drains		11
	Terrace systems		6,855 ft
	Underground outlet		26
	Water and sediment control basins		6
	Waterway systems	177.93	
Manure Management	Manure storage closure		26
	Manure storage systems		24
	Access roads		7,353 ft
	Barnyard runoff control systems		33
	Livestock fencing		49,702 ft
	Livestock watering facilities		20
	Milking center waste control systems		3
	Nutrient management	78,103.00	
	Roof runoff systems		14
	Roofs		1
	Sediment basins		2
	Waste transfer systems		13
	Wastewater treatment strips		7,852 ft
Other Practices	Prescribed grazing; permanent fencing		70,143 ft
	Well decommissioning		169
	Wetland development or restoration	9.50	
	Feed storage runoff control systems		6

Wisconsin Farmer-Led Watershed Groups

Farmer-Led Watershed Groups have emerged as an effective tool to improve water quality by developing farmer leadership and strong partnerships for increased on-farm conservation. The most mature of these groups are the St. Croix/Red Cedar (described in Chapter 5 of this report) and Yahara Pride Farms (described in Chapter 1) that are making measurable progress in reducing phosphorus losses to water. Objectives of these groups include improving water quality through reduced phosphorus and sediment loading, increasing farmer knowledge of/engagement with water quality issues (including adoption of conservation practices) and developing water quality leadership among farmers in the watershed for sustained action. In 2016, DATCP began making grants to producer-led groups for projects that focus on ways to prevent and reduce water quality impacts from farming operations and that work to increase farm participation in

these voluntary efforts (see https://datcp.wi.gov/Pages/Programs_Services/ProducerLedProjects.aspx). Each application must come from a group of at least five farmers in the same watershed, collaborating with conservation agencies, institutions or nonprofit organizations. The maximum grant award **per** group is \$20,000. The list of 2016/2017 grantees is shown in Table 3 and the locations are found in [Figure 8 on page 26](#).

In 2016, DATCP began sponsoring a state-wide annual workshop for grant recipients and interested partners to exchange information and promote interest in producer led projects. At the first conference, over 70 attendees including producer-led group members, collaborators and interested partners shared information about cover crop demonstration plots, low-disturbance manure injection, the Discovery Farms Farmer Network, and successes in producer-led efforts to date.

State Financial Assistance

DNR and DATCP partner to provide financial support that is critical to achieving nutrient reductions through agricultural non-point source conservation practices. In 2015, DATCP provided over \$9 million statewide to technical staff at county Land and Water Conservation Departments and to pay for support services provided by cooperators such as University of Wisconsin-Madison. County staff, with the help of cooperators, are key providers of outreach, education and assistance to farmers in planning/funding/installing conservation practices that protect water quality. In 2015, DNR and DATCP together provided \$9.1 million in grant funding used to cost-share conservation practices. In 2016, DATCP provided similar levels of funding for staff and cooperators and combined with DNR to provide \$9.5 million in grant funding to cost-share conservation practices.

The following state programs are particularly focused on reducing nutrient impacts on water quality:

Targeted Runoff Management (TRM) (DNR)

TRM grants are provided by DNR to control nonpoint source pollution from both agricultural and urban sites. A combination of state segregated funds, state bond revenue and federal Section 319 grant funds may be used to support TRM grants. The grants are available to local units of government (typically counties) and targeted at high-priority resource problems. TRM grants can fund the design and construction of agricultural and urban BMPs. In FY 2017, \$3.8 million in TRM grants were awarded by DNR to counties, with large scale projects receiving local assistance grants to pay for staff.

Notice of Discharge (NOD) (DNR) NOD grants are provided by DNR and DATCP to local units of government (typically counties). A combination of state segregated funds, state bond revenue, and federal Section 319 grant funds may be used to support NOD grants. The purpose of these grants is to provide cost sharing to farmers who are required to install agricultural best

management practices to comply with Notice of Discharge requirements. Notices of Discharge are issued by DNR under ch. NR 243 Wis. Adm. Code, to small and medium animal feeding operations that pose environmental threats to state water resources. The project funds can be used to address an outstanding NOD or an NOD developed concurrently with the grant award. Both state agencies work cooperatively to administer funds set aside to make NOD grant awards. In FY 2017, \$2.4 million in NOD grants were awarded by both agencies, including funds to ensure that vegetated treatment areas are effectively designed to control runoff to surface water.

Soil & Water Resources Management (SWRM) (DATCP)

DATCP administers the SWRM Grant Program that supports locally-led conservation efforts. Each year DATCP awards grants, primarily to counties, to pay for conservation staff and provides landowner cost sharing to implement Land and Water Resource Management

Table 3. 2016/17 Farmer-Led Watershed Group Grantees

Name	Watershed	Overview
<i>Buffalo-Trempealeau Farmer Network-Elk Creek</i>	Elk Creek	Understanding and improving nitrogen application
<i>Buffalo-Trempealeau Farmer Network - Waumandee Creek</i>	Waumandee Creek	Reducing soil and nutrient loss through the adoption of cover crops
<i>Peninsula Pride Farms</i>	Ahnapee River	Protecting groundwater
<i>Farmers for Lake Country</i>	Oconomowoc River	Offer incentives to install filter strips, plant cover crops and adopt reduced tillage systems
<i>South Kinni Farmer-Led Council</i>	South Kinnikinnic	Offer incentives and evaluate the effectiveness of conservation practices
<i>Dry Run Creek Farmer-Led Council</i>	Dry Run Creek	Offer incentives and evaluate the effectiveness of conservation practices
<i>Horse Creek Farmer-Led Council</i>	Horse Creek	Offer incentives and evaluate the effectiveness of conservation practices
<i>Hay River Farmer-Led Council</i>	Hay River	Offer incentives and evaluate the effectiveness of conservation practices
<i>Milwaukee River Watershed Clean Farm Families</i>	Milwaukee River	Improving soil health and water quality
<i>Farmers of Barron County</i>	Yellow River	Reducing nutrient and sediment loss
<i>Farmers of Mill Creek Watershed</i>	Mill Creek	Water quality improvement and public outreach
<i>Farmer Led Watershed Group in Iowa County</i>	Trout Creek, Mill Creek	Incentives for conservation practices, nutrient management
<i>Yahara Pride Farms</i>	Yahara River	Reducing agricultural phosphorus loss to surface waters
<i>Upper Sugar Watershed Coalition</i>	Sugar River	Identify highly erodible areas to focus conservation efforts
<i>Pecatonica Pride Farms</i>	Pecatonica River	Farmers, landowners, community groups working to restore all designated uses

(LWRM) Plans. Counties must receive DATCP approval of their LWRM plans to receive cost-sharing grants for BMP implementation. In 2017, the SWRM Program provided counties \$5.4 million in grants for landowner cost-sharing. DATCP is also responsible for providing local assistance grants for

county conservation staff implementing the NPS control activities included in the LWRM plans. DATCP’s annual staffing grant allocation, which in 2017 approached \$9 million, supplemented by local and other sources to support a statewide network of over 350 conservation department staff in 72 counties

Highlights of land and water conservation programs and project success stories can be found in the Land and Water Conservation 2015 Annual Report <https://datcp.wi.gov/Documents/LandWaterAnnualReport2015.pdf>

Farmland Preservation Program Participation and Conservation

Landowners can participate in the farmland preservation program via farmland preservation zoning or farmland preservation agreements. Landowners whose land is covered by a farmland preservation zoning ordinance may be eligible to claim an income tax credit if they meet state soil and water conservation standards. Another avenue for participation in the program is a farmland preservation agreement. Landowners sign a contract with the state agreeing to keep their land in agricultural use and follow state conservation standards for 15 years in exchange for a farmland preservation tax credit. Statewide,

the most recent available data for tax year 2015, shows that 13,376 landowners claimed FPP tax credits based on their participation in either farmland preservation agreements or farmland preservation zoning or both. This participation accounted for 2.53 million acres of farmland. The number of FPP claimants and the farmland acreage over the tax years 2013, 2014 and 2015 have remained relatively stable. Beginning with tax year 2016, DATCP and the Department of Revenue tightened conservation compliance requirements by requiring that landowners obtain a certificate of compliance as a condition for claiming a tax credit.

Conservation Reserve Enhancement Program (CREP)

CREP is a subprogram of CRP and is administered by both USDA and the state of Wisconsin DATCP through county land conservation departments. Participating landowners voluntarily establish conservation practices on environmentally sensitive agricultural land near bodies of water. The conservation practices are intended to decrease erosion, safeguard ground and surface water, and restore wildlife habitat. Enrollment is through 15-year agreements or perpetual easements. From 2002 to June 2016, 4300 CREP contracts have resulted in the enrollment of 46,600 acres into agricultural conservation practices, with 39,800

acres entered in 15-year agreements and 6,800 acres in perpetual easements. Federal and state payments during this period have totaled over \$113 million. CREP installed buffers and other practices are estimated to return the following annual water quality benefits: (a) buffered 1,500 miles of streams, part of the state goal of 3,700 miles; (b) prevented 145,000 pounds of phosphorus deposition, part of the state goal of 610,000 pounds annually; (c) prevented 77,000 pounds of nitrogen deposition, part of a goal of 305,000 pounds annually; and (d) removed 71,200 tons of sediment, part of a goal of 355,000 tons annually.

USDA Natural Resource Conservation Service (NRCS) Programs

The Wisconsin NRCS programs and staff play a key role in providing technical and financial assistance for implementing practices that reduce nutrient losses to water. The ongoing EQIP, CSP and statewide easement programs provide base funding (\$51 M in 2015) for conservation practices in every watershed. In FY 15, \$2.34 M from EQIP funded 513 cover crop contracts. Through all NRCS programs in FY15, 426,436 acres had conservation practices applied to improve water quality. In addition, the following programs are particularly focused on reducing nutrient impacts on water quality:

National Water Quality Initiative

NWQI – Through the [*National Water Quality Initiative*](#) (NWQI), the Natural Resources Conservation Service and partners work with agricultural producers to implement voluntary conservation practices to improve water quality in high-priority watersheds while maintaining agricultural productivity. NWQI is designed to help individual agricultural producers take actions to reduce the runoff of sediment, nutrients and pathogens into waterways where water quality is a critical concern. The goal is to implement conservation practices in focused watersheds in a concentrated area so that agriculture no longer contributes to the impairment of water bodies within these priority watersheds. Within NWQI eligible producers may receive assistance through the Environmental Quality Incentives Program (EQIP) for installing on-farm conservation practices. With coordination through the Wisconsin Department of Natural Resources and local Land Conservation Departments, two new watersheds were approved for NWQI in 2016: Wilson Creek in Dunn and St. Croix County and Spring Creek in Green County.

Mississippi River Basin Healthy Watersheds Initiative

MRBI – To improve the health of the Mississippi River Basin, NRCS established the [*Mississippi River Basin Healthy Watersheds Initiative*](#) (MRBI). Through this Initiative, NRCS and its partners help producers in selected watersheds in the Mississippi River Basin voluntarily implement conservation practices that avoid, control and trap nutrient runoff; improve wildlife habitat; and maintain agricultural productivity. Project work in five subwatersheds of the Rush River watershed in Pierce County began in 2015 and in 2016 in ten subwatersheds of the Kickapoo River watershed in Vernon, Crawford, and Richland County. Funding through the Environmental Quality Incentives Program will continue through 2018. To date, with the help of numerous partners, \$1.5 million has been obligated through 54 contracts on nearly 7,300 acres. Cover crops, grassed waterways and animal feedlot/pasture management are the most utilized conservation practices.

Regional Conservation Partnership Program

RCPP – The *Regional Conservation Partnership Program* (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. Water quality is the top resource priority for RCPP in Wisconsin and several new projects

approved in 2015 and 2016 directly address the concern. Projects with partners in the Yahara River (described in Chapter 4), Baraboo River (below), Oconomowoc River (Chapter 4), and Milwaukee River (Chapter 5) watersheds are implementing several strategies for reducing nutrient loading to surface waters. In addition, riparian corridors in the Driftless Area will benefit from improved water quality and fish and wildlife habitat from a new 2016 RCPP project sponsored by Trout Unlimited.

RCPP Spotlight:

Baraboo River Watershed RCPP/Sauk County Conservation, Planning and Zoning Dept.

The Baraboo River has been identified as the second greatest contributor of total phosphorus loading to the Wisconsin River (TMDL development in progress, see Chapter 4). The Sauk County Conservation, Planning and Zoning Department has partnered with five other County Land and Water Conservation Departments to improve water quality in the Baraboo River Watershed through promotion and installation of soil and water conservation practices in high-yield locations identified through EVAAL and SWAT modeling. The process of identifying priority fields has been completed in Sauk County. The other partnering counties have plans to complete their priority landowner list in the future. A total of 274 priority landowners have been identified in Sauk County, meaning that 137 priority landowners will be assisted to reach the project goal of 50 percent. To date, Sauk County has assisted nine priority landowners. Sauk County is working to increase contacts with priority landowners in the future. Outreach and education to promote practices has occurred through field day demonstrations focused on cover crops and rotational grazing, nutrient management education classes and direct mailings to priority landowners identifying available cost-share for conservation practices. The project also includes monitoring of chemistry and biology at 10 sites in the Baraboo River watershed to evaluate water quality status and progress.

Wisconsin NRCS Revisions

Revision to the NRCS 590 Nutrient Management Standard

In 2015, NRCS released a revision to the Wisconsin 590 Nutrient Management technical standard. The 590 Standard was revised over a period of two years by a team of technical experts on nutrient management. The team was composed of farmers, agronomists, DATCP and DCNR representatives, UW soil professors, and NRCS specialists. The revisions to the standard greatly increased the protections for ground and surface water resources. The 2015 590 standard is expected to be adopted by DATCP in 2017. Once adopted the new standard will then be applied on a statewide basis. While the entire 2015 Wisconsin 590 NM Standard can be found [here](#), a few notable revisions include:

1. Prohibiting nutrient applications within 50' of all direct conduits to groundwater where only grazing and a limited amount of corn starter fertilizer may be applied. This change was added to all direct conduits to groundwater, not just wells. However, the 2015-590 NM Standard deletes a 200' incorporation requirement for non-winter nutrient applications, allowing farmers to use less erosive tillage practices.
2. Prohibiting applications of manure within 100' of a non-community well which includes schools, restaurants, churches, and within 1,000' of a community well unless the manure is treated to reduce pathogen content.
3. Prohibiting winter nutrient applications within 300' of all direct conduits to groundwater, unless manure is directly deposited by gleaning or pasturing animals. This setback increased 100' from the 200' setback in the 2005-590 Standard.
4. Prohibiting liquid manure application in February or March on DNR Well Compensation Areas, or on fields with Silurian dolomite bedrock within 5' of the surface.
5. Limiting manure nitrogen (N) applications in late summer or fall using the lower application rate of either the current 2012 version of UW Pub. A2809 or 2015-590 NM Standard available N per acre rate for the situation on sites vulnerable to N leaching high permeability (P) soils, or rock (R) soils with < 20 inches to bedrock, or wet (W) soils with < 12 inches to apparent water table (PRW Soils). N rates of 90 or 120 lbs. N per acre have not changed. The rates depend on the crop, manure dry matter, and soil temperature.
6. Limiting winter manure applications when frozen or snow-covered soils prevent effective incorporation. The NM plan must limit these applications when slopes are > 6 percent and if fields have concentrated flow areas using 2 practices listed in the winter application section of the 2015-590 NM Standard. These requirements do not apply to manure deposited through winter gleaning or pasturing. Farmers will need more application acreage if they choose these practice options as either or both of the required practices for each field: apply manure in intermittent strips on no more than 50 percent of field; reduce manure application rate to 3,500 gal. or 30 lbs. P2O5, whichever is less; no manure application within 200 feet of all concentrated flow channels; fall tillage is on the contour and slopes are lower than 6%.

7. Prohibiting manure applications to areas locally delineated by the Land Conservation Committee as areas contributing runoff to direct conduits to groundwater, unless manure is substantially buried within 24 hours of application. This provision now requires incorporation to reduce the risk of runoff being intercepted by the conduit to groundwater in all seasons. Therefore, winter applications are prohibited, because the manure cannot be

effectively incorporated if the ground is frozen. Farmers may need more application acreage if the field's soil loss will be too high with the required manure incorporation or if crops are no-tilled. A conservation plan, signed by the land operator and approved by the county Land Conservation Committee, will be needed for designating winter spreading restrictions other than those specifically listed in the standard.

Revision to the NRCS 635 Vegetated Treatment Area

The 2016 revision had two goals: (1) update the state standard to comply with the recently released (Sept. 2015) National 635 standard, and meet EPA's effluent guideline of no discharge for large CAFO's (>1000 animal units) and decide if/how to

develop criteria for smaller animal feeding operations separately. The resulting design requirements will curtail the use of vegetated treatment areas without storage, and reduce the potential of discharges from feedlots and feed storage areas.

Tracking and Measuring Progress

Tracking the implementation of nonpoint source (NPS) pollution reduction practices on the landscape is an important but often challenging component of TMDL implementation tracking and assessment. These challenges become even greater in the context of point source permit compliance programs that require NPS partnerships such as adaptive management, water quality trading and the multi-discharger variance. A database system for efficiently and effectively tracking implementation of

nonpoint source (NPS) pollution implementation practices is currently under development. The system will include a web-based portal so external entities can easily and efficiently submit information. Gathering practice information in an electronic format will then allow for sharing the information in a map-based application, making it easy for the public to access and visualize NPS implementation activities. This system will also allow for easy submittal of information through data flows to EPA.

Chapter 4. Nutrient Reduction in Targeted Watersheds

Six clusters of watersheds were identified in the 2013 strategy as the top group of watersheds in the state for phosphorus control based on stream concentration of phosphorus and modeled phosphorus loads (pounds lost per acre per year). A top group of watersheds was also identified for nitrogen management and a top group for groundwater nitrate concerns.

Figure 10: Top Group Watersheds for Phosphorus.

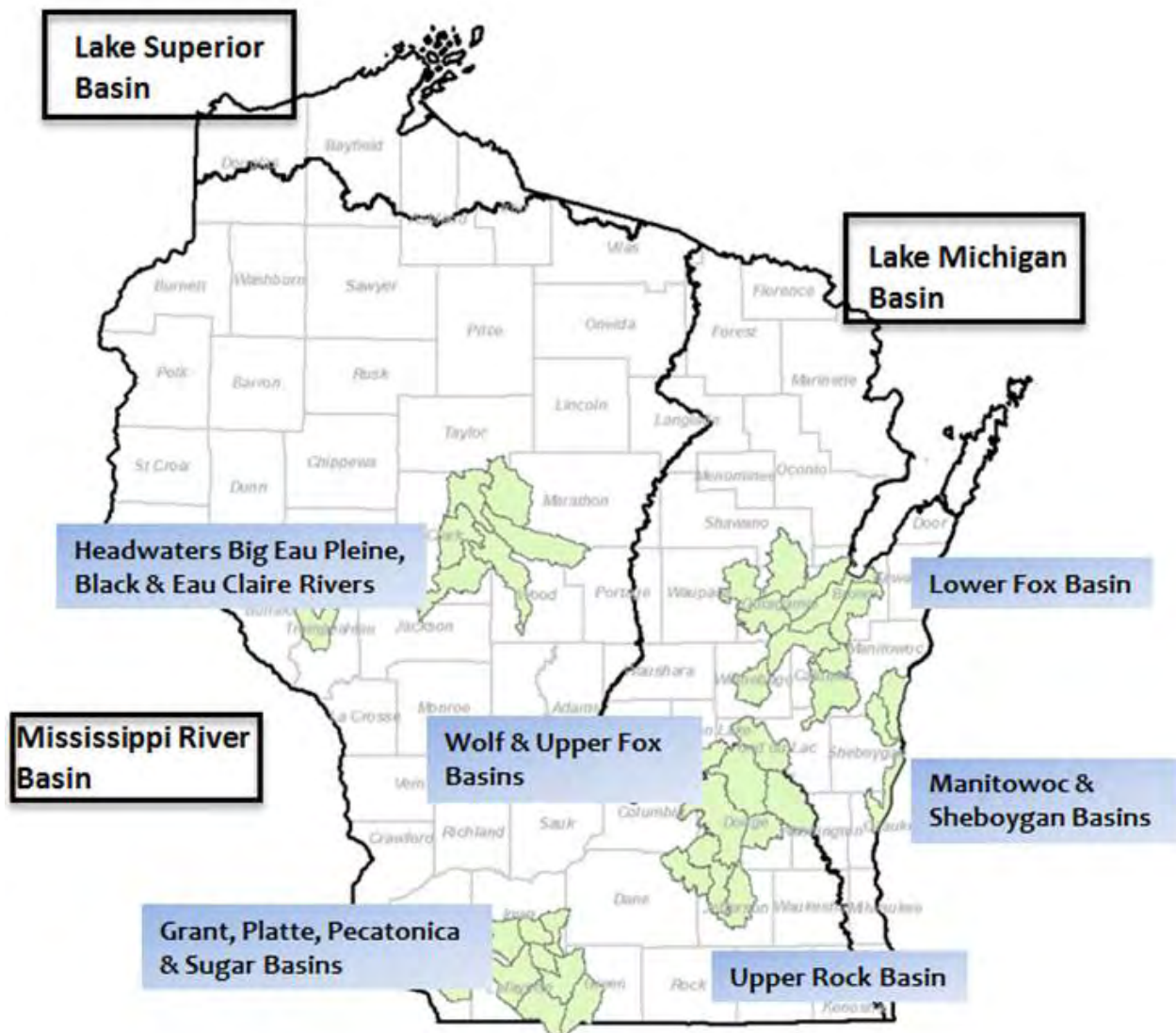


Figure 11: Top Group Watersheds for Nitrogen

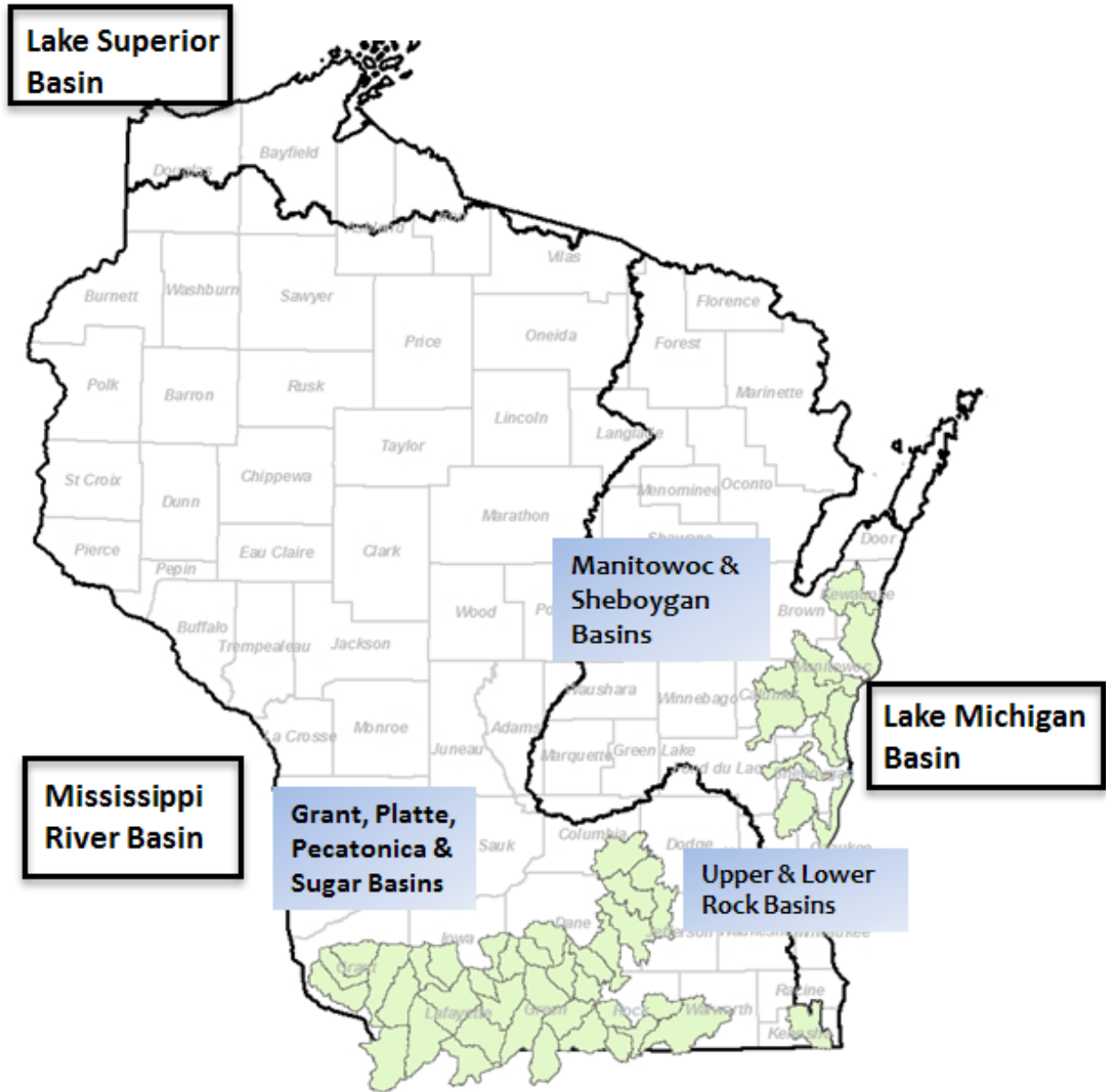
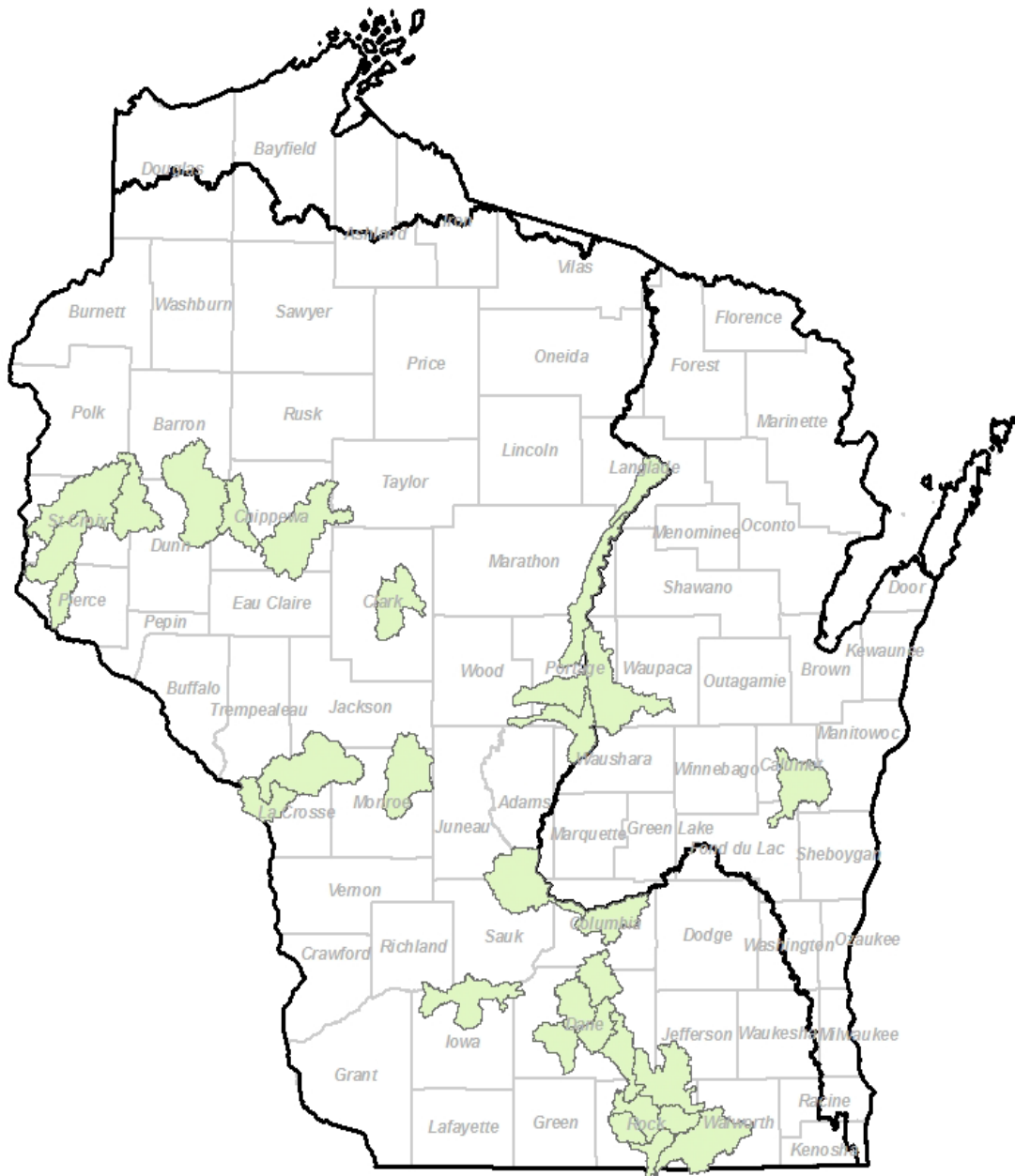


Figure 12: Top Group Watersheds for Drinking/Groundwater



4.1 Reducing Phosphorus Loss in Targeted Watersheds

– Mississippi River Basin

Rock River Basin

Rock River: TMDL implementation

The Rock River TMDL was published in September 2011. At the same time the TMDL was being developed, DNR was drafting the statewide phosphorus criteria for surface waters in Wisconsin. These criteria are incorporated in WPDES permits and consistent with implementation of the TMDL.

Point Sources

- 88 percent of WPDES point source discharge permit holders in the Rock River Basin have new permits with interim limits. Once P compliance schedules are completed, final TMDL-based WQBELs will take the place of interim limits.
 - Remaining permits are being issued as they expire.
 - Yahara WINS adaptive management pilot project (see further description below) concluded June 2016. The pilot project was very successful and resulted in the creation of a farmer led group called Yahara Pride, tens of thousands of acres receiving updated nutrient management plans, reducing thousands of pounds of phosphorus runoff to Six Mile Creek, and the development of a Nine Key Element Plan in Dorn Creek. This project has been expanded to a full-scale adaptive management project for the entire Yahara watershed (540 square miles or 16 percent of Rock River Basin) with 23 municipal partners, three county partners and 106,000 lb/yr P reduction target. Project targets, once reached, are projected to exceed TMDL goals.
 - Oconomowoc Watershed Protection Project has now been formally filed with DNR and completed its first year of implementation (see further description below). Total combined reductions when fully operational will exceed 4,500 lbs/yr of P.
 - Numerous other point sources are actively exploring water quality trading and adaptive management to meet their TMDL limits. For example, Sun Prairie and Edgerton are in discussions with other facilities to combine optimization with trading to meet TMDL limits.
- DNR staff have developed a TMDL permitting strategy for permitted MS4 communities to roll out TMDL implementation over three permit cycles. Existing communities have already received the first (general and individual) permit in this cycle for the Rock River Basin. Seven communities were newly identified as needing an MS4 permit, based on 2010 census information and will be expected to comply with TMDL reductions

Nonpoint Sources

- The Rock River TMDL includes 10 county partners in NPS implementation. The past three years have focused on working with counties, the Department of Agriculture, Trade and Consumer Protection and numerous watershed partners to develop a workable NPS implementation plan that is also consistent with the USEPA Nine Key Elements. DNR has developed a “county template” for the plan to facilitate implementation and tracking of NPS reductions – consistent with DATCP requirements for county Land & Water Resource Management Plans. Five of the 10 counties, representing a majority of NPS lands in the Rock River Basin, are either utilizing the implementation plan template, or a similar Nine Key Element watershed planning approach to implement NPS practices consistent with TMDL goals.
- NPS implementation focuses on local control, soil health and water quality, which are interrelated. A tool for recognizing these is the development and support of Farmer-Led Watershed Initiatives/Coalitions (see further description in Chapter 4). There are now two legally recognized groups (Yahara & Oconomowoc), one more being actively formed (Dodge County Soil Health), and three others being developed in Jefferson, Rock and Walworth Counties.

Rock River: Oconomowoc Watershed Protection Program

In 2013, Oconomowoc was informed of its future phosphorus limits and compliance schedule to be included in the next WPDES permit to be issued in early 2014 to its 4.0 MGD treatment facility. The estimated cost to implement phosphorus controls to meet permit limits for the treatment facility and MS4 was \$15 million. The City began to investigate the value of Water Quality Trading and Adaptive Management alternatives, and became aware of problem areas in the watershed and remedial projects taking place in areas upstream of the City. A partnership formed with Tall Pines Conservancy, a nonprofit agency that is heavily involved in land and water conservation efforts in northwest Waukesha County.

By mid-2014, the city had determined that adaptive management (see program description in Chapter 32) would be its method of complying with new phosphorus limits. Oconomowoc submitted its adaptive management application and plan to DNR and simultaneously applied for a Regional Conservation Partnership Program (RCPP) grant from NRCS (see program description in Chapter 3) to assist with implementation costs. Both applications were approved in 2015. The Oconomowoc plan identifies phosphorus reductions at the treatment plant (and timeline) but also identifies 79 potential critical source area project sites and associated phosphorus reductions, encompassing more than 1,700 acres. The approval of the adaptive management plan meant the city now had the main

tool in hand to fully implement a holistic watershed program to address point and non-point sources of nutrient loading to the entire 49 mile length of the Oconomowoc River. More than 25 partners made up of public and private entities, lake management districts and local government agencies were already signed on as a result of the application process for the RCPP and AMP and the city council had already passed budgets reflecting the anticipated costs of the program. With the adaptive management plan approach, it is anticipated the city and utility will save in total, \$10 to \$12 million over the next 15 years.

By the end of 2015, boots on the ground efforts were being deployed to educate local governments and land owners and coordinate potential projects in conjunction with the NRCS. By early 2016, the Oconomowoc Watershed Protection Program was conducting its second round of farmer education meetings. A farmer leadership group was formed consisting of five well respected producers from various locations in the watershed. This group has provided a wealth of knowledge and has given valuable testimony at outreach meetings. In June of this year the Oconomowoc project, in conjunction with its three main partners, Tall Pines Conservancy; Ruckert and Mielke; and the Clean Water Association put on the group's first Healthy Lakes Conference. This conference was geared toward shoreline management, lake water quality, the lake association membership and involvement in the Oconomowoc project.

Monitoring is a major component of the Oconomowoc effort and city staff and volunteers are sampling at more than 30

locations throughout the watershed. Official monitoring required by the adaptive management program is done once per month from May through October, and event monitoring is completed whenever possible during or after significant rainfall or snow melt. The data collected during the last two years has been extremely valuable and has confirmed some initial assumptions but has also exposed problem areas that were not expected. The city will be evaluated for compliance with the adaptive management program at Site #18 located just upstream of the confluence with the Rock River. By the beginning of the third WPDES permit term, (approximately 2027) the value of total phosphorus at this location must be at or below 0.075 mg/l based on a five-year statistical average. The Oconomowoc watershed monitoring effort will be enhanced by the fall of 2016 when five flow monitoring stations are installed at strategic locations on the Oconomowoc River through an agreement with Sand County Foundation, one of the program partners. This effort will provide valuable information on the mass of phosphorus moving through key points along the Oconomowoc River and through some of the larger lakes.

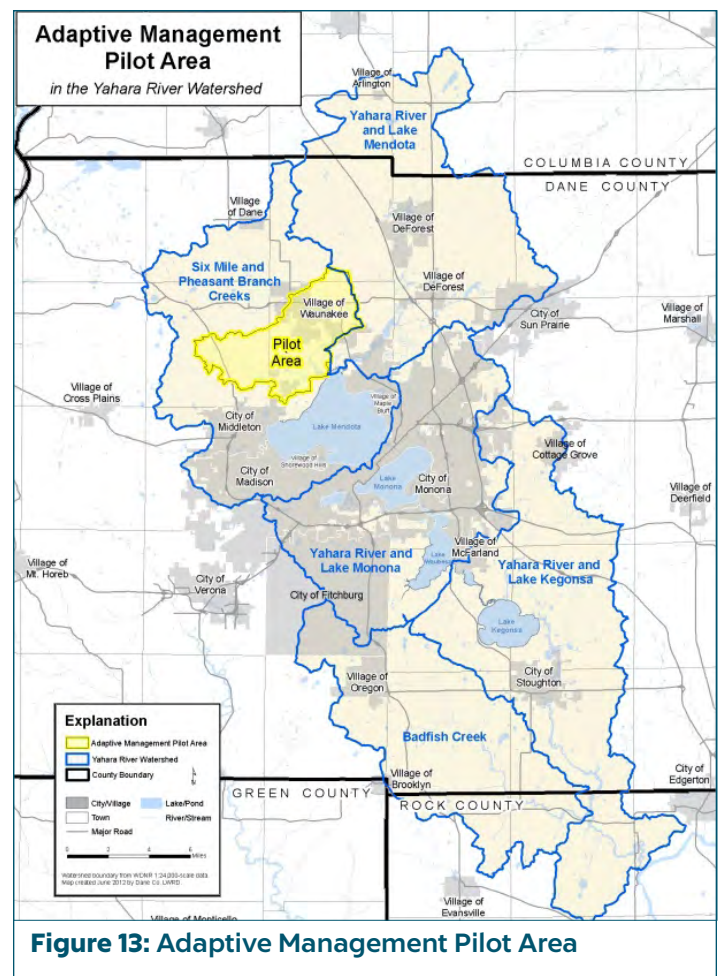
Rock River: Yahara WINs – Adaptive Management in the Yahara River Basin

Pilot Project: From mid-2012 to December 31, 2015, a diverse group of partners led by the Madison Metropolitan Sewerage District participated in an adaptive management pilot project. Partners included cities, villages, towns, wastewater treatment plants, agricultural producers, Dane County, the University of Wisconsin-Madison, the Wisconsin Department of Natural Resources, environmental organizations and others. The Yahara WINs pilot project took place in the Six Mile Creek watershed, an approximately 11,000-acre (17-square-mile) watershed located northwest of Lake Mendota (*See Figure 13*).

Project goals:

- Evaluating the cost, performance and the ability to implement phosphorus control practices, with a primary focus on agricultural control practices;
- Gauging the level of support for a full-scale project from participating partners and the broader community; and
- Establishing a baseline water quality monitoring program and evaluating (to the extent practicable) water quality impacts associated with implementing phosphorus control practices.

Full Scale Yahara WINs: the pilot project was successful in meeting these goals and provided Yahara WINs partners with enough confidence in adaptive management to transition to a full-scale adaptive management project. The project is being used by partners as a regulatory compliance strategy to meet phosphorus requirements laid out in the Rock River TMDL.



In 2016, 23 partners signed an Intergovernmental Agreement in which they are pooling resources to invest in a low-cost mix of phosphorus reducing practices aimed at permit compliance. Yahara WINs submitted an adaptive management plan to DNR that outlines the process to accomplish the needed reductions. WINs will work with

county land conservation departments, the Yahara Pride Farm Group (a producer led group), the Clean Lakes Alliance, USGS and many others in carrying out project objectives. The full scale project is poised to start in early 2017. In addition to focusing on phosphorus reductions, Yahara WINs has implemented a robust water quality monitoring program.

The intergovernmental agreement; pilot project report and draft Adaptive Management Plan as well as additional information are available on the Yahara WINS portion of the Madison Metropolitan Sewerage

District website (<http://www.madsewer.org/Programs-Initiatives/Yahara-WINs>)

The plan has been approved by DNR and will be incorporated into MMSD's WPDES permit upon permit reissuance in 2017.

Rock River: 2015 Yahara Pride Farms Outcomes

Yahara Pride Farms combines a diverse set of partners including the Clean Lakes Alliance, the Madison Metropolitan Sewerage District, the Natural Resource Conservation Service, UW-Extension Dane County and more than 20 other agribusiness and cooperative organizations. To increase the use of conservation practices in the watershed, Yahara Pride Farms provides a cost-share program. The goal of the cost-share program is to allow farmers the opportunity to test new, innovative technologies at a minimized risk, in hopes that farmers will see the benefits from the technology and incorporate the practice into their standard operations.

In 2015, farmers in the program documented the adoption of practices that reduced phosphorus delivery to the Madison chain of lakes and the Yahara River by 8,642 lbs.

Since 2012, farmers have documented a total phosphorus delivery reduction of 15,872 lbs. Documented practices include: cover crops, strip tillage, low disturbance manure injection, manure composting and low disturbance deep tillage. New data shows the promise of even greater reductions if practices are combined (known as stacking practices) and when practices are used for several years in a row.

Agriculture is vast in Dane County and the ability to impact clean water is more cost effective than some of the other viable options including storm water and waste water treatment. Across the state, farmers and municipalities alike are taking note of the successes of Yahara Pride Farms and working to replicate aspects of the program. Yahara Pride Farms is also gaining traction on a national level.

Rock River: Dredging of Legacy Sediments

Dane County is proposing to invest \$12 million over the next four years to remove 870,000 pounds of phosphorus in 33 miles of streams leading to county lakes. Years of accumulated sediment at the bottom of these streams may be leaching phosphorus into Dane County lakes. A county-funded study found that if the sediment is not removed, it will take 99 years to get a 50 percent reduction in phosphorus. The

first phase of the project will remove sediment in 2.3 miles of Dorn Creek, located northwest of Lake Mendota. Next phases of the project expand dredging to 30 miles of the Yahara Watershed, including Cherokee Marsh, Token, Six Mile, Dorr and Nine Springs creeks. Monitoring of water quality and biology will also be conducted at each stage of this pilot effort to gauge effectiveness.

Grant-Platte Watersheds

Of the 13 active point sources in the Grant-Platte, 11 have WQBELS for phosphorus. That means 85 percent of

dischargers have WQBELS and one has the technology standard of 1.0 mg/L.



Pecatonica – Sugar Watersheds

Green County Land and Water Conservation and the NRCS have been making a concerted effort to roll-out cover-crop, soil health and minimum/no-till education efforts across the Sugar and Pecatonica River Basin in Green County. They've conducted four field demonstration visits in 2016 and four in 2015. Events have been well attended/received with participation by producers, agronomists, and agricultural retailers. Specifically within the Sugar River Watershed, the majority of producers is now using cover crops, residue management and reduced tillage systems. UW-Extension also conducts annual workshops on nutrient management and optimization. Working in concert with UW-Extension and DNR, a Sugar River producer-led soil health initiative has been developed. Twelve producers have agreed to participate and are part of a committee to plan a producer-led soil health and water quality event for 2017. Many of these producers have already adopted advanced sustainable ag practices, such as no-till and manure injection and are committed to furthering the use of these practices across the watershed. For example, one of the members is one of the largest cash-grain operations in Green County – farming more than 2,500 acres no-till, for more than 20 years. A second member milks 450 cows and works 1,200 acres with extensive soil building practices, manure management and cover cropping

to restore soil health on depleted fields he has been acquiring from closing farms in the area. Two other producers also happen to be CAFOs and implement innovate manure handling practices including solids separation for bedding, sand reclamation, precision ag, cover crops and manure injection. These producers represent some of the most productive and respected farmers in the region and, working together, they have committed to further the soil health movement across the Sugar River watershed.

In order to address phosphorus, two WPDES permitted communities (Brooklyn and Brodhead) have chosen water quality trading as their permit compliance option. Both communities desire to work with local producers to recognize significant point and NPS reductions in phosphorus and TSS loading to the Sugar River. Grande Cheese in Juda is also considering water quality trading as the company's food/industrial WPDES permit compliance option and is considering a combination of land application and sustainable ag practice agreements to meet load reductions.

A Sugar River Watershed conference was held in April by the Lower Sugar River Watershed Association and a number of other partners. The event was attended by agency, community, farmers/producers and students and featured presentations on water quality,

soil health, point source pollution and aquatic ecosystems. Attendees represented both the Sugar and Pecatonica watersheds.

In the Pecatonica watershed, DNR hosted a series of nutrient reduction workshops in 2015/2016 and worked closely with WPDES permitted communities to explore and encourage the exploration of adaptive management and water quality trading

for permit compliance. The communities of Hollandale, Argyle, Blanchardville, and Barneveld have expressed a desire to potentially partner in a large-scale Pecatonica Watershed Water Quality Trading Project and work jointly to develop practices to meet point source pollution reduction requirements. DNR wastewater staff are working with the communities to facilitate permitting.

Pleasant Valley Watershed

The Nature Conservancy/Wisconsin is working with farmers to test a new approach to improving water quality in Wisconsin's lakes and rivers. The results of a nine-year effort to improve water quality in a tributary of the Pecatonica River in Dane and Green counties in southwest Wisconsin shows that targeting the application of conservation practices on agricultural lands with the highest estimated phosphorus runoff to streams, rather than randomly throughout a watershed, will result in cleaner water.

also significant. These results were obtained through the use of a paired watershed study using a test and a control watershed. The project focused on 11 farmers with fields and pastures with the highest estimated runoff phosphorus losses during storm events. Farmers who changed their management practices reduced both their estimated phosphorus and sediment losses by about half, keeping an estimated average 4,400 pounds of phosphorus and 1,300 tons of sediment out of the water each year.

Water quality monitoring data, following a three-year implementation period, show a 55 percent decrease in phosphorus loading in the test watershed. These results are the result of the conservation practices that farmers put into place. With 95 percent confidence this result is statistically significant. Similarly, the reduction in phosphorus concentration was

Another way to think about the reduction in phosphorus loading is that on a warm spring day with steady rainfall, if there would have been 500 pounds of phosphorus run-off without the project, after farmers put conservation practices in place on targeted fields and pastures there would only be 225 pounds.”



Headwaters Big Eau Pleine, Black and Eau Claire River

These are included as part of the Wisconsin River TMDL, see [Chapter 5](#) for further description.

Reducing Phosphorus Loss in Targeted Watersheds

– Lake Michigan Basin

Lake Michigan: Lower Fox River Basin

The Lower Fox River Basin, located between Lake Winnebago and Green Bay, is one of the highest priority watersheds in the Great Lakes Basin as well as having one of the first basin-wide Total Maximum Daily Load plans (TMDLs) for phosphorus. Implementation activities have received federal funding from the USDA Natural Resources Conservation Service (NRCS) and from the US Environmental Protection Agency's Great Lakes Restoration Initiative (GLRI), as well as state funding.

Key activities:

- TMDL Implementation
- Lower Fox Demonstration Farms
- Plum-Kankapot GLRI Project
- Fox P Trade
- Nine Key Element Watershed Plans
- The Lower Green Bay & Fox River AOC

TMDL Implementation

EPA approved the Lower Fox TMDL for phosphorus on May 18, 2012. **Point source** reductions of 107,595 pounds P per year will occur when all WPDES permits are reissued and all reduction actions are fully implemented. Currently, nine of the 30 total permits have been reissued, with an additional 12 expected to be reissued by mid-2017. Remaining permits will be re-issued as they expire. **Municipal separate storm sewer systems (MS4s)** in 29 municipalities received coverage under the WPDES general permit in May 2014. Full implementation will reduce 21,058 pounds P per year.

- Both TSS and TP loading reductions in the Lower Fox TMDL area continue to be pursued by permitted MS4s in 2015 and 2016. The department has supported those efforts through urban nonpoint source construction grants on

construction of five new regional ponds, one streambank stabilization project and one purchase of a high-efficiency street sweeper. The focus of TMDL-related MS4 permittee efforts during the current five year permit term is on assessment and planning. Many of the communities have either recently completed or are in the process of completing community-wide pollutant modeling to estimate pollutant reductions achieved within the TMDL watersheds and identify locations for new structural best management practices to be installed in the future. The department is providing cost-share dollars through the urban nonpoint source planning grant program for five permitted MS4's in the Lower Fox TMDL.

- The Heart of the Valley MSD has submitted the first water quality trading plan (see Chapter 3 for description of trading) within a TMDL area in the

state. Heart of the Valley is a major municipal wastewater treatment facility discharging to the Lower Fox River. Heart of the Valley is working to install a detention basin to precipitate TSS

and TP out of agricultural runoff from cropland in a predominately dairy crop rotation before the runoff can enter the Lower Fox River. TSS and TP credits will be generated from this practice.

Lower Fox Demonstration Farms

The USDA Natural Resources Conservation Service (NRCS) and the Great Lakes Commission (GLC) partnered to establish a Great Lakes Demonstration Farm Network, the first of its kind in Wisconsin. Other partners include the Brown County Land & Water Conservation Department and Outagamie County Land Conservation Department. The network is working to provide better information on the effectiveness of conservation systems used to improve water quality. The participating farms demonstrate effectiveness and adaptability of conservation practice systems to reduce erosion and sedimentation, control phosphorus runoff and address other nonpoint source pollution issues. The network also provides educational technology transfer opportunities for the public, farmers, land managers, agribusiness, environmental organizations, natural resource agencies and research entities and their partners.

The Demonstration Farm Network objectives are to:

- establish demonstration farms within the Lower Fox Watershed to test new and standard conservation systems in reducing phosphorus and sediment;
- establish an efficient mechanism to share this technology and information with farmers, agribusiness, conservation agencies and the public;
- create opportunities for others to test their research, technical and program ideas at the demonstration farms; and
- share information and lessons learned from the Lower Fox Watershed throughout the Great Lakes basin.

The four farms participating in the Network are Brickstead Dairy, operated by Dan Brick; Nettekoven Farms, operated by Greg and Karon Nettekoven; Tinedale Cropping, operated by Scott Theunis and family; and Van Wychen Farms, operated by George Van Wychen and his son Nick. Each of these farms has played an intricate role in trying, demonstrating and sharing information about leading-edge practices and technologies applied on their farms. Practices include cover crops, reduced tillage, reduced-disturbance manure application, pesticide management and water quality monitoring.

Plum-Kankapot GLRI Project

The Fox-Wolf Watershed Alliance was awarded a \$4.2 million Great Lakes Restoration Initiative (GLRI) Grant from U.S. EPA in March of 2015 to begin implementation of a watershed recovery effort for the Lower Fox River over the next five years. The Plum and Kankapot sub-watersheds were identified as the highest loading sediment and phosphorus watersheds to the Lower Fox River per agricultural acre. The project team will work with producers in the Plum and Kankapot Creek sub-watersheds to reduce sediment and phosphorus runoff.

Partners in the project include: Outagamie County and Brown County Land Conservation Departments, the Nature Conservancy, University of Wisconsin - Green Bay and the Great Lakes Commission.

The funding will give Land Conservation Department staff the ability to offer financial assistance to farmers to install land conservation best management practices that work towards keeping the soil in place. Practices such as cover crops, streambank protection, stream buffering, concentrated flow area seeding and agricultural treatment wetlands are being promoted and installed throughout the watershed. Funding for equipment to showcase and allow producers to test on their own farms

was also included as a part of the project. In 2015, a vertical till manure injector was purchased and used throughout the Plum and Kankapot Watershed. This equipment has sparked the interest among producers in the Plum Creek and Kankapot Creek subwatershed, but throughout the Lower Fox River Basin. A private hauler has since purchased his own injector.

Staff from the UW-Green Bay (UWGB) Department of Natural and Applied Sciences in cooperation with the US Geological Survey Wisconsin Water Science Center will conduct water quality monitoring activities and investigate data associated with sediment reduction strategies in Plum and Kankapot Creek sub-watersheds. Two subwatersheds, Plum and West Plum, will be compared using existing data as the baseline period. After the land conservation best management practices (BMPs) are installed in the Plum Creek subwatershed, the pre- and post- treatment relationships between the control and treated watersheds will then be compared. UWGB and the USGS are also conducting edge-of-field monitoring to determine the effectiveness of the practices in controlling sediment runoff as well as monitoring the effectiveness of small treatment wetlands installed as part of the project.

Fox P Trade

The Fox P Trade project has continued to test the Wisconsin water quality trading guidance (adopted in 2013) as it applies in the Fox River Watershed, which is subject to a TMDL. This 3.5 year project is scheduled to end September 30, 2016. Templates for documents to support phosphorus credit trading have been developed and tested through hypothetical trades. Workshops and webinars were held throughout to share progress, teach stakeholders about water quality trading and gain feedback on key elements of a trading program. Through these activities, the project built consensus around recommended ways to structure the trading market, and which entities are best suited to perform key roles, such as credit certification, practice verification, and brokering trades. Additional details about the project are on the Great Lakes Commission's web site at <http://glc.org/projects/water-quality/foxptrade/>

In October 2016, the project culminated with a pilot phosphorus trade agreement between NEW Water (Green Bay Metropolitan Sewerage District) and Bob Van De

Loo and Sons Inc. of Kakauna, in Outagamie County. In the agreement, the farmer will be compensated by NEW Water for the use of cover crops, conservation tillage and buffers. A portion of the pounds of phosphorus reduced from the farm will be credited for trading. While this initial trade is not necessary for NEW Water to be compliance with its current Wisconsin Pollutant Discharge Elimination System permit, it lays the groundwork for trading as a future compliance option and demonstrates the process of how trading works in a TMDL watershed. To this end, the project has been a valuable exercise in assisting the stakeholders in the watershed as well as the Wisconsin Department of Natural Resources to better understand the various issues that arise as the guidance is implemented in impaired watersheds. A trading handbook and interactive web-based trading portal (www.foxptrade.org) tailored to this watershed are key final products. The Great Lakes Commission looks forward to seeing the trading in the Lower Fox River Watershed live on under the guidance of the local Fox-Wolf Watershed Alliance.

Nine Key Element Watershed Plans

DNR completed review and issued approval of Nine Element watershed plans for the Upper East River watershed and Upper Duck Creek watershed plans in 2016. The East River, Duck and Plum/Kankapot watersheds have been identified via water quality monitoring and Lower Fox TMDL calculations, as three of the largest sediment and P loading areas to the Lower Fox River (listed as impaired for phosphorus and sediment).

The Upper East River and Upper Duck plans use the same approach as the Plum/Kankapot plan by using DNR and EPA modeling tools – EVAAL and STEPL – to identify priority areas and model pollutant reductions from a combination of various practices in order to address the Nine Key Elements and Lower Fox TMDL reduction goals. The plans also rely upon existing or new water quality monitoring stations at the mouth of each of these watersheds to confirm if practices (and modeled reductions) implemented result or do not result in improved water quality.

All three plans have 10 year schedules and contain milestones that reflect realistic landowner participation rates and implementation of various practices on 75 percent of cropland acres in each watershed. Because of this, the plans explain they will make substantial progress towards, but fall short of, meeting overall Lower Fox

TMDL P reduction goals. To meet the Nine Key Elements, each plan explains additional practices or new technologies to meet the remaining TMDL P and sediment reductions that are predicted, via SWAT modeling, to restore impaired waters in the basin. The plans represent current examples of the overall Lower Fox TMDL implementation plan strategy. Additional Nine Key Element watershed plans are expected to be developed for other Lower Fox river subwatersheds in the next two years.

In addition to NineKey Element plans, DNR initiated a new project to further assist with Lower Fox TMDL implementation. The new project will define Lower Fox TMDL baseline conditions for multiple sub-basins within the Lower Fox River watershed by incorporating the Lower Fox TMDL SWAT model assumptions for NPS Agriculture into Wisconsin's SNAP+ model. Once complete, the SNAP+ model sub-basin outputs will help explain (in a language that agriculture understands) how the Lower Fox TMDL NPS reductions apply to croplands and pastures on either a field or farm wide basis. Currently, the SWAT model TMDL reductions are difficult to apply/interpret on these scales. Using SNAP+ model outputs will help DNR, county, farmers and consultants determine what NPS practices and reductions are ne to meet TMDL reductions

The Lower Green Bay & Fox River AOC

Great Lakes rivers and harbors that have been most severely affected by historical pollution and habitat loss are considered “Areas of Concern,” or AOCs. Designated in 1987 under an international agreement between the U.S. and Canada known as the Great Lakes Water Quality Agreement, these sites need special attention for restoration and cleanup. The Lower Green Bay/Fox River is one of Wisconsin’s five designated AOCs. It is impaired for “Eutrophication or Undesirable Algae,” one of 14 possible impairments listed in the Great Lakes Water Quality Agreement (it is considered impaired for 13 of the possible 14 impairments overall). Wisconsin is exploring ways that the AOC program can address this impairment while acknowledging the scope of the program, which focuses on defined

geographic areas and legacy pollutants. Given the scope and complexity of the eutrophication issue, the AOC program aims to complement and support efforts that are underway through other programs and initiatives.

DNR has been working with partners and stakeholders to refine the outcomes that will define success for the AOC program for the “eutrophication or undesirable algae” impairment as well as to establish the types of actions that AOC GLRI funds can support. Together, these will set the stage for the AOC to contribute a defined amount of conservation practice implementation to reduce nutrient loading to the Lower Fox River and Lower Green Bay.

Lake Michigan: Manitowoc-Sheboygan River Basins

The Nature Conservancy/Wisconsin is leading a project in the Sheboygan River watershed that mirrors the approach used in the Pecos River watershed. In 2013, work began with farmers to implement conservation practices designed to reduce phosphorus runoff from the targeted fields. Through the summer of 2016, changes to farming practices were implemented and the impacts on water quality were measured in Otter Creek, the test watershed. In this project, 10 farmers with fields with the highest phosphorus index values made changes to improve conservation on their farms. Through the project there are 1,710 acres of nutrient management plans, 6 grass buffers, four grass waterways, a bioreactor, 60 acres of conservation tillage, and pasture fencing and milk house system on a dairy that focuses on grazing. The Nature

Conservancy will continue to track water quality with USGS monitoring stations at the mouth of the two small watersheds (HUC 14).

In 2015, this work was expanded to the Mullet River, another tributary of the Sheboygan River. The city of Plymouth is located on this river. This city has a wastewater treatment plant discharging treated water into the river. Like hundreds of cities across Wisconsin, Plymouth will take a serious look at the feasibility of providing funding to farmers to change practices on their farms to avoid large capital costs with advanced treatment needs. The Nature Conservancy has worked with two farmers with incentive funding for the construction of a manure pit and nutrient management planning. On the second farm a grassed waterway was installed.

Reducing Nitrate in Groundwater

Nitrate Demonstration Initiative

DNR Bureau of Drinking Water and Groundwater is conducting pilot projects to target groundwater watersheds where public water systems are experiencing rising nitrate trends as a result of nonpoint contributions. Known as the Nitrate Demonstration Project, pilot projects have been initiated in three separate communities: the village of Spring Green; village of Fall Creek; and the city of Waupaca. These projects serve as “problem focus areas,” as each of them have community water systems with nitrate trends above 5 mg/L and approaching the maximum contaminant level of 10 mg/L. The objective is to demonstrate methods and ultimately create a set of decision support tools, to enable communities and landowners to protect and improve source water quality by optimizing nitrogen management practices.

The process starts with an assessment of individual wellhead vulnerability to nitrate impacts, consideration of refinements to existing delineations of source water protection areas where necessary and assessment of existing nitrogen management practices with a view toward opportunities to increase nutrient utilization efficiency and reduce losses to groundwater. Additionally, data is being collected to: 1) assess water quality changes on the basis of improved management practices; and 2) to improve methods to evaluate the potential water quality benefits of management practices, including nitrogen budgeting (mass balance) and the use of process based agro-ecosystem modeling for the purpose of nitrogen management scenario testing. Agreements to significantly modify nitrogen management in order to achieve water quality benefits are developed using voluntary, incentive-based mechanisms.

Accomplishments to date:

- Statewide assessment of all subwatersheds (groundwater nitrate condition, sensitive drinking water receptors, wastewater discharge collaboration opportunities, hydrogeologic data and flow model availability).
- Development of a monitoring and modeling scope of work and identification of partner capacity. See “Nitrate Transport Monitoring Scope _ Draft 6-5-13”
- Identification of geographic priority areas through application of Selection Criteria.
- Recruitment of the village of Spring Green, village of Fall Creek and the city of Waupaca to participate in comprehensive pilot projects.
- Landowner recruitment (cooperating farmers) in each pilot demonstration area.
- Agreements with landowners and municipalities concerning regulatory assurance and confidentiality of sensitive producer records.
- Evaluation of wellhead protection area delineations for priority areas.
- Installation of local hydrogeologic characterization and a field-edge nitrate flux monitoring system in Spring Green.
- Commencement of detailed wellhead

vulnerability assessment work in Waupaca, Spring Green and Fall Creek.

- Successful application of frequent interval, low cost monitoring techniques for measuring nitrate mass flux using supply wells as integrative monitoring wells.
- Contract for evaluation and adaptation

of an agro-ecosystem model for use in demonstration areas.

- Baseline nitrogen management data for three demonstration areas; for estimation of nitrate loading to groundwater by use of nitrogen budget methods; and for calibration of the agro-ecosystem models.

Steps planned for FFY2017 include:

- Additional agricultural producer and landowner recruitment (tailored methods based on producer advice and UW-Extension proposed value-add services to encourage participation).
- Continued data collection on groundwater quality, nitrogen management in agricultural production and parameters related to nitrate fate and transport.
- Groundwater modeling to better define volumetric recharge areas, nitrate loading tolerance of supply well and guide design of long term wellhead protection area nitrogen management.
- Testing of crop system and leaching models (agro-ecosystem), comparison with monitored groundwater conditions and comparison of other nitrogen

management and crop system methodologies

- Continued development of site-specific nitrogen management systems to achieve wellhead protection goals.
- Data collection and initial algorithm development for in-season crop sensing tools to aid nitrogen application timing and rate for corn.
- Begin economic analysis scoping and decision support tool development to compare cost of providing drinking water that meets nitrate standards by water supply infrastructure (new well or treatment system) versus incentivized implementation of nitrogen management practices within wellhead protection areas.

Addressing Groundwater Issues in Kewaunee County and Other Susceptible Areas

Kewaunee County contains areas known as “karst,” where fractured bedrock creates conduits for pollutants (nitrates, pathogens) to move from the surface to the groundwater. These pollutants can, in turn, be taken up in water wells, causing the water to be unsafe for drinking and other household uses. Kewaunee and Door Counties have areas where the soil depth over the karst geology is thin, creating increased risk of groundwater and well contamination. Sources of these pollutants may be from agricultural fields or septic systems. Wells constructed with inadequate casing may also be more susceptible to contamination. Public concern about contaminated wells in Kewaunee County led DNR along with other agencies and stakeholders to work together during 2015/2016 to develop recommendations for reducing the risk of groundwater contamination. The final report was issued in June 2016.

Wisconsin DNR has implemented a number of the work group recommendations including:

- Implementing field audits of manure spreading practices;
- Reallocating four staff to the CAFO permitting program (further resource enhancements may be considered for the FY2017-19 state budget);
- Revising emergency manure spreading guidance;
- Holding an informational meeting with Kewaunee County citizens regarding the recommendations; and
- Providing area farmers with recommended revised manure spreading practices.

Other recommendations in the process of implementation include reviewing and revising well contamination investigations, clarifying eligibility and process for supplying emergency drinking water, improving response coordination to contamination events between local governments and the state, and providing increased consistency in compliance activities.

In addition, Wisconsin DNR is in the process of implementing many more of the recommendations through revising the administrative rule that establishes nonpoint source pollution performance standards (NR 151). These revisions are intended to provide targeted pollution reducing performance standards for sensitive karst areas, wherever they occur in the state. The rules scoping statement was approved by Gov. Scott Walker and Natural Resources Board over the summer of 2016. The first meeting of the stakeholder’s technical advisory committee was held on Oct. 28, 2016. Five more meetings of the technical advisory committee are planned, followed by public hearings on proposed administrative rule revisions to be held in the summer of 2017. A final package is anticipated to be submitted to the Legislature for approval in early 2018.

Chapter 5. Integrating Point Source and Nonpoint Source Management in TMDL Watersheds

TMDL Implementation

In addition to the TMDL implementation occurring in the highest phosphorus yielding watersheds described in Chapter 4, efforts to reduce phosphorus losses are occurring in watersheds with established and developing TMDLs.

Red Cedar River Basin

A TMDL for phosphorus impairment of two impoundments of the Red Cedar River, Tainter Lake and Lake Menomin, was approved by U.S. EPA in 2012. Local water resource partners within the watershed (Red Cedar Water Quality Partnership) collaborated to develop a comprehensive water quality improvement strategy focused on implementing the TMDL that was finalized in 2015. The strategy meets the definition of a Nine Key Element plan, including in-depth analysis of phosphorus sources, control approaches and methods of tracking progress. It is a guide for the approaches and techniques that will be used over a ten-year period to reduce the levels of phosphorus entering the Red Cedar River system.

Point Sources

As a group, watershed point sources are already below their final TMDL phosphorus wasteload allocation goal. There are 19 active point sources with specific permits covered by the Red Cedar TMDL. All but one have been reissued since the TMDL was approved, and all have phosphorus limits that meet the TMDL

Nonpoint Sources

The partnership selected an interim goal for phosphorus reductions from nonpoint sources over 10 years (by 2025) based on anticipated reductions in phosphorus loads coming from multiple sources, but realizing the difficulty of achieving the full TMDL goals in only 10 years. The result is a goal for an overall reduction from all nonpoint sources of 40 percent or 186,000 lbs/yr above Tainter Lake over the next 10 years. Additional reductions would occur when similar efforts are made in the watershed area between Tainter and Menomin Lakes. An analysis was conducted of expected phosphorus load reduction from each BMP and how a combination of BMPs can be applied to conditions thought to exist in Red Cedar Basin to obtain substantial watershed phosphorus reductions.

The primary vehicle for outreach, education and implementation of this strategy is through the farmer-led council initiative, described below..

St. Croix River Basin

Point Sources

There are 24 active point sources with specific permits covered by the St Croix TMDL. Fourteen have been reissued since

Nonpoint Sources

The St. Croix/Red Cedar River Basin Farmer-Led Watershed Council Project. This project began in 2013 as a collaboration between farmers, UW-Extension and state and county government agencies to improve water quality in the St. Croix and Red Cedar River Basins. Participating farmers are located in four sub-watersheds, one each in Dunn, Pierce, Polk and St. Croix counties. The watersheds (each about 20,000 acres) are all contributors to TMDL areas in northwestern Wisconsin and were selected based on an assessment that conservation practice adoption is likely and ultimately water quality improvements will follow.

Work to date has focused on data collection to create a baseline for phosphorus movement in the watersheds; education for farmers and all project partners on topics related to water quality, soil health and climate change; and conservation incentives created by the farmers to encourage greater adoption of particular conservation practices. Cost-sharing was offered in 2015 for grassed waterways, soil tests, cover crops, manure spreader calibration and no-obligation conservation “walkover”.

In 2015, an on-farm research program was developed to test no-till and cover crop scenarios. Further, the councils held dozens of meetings, seminars and field days with

the TMDL was approved, all have phosphorus limits that meet the TMDL.

farmers focused on conservation, water quality and soil health. The primary purpose is to work in partnership with farmers to find effective, efficient and adoptable solutions that improve both water quality and farm performance.

In an effort to measure progress toward the goal of reducing phosphorus runoff into surface water, the councils began using the Spreadsheet Tool for Estimating Phosphorus Loads , a model developed by the Environmental Protection Agency. STEPL allow a user to input various data and then calculate the nutrient and sediment reductions from the installation of best management practices like cover crops, grassed waterway construction, reduced tillage, etc. In the Dry Run Creek watershed, the STEPL indicated that from the start of the project in 2013 through the end of 2015, BMP implementation resulted in a 496 lb/year P reduction or about 1.5 percent reduction in phosphorus loss. In the Horse Creek watershed, the model indicated a reduction of 4705 lb/year of phosphorus, equivalent to a 12 percent reduction. Models for the South Kinni and Hay River watersheds are forthcoming.

TMDL Development

Wisconsin River TMDL

Petenwell and Castle Rock Lakes, Wisconsin's second and fifth largest inland lakes, along with many reservoir lakes and tributaries in the Wisconsin River Basin are impaired as a result of excessive nutrient loading. Algal cell counts in these two lakes have measures that are several orders of magnitude in excess of the World Health Organization's guidelines for recreational waters. Overall, there are 85 waterways in the basin on the 2016 impaired waters list due to phosphorus, which feeds the excessive algal growth. Completion and EPA approval of the Wisconsin River Basin TMDL is expected in 2017.

In advance of TMDL completion, many actions to reduce phosphorus loss to water are already being implemented.

Implementation Planning

The next step following approval of the TMDL is to develop an implementation plan that specifically describes how the TMDL goals will be achieved. Wisconsin DNR has initiated an implementation planning process, which builds on past planning and implementation of practices to control or reduce nutrient and sediment pollutants in the Wisconsin River Basin.

The implementation planning process will develop strategies to most effectively utilize existing federal, state, and county-based programs to achieve wasteload and load allocations outlined in the TMDL. Details of the implementation plan will include project goals, actions, costs, timelines, reporting requirements, and evaluation criteria.

Targeted Runoff Management (TRM) grant projects in the TMDL project area

Since 2005, 29 TRM grants have funded the construction and implementation of agricultural best management in the TMDL project area. More than \$3.7 million in TRM grant awards have gone toward funding more than \$5.3 million in agricultural management practices, including construction manure facilities storage, barnyard runoff control practices and implementation of other NR 151 runoff management standards. One recent notable TRM grant awarded in the project area was the \$805,385 award received by Marathon County

for the Fenwood Creek Watershed, the most significant P loading HUC-12 within the Big Eau Pleine Watershed; the Big Eau Pleine itself is the highest loading tributary upstream of Petenwell Reservoir. This grant award spans Jan. 1, 2016 to Dec. 31, 2018 and includes funding for both cropping (\$25,373) and structural BMP's (\$739,935), as well as local assistance (\$39,825). Marathon County developed a Nine Key Element watershed plan for Fenwood Creek (HUC-12) watershed to meet Wisconsin River TMDL water quality reduction goal requirements.

Notice of Discharge (NOD) grant projects in the TMDL project area

Since 2005, 14 NOD grants have funded the construction and implementation of agricultural best management in the TMDL project area. More than \$2.1 million dollars in NOD grant awards have gone toward funding more than \$3 million in agricultural management practices, including constructing manure facilities storage, barnyard runoff control practices and implementation of other NR 151 runoff

management standards. Currently, there are six livestock facilities located within project area that have been determined to be in violation of state agricultural performance standard and/or manure management prohibition requirements. As a result, these facilities have received NOD grants to install and implement BMPs to meet NR 151 agricultural performance standards and manure management rules.

Lake and River Planning & Protection Grants in the TMDL Project area

Since 2005, more than \$2 million in lake and river planning projects and nearly \$3 million in lake protection grants have funded over

\$7.8 in lake and river planning and projects in the TMDL project area.

DATCP Producer Led Watershed Councils Grants

Included in this first round of awards was a \$20,000 award to the Farmers of Mill Creek for Water quality improvement and public outreach in Mill Creek. Specifically, through this project, the Farmers of Mill Creek Watershed Council will work with Portage County UW-Extension to perform cover crop research regarding effects on

soil moisture and temperature, as well as research on agricultural drains to improve water management. The group will also offer incentives for planting cover crops and focus on outreach to farmers through educational field days. Mill Creek is the fourth highest TP loading tributary watershed upstream of Petenwell Reservoir.

Healthy Soil, Health Water Partnership

DNR staff had a lead, but “behind the scenes” role in establishing a partnership between ag producers and water quality advocates to find common ground and develop a strategy for promoting phosphorus reductions from agricultural operations that focused on healthy soil including cover crops and no-till practices. The first activity was a Healthy Soil, Healthy Water workshop for producers

in the basin to learn and share stories about no-till and cover crop practices. The workshop featured a nationally known soil health expert as well as local producers who have already implemented no-till and cover crops practices, who shared their experiences about what works and what doesn’t in their specific location. More than 65 producers participated in the workshop. The partnership’s

next intended effort is to invite agronomists and the producers they work with to participate in a workshop as a group, so producers and agronomists that work with similar operation types and in similar physical settings can learn together

about the locally and operation specific information they need to implement no till and cover crops and provide each other with post-workshop peer support and peer reinforcement.

Milwaukee River TMDL

The Milwaukee River Basin TMDL is comprised of four individual TMDLs: the Milwaukee River, Kinnickinnic River, Menomonee River and the Milwaukee Harbor/Estuary (which is also a Great Lakes Area of Concern). The TMDL is being developed as a third party TMDL by Milwaukee Metropolitan Sewerage District and its consultant, CDM-Smith. A major portion of the funding came from U.S. EPA via a Great Lakes Restoration Initiative grant. DNR and U.S. EPA have been on the TMDL development team providing quality assurance, policy input, regulatory guidance and independent direction to MMSD and its consultants. MMSD released the TMDL, on behalf of DNR, for preliminary public review in July 2016. DNR has conducted numerous stakeholder meetings throughout the TMDL area with all stakeholder groups including wastewater, industry, municipalities (storm-water), numerous public NGO partners and the agricultural community. DNR will conduct a public hearing and public comment period in November.

DNR is working with stakeholders to transition from TMDL development into the implementation phase. A significant proportion of pollutant loading (TSS, P, and fecal/e-coli) in the Milwaukee area comes from point sources – both municipal and industrial waste water discharges and urban stormwater. Nearly 100 percent of reductions in Kinnickinnic River (fully developed) and Menomonee River (~80 percent developed) will be required to come from point sources, while approximately 50% - >75 percent in the Milwaukee River will be required of point sources.

Point Sources

- DNR staff are conducting focused stakeholder meetings with WPDES permit holders to describe how TMDL limits will be incorporated into permits, what the permit cycle will look like and how permittees can work with DNR to address questions and best work together to facilitate smooth transition to new permits with TMDL limits.
- DNR staff are drafting TMDL-based WQBEL recommendations, in preparation for permit reissuances to begin once the TMDL has been approved by USEPA.
- DNR staff are working with community partners throughout the basin to facilitate watershed based permitting, water quality trading and adaptive management for facilities that may choose to explore these alternative permit compliance options.

Nonpoint Sources

Nonpoint contributions in the Milwaukee River Basin TMDL are primarily focused in the upper half of the Milwaukee River watershed, which includes portions of five counties. DNR has been working with county partners over the past two-plus years to prepare counties for TMDL implementation and addressing required reductions for NPS load allocations. Emphasis has been on developing partnerships to facilitate trading, development of farmer-led watershed initiatives and prioritizing potential project areas to facilitate the most effective implementation and utilization of NPS funding. DNR is encouraging the development of a nonpoint source plan that is also consistent with the Nine Key Elements of watershed-based planning.

DNR has developed a “county template” to facilitate implementation planning and tracking of NPS reductions – consistent with DATCP requirements for county Land & Water Plans.

A farmer-led coalition has formed in Ozaukee County – which covers the majority of the agricultural lands in the Milwaukee River watershed.

DNR staff are working with MMSD to help facilitate implementation of two large nonpoint source reduction efforts – Green Seams (buffer and easement program) and Working Lands (soil health and agricultural wetland restoration) Initiative. MMSD has dedicated staff and allocated approximately \$1.5 million to these programs over three years.



Upper Fox River & Wolf River Basins

Lake Winnebago, Wisconsin’s largest inland lake and the Winnebago pool lakes account for 17 percent of the state’s surface water resources. However, these lakes, along with many other lakes and tributaries within the Upper Fox and Wolf basins, are impaired due to excess phosphorus. Water leaving Lake Winnebago enters the Lower Fox basin. Because of this link, the completion

of the Upper Fox-Wolf River TMDL is also important to addressing impairments in the Lower Fox. Overall, there are 69 waterways in the two basins listed on the 2016 impaired waters list due to phosphorus which feeds the excessive algal growth. Completion and EPA approval of the Upper Fox and Wolf River Basin TMDL is expected in 2017.

During the TMDL development process DNR has been engaging all stakeholders regarding development and planning for implementation.

Conclusion

The above compendium of activities demonstrates significant implementation of nutrient reduction practices in 2015-16 through existing local, state and federal programs, as well as through non-governmental action. Measurable progress has been made in reducing phosphorus from point sources and agricultural nonpoint sources, and the point source compliance options of adaptive management/water quality trading, as well as TMDL implementation, are catalyzing collective action by point and nonpoint sources in key watersheds. Further, farmer-led efforts in many watersheds are putting a spotlight on how the agricultural community can successfully both minimize nutrient losses and be profitable—a key dynamic needed for effective nonpoint source pollution control. Wisconsin’s investment in and focus on improving water quality in its rivers, lakes and streams will also reduce nutrient losses to the Mississippi River and Gulf of Mexico.

Future Steps

Measurement/Tracking of Nonpoint Source Progress

The ability to measure and track implementation of nutrient reduction BMPs at the watershed scale is critical to the ability to evaluate progress in reducing the nonpoint source component of nutrient loading. This is necessary for reporting progress regarding the Nutrient Reduction Strategy, but also for determining whether the load allocations for particular TMDLs are being achieved. Work continues on developing a tracking tool for implementation funded through all state programs; project completion is expected in 2017. However, additional steps will be needed to capture BMP implementation funded through federal programs, notably Farm Bill programs administered by NRCS, and implementation that occurs outside of government programs. Some states have successfully entered into data-sharing agreements with NRCS and this may be an option for Wisconsin. Other states have developed approaches to capturing private nutrient BMP implementation data that Wisconsin may explore.