Madison Metropolitan Sewerage District
Adaptive Management Plan

September, 2025 (update #1)

January, 2017 (original)

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I. Introduction and Background

In 2010, the Wisconsin Department of Natural Resources (DNR) adopted revisions to administrative rules designed to control phosphorus discharges to waters of the state. These revisions, collectively referred to as the Phosphorus Rule Making Package, included the establishment of numeric water quality criteria for phosphorus.

In 2011, USEPA approved a Total Maximum Daily Load (TMDL) for the Rock River Basin to address water quality impairments caused by phosphorus and/or total suspended solids (TSS). The Rock River Basin covers an area of 3,300 square miles and includes the approximately 536-square-mile Yahara River Watershed, located in the west-central portion of the basin.

The Rock River TMDL identifies several stream segments in the Yahara Watershed that are impaired by phosphorus and/or TSS. The TMDL establishes allocations for phosphorus and TSS for all major source categories (municipal/industrial wastewater, municipal storm water, and agriculture), which are designed to bring impaired water bodies into compliance with applicable water quality criteria. To meet these allocations, reductions in phosphorus and TSS loads will be required from all source categories. The 2010 Phosphorus Rule Making Package included a provision for a new regulatory compliance strategy for phosphorus called the Watershed Adaptive Management Option (Wis. Admin Code § NR 217.18), commonly referred to as adaptive management. Adaptive management is a collaborative, watershed-based approach that allows phosphorus sources to work together to achieve the phosphorus water quality criteria in the most economically efficient manner, taking into consideration the contributions of phosphorus from point and nonpoint sources in a watershed. The authorizing language for adaptive management and its eligibility requirements are contained in Wis. Admin Code § NR 217.18. Per Wisconsin Act 378 and subsequent revisions to Wisconsin State Statutes (Wis. Stat. § 283), adaptive management can be used to address both phosphorus and TSS.

Madison Metropolitan Sewerage District (MMSD or the District) is a WPDES-permitted point source that discharges the majority of its effluent to Badfish Creek, which is located in the southern part of the Yahara Watershed. A preliminary review of the Rock River TMDL allocation for phosphorus led MMSD staff to conclude that a traditional "brick and mortar" compliance approach would likely require the use of filtration technology that would be extremely expensive and benefit only the limited portion of the Yahara Watershed located downstream from MMSD's effluent discharge point.

The need for filtration technology and the associated high cost were confirmed in an evaluation of nutrient removal technologies and associated costs conducted for the District by the consulting firm CH2MHILL. This evaluation was completed in early 2012. A range of potential effluent phosphorus limits were evaluated, including target values of 0.13 and 0.075 mg/L (values needed for the District to comply with the TMDL and the numeric water quality criterion for Badfish Creek, respectively). The study determined that meeting either of these target values required filtration. The estimated life cycle costs, expressed as Net Present Value costs, ranged from $78 M (to meet 0.13 mg/L) to $124 M (to meet 0.075 mg/L).

In 2011, District staff conducted a preliminary evaluation of adaptive management as an alternative phosphorus compliance strategy. This evaluation concluded that adaptive management could be a cost-effective and environmentally sound approach to addressing phosphorus from all sources within the Yahara Watershed. In late 2011, the MMSD Commission authorized District staff to conduct an adaptive

management pilot project in the Yahara Watershed to gain experience with adaptive management on a small scale.

In 2012, the District, in collaboration with over 30 municipal partners and other interested stakeholders, began the Yahara WINs adaptive management pilot project, a four-year effort to evaluate adaptive management as a phosphorus compliance strategy. The pilot project was conducted in the Six Mile Creek Watershed, located northwest of Lake Mendota (Figure 1) and was the first effort in Wisconsin to test the adaptive management concept.

Pilot project goals included:

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

Pilot project participants operated under a Memorandum of Understanding (MOU) and provided financial support for this approximately $3 million effort. The pilot project has been a success, demonstrating that point and nonpoint sources of phosphorus can work in a collaborative manner (including pooling financial resources) to advance a shared objective of reducing phosphorus loads needed to meet phosphorus water quality goals in the Yahara Watershed.

In 2014, Yahara WINs participants identified the need to build capacity to support a potential transition to a full-scale adaptive management project that would focus on the entire Yahara Watershed. This led to an expansion of phosphorus-reducing practices and water quality monitoring activities targeting areas outside of the pilot project area but within the broader Yahara Watershed.

In 2014, District staff also engaged in discussions with DNR that led to the execution of a new MOU (Appendix 1) that addresses several key areas relating to implementation of a full-scale adaptive management project in the Yahara Watershed, including the following:

- Development of an adaptive management plan
- Quantifying phosphorus and TSS reductions
- Measuring interim progress in meeting phosphorus and TSS reduction goals
- Reduction Credits for State-Funded Nonpoint Reductions
- Compliance at the end of the adaptive management period

In 2015, District staff evaluated estimated costs associated with a range of phosphorus compliance strategies and concluded that adaptive management represents a fiscally and environmentally responsible approach to achieving compliance with phosphorus WPDES permit requirements.

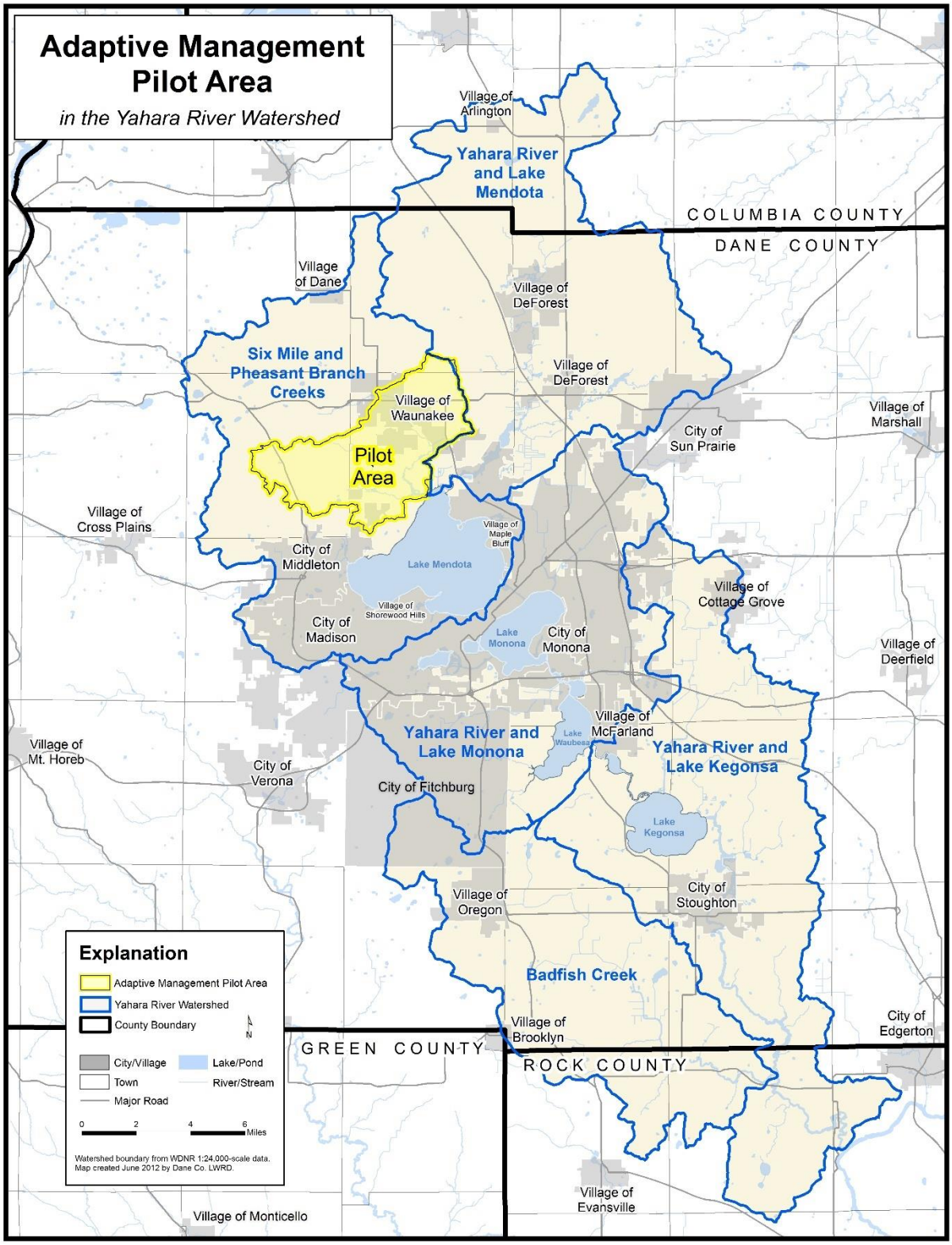


Figure 1: Six Mile Creek Pilot Project Area for Yahara WINs

In May 2015, the District Commission formally adopted a resolution directing District staff to:

- Meet and work with current Yahara WINs pilot project participants and other entities, including the agricultural sector, to determine if there is sufficient interest in participating in the full-scale adaptive management project;
- Begin work on developing an adaptive management plan consistent with the requirements in Wis. Admin Code § NR 217.18 and DNR guidance;
- Once the plan has been developed and assuming that there is demonstrated interest on the part of current pilot project participants, submit an adaptive management plan to DNR for review and potential approval;
- Develop other tools and conduct other activities as deemed necessary to support transition to a full-scale adaptive management project in a timely manner.

Based on experience gained through the pilot project and discussions with pilot project participants, District staff determined that there was sufficient interest on the part of Yahara WINs pilot project participants and other entities in advancing an adaptive management project covering the entire Yahara Watershed. District staff developed this adaptive management plan for this effort in consultation with multiple stakeholders and interested parties. District eligibility for the adaptive management option, background information on the Yahara Watershed, and the proposed adaptive management plan are laid out in the following sections. The Oregon and Stoughton Wastewater Treatment Facilities both participated in the adaptive management pilot project and they are also participating in a full-scale adaptive management project. Therefore, eligibility for the Oregon and Stoughton Wastewater Treatment Facilities is also addressed in this plan.

Per the 2014 Memorandum of Understanding between MMSD and DNR, the adaptive management project will be used by participating entities to meet numeric water quality criteria for phosphorus and reduce TSS to achieve applicable narrative standards. The TMDL outlines anticipated modeled reductions needed to meet phosphorus water quality criteria and narrative TSS standards. The adaptive management plan is structured to meet both the phosphorus and (TSS) allocations specified in the Rock River TMDL and will be used by participating entities as the TMDL compliance strategy.

2024 Update

The District found as part of the final adaptive management report for 1st permit term (5 year report) examining the process of the adaptive management project, the following highlights:

- Recognized by EPA as the national standard in watershed-based collaboration for reducing phosphorus runoff to meet water quality improvement goals.
- Exceeds annual phosphorus reduction goals every year since full-scale implementation across the entire watershed began in 2017.
- As of 2023, reduced 54,541 lbs. of phosphorus from entering surface waters in the Yahara River watershed.

Additional program highlights can be found within the annual reports available on the Yahara WINS website at https://yaharawins.org/resources/annual-reports/.

Meeting DNR Adaptive Management Planning Elements

This document contains all of DNR's nine required steps for an adaptive management plan, per the "Adaptive Management Technical Handbook-A Guidance Document for Stakeholders" (DNR, 2013). However, for purposes of organization and to eliminate redundancies, these elements are presented in a different order than shown in the Technical Handbook. For ease of cross-referencing, DNR elements appear in this document in the following locations:

Eligibility for Adaptive Management

The authorizing language for adaptive management and the eligibility requirements are contained in Wis. Admin Code § NR 217.18. DNR may approve and authorize a permittee to implement an adaptive management program if the permittee demonstrates and the Department concurs that all of the following have been met:

a. The exceedance of the applicable phosphorus criterion in s. NR 102.06 is caused by phosphorus contributions from both point sources and nonpoint sources.
b. Either the sum of the nonpoint sources and the permitted municipal separate storm sewer system contribution of phosphorus to the receiving water is at least 50 percent of a total contribution within the watershed of the receiving water where the applicable phosphorus criterion in s. NR 102.06 is exceeded; or the permittee demonstrates that the applicable phosphorus criterion cannot be met in the watershed without the control of phosphorus from nonpoint sources.
c. Documentation that the proposed water quality based effluent limit in the applicant's permit will require filtration or other equivalent treatment technology to achieve compliance.
d. The permittee has submitted an adaptive management plan that identifies specific actions to be implemented that will achieve compliance with the applicable phosphorus criterion in s. NR 102.06 through verifiable reductions of phosphorus from point and nonpoint sources within the watershed.

Each of these eligibility requirements is briefly addressed below. These eligibility requirements must be met by all point sources regulated under NR 217 that are participating in adaptive management. Therefore this section addresses the eligibility of MMSD, as well as the Oregon and Stoughton Wastewater Treatment Facilities.

A. Exceedance caused by phosphorus contributions from both point and nonpoint sources

The geographic scope for the District's watershed adaptive management option is the entire Yahara Watershed. Per the Rock River TMDL, the Yahara Watershed consists of stream reaches 62 through 69. The Rock River TMDL report provides baseline total phosphorus loads by stream reach for agriculture/non-permitted urban, municipal separate storm sewer systems (MS4s), and point sources, respectively. The TMDL data demonstrates that all stream reaches in the Yahara Watershed are impacted by phosphorus contributions from both point and nonpoint sources, including stream reach 69, in which the District and Oregon Wastewater Treatment Facility is located, and stream reach 68 in which the Stoughton Wastewater Treatment Facility is located. The growing season median concentration (2014-2016) for Badfish Creek at the closest sampling location to the confluence with the Yahara River is 0.26 mg/L. The growing season median concentration (2014-2016) for the Yahara River at the closest sampling location downstream of the confluence with Badfish Creek is 0.15 mg/L.

B. Either the sum of the nonpoint sources and the permitted municipal separate storm sewer system contribution of phosphorus to the receiving water is at least 50 percent of the total contribution within the watershed of the receiving water where the applicable phosphorus criterion in s. NR 102.06 is exceeded; or the permittee demonstrates that the applicable phosphorus criterion cannot be met in the watershed without the control of phosphorus from nonpoint sources.

Baseline phosphorus information for stream reaches located in the Yahara Watershed is summarized in Tables 1 and 2.

Table 1 contains the annual baseline phosphorus loads by source category with point source loads assuming design conditions. Under this load scenario, nonpoint and MS4 sources account for a combined 60% of the phosphorus load in the Yahara Watershed while point sources account for 40% of the phosphorus load.

Table 2 contains the annual baseline phosphorus loads by source category with adjustments made to reflect more recent information. Information sources include updated SWAT modeling conducted by MARS and Associates, updated stormwater modeling information for MS4s that was reviewed by DNR staff, and point source load information for the most recent five years on record (2011-2015) as obtained from DNR staff. Under these conditions, nonpoint and MS4 sources account for a combined 85% of the phosphorus load in the Yahara Watershed, while point sources account for 15% of the phosphorus load.

In both of the above cases, nonpoint and MS4 sources account for more than 50% of the baseline phosphorus load in the Yahara Watershed, demonstrating that this eligibility requirement is met. It should also be noted that early DNR staff presentations regarding the Rock River TMDL indicated that applicable phosphorus water quality criteria could not be met without the control of phosphorus from both point and nonpoint sources.

Source Category	Annual TP Load (lb)	Percent of Total
Agriculture	184,028	45%
Background	8,966	2%
Non-permitted urban	5,075	1%
MS4s	49,599	12%
Point sources	163,952	40%

Table 1: TMDL Annual TP Baseline Load (lb) in the Yahara Watershed by source category with Point Sources at design load. Data derived from Rock River TMDL Tables and Excel Spreadsheets containing TMDL data provided by Matt Diebel (DNR)

Source Category	Annual TP Load (lb)	Percent of Total
Agriculture	161,243	62%
Background	8,966	3%
Non-permitted urban	5,075	2%
MS4s	47,923	18%
Point sources	38,202	15%

Table 2: TMDL Annual TP Baseline Load (lb) in the Yahara Watershed by source category. Point sources at current loads using information provided by DNR (Theresa Nelson). MS4 at current loads using updated and DNR reviewed information when available. Agriculture loads using updated SWAT modeling by MARS and adjustments per DNR.

C. Documentation that the proposed water quality based effluent limit in the applicant's permit will require filtration or other equivalent treatment technology to achieve compliance.

Madison Metropolitan Sewerage District

In 2011 the District engaged the consulting firm CH2MHILL to evaluate the cost of nutrient removal technologies at the District's Nine Springs Wastewater Treatment Plant to meet potential future effluent limitations for phosphorus and nitrogen. The results of this evaluation were presented in a report titled "*Preliminary Nutrient Removal Cost Estimates Study*" (CH2MHILL; 2012).

In summary, the nutrient removal study evaluated nine different scenarios that involved phosphorus treatment alone or in combination with nitrogen treatment. Scenarios were based on potential future effluent limitations for phosphorus and/or nitrogen. Target effluent limitations are shown in Table 3.

Scenario	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
1	0.225 [2]	None [1]
2	0.130 [2]	None [1]
3	0.075 [3]	None [1]
4	0.225 [2]	10 [2]
5	0.130 [2]	10 [2]
6	0.075 [3]	10 [2]
7	0.225 [2]	3 [2]
8	0.130 [2]	3 [2]

9	0.075 [3]	3 [2]

Table 3: Target Effluent Limitations in Evaluated Scenarios (CH2MHill; 2012)

[1] Existing ammonia limits apply
[2] Monthly average concentrations
[3] Annual average concentrations

Scenarios 1 through 3 represent a range of potential future effluent phosphorus limitations for the District. Scenario 2 is based on meeting the most limiting monthly phosphorus allocation for the District from the Rock River TMDL. Scenario 3 is based on meeting the water quality criterion for streams in Wis. Admin Code § NR102. Per the CH2MHILL report, all three scenarios would require filtration. The CH2MHIILL report is not included as part of this adaptive management plan, but is available upon request.

2024 Update

It was confirmed that the CH2MHill study results are still accurate. To meet phosphorus requirements, filtration technology would still be needed for the Nine Springs Wastewater Treatment plant.

Stoughton and Oregon Wastewater Treatment Facilities

Using phosphorus load information from the Rock River TMDL, the most limiting monthly phosphorus allocation would result in phosphorus limits of 0.28 mg/L for the Stoughton facility and 0.13 mg/L for the Oregon facility. The applicable numeric water quality criterion for Badfish Creek, which receives the discharge from the Oregon Wastewater Treatment Facility, is 0.075 mg/L. Per the Adaptive Management Technical Handbook (DNR, 2013), DNR has concluded that if the calculated WQBEL is 0.40mg/L or less as a monthly average, that limit cannot be achieved without addition of filtration or other equivalent technology. Thus, both the Stoughton and Oregon wastewater treatment facilities meet this eligibility requirement. Stoughton has provided additional information demonstrating that filtration or equivalent technology is required to meet anticipated future phosphorus limits at design conditions. This information is provided in Appendix 13.

The April 24, 2015 Economic Impact Analysis presented to DNR and DOA (prepared by ARCADIS, Sycamore Advisors, and UMass) included capital and annual O&M cost estimates for treatment plant process upgrades necessary for achieving future phosphorus limits for each WPDES permitted discharger in Wisconsin. Filtration was the assumed treatment technology in this evaluation. Costs for both the Oregon and Stoughton Wastewater Treatment Facilities are shown below. Also shown is the estimated cost for adaptive management as based on cost information derived from the adaptive management cost/implementation model, which is briefly described in Section III of this plan. For both facilities, the annual O&M cost alone is higher than the estimated annual cost for each facility to participate in adaptive management.

Facility	**Capital Cost**	**Annual O&M Cost**	**Estimated Annual AM Cost**
Oregon	$ 7.3 M	$363,000	$80,000
Stoughton	$5.1 M	$236,000	$5,400

D. The permittee has submitted an adaptive management plan that identifies specific actions to be implemented that will achieve compliance with the applicable phosphorus criterion in s. NR 102.06 through verifiable reductions of phosphorus from point and nonpoint sources within the watershed.

The adaptive management plan for the Yahara Watershed is contained in the following sections. The plan is being advanced by the District, but represents a collaborative effort that includes over 30 municipal and other partners working together with the common objective of reducing phosphorus and TSS loads to receiving waters throughout the entire Yahara Watershed. Consistent with time frames specified in Wisconsin Act 378 and subsequent revisions to Wisconsin State Statutes (Wis. Stat. § 283), the adaptive management plan is based on implementation occurring over four permit terms (e.g. a 20-year implementation period). The adaptive management plan is consistent with the requirements in Wis. Admin Code § NR 217.18, and addresses the nine required steps identified in the "Adaptive Management Technical Handbook-A Guidance Document for Stakeholders" (DNR, 2013).

Table 4 identifies those Municipal WPDES permitted entities that have executed an Intergovernmental Agreement (Yahara WINS IGA) in which they have agreed to work collaboratively to meet phosphorus numeric water quality criteria and TSS narrative standards. These entities are using the Yahara WINS adaptive management project where necessary to meet their allocated phosphorus and TSS loads as specified in the Rock River TMDL.

Cities		Towns	
Madison	Monona	Blooming Grove	Middleton
Fitchburg	Sun Prairie	Cottage Grove	Westport
Middleton	Stoughton	Dunn	
Villages		**Point Sources**	
Cottage Grove	Shorewood Hills	MMSD	DNR-Nevin Fish Hatchery
Deforest	Waunakee	Oregon WWTF	
Maple Bluff	Windsor	Stoughton WWTF	
McFarland			
Others			
UW-Madison			

Table 4: Yahara WINs Partners with WPDES permits

Two of the municipal entities shown in Table 4 (Town of Dunn, and the Town of Westport) submitted updated stormwater modeling information to DNR after executing the IGA, demonstrating that they have complied with their TMDL allocated loads for phosphorus and/or TSS. DNR has concurred with the modeling results, but these entities will continue to participate in the adaptive management project.

Per the 2014 Memorandum of Understanding between MMSD and DNR, the targeted reductions for the adaptive management project will be adjusted to account for those entities that have chosen not to participate in the adaptive management project at this time, either because they have already met their TMDL allocations or because they will meet their allocations independently. These entities include the Town of Bristol, the Town of Burke, the Town of Dunkirk, Madison Gas and Electric, the Town of Madison and the Town of Pleasant Springs. The Town of Madison has border agreements with the City of Fitchburg and the City of Madison and will eventually become part of these cities. Once this occurs, the TMDL allocations associated with the Town of Madison will be added back in to the target reductions for the adaptive management project.

Requirement 1:

The exceedance of the applicable phosphorus criterion in s. NR 102.06 is caused by phosphorus contributions from both point sources and nonpoint sources.

- ✓ *The Rock River TMDL identifies both point and nonpoint sources for phosphorus loading in the Yahara River Watershed.*

Requirement 2:

Either the sum of the nonpoint sources and the permitted municipal separate storm sewer system contribution of phosphorus to the receiving water is at least 50 percent of the total contribution within the watershed of the receiving water where the applicable phosphorus criterion in s. NR 102.06 is exceeded; or the permittee demonstrates that the applicable phosphorus criterion cannot be met in the watershed without the control of phosphorus from nonpoint sources.

- ✓ *Nonpoint sources and MS4s account for 60% (point sources at design conditions) to 87% (point sources at "current" conditions) of the annual TP baseline load to the Yahara River Watershed.*

Requirement 3:

Documentation that the proposed water quality based effluent limit in the applicant's permit will require filtration or other equivalent treatment technology to achieve compliance.

- ✓ *CH2MHILL 2012 nutrient evaluation report for MMSD demonstrated that filtration technology is required to achieve water quality standards for phosphorus.*
- ✓ *For the Oregon and Stoughton WWTF's, TMDL limits based on the most limiting month demonstrate the need for filtration or equivalent treatment technology.*

Requirement 4:

The point source has submitted an adaptive management plan that identifies specific actions to be implemented that will achieve compliance with the applicable phosphorus criterion in s. NR 102.06 through verifiable reductions of phosphorus from point and nonpoint sources in the watershed.

- ✓ *The adaptive management plan is contained in this document.*

Table 5: Summary of Adaptive Management Eligibility Requirements

II. Watershed Background and Current Conditions

This section includes information about the Yahara Watershed that helps establish baseline conditions and provides context for later sections of the adaptive management plan. Essentially, this section houses existing information that sets the stage for planned actions. However, this section meets several criteria for DNR's 9 steps for adaptive management, so sections that include related information are indicated as such.

This section is divided into two parts:

- A description of the Yahara Watershed and an inventory of baseline conditions and factors that influence water quality related to phosphorus and TSS.
- An overview of current phosphorus loads by different sources (i.e., point and nonpoint), the method of calculating needed reductions, and projections of how and when those reductions will be achieved.

By establishing the current conditions that contribute to phosphorus pollution in the Yahara Watershed, this section provides rationale for the practices and strategic actions chosen for the adaptive management plan.

Part 1: Watershed Description and Inventory

DNR 9 Steps	
2 3	**This section meets DNR Adaptive Management Step 2: Describe the Watershed and Set Load Reduction Goals and Step 3: Conduct a Watershed Inventory**

General

The Yahara River Watershed is an approximately 536-square mile (344,000 acres) watershed located in the west-central portion of the Lower Rock River Basin. The majority of the Yahara Watershed is located in Dane County (299,665 acres), with smaller sections located in Columbia County to the north (17,694 acres) and Rock County to the south (26,115 acres). In the Rock River TMDL, the Yahara Watershed was divided into eight stream reaches, as shown in Figure 2.

Much of the watershed is farmed, as the watershed is home to some of the state's most productive agricultural land. The upper portion of the watershed has a high density of dairy farms that have been in the family for generations, while the lower portion of the watershed tends to be dominated by cash crop production. The central part of the watershed includes the Yahara River chain of lakes (Mendota, Monona, Waubesa and Kegonsa) and significant urbanized areas.

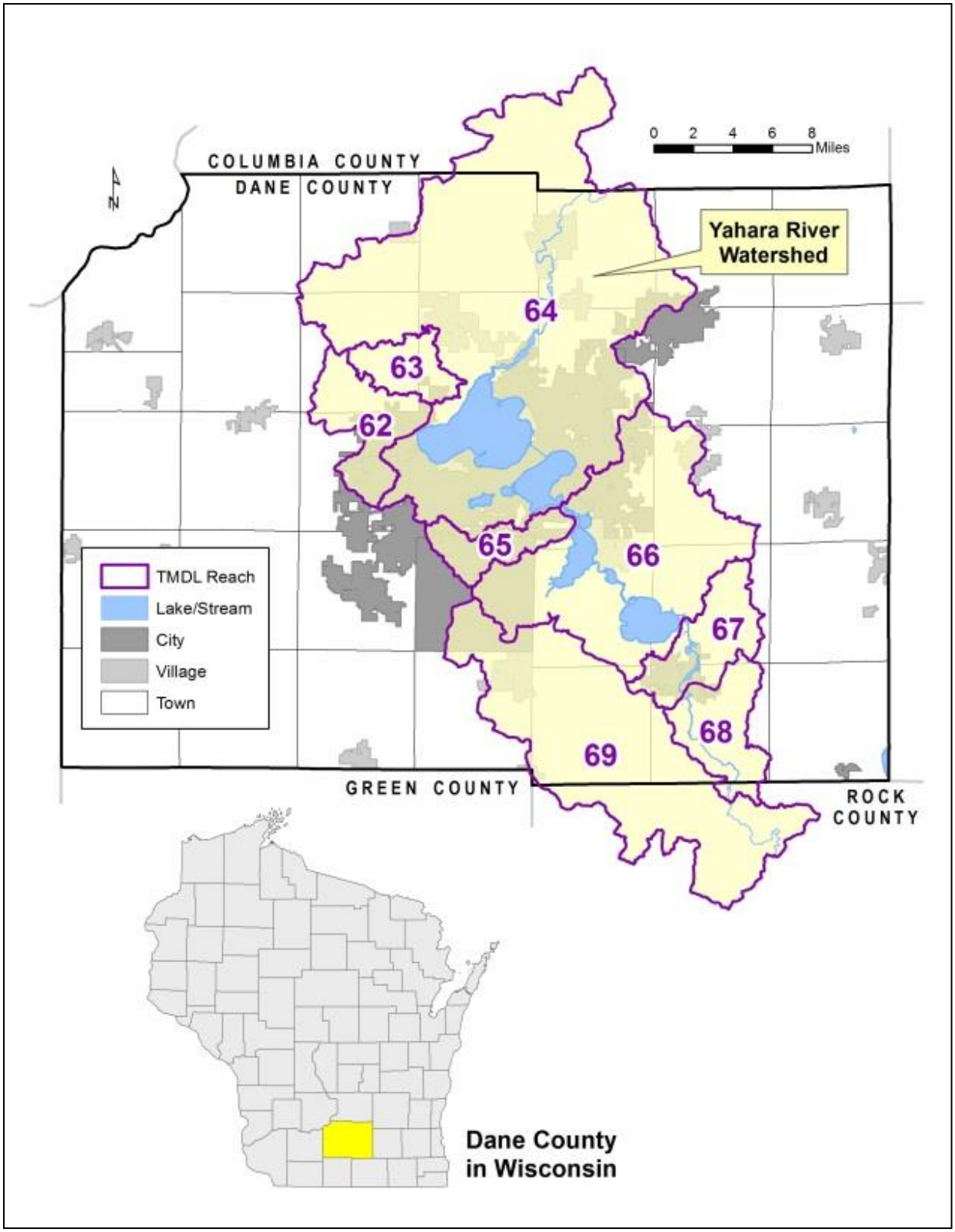


Figure 2: Location of Yahara River Watershed broken into TMDL stream reaches 62-69.

Municipal Jurisdictions in the Yahara Watershed

All or parts of 6 cities, 10 villages and 27 towns are located in the Yahara Watershed, as shown in Table 6. Unless otherwise noted, all municipalities are located in Dane County. Municipal jurisdictions shown in bold were specifically identified asMS4s in the Rock River TMDL.

Cities		Towns	
Madison	**Monona**	Albion	**Madison**
Fitchburg	**Sun Prairie**	Arlington [C]	**Middleton**
Middleton	**Stoughton**	Berry	Oregon
		Blooming Grove	**Pleasant Springs**
Villages		**Bristol**	Porter [R]
Arlington [C]	**Maple Bluff**	**Burke**	Roxbury
Brooklyn	**McFarland**	Center [R]	Rutland
Cottage Grove	Oregon	**Cottage Grove**	Springfield
Dane	**Shorewood Hills**	Dane	Sun Prairie
DeForest	**Waunakee**	**Dunkirk**	Union [R]
	Windsor	**Dunn**	Vienna
		Fulton [R]	**Westport**
		Leeds [C]	
		Lowville	

Table 6: Municipal Jurisdictions in the Yahara Watershed. **[C] Located in Columbia County. [R] Located in Rock County**

Phosphorus Source Area Identification

The Rock River TMDL identifies five main source categories for phosphorus and TSS: Point, Background, Non-permitted Urban, MS4 Urban, and Agriculture. Figure 3 shows the geographical distribution of the five phosphorus source categories in the Yahara Watershed. This figure also shows the location of seven point sources identified in the TMDL as having surface water discharges to the Yahara Watershed. Of note is that DNR recently determined that the Village of Arlington Wastewater Treatment Plant, located in the far northern part of the watershed, discharges to a waterbody that is not hydrologically connected to the Yahara River Basin and the Rock River. Also, although Middleton Tiedeman Pond was identified as a point source in the TMDL, for implementation purposes Tiedeman Pond is included as part of the City of Middleton MS4 load.

Table 7 lists each of the 23 MS4s identified in the Rock River TMDL as having a discharge to the Yahara Watershed, and the TMDL stream reach that each MS4 discharges to. Note that in many cases the TMDL identified multiple stream reaches for a given MS4. Adjustments to the stream reach information have been subsequently made based on updated MS4 modeling that was conducted consistent with DNR guidance and subsequently reviewed by DNR staff. These adjustments are reflected in load reduction information contained elsewhere in this adaptive management plan.

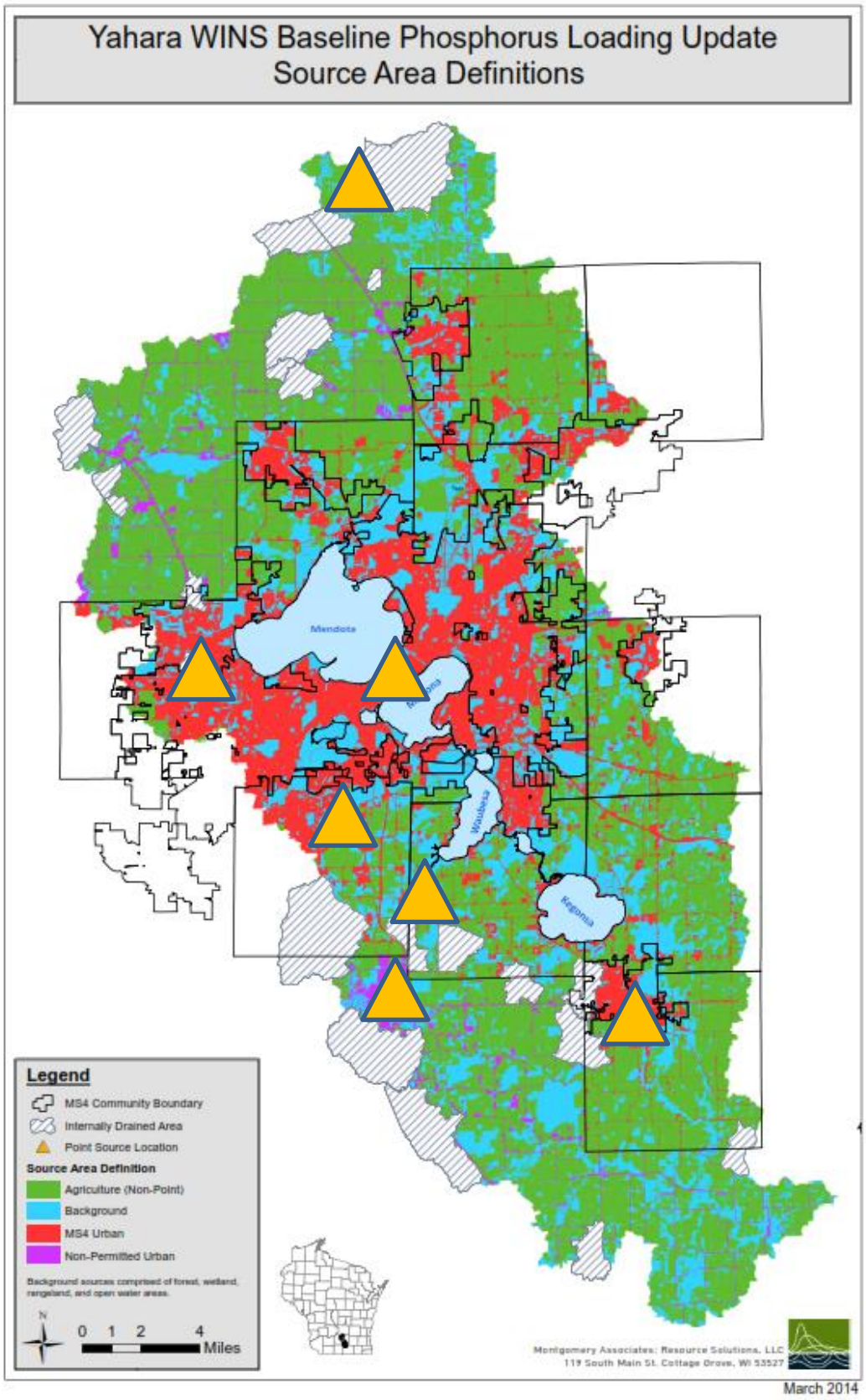


Figure 3: Geographical Distribution of Phosphorus Sources

Municipality	Stream Reaches
Blooming Grove, Town	64, 65, 66
Bristol, Town	64
Burke, Town	64, 66
Cottage Grove, Town	66
Cottage Grove, Village	66
DeForest, Village	64
Dunkirk, Town	67, 68, 69
Dunn, Town	65, 66, 67, 69
Fitchburg, City	64, 65, 66, 69
Madison, City	62, 64, 65, 66
Madison, Town	64, 65
Maple Bluff, Village	64
McFarland, Village	66
Middleton, City	62, 63, 64
Middleton, Town	62, 64
Monona, City	64, 65, 66
Pleasant Springs, Town	66, 67, 68
Shorewood Hills, Village	64
Stoughton, City	66, 67, 68
Sun Prairie, City	64
Waunakee, Village	63, 64
Westport, Town	62, 63, 64
Windsor, Village	64

Table 7: MS4s identified in the Rock River TMDL with discharges to the Yahara Watershed and their associated discharge stream reaches as identified in the TMDL and supporting information provided by DNR (Matt Diebel; 2/28/2012 email).

Water Quality

The Rock River TMDL identifies a number of stream segments in the Yahara Watershed that are impaired due to phosphorus and/or TSS. Impaired stream reaches are identified in Figure 4 and relevant information for each of these impaired segments is provided in Table 8. The District has access to all water quality monitoring data used in the TMDL development process in spreadsheet form, provided by DNR staff. Figure 4 also shows additional lakes and streams located in the Yahara Watershed that are on the 303(d) list of impaired waters for phosphorus and/or TSS, with Table 9 providing relevant information for the lakes. Actions taken through adaptive management to reduce phosphorus and TSS loads should help address all waters identified as impaired for these parameters.

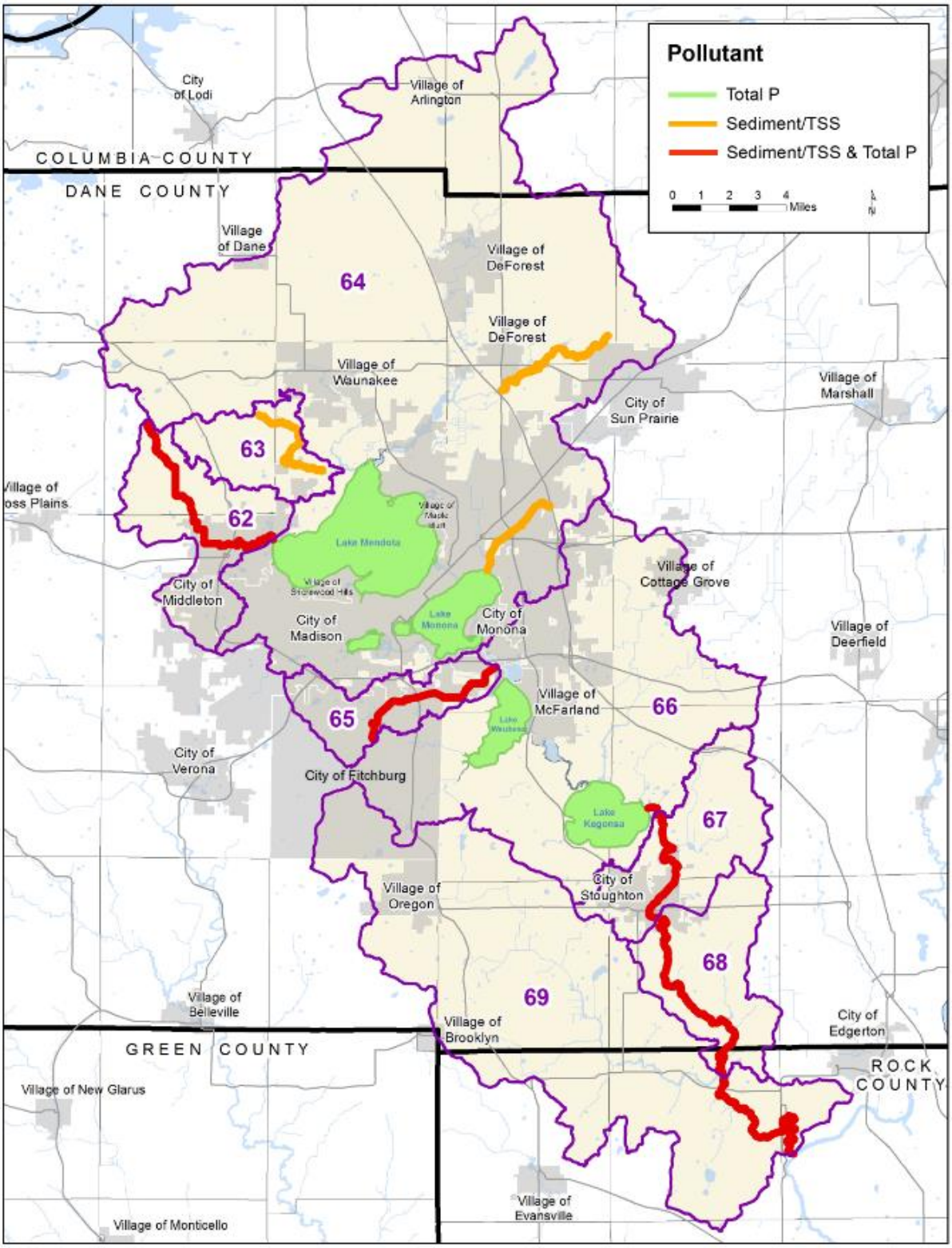


Figure 4: Phosphorus and/or Sediment Impaired Stream Reaches in the Yahara Watershed

TP and TSS Impairments in the Yahara Watershed: Stream and River Segments					
Name	**Pheasant Branch Creek**	**Dorn (Spring) Creek**	**Nine Springs Creek**	**Yahara River**	**Badfish Creek**
Reach	**62**	**63**	**65**	**67, 68, 69**	**69**
Segment Location	Mile 0.0-1.0 and Mile 1.0-9.09	Mile 1.00-6.46	Mile 0.0-6.16	Mile 0.0-7.29-16.32	Mile 0.0-12.3
Pollutants	TP,TSS and TP, TSS	TSS	TP, TSS	TP, TSS	TP, TSS
Impairments	Low DO, Degraded Habitat and Low DO, Degraded Habitat	Elevated Water Temperature	Low DO, Elevated Water Temperature	Low DO, Degraded Habitat	Low DO, Degraded Habitat, Contamination in Soil
Classification	NR 102.06 (3)(b)	NR 102.06 (3)(b)	NR 102.06 (3)(b)	NR 102.06 (3)(a) 46.	NR 102.06 (3)(b)
TP Criteria	0.075 mg/L	0.075 mg/L	0.075 mg/L	0.10 mg/L	0.075 mg/L
Status	TMDL approved	TMDL approved	TMDL approved	TMDL approved	303 (d) listed
Current Use	WWSF and LFF	LFF-Not Supporting	WWFF-Not supporting	WWSF-Not Supporting	WWSF-Not Supporting
Designated Use	WWSF and LFF	WWSF	WWSF	WWSF	WWSF[1]
Attainable Use	WWSF and LFF	WWSF	WWSF	WWSF	WWSF

Table 8: Impaired for TP and/or TSS River and Stream Segments in Yahara Watershed (DNR Impaired Water search, Rock River TMDL)

(1) The District's Outfall 001 discharge is to Badfish Creek is classified according to chapters NR 102 and NR 104 of the Wisconsin Administrative Code: from Madison MSD outfall to the confluence with Oregon Branch as limited aquatic life (marginal) stream, from there to CTH "A" bridge as limited forage fish communities (intermediate), and downstream of CTH "A" bridge to the confluence with the Yahara River near Cooksville, it is classified a warmwater sport fish communities. CTH "A" to the confluence with the Yahara River is the same stretch (mile 0-12.3) that is 303 (d) listed for phosphorus and therefore included in Table 8.

TP and TSS Impairments in the Yahara Watershed: Lakes					
Name	**Lake Mendota**	**Lake Monona**	**Lake Wingra**	**Lake Waubesa**	**Lake Kegonsa**
Reach	**62**	**63**	**65**	**66**	66
Location	First in Yahara Chain of Lakes	Second in Yahara Chain of Lakes	Tributary to Yahara Chain of Lakes	Third in Yahara Chain of Lakes	Fourth in Yahara Chain of Lakes
Pollutants	TP/ TPP, TSS	TSS	TP, TSS	TP	TP
Impairments	Water Quality Use Restrictions, Excess Algal Growth	Eutrophication, Excess Algal Growth	Impairment Unknown	Water Quality Use Restrictions, Excess Algal Growth	Excess Algal Growth
Classification	NR 102.06 (4)(b)2. Two story	NR 102.06 (4)(b)2. Two Story	NR 102.06 (4)(b)2. Shallow Lowland Lake	NR 102.06 (4)(b)2. Shallow Lowland Lake	NR 102.06 (4)(b)2. Shallow Lowland Lake
TP Criteria	15 µg P/L	15 µg P/L	40 µg P/L	40 µg P/L	40 µg P/L
Status	TMDL approved	TMDL approved	303 (d) listed	TMDL approved	TMDL approved
Current Use	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation
Designated Use	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation
Attainable Use	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation	Full Body Contact Recreation

Table 9: Impaired for TP and/or TSS Lakes in the Yahara Watershed. Applicable TP Criteria provided by DNR Aaron Larson of DNR on 12/14/15.

Additional efforts outside of the TMDL development have been undertaken to evaluate water quality in the Yahara Watershed. As part of the adaptive management pilot project, an extensive water quality monitoring network was developed to support the pilot project and the subsequent transition to a full-scale adaptive management project. This network included new USGS gaging stations as well as additional volunteer water quality monitoring sites.

Four USGS gaging stations were installed as part of the pilot project, as shown in Figure 5. Three of these stations are located in the pilot project area and one is located just to the north of the pilot project area.

Water quality sampling at these locations began in mid-2012. In 2014, water quality monitoring was added at the USGS Fulton gaging station, which previously was used only for flow/discharge monitoring. Routine monthly samples and storm event-related samples are collected at all five sites. A total of over 1,900 samples have been collected and analyzed since initiation of the pilot project.

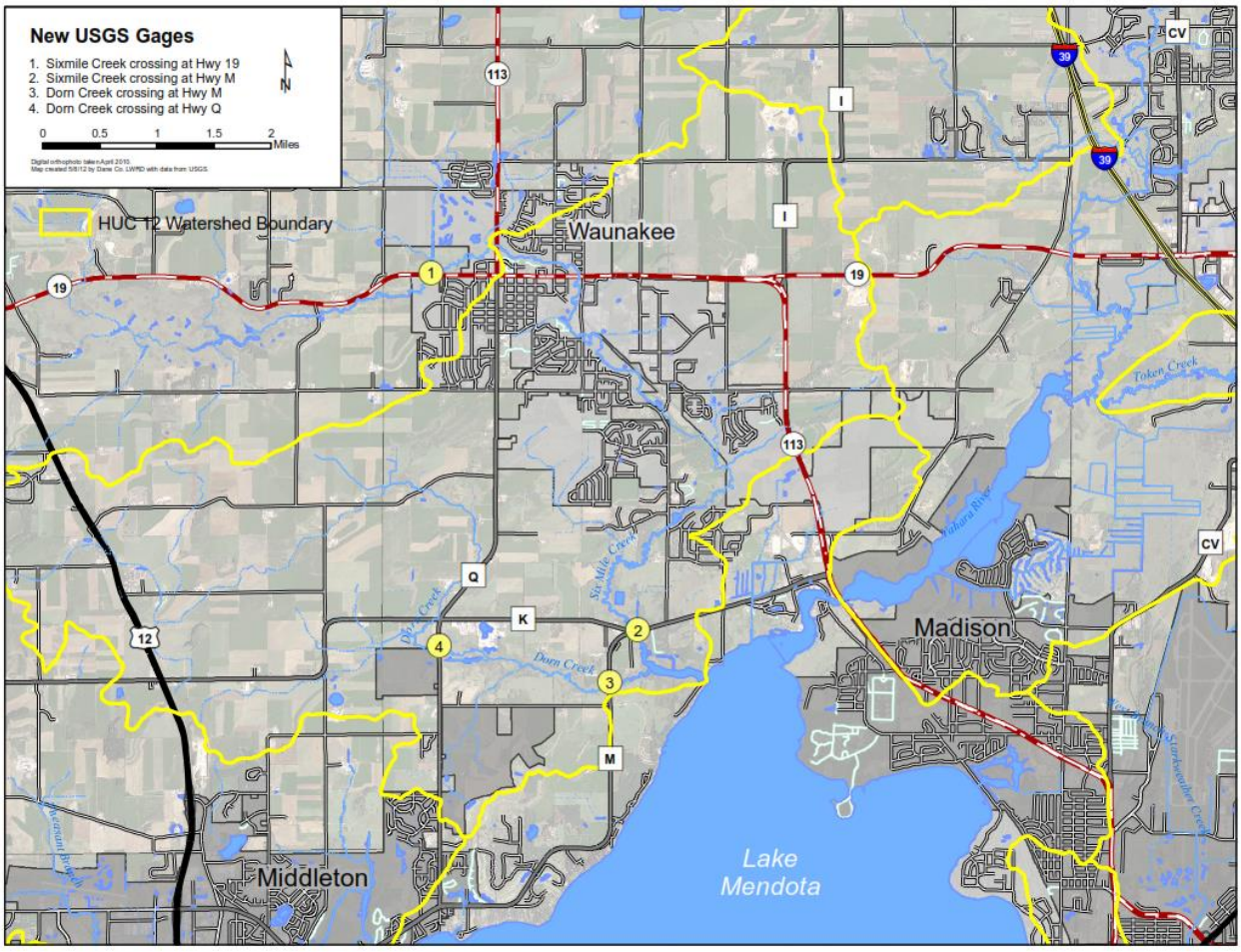


Figure 5: Location of USGS Gaging Stations Associated with the Adaptive Management Pilot Project

Water quality samples collected at the gaging stations during both baseflow conditions and storm events are routinely analyzed for the following parameters:

- TSS
- NO3 + NO2
- NH3-N
- TKN
- TP
- OP-DRA
- Chlorophyll A (only analyzed on samples collected May-Oct)

All samples are analyzed at the MMSD Laboratory, which is a DNR Certified Laboratory. Analytical methods for the above parameters, limits of detection (LOD), and the limits of quantitation (LOQ) are

shown in Appendix 2. The complete water quality monitoring dataset associated with these gages is available from MMSD upon request. USGS is responsible for data evaluation, including computation of median phosphorus concentrations and phosphorus loads. Baseflow growing season (May-Oct) median concentrations for both total phosphorus and dissolved phosphorus at each of the four gaging stations installed as part of the pilot project are presented in Table 10 below.

	Total P (mg/L)
Dorn Creek at Hwy Q	0.11
Dorn Creek at Hwy M	0.21
Sixmile Creek at Hwy 19	0.16
Sixmile Creek at Hwy M	0.17

Table 10: July 2012-October 2016 Data-Growing Season Median P Concentrations. (Data from Todd Stuntebeck, USGS; Dec 21, 2016)

USGS also calculates time integrated daily concentrations based on all sampling results using the Graphical Constituent Loading Analysis System, details of which can be found at http://pubs.usgs.gov/tm/2006/tm4C1/pdf/tm4C1.pdf. For comparison, Table 11 shows the growing season median concentrations using the time integrated concentrations from the fifteenth of each month.

	Total P (mg/L)
Dorn Creek at Hwy Q	0.12
Dorn Creek at Hwy M	0.24
Sixmile Creek at Hwy 19	0.15
Sixmile Creek at Hwy M	0.15

Table 11: July 2012-October 2014 Data-Growing Season Time Integrated Median P concentrations for the 15th of each month (Data from Todd Stuntebeck , USGS; Dec 21, 2016)

The adaptive management project has funded additional monitoring efforts in the Yahara Watershed through a citizen volunteer monitoring program coordinated by the Rock River Coalition. Monitoring protocols follow those established by the DNR Water Action Volunteer (WAV) Program. The sampling effort began in 2013 and expanded to 34 sites by 2016. To date, approximately 600 samples have been collected in the watershed by the volunteer monitors. All of the samples are analyzed by the MMSD laboratory. Analytical methods, limits of detection (LOD), limits of quantitation (LOQ) are provided in Appendix 2. The complete dataset is available from MMSD upon request.

Data collected through 2015 as part of the citizen volunteer monitoring program has been entered into the DNR surface water integrated monitoring system (SWIMS) database. A review of the data shows that phosphorus concentrations vary with both sample location and by date within a given sample location. Growing season median concentrations often exceed the applicable numeric water quality criterion. Median total phosphorus concentrations for select monitoring locations throughout the Yahara River and Lake Mendota watershed collected during the 2016 growing season (May-Oct) are shown in Figure 6 for illustrative purposes only.

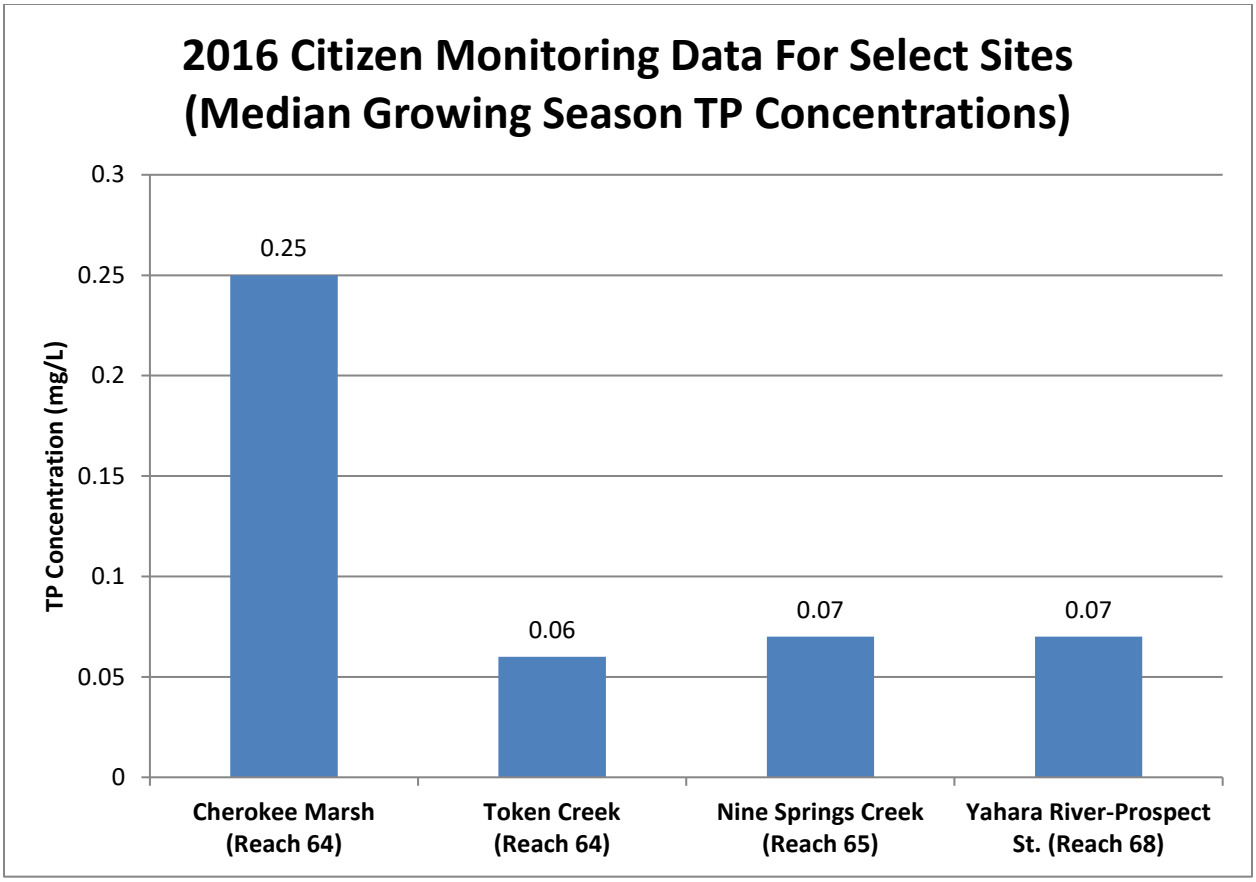


Figure 6: Select Citizen Monitoring Data in Yahara Watershed (Data from the Rock River Coalition)

Water quality monitoring has also been conducted directly by District staff, with monitoring locations generally located in the Badfish Creek Watershed. A map showing all District monitoring locations in the lower portion of the Yahara Watershed is shown in Appendix 3. Monitoring frequency has varied over the period of record (1980-2016). Starting in 2013, monitoring was conducted on a monthly basis during the growing season of May-October. Growing season average and median total phosphorus concentrations at the following four locations for the three most recent years on record (2014-2016) is presented in Table 12:

- Effluent pipe bridge (upper portion of Badfish Creek-Stream Reach 69)
- Hwy 59 bridge (lower portion of Badfish Creek-Stream Reach 69)
- Yahara River (10-Y, upstream of the Badfish Creek/Yahara River confluence-Stream Reach 68)
- Yahara River (9A-y, downstream of the Badfish Creek/Yahara River confluence-Stream Reach 69)

A review of the data shows phosphorus concentrations in the upper part of Badfish Creek closely match concentrations in the District's effluent concentration. This is not surprising since Badfish Creek is an effluent-dominated stream with minor dilution in the upper portions. Concentrations decrease in the lower part of Badfish Creek due to dilution from other sources. Concentrations in the Yahara River upstream of the Badfish Creek confluence are generally lower than the downstream concentrations. Concentrations upstream of the confluence with Badger Mill Creek are generally at or near the applicable water quality criterion of 0.10 mg/L.

Growing season mean and median concentrations in the Yahara downstream of the Badfish Creek confluence (location 9A-Y) were slightly to moderately higher than the upstream concentrations in all years and were higher than the applicable numeric water quality criterion of 0.10 mg/L.

		BFC Pipe Bridge (Reach 69)	BFC Hwy 59 (Reach 69)	Yahara 10-Y (Reach 68)	Yahara 9A-Y (Reach 69)
		----------mg/L----------			
2014 (May-Oct)	Mean	0.34	0.22	0.10	0.12
	Median	0.37	0.23	0.11	0.12
2015 (May-Oct)	Mean	0.46	0.32	0.09	0.17
	Median	0.45	0.28	0.10	0.16
2016 (May-Oct)	Mean	0.31	0.30	0.11	0.18
	Median	0.30	0.30	0.11	0.16

Table 12: Growing Season (May-Oct) Total P Concentrations at Selected Sampling Locations (Source: MMSD, 2017. Raw data, analytical methods and LOD/LOQ information provided in Appendix 2)

In addition to the above monitoring efforts, DNR and other entities have conducted water quality monitoring activities in the Yahara Watershed. A map showing all known "active" monitoring locations in the Yahara Watershed is provided in Appendix 4. Active is defined as at least one sample being collected at the location during the past two years.

In summary, there is an extensive data set for the Yahara Watershed that demonstrates high variability in baseline phosphorus concentrations between different dates and between different locations throughout the Yahara Watershed. While phosphorus concentrations at some locations are near or below applicable water quality criteria, they more commonly exceed the applicable criterion. The factors that influence phosphorus (and sediment/TSS) levels and their variation in the Yahara Watershed are identified and discussed in the following section.

Watershed Inventory

This section presents an overview of various characteristics of the Yahara Watershed that influence phosphorus and TSS loading. This information is included in part to provide context and rationale for the practices selected to control phosphorus in the adaptive management plan.

Climate and Precipitation

Climatological information for the Yahara Watershed was obtained from the National Oceanic and Atmospheric Administration. Data from the Dane County Regional Airport is used to generally characterize climate in the Yahara Watershed. Table 13 presents average monthly data for the 30 year reporting period of 1981-2010. Average monthly temperatures range from a low of 19 °F in January to a high of 71 °F in July. The average annual precipitation and snowfall are approximately 35 inches and 51 inches, respectively. Precipitation associated with any given event can vary significantly throughout the watershed and can influence phosphorus and TSS loading at the subwatershed scale.

Future projections of temperature and precipitation patterns by University of Wisconsin-Madison climate scientists indicate that Wisconsin will likely see warmer temperatures and increased

precipitation. Large storm events are also likely to increase in frequency during spring and fall, increasing the chance of significant runoff events.

Although climate is an uncontrollable variable in phosphorus and TSS reductions, it will be important to consider climate trends in subsequent modeling work conducted as part of the adaptive management project. As an example, the Rock River TMDL used a ten year precipitation record of 1989-1998 for Soil and Water Assessment Tool (SWAT) modeling. The Yahara WINs updated SWAT modeling discussed later in this adaptive management plan looked at two different precipitation periods (1989-1998, and 1999-2008). Modeled phosphorus loads for all eight TMDL stream reaches were higher using the more recent precipitation record. Future modeling of phosphorus and TSS loads as part of the adaptive management project will need to reflect relevant precipitation periods to arrive at more accurate load projections.

Month	Precip (inches)	Snow (inches)	Ave Temp (F)
Jan	1.2	12.9	19
Feb	1.5	10.6	23
Mar	2.2	7.0	34
Apr	3.4	2.6	47
May	3.6	0.2	57
Jun	4.5	0.0	67
Jul	4.2	0.0	71
Aug	4.3	0.0	69
Sep	3.1	0.0	61
Oct	2.4	0.5	49
Nov	2.4	3.6	36
Dec	1.7	13.5	23
Annual Total	**34.5**	**50.9**	

Table 13: Climatological Information for the Yahara Watershed (1980-2010) - Dane County Airport Location

Soils

General soil survey and related information for the watershed is available through multiple sources, including the Natural Resource Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) and the Dane County Land and Water Resources Data Viewer. Major soil groupings by TMDL stream reach as derived from the National Cooperative Soil Survey (USDA/NRCS) STATSGO2 dataset are shown in Appendix 5, along with brief descriptions of dominant soil series. This information is provided to present a broad overview of soils in the Yahara Watershed.

This section does not include detailed information about soil types and their distribution because on its own, the soil data does not create much of a picture of watershed conditions. However, soil information is reflected in the process of modeling and selecting management practices. For example, soil type is a

data input for calculating the Phosphorus Index (PI) of agricultural lands. SNAP-Plus, Wisconsin's nutrient management planning software, is a tool that will be used extensively in the adaptive management project to calculate PI on a field by field basis. More detailed identification of soil types will be critical when using SNAP-Plus. Links to soil survey and other relevant information are available through SNAP-Plus.

Dane County Land and Water Resources Department (LWRD) staff and County Conservation staff from Columbia and Rock Counties will play important roles in working with agricultural producers in the adaptive management project. They are skilled in using both SNAP-Plus and soil survey mapping tools.

Land Cover

Land cover for each TMDL stream reach is shown in Table 14 and was derived from the National Agricultural Statistics Service 2013 Cropland data layer. This information is also visually shown in Figure 7. There are some significant differences between land use/land cover between stream reaches that help inform the suite of phosphorus-reducing practices and opportunities that may be available and/or appropriate for each reach. As an example, Reach 64 has a relatively high percentage of agricultural and grass/pasture land compared to Reach 66.

Agricultural Cropping Practices in the Yahara Watershed

Data on cropping history for the period of 1993-2013 broken down by TMDL stream reach is shown in the graphs in Figure 8. Cropping history is not provided for reach 65 as this reach contains only a small amount of agricultural land. The upper part of the watershed (e.g. reaches 62 and 63) has a high concentration of dairy farms and the crop history reflects dairy rotations. The lower part of the watershed is more reflective of cash crop rotations. County conservation staff knowledge of cropping practices and general farming practices will help inform the appropriate suite of engineering and conservation practices for each TMDL stream reach in the full-scale adaptive management project.

Land use	TMDL Stream Reach							
	62	63	64	65	66	67	68	69
	----------Acres----------							
Agriculture	4,766	5,430	60,462	489	19,674	6,253	8,264	37,437
Developed/High Intensity	563	22	3,429	421	581	133	84	83
Developed/Low Intensity	2,297	194	18,668	2,234	5,011	1,411	472	2,217
Developed/Medium Intensity	1,584	79	8,269	1,142	2,049	424	115	491
Developed/Open Space	1,330	274	11,651	895	3,864	748	446	2,421
Grass/Pasture	2,505	1,318	19,792	832	10,256	2,021	1,922	11,483
LWRD Wetland	415	524	10,184	1,573	8,612	1,719	1,183	5,953
Other	81	29	562	10	247	41	53	128
Water	26	8	13,983	40	4,867	291	208	485
Wetland	77	52	1,443	147	842	192	289	764
Woodland	757	189	7,128	870	5,351	1,261	996	5,417

Table 14: Land Cover by TMDL Stream Reach to the nearest acre. (From NASS 2014 with DNR Wetlands-created 09/11/2015 by Dane County LWRD)

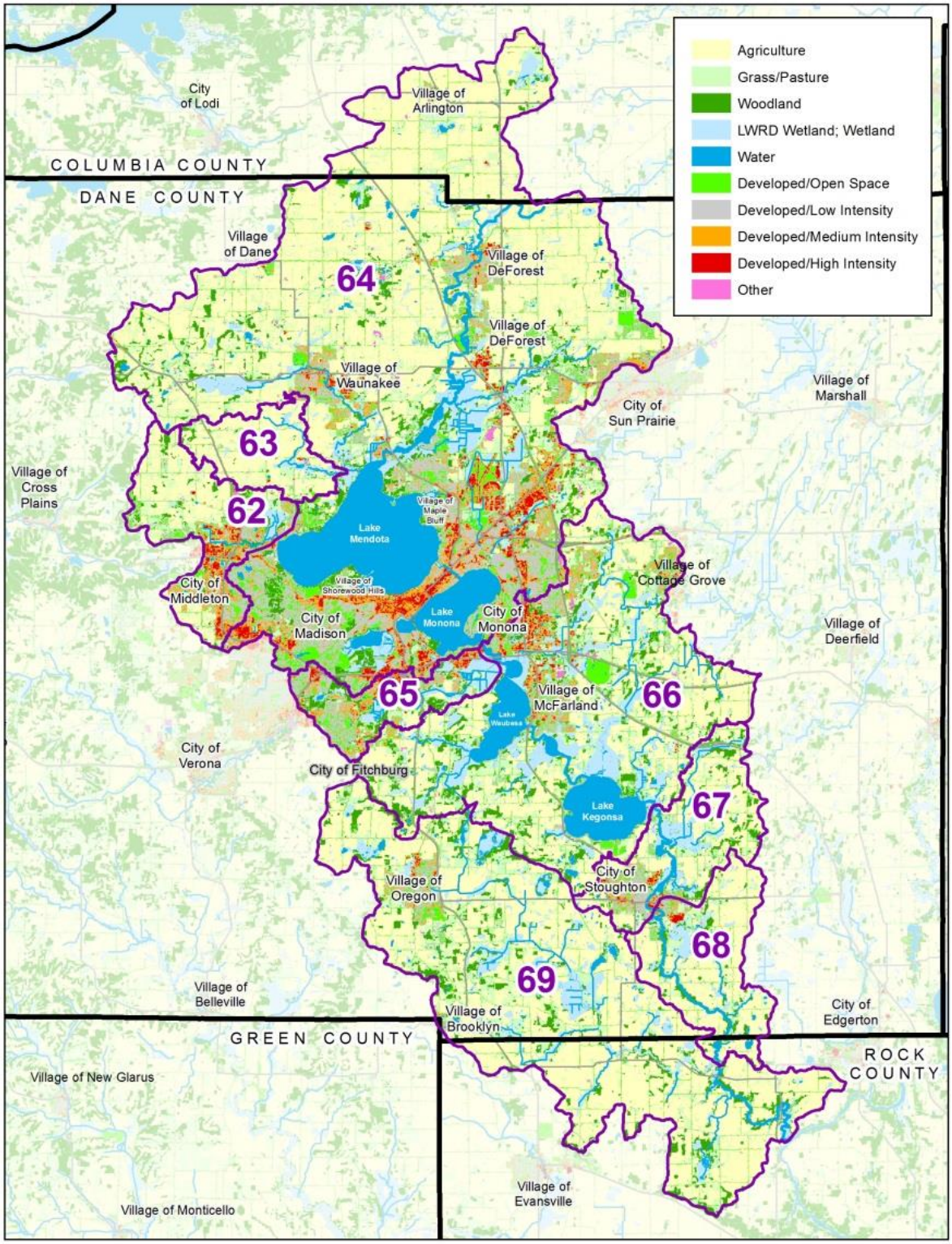
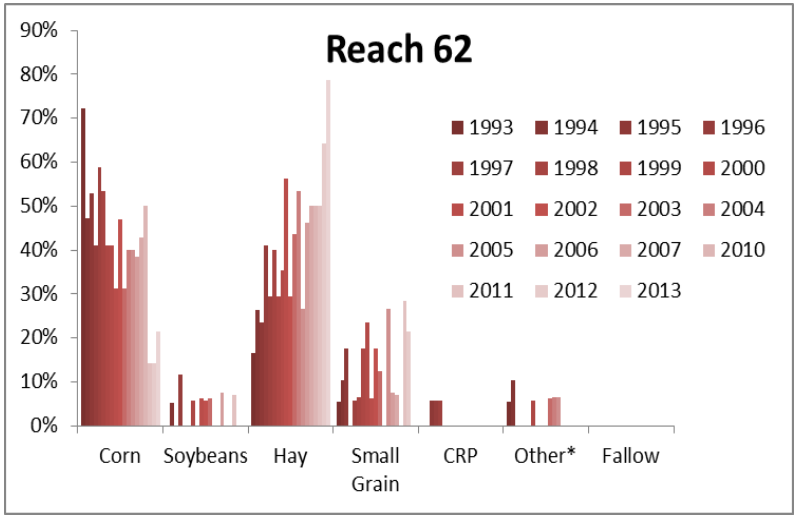
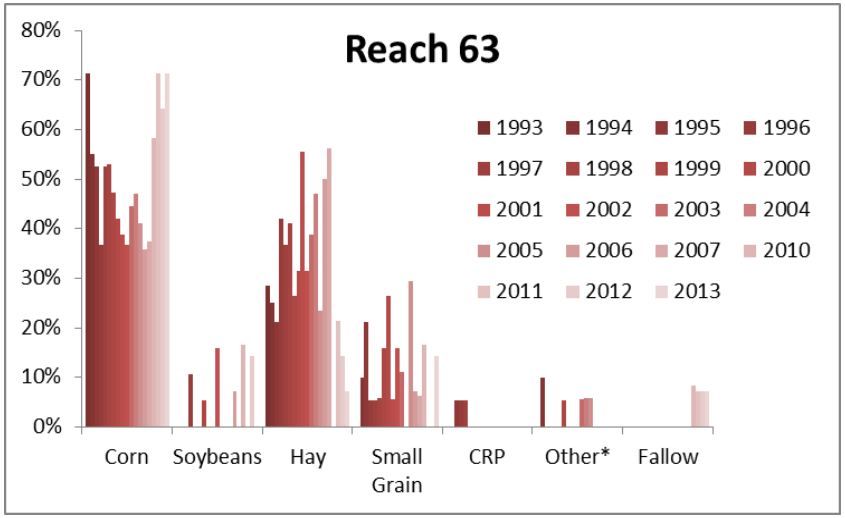


Figure 7: Land Cover in the Yahara Watershed (Dane County LWRD)


Reach 62
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1993 1994 1995 1996
1997 1998 1999 2000
2001 2002 2003 2004
2005 2006 2007 2010
2011 2012 2013
Corn
Soybeans
Hay
Small Grain
CRP
Other*
Fallow


Reach 63
80%
70%
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50%
40%
30%
20%
10%
0%
1993 1994 1995 1996
1997 1998 1999 2000
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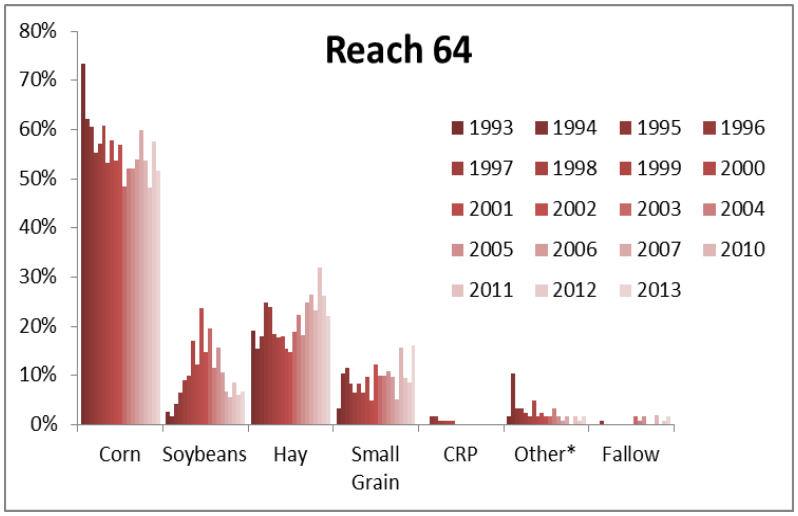
2011 2012 2013
Corn
Soybeans
Hay
Small Grain
CRP
Other*
Fallow


Reach 64
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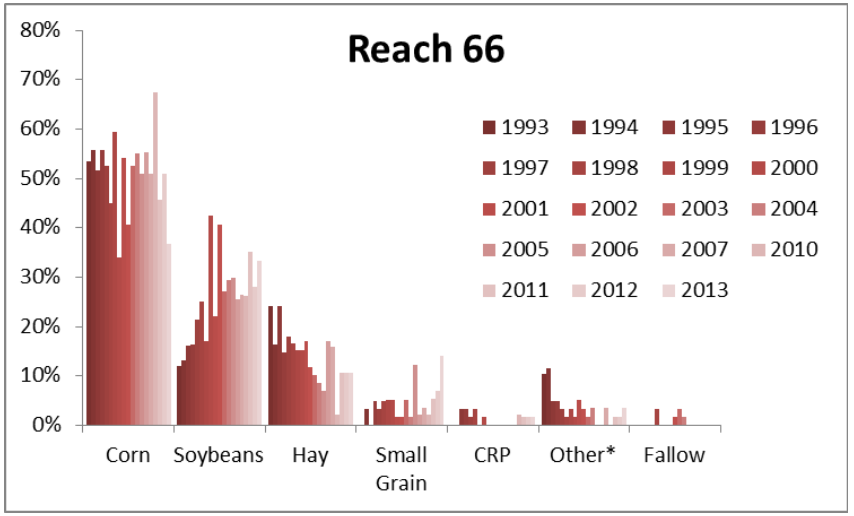
2011 2012 2013
Corn
Soybeans
Hay
Small Grain
CRP
Other*
Fallow


Reach 66
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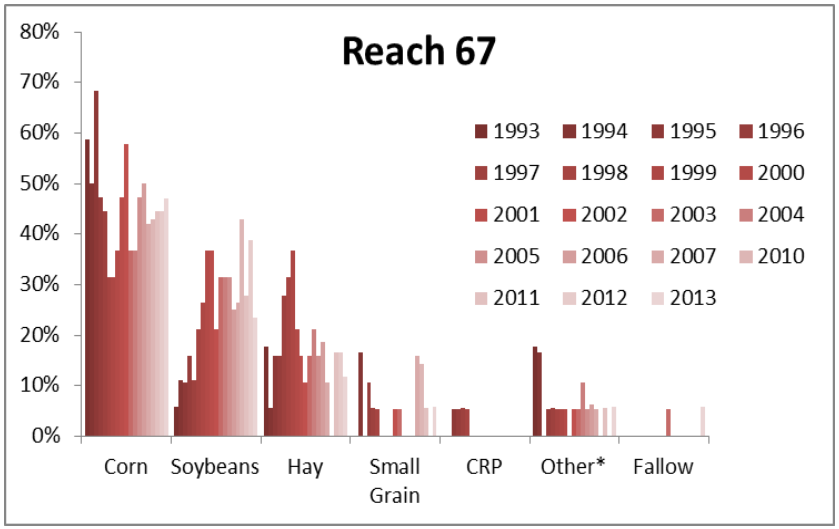
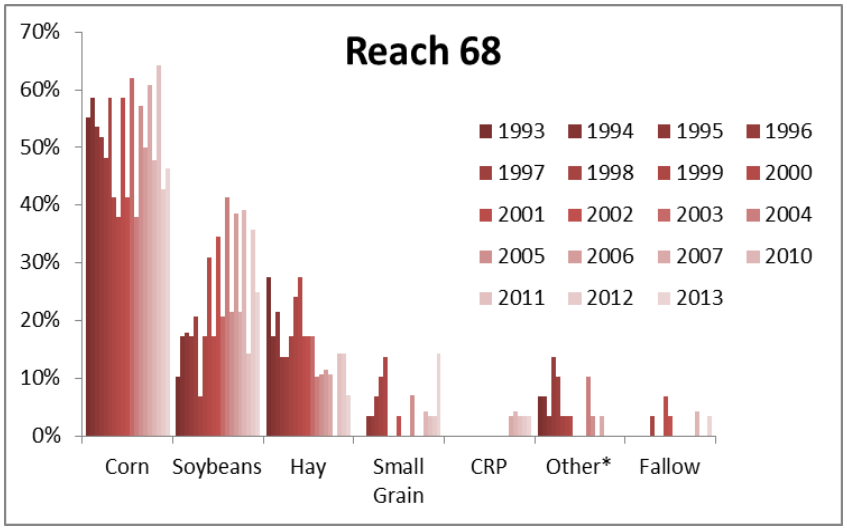




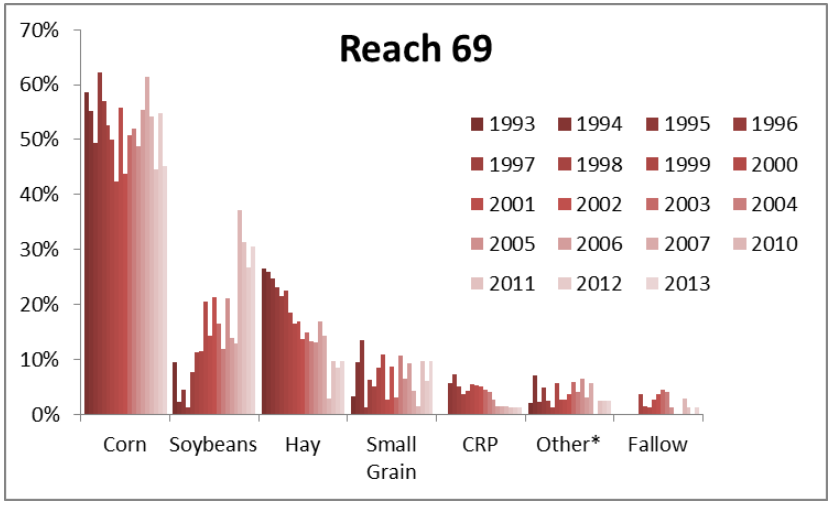


Figure 8: Historic Cropping Practices by Stream Reach (Dane County LWRD)

Animal Agriculture

The USDA-National Agricultural Statistics Service (USDA/NASS) provides county by county information on a variety of agricultural statistics, including cattle, milk cows, hogs/pigs and poultry densities. The most recent available report (2012) shows the following for Dane County:

Category	Number of animals
All cattle	135,000
Milk cows	52,000
Hogs and pigs	28,000
Poultry	71,300

Animal density information is not routinely available at a finer resolution (e.g. by TMDL stream reach). However, University of Wisconsin-Madison researchers are attempting to assemble data from a variety of information sources, which, when combined with a GIS overlay of TMDL stream reaches, would allow for a semi-quantitative estimate of animal units by stream reach. If available, this information will be considered in the implementation phase of the adaptive management project to help make adjustments to phosphorus load reductions

The Rock River TMDL identified seven concentrated animal feeding operations (CAFOs) in the Yahara Watershed. In addition, the watershed is home to two community manure digesters, one in the Town of Vienna and the other in the Town of Springfield. The accompanying land management practices required of producers using these digesters, coupled with the potential export of products (e.g. "cake" and/or composted manure) out of the watershed can result in reduced phosphorus and TSS loads. There are also two privately owned manure digesters are located in the Town of Sun Prairie.

Wetlands

The Yahara Watershed contains significant wetlands and hydric soils. Spatial/locational information is available through both the Dane County Land Information Office Access Dane/DciMap GIS application (Water Resources Layer) and the Wisconsin DNR Surface Water Data Viewer (SWDV) application. Information on "potentially restorable wetlands" is also available. Wetland restoration is a practice that will be considered as part of the adaptive management implementation strategy, although it is worth noting that wetlands can be both a source and sink of phosphorus.

Part 2: Current Phosphorus Loads and Load Reduction Targets

DNR 9 Steps	
6	**This section meets DNR Adaptive Management Step 6: Estimate load reductions expected by permit term.**

General

Baseline phosphorus load estimates for the Yahara Watershed by source and TMDL stream reach were made in the Rock River TMDL. The December 2014 MOU between the District and DNR allows for adjustments to the TMDL baseline loads for point sources, nonpoint (agriculture) and MS4s to reflect current conditions. Per the MOU, adjustments are to be made as follows:

- Current conditions for municipal and industrial point sources at the start of the adaptive management project will be determined based on actual flow and effluent phosphorus concentrations reported to DNR on discharge monitoring reports (DMRs) using the most recent five year average. The difference between the current conditions and the TMDL baseline may be counted toward the reduction goal for the applicable reach.

- Conditions for nonpoint sources at the start of the adaptive management project will be determined using loads from the original Yahara Clean SWAT model (2010) that was updated in 2014 by extending the SWAT model to include the entire Yahara Watershed. The Yahara Watershed SWAT model should be consistent with methodologies and assumptions used in the EPA-approved TMDL. Revisions to the nonpoint loads generated by the Yahara Watershed SWAT model will be made to reflect the changes in nonpoint loads from both the installation of agricultural best management practices (BMPs) and any increases in loading from changes in agricultural management that have occurred since the time period covered in the Yahara Watershed SWAT model.

  Analysis for Municipal Separate Storm Sewer Systems (MS4s) will be consistent with DNR's "TMDL Guidance for MS4 permits: Planning, Implementation, and Modeling Guidance

The following sections summarize the current phosphorus loads in the Yahara Watershed by sector. If adjustments were or will be made to the TMDL baseline levels, these sections indicate the process for making those adjustments.

Point Sources - Current Phosphorus Loads

Data on current phosphorus loads for each of the 6 identified point sources located the Yahara Watershed was obtained from DNR staff (note that the Rock River TMDL report included Arlington as a point source, but DNR subsequently determined that Arlington does not discharge to a water body that is hydrologically connected to the Yahara River Basin and Rock River). Per the 2014 MOU with DNR, current loads are based on the most recent five year average, which for the purpose of this plan is the period of 2011-2015 2019-2023 (***2024 update***). The corresponding flow and effluent phosphorus concentrations and are shown in Table 15. The raw data is provided in Appendix 6. These are the loads being used to determine phosphorus reductions required from point sources in the adaptive management project during the first five years of the adaptive management project (note: these loads will be adjusted every five years at WPDES permit reissuance). While the Middleton-Tiedeman Pond is identified as a point source in the TMDL, subsequent discussion with DNR has indicated that the load was included in the City of Middleton MS4 calculations.

2024 Update

The current 5-year average (2019-2023) total phosphorus loads were updated for MMSD WWTF, Oregon WWTF, and Stoughton WWTF in Table 15. The new phosphorus load for MMSD includes the additional TP load from Badger Mill Creek.

Point Source	Stream Reach	Flow (MGD)	Effluent P Conc (mg/L)	P Load (lb)
MMSD WWTF	69	40.37	0.31	38,167
Oregon WWTF	69	1.47	0.66	3,027
Stoughton WWTF	68	1.11	0.44	1,487
DNR-Nevin Fish Hatchery	65	2.21	0.06	409
MG&E	64	0.04	0.04	4
Middleton-Tiedeman Pond	64	0.13	0.58	209

Table 15: Annual Phosphorus Loads by Point Source (2019-2023 Average).

2017 Original

Point Source	Stream Reach	Flow (MGD)	Effluent P Conc (mg/L)	P Load (lb)
MMSD WWTF	69	36.89	0.29	32,959
Oregon WWTF	69	1.22	0.79	2,943
Stoughton WWTF	68	0.97	0.56	1,678
DNR-Nevin Fish Hatchery	65	2.21	0.06	409
MG&E	64	0.04	0.04	4
Middleton-Tiedeman Pond	64	0.13	0.58	209

Nonpoint Sources - Current Phosphorus Loads

The 2014 MOU with DNR states that conditions for nonpoint sources at the start of the adaptive management project will be determined using loads from the original Yahara Clean SWAT model (2010) which was updated in 2014 by extending the SWAT model to include the entire Yahara Watershed (Yahara WINs Extended SWAT Model to estimate Baseline Phosphorus Loading to the Yahara Watershed: MARS; 2014). The updated SWAT model used much of the same information and modeling approaches as in the Rock River TMDL, with the exception of updated data sources and a higher resolution spatial scale

The extended SWAT model was run using two different precipitation records (1989-1998 and 1999-2008). The 1989-1998 precipitation record was the precipitation record used in developing the nonpoint baseline phosphorus loads in the Rock River TMDL. When comparing loads between the two precipitation periods, the precipitation period of 1999-2008 returned the highest loads for each stream reach, as shown in Figure 9. To be conservative, the 1999-2008 precipitation period was used to characterize the extended SWAT modeled nonpoint loads.

When comparing 2014 SWAT model nonpoint phosphorus loads to TMDL baseline loads for nonpoint, the 2014 SWAT model showed slightly higher loads for two stream reaches (63 and 66) than the TMDL baseline. Therefore, the higher loads were used for these two reaches to describe current loads. In the remaining stream reaches (62, 64, 65, 67, 68 and 69) the TMDL showed higher baseline loads than the 2014 SWAT modeled loads. For these stream reaches a reasonably conservative approach was used to describe current conditions. Specifically, the difference between the TMDL baseline and the 2014 SWAT modeled load was calculated for each stream reach. Seventy-five percent (75%) of the difference was then added back to the 2014 SWAT modeled load as a conservative estimate of current conditions. The resulting conservatively estimated annual current phosphorus loads by stream reach for nonpoint sources, expressed as annual averages, are shown in Table 16.

Stream Reach	62	63	64	65	66	67	68	69	Total
Phosphorus load (lbs./yr.)	14,559	4,916	83,635	675	23,264	4,364	4,593	25,237	**161,243**

Table 16: Annual Nonpoint Phosphorus Loads (non-MS4) by TMDL Stream Reach

MS4s – Current Phosphorus Loads

Current annual phosphorus loads for MS4s with discharges to the Yahara Watershed are summarized by stream reach in Table 17. The 2014 MOU with DNR states that analysis for MS4s will be consistent with the Department's "TMDL Guidance for MS4 permits: Planning, Implementation, and Modeling Guidance." If the current conditions discharge value from an MS4 is lower than the TMDL baseline loading condition for the MS4, then the difference may be counted toward the TMDL percent reduction goals in the applicable reach.

Many of the MS4s that discharge to the Yahara Watershed have updated their stormwater models consistent with the aforementioned guidance. Based on discussions with pilot project partners, it appears that the remaining MS4s will have their updated modeling completed within the next 18 months. In cases where MS4s have conducted updated stormwater modeling and the results have been reviewed by DNR, the updated information was used to develop Table 17. For those MS4s that have not updated their stormwater modeling, the information in Table 17 is based directly on the TMDL using information provided by DNR staff.

Detailed information for each MS4 by stream reach is shown in Appendix 7. Loads and load reductions associated with MS4s in all relevant tables assume full participation by all MS4s. Per the 2014 MOU, if an individual MS4 decides not to participate in the full-scale adaptive management project, adjustments to all tables characterizing both current conditions and required reductions for MS4s will be made as appropriate.

Stream Reach	62	63	64	65	66	67	68	69	Total
MS4 P load (lb/yr)	2,944	9	30,575	4,231	8,530	1,325	336	284	**48,234**

Table 17: Annual MS4 Phosphorus Loads by TMDL Stream Reach. Data compiled by MMSD staff from TMDL spreadsheets provided by Matt Diebel of DNR and updated MS4 stormwater modeling reviewed by DNR staff.

Nonpermitted Urban and Background-Current Phosphorus Loads

Nonpermitted urban and background loads are assumed to be consistent with the TMDL baseline loads for those categories and are shown in Table 18.

Stream Reach	62	63	64	65	66	67	68	69	Total
	Phosphorus Load (lb/yr)								
Non-permitted Urban	387	5	2,928	500	366	272	0	617	
Background	315	283	2,787	158	3,066	450	535	1,372	

Total	702	288	5,715	658	3,432	722	535	1,989	14,041

Table 18: Annual Nonpermitted Urban and Background Phosphorus Loads by TMDL Stream Reach. Data compiled by MMSD staff from information contained in the Rock Rive TMDL Document.

Summary of Current Phosphorus Loads

Current annual phosphorus loads as previously determined are summarized by stream reach in Table 19.

2024 Update

Current 5-year average (2019-2023) total phosphorus loads were updated for MMSD WWTF, Oregon WWTF, and Stoughton WWTF in Table 19. The new phosphorus load for MMSD includes the additional TP load from Badger Mill Creek.

Stream Reach	62	63	64	65	66	67	68	69	Total
				Phosphorus Load (lb/yr)					
Point			213	409			1,487	41,194	**43,303**
Nonpoint	14,559	4,916	83,635	675	23,264	4,364	4,593	25,237	**161,243**
MS4	2,944	9	30,575	4,231	8,530	1,325	336	284	**48,234**
Nonpermitted Urban	387	5	2,928	500	366	272	0	617	**5,075**
Background	315	283	2,787	158	3,066	450	535	1,372	**8,966**
Total	**18,205**	**5,213**	**120,138**	**5,973**	**35,226**	**6,411**	**7,142**	**63,412**	**266,821**

Table 19: Total Annual Phosphorus Loads by Source and TMDL Stream Reach

2017 Original

Stream Reach	62	63	64	65	66	67	68	69	Total
				Phosphorus Load (lb/yr)					
Point			213	409			1,678	35,902	**38,202**
Nonpoint	14,559	4,916	83,635	675	23,264	4,364	4,593	25,237	**161,243**
MS4	2,944	9	30,575	4,231	8,530	1,325	336	284	**48,234**
Nonpermitted Urban	387	5	2,928	500	366	272	0	617	**5,075**
Background	315	283	2,787	158	3,066	450	535	1,372	**8,966**
Total	**18,205**	**5,213**	**120,138**	**5,973**	**35,226**	**6,411**	**7,142**	**63,412**	**261,720**

Phosphorus Load Reductions Required By Sector

This section explains the assumptions and calculations used to calculate the phosphorus load reductions required to meet the TMDL load allocations for each sector. When this section refers to "current loads," the values from the preceding section apply.

Method for calculating required reductions

The method for determining the load reductions for each sector are shown below:

- **Point sources**
  The annual phosphorus load reduction is calculated as the current load minus the annual target or allocated load from the TMDL. For wastewater treatment plants with current effluent concentrations above the adaptive management interim effluent limits of 0.6 mg/L and 0.5 mg/L, it was assumed that those reductions will be accomplished by the individual treatment plants and are not included in the load reduction accomplished through the adaptive management project.

- **Nonpoint sources:**
  The annual phosphorus load reduction is calculated as the current load minus the annual target or allocated load from the TMDL. This results in a conservative load reduction estimate since the current nonpoint baseline was updated using conservative assumptions, as explained in the preceding section.

- **MS4 sources:** If available, updated stormwater modeling information submitted by MS4s and reviewed by DNR was used in combination with the percent reduction approach in DNR guidance ("TMDL Guidance for MS4 permits: Planning, Implementation, and Modeling Guidance.") to calculate load reductions. When updated stormwater modeling information was not available, MS4 load reduction in this adaptive management plan was calculated as the TMDL baseline load minus the TMDL allocation.

- **Nonpermitted Urban and Background sources:** The annual phosphorus load reduction for these two categories was calculated as follows:

TMDL Baseline x % reduction = Annual load reduction

Required phosphorus reductions by TMDL stream reach

Required phosphorus load reductions summarized by source category and stream reach are shown in Table 20. Reductions for the three point sources that are wastewater treatment plants, and the DNR Fish Hatchery are specifically shown in this table. Corresponding detailed reduction information for all sources is provided in Appendix 8. It is important to point out that these load reductions may not be accomplished entirely through the adaptive management project. For example, an MS4 community may choose to accomplish a portion of their load reduction through projects implemented independently. Those reductions (if any) will be subtracted from the load reductions identified above. For example, the City of Madison plans on accomplishing approximately 5,000 lb/year of phosphorus reduction independent of the adaptive management project through a variety of phosphorus reduction efforts that could include chemical treatment of stormwater. Therefore, 5,000 lb/year will be deducted from the City of Madison's proportional adaptive management contribution.

It is also important to note that loads associated with point sources can vary from year to year as flow and effluent phosphorus concentrations change, and the loads associated with nonpoint can vary with cropping practices and animal density. Thus, the load reductions are considered as a starting point and

adjustments (either up or down) will need to be periodically made to reflect changing conditions. Adjustments will be made at the beginning of each WPDES permit term.

2024 Update

Table 20 was updated with the new phosphorus reduction goals. The new reduction goal includes the 5-year average TP load (2019-2023) and for MMSD, it includes the additional TP load from Badger Mill Creek compared to the TMDL wasteload allocation.

Reach 69 is monitored at Fulton and Highway 59, to allow monitoring downstream and upstream of the confluence between Badfish Creek and the Yahara River. Reductions prescribed by the TMDL are retained but reduced on an area-weighted basis for nonpoint sources. The calculations in Table 20 assume an in-stream phosphorus concentration of 0.28 mg/L, average streamflow of 86.70 CFS or 56.04 MGD, and a water quality standard of 0.075 mg/L.

Stream Reach	62	63	64	65	66	67	68	69		Total
								Fulton[1]	Hwy 59[2]	
	----------Phosphorus load Reductions (lb/yr.)----------									
Point										
MMSD									16,771	16,771
Oregon									1,524	1,524
Stoughton							25			25
DNR				209						209
Nonpoint	6,951	1,946	24,521	253	10,949	0	1,403	1,669	15,754	63,446
MS4	1,800	0	14,799	2,775	2,292	0	222	48	200	22,136
Nonpermitted Urban	221	2	1,200	215	143	14	0	54	224	2,073
Background	180	102	1,143	68	1,196	23	193	119	498	3,522
Total	**9,152**	**2,050**	**41,663**	**3,520**	**14,580**	**37**	**1,843**	**1,890**	**34,971**	**109,706**

Table 20: Required Phosphorus Load Reductions (lb/year) by TMDL Source Category and TMDL Stream Reach. Data compiled by MMSD staff using information contained in the Rock River TMDL, updated MS4 stormwater modeling information, and point source load information obtained from DNR staff.

[1] Fulton is the location within Reach 69 where water quality is measured to assess phosphorus reductions downstream of the Badfish Creek and Yahara River confluence.
[2] Highway 59 is the location within Reach 69 where water quality is measured to assess phosphorus reductions upstream of the Badfish Creek and Yahara River confluence.

2017 Original

Stream Reach	62	63	64	65	66	67	68	69	Total
----------Phosphorus load Reductions (lb/yr.)----------									
Point									
MMSD								11,562	11,562
Oregon								1,524	1,524
Stoughton							25		25
DNR				209					209
Nonpoint	6,951	1,946	24,521	253	10,949	0	1,403	8,650	54,673
MS4	1,800	0	14,799	2,775	2,292	0	222	248	22,136
Nonpermitted Urban	221	2	1,200	215	143	14	0	278	2,073
Background	180	102	1,143	68	1,196	23	193	617	3,522
Total	**9,152**	**2,050**	**41,663**	**3,520**	**14,580**	**37**	**1,843**	**22,879**	**95,724**

MMSD and the Dane County LWRD developed a comprehensive adaptive management cost/implementation model to guide adaptive management efforts. For this model, it was necessary to select phosphorus-reducing practices and estimate the load reductions and costs associated with those practices; so much of the adaptive management plan naturally reflects this model. The model is explained in more detail later in this document. Model outputs include phosphorus reductions by year and by TMDL stream reach. The model includes a ramp-up period that would result in 50 percent of the necessary load reduction being achieved by the end of the eighth year of the project, and 100 percent of the required load reductions being achieved in all eight stream reaches by the end of the seventeenth year.

Required TSS reductions by TMDL stream reach

Sediment reductions required to meet the narrative TSS standard are summarized by source and TMDL stream reach are in Table 21. To the extent available, the information for MS4s in Table 21 reflects updated stormwater modeling information that has been reviewed by DNR. Information for point sources is based on the most recent five year (2011-2015) average load as obtained from DNR staff. Detailed information about required sediment reductions by stream reach is provided in Appendix 9. Sediment reductions will be tracked throughout the adaptive management project in the same manner that phosphorus reductions will be tracked.

Stream Reach	62	63	64	65	66	67	68	69	Total
----------TSS Load Reductions (tons/yr.)----------									
Point	0	0	0	0	0	0	0	0	0
MMSD								0	
Oregon								0	

Stoughton DNR				0			0		
Nonpoint	2,917	147	8,660	0	810	0	16	2,270	14,820
MS4	213	0	1,409	202	157	0	3	6	1,990
Nonpermitted Urban	13	0	115	0	0	7	0	0	135
Background	0	0	0	0	0	0	0	0	0
Total	**3,143**	**147**	**10,184**	**202**	**967**	**7**	**19**	**2,276**	**16,945**

Table 21: Required Sediment Load Reductions (lbs./year) by TMDL Source Category and TMDL Stream Reach. Data compiled by MMSD staff using information contained in the Rock River TMDL, updated MS4 stormwater modeling information, and point source load information obtained from DNR staff.

III. Adaptive Management Strategy

While the previous section provided background and context for adaptive management in the Yahara Watershed, this section contains the implementation strategy for adaptive management itself.

This section is divided into three parts:

1. The cost/implementation model that guides key aspects of the Adaptive Management Plan
2. Identification of partners that will be involved in implementing adaptive management and their associated roles
3. Implementation strategy including a list of phosphorus-reducing practices that will likely be used in adaptive management and a detailed methodology that will be used to identify, incentivize, implement and verify agricultural phosphorus-reducing practices

Part 1: Cost/Implementation Model

DNR 9 Steps	
6 **9**	**This section meets some requirements of the DNR Adaptive Management Step 6: Estimate load reductions expected by permit term; and Step 9: Implementation Schedule with Milestone**

The adaptive management strategy frequently references information derived from the adaptive management cost/implementation model. This spreadsheet-based model was developed by MMSD and Dane County LWRD to estimate the cost associated with the adaptive management plan. However, model inputs/outputs also help inform key aspects of the adaptive management plan, such as estimated phosphorus reductions due to implemented practices. The cost/implementation model is briefly described below.

Model Inputs

Model "inputs" include the following:

- Phosphorus management practices and associated phosphorus reduction (lb/year)
- Practice shelf life
- Practice cost by unit (e.g. per acre of cover crop)
- Staff cost by practice for implementation
- Phosphorus reduction requirement by TMDL stream reach
- Ramp-up period to achieve phosphorus reductions and interim targets
- Anticipated staffing efficiencies in delivering phosphorus reduction practices during the life of the adaptive management project
- Water quality monitoring cost
- Inflation factor (2.4% annual inflation factor was used in the model)

Dane County LWRD staff inventoried all conservation practices that were installed in the Yahara Watershed for the period of 2008-2013. The list was broken down by TMDL stream reach. Dane County LWRD staff categorized practices by type (Engineering vs. Management), and calculated the estimated phosphorus reduction for each practice. Dane County LWRD staff also estimated the amount of staff time that it typically takes for practice implementation, including landowner contacts, planning, design, and practice implementation.

The designed life expectancy of each practice was identified, along with the practice cost and the cost per pound of phosphorus reduced. Where practice cost for a given practice varied, the practice cost used in the model was conservatively set at the highest practice cost. Dane County LWRD staff then used this information to develop a suite of phosphorus-reducing practices by stream reach for the full-scale adaptive management project. The suite of practices used in the cost model is not identical to the historic suite of practices, as some preference was given to practices with longer designed life expectancies. In addition, in some cases it was assumed that the designed life expectancy could be extended through contractual agreements.

Model Outputs

The model outputs include:

- Total project cost and annual costs, both with and without inflation
- The cost per pound of phosphorus reduced
- Annual phosphorus reduction (pounds) by stream reach based on total project phosphorus reductions and ramp-up periods
- Staffing needs based on current and anticipated staffing efficiencies for practice implementation
- Allocation of adaptive management cost for project participants

The model designates phosphorus reductions as either "new" or "carry-over" pounds of phosphorus. This distinction is needed for accounting and tracking purposes over the 20 year adaptive management period. For example, if a practice has an effective shelf life of ten years and results in an annual phosphorus reduction of 100 lb/year, the pounds in the first year are considered "new" while the pounds in the remaining year(s) are considered as "carry over".

The model contains phosphorus reduction goals by TMDL stream reach and year, and uses a 17-year ramp-up period to accomplish 100% of the phosphorus reductions needed to meet the TMDL allocations for all sources/source categories in the Yahara Watershed. The model also includes funding to support water quality monitoring activities associated with the adaptive management project.

Part 2: Identification of Partners

DNR 9 Steps	
1 8	**This section meets DNR Adaptive Management Step 1: Identify Partners; and Step 8: Financial Support**

This adaptive management plan builds off of the existing partnerships formed through the adaptive management pilot project. Partners fall into two broad categories. The first category contains WPDES permit holders specifically identified in the Rock River TMDL as having a discharge to the Yahara Watershed. This category includes traditional point source dischargers such as wastewater treatment plants, and MS4s. The second category includes a diverse group of entities that are not WPDES permit holders, but will likely play important roles in the success of adaptive management. This category includes:

- Agricultural producers (e.g. Yahara Pride Farms)
- County, state and federal agencies (e.g. Dane County LWRD, USGS)
- Non-profit groups focused on conservation and/or water quality (e.g. Sand County Foundation, Clean Lakes Alliance)
- Friends groups
- University researchers
- Others

Table 22 identifies current and potential adaptive management partners along with their corresponding roles and responsibilities. It is anticipated that this list will continue to expand as the adaptive management project moves forward. Letters of support from a representative cross section of partners in the second category are included in Appendix 11.

Of note is the fact that the Wisconsin DNR has a unique role in the adaptive management project in that it is a permitted entity listed in the TMDL, is engaged in water quality monitoring activities (including water chemistry and biological monitoring) in the Yahara Watershed and has the responsibility of reviewing and approving the adaptive management plan.

2024 Update

The District verified that all partners listed in our AM plan still carry the same responsibilities as they did in 2017 and there are no new partners to add. Table 22 was updated to reflect the current municipal status for the Village of Windsor.

Table 22: Participating Partners and Associated Roles

Partner	Roles and Responsibilities
Point Source WPDES permitted discharges	
Madison Metropolitan Sewerage District	Plan development/review, project coordination, agricultural engagement, measurement/monitoring, I&E, in-kind support, funding, submitting annual reports to DNR, laboratory analytical support
Oregon WWTP, *Stoughton Utilities*, *Madison Gas & Electric, DNR-Fish Hatchery*	I&E, funding, in-kind support, measurement/monitoring
Municipal Separate Storm Sewer System (MS4s) Permitted Communities	
Towns: *Blooming Grove*, *Bristol*, *Burke*, Cottage Grove, Dunkirk, Dunn, *Middleton*, *Pleasant Springs*, *Westport*, ~~*Windsor*~~ Villages: *Cottage Grove*, *DeForest*, *Maple Bluff*, *McFarland*, *Shorewood Hills*, *Waunakee*, *Windsor*, *Others* Cities: *Fitchburg*, *Madison*, *Middleton*, *Monona*, *Stoughton*, Sun Prairie, UW-Madison	I&E, funding, in-kind support, measurement/monitoring, practice implementation
Other partners	
Dane County Land and Water Resources Department *Columbia County Land and Water Department* *Rock County Land Conservation Department*	Plan review, agriculture engagement, verification/auditing of practices, measurement/monitoring of phosphorus reductions, I&E, in-kind support, potential targeted funding
USGS	Water quality monitoring, data evaluation/reporting, and related funding support
Clean Lakes Alliance	Private sector funding, technical support, I&E, community engagement
Clean Wisconsin	Plan review, I&E, in-kind support
Sand County Foundation	I&E, possible targeted funding
Yahara Pride Farms	I&E, in-kind support, P reduction practice implementation
Capital Area Regional Planning Commission	I&E, in-kind support
"Friends" Groups-e.g. Friends of Pheasant Branch Conservancy	I&E
River Alliance of Wisconsin	Plan review, I&E, in-kind support
Rock River Coalition	Water quality monitoring, I&E
USDA/NRCS	Funding for P reduction practices, I&E
Wisconsin Department of Agriculture, Trade and Consumer	Plan review, in-kind support, targeted funding
Yahara Lakes Association	I&E
UW Extension	I&E, in-kind support
DNR	Plan review, measurement/monitoring, I&E, regulatory oversight
Wisconsin Land and Water Conservation Ass.	I&E

Part 3: Phosphorus-Reducing Practices

DNR 9 Steps	
4 5	**This section meets DNR Adaptive Management Step 4: Identify where reductions will occur; and Step 5: Describe management measures.**

Phosphorus-Reducing Practices - Urban

Control of phosphorus from urban sources will be important in the adaptive management project. At a minimum, MS4s participating in the adaptive management project will need to meet the baseline phosphorus and TSS control levels assumed in the Rock River TMDL independent of adaptive management. These municipal entities may also choose to accomplish some portion of their required phosphorus and TSS reductions (above the baseline) independent of adaptive management. Alternatively, investments in cost-effective urban practices may be part of the adaptive management plan. MS4 partners will likely identify opportunities through their stormwater management plans. Practices resulting in phosphorus or TSS reductions in excess of those required to meet baseline TMDL conditions will be candidates for funding under the adaptive management project. Actual decisions to fund will be based on the cost per pound of phosphorus controlled and other relevant factors.

A suite of urban practices have been used or could potentially be used as part of adaptive management. A short list is shown below:

- Improved leaf collection
- Rain gardens
- Street sweeping
- Construction site erosion control
- Porous pavement
- Biofiltration
- Detention ponds
- Retention ponds
- Proprietary devices
- Stream bank stabilization
- Chemical treatment
- Swales/vegetative filter strips

Phosphorus-Reducing Practices - Rural

Adaptive management partners will support a suite of management measures to reduce agricultural phosphorus runoff in the Yahara Watershed. A list of NRCS National Conservation Practice Standards that will likely (although not exclusively) be used to reduce phosphorus runoff is shown in Table 24. This list was developed by the Dane County LWRD based on a review of practices known to have been implemented in the Yahara Watershed during the period of 2008-2013 and additional insights by Dane County LWRD staff. The list in Table 23, along with costs and estimated phosphorus reductions

associated with each practice, was used in the development of the adaptive management cost/implementation model described earlier in this document.

In addition to the NRCS National Conservation Practice Standards, there are two new practices that show promise for use in the watershed based on experience gained in the adaptive management pilot project: low disturbance manure injection (LDMI) and harvestable buffers.

For many livestock operations in the Yahara River Watershed, manure incorporation is a standard practice. While traditional incorporation methods move a great deal of soil and increase the potential for soil erosion, low disturbance manure injection (LDMI) is a relatively new farming system that incorporates manure into the soil with minimal soil disturbance. A cost share program for LDMI equipment purchase by farmers was pilot tested in the Yahara Watershed in 2015, with funding support from Dane County, Yahara WINs and the Clean Lakes Alliance. Dane County continues to make cost share funding available for LDMI.

NRCS National Conservation Practice Standards

Code	Name	Type
313	Waste Storage Facility	Engineering
328	Conservation Crop Rotation	Management
329	Residue and Tillage Management – No Till	Management
330	Contour Farming	Management
332	Contour Buffer Strips	Management
340	Cover Crop	Management
342	Critical Area Planting	Management
362	Diversion	Engineering
391	Riparian Forest Buffer	Management
393	Filter Strip	Engineering
410	Grade Stabilization Structure	Engineering
412	Grassed Waterway	Engineering
512	Forage and Biomass Planting	Management
558	Roof Runoff Structure	Engineering
580	Streambank and Shoreline Protection	Engineering
590	Nutrient Management	Management
592	Feed Management	Management
600	Terrace	Engineering
612	Tree/Shrub Establishment	Management
629	Waste Treatment	Engineering
635	Vegetated Treatment Area	Engineering
638	Water and TSS Control	Engineering
643	Restoration and Management of Rare and Declining Habitats	Management

657	Wetland Restoration	Engineering

Table 23: NRCS Conservation Practice Standards

Yahara WINs and Dane County LWRD have also initiated a Harvestable Buffer Program. The value of stream buffers in protecting water quality has long been recognized. However, there has been reluctance on the part of some agricultural producers to install buffers since this takes agricultural land out of production. The Harvestable Buffer Program allows producers to install buffers using vegetation that has agricultural value. Initiated in 2014, the Harvestable Buffer Program has been very successful. Producers are paid per acre plus the cost of seed and agree to maintain the buffers for five to ten years. In 2016 the harvestable buffer program was expanded to include a 15 year contract option.

2024 Update

Yahara Pride Farms (YPF) has been a major implementing partner for Yahara WINS since the beginning of the project in 2012. They are the only implementation partner that can work throughout the entire adaptive management (AM) action area as they are not restricted by county boundaries. YPF implements a suite of cropland conservation practices through their cost share program, including the following:

- Strip Tillage
- Low Disturbance Manure Injection
- Cover Crops
- Disturbance Deep Tillage & Cover Crop
- Winter Headland Stacking
- Composting Manure
- Adding Grass to Alfalfa Seedings on Highly Erodible Land
- No-Till Planting into Alfalfa, Soybean Stubble, or Cover Crops.

Other practices are likely to emerge and adaptive management project partners will work to encourage new and/or innovative approaches. For example, Dane County recently approved a four year, $12 million dollar initiative directed at removing phosphorus laden sediment from steams in the Yahara Watershed. Yahara WINs also encourages new and innovative approaches by administering a phosphorus reduction grant program. Started in 2013, this program allows Yahara WINs partners with ideas for phosphorus-reducing practices to apply directly for WINs funding. Each proposal is reviewed and ranked based on the lowest cost per pound of phosphorus reduced. Examples of projects funded to date are the installation of stormwater treatment devices, a dairy heifer grazing initiative and conversion of farmland to prairie.

2024 Update

Phosphorus Reduction Innovation Grant Program funding has been removed. Since 2019 this expense category focused on a grant program that placed an emphasis on innovative phosphorus reduction practices vs. conventional practices. This grant program has seen a limited number of applications the last few years despite the executive committee efforts to expand the program and isn't designed to necessarily result in projects that provide significant phosphorus reductions toward adaptive management goals. The last projects from 2022 proposed to use EutroSORB products to remove soluble reactive phosphorus. City of Madison placed EutroSORB bags in bioretntion devices to remove phosphorus from urban stormwater. This project was completed but only a small amount of P was

removed. EutroPhix proposed to apply a liquid form of EutroSORB in Dorn Cr. to remove phosphorus. This project was never implemented because EutroPhix was unable to get approval for instream liquid application of their product.

Agricultural Implementation Strategy

The adaptive management implementation strategy focuses primarily on implementation of agricultural phosphorus control practices since these will generally have a lower unit cost per pound of phosphorus control than urban practices. The majority of the Yahara Watershed is located in Dane County. Therefore, this agricultural implementation strategy focuses on the Dane County portion of the Yahara Watershed. Key elements of this strategy will be transferred as appropriate to the portions of the watershed outside of Dane County through coordination between Dane County LWRD and neighboring county conservation departments. The Dane County LWRD played a key role in developing the agricultural implementation strategy.

Implementation Plan:

To ensure achievement of the overall adaptive management phosphorus reduction goal of roughly 91,000 pounds per year (excluding the approximately 5,000 lb/year that will be achieved independently by the City of Madison), a three phased approach will be used to prioritize, implement, verify and quantify phosphorus reductions associated with conservation practices. This procedure ensures execution efficiencies while promoting a systems approach that encourages the implementation and management of multiple practices that work together to reduce phosphorus losses. In addition, this approach is similar to existing implementation procedures Dane County LWRD utilizes to implement conservation work throughout Dane County.

The following sections provide specific details on each of the three phases. Dane County LWRD intends to use this focused implementation strategy to maximize resource efficiency. However, phosphorus-reducing efforts will not be limited to priority areas. Dane County LWRD provides numerous services to landowners throughout Dane County and will continue to work with all county individuals on implementing phosphorus-reducing practices regardless of whether they are located within currently identified priority areas. This is beneficial in that it can help build momentum and support in areas that may, in the future, become priority areas for a variety of implementation programs.

Phase 1: Watershed Evaluation, Prioritization and Inventory

Phase 1 will involve the following three steps:

1. Conduct an evaluation of the Rock River TMDL and establish load reductions for nonpoint source phosphorus contributing areas-note that this has already been done elsewhere in the adaptive management plan document.
2. Prioritize identified nonpoint source phosphorus contributing areas.
3. Inventory resource concerns based on prioritized source areas.

Evaluation

The Rock River TMDL serves as the primary source for the quantitative analysis of nonpoint source phosphorus within the Yahara and Badfish Creek Watersheds. The Cadmus Group conducted this analysis for the Wisconsin DNR and U.S. Environmental Protection Agency (EPA). The analysis used the Soil and Water Assessment Tool (SWAT) which incorporated data on land use, land cover, land topography, soils, climate, and other factors to determine the pounds of phosphorus running off and entering surface waters from both nonpoint and point sources. These loadings were based on defined TMDL reaches of which eight (62, 63, 64, 65, 66, 67, 68, and 69) are located within the Yahara and

Badfish Creek Watersheds. These TMDL reaches are important in that they serve as the base geographic area for reporting accomplishments and progress towards meeting established adaptive management phosphorus reduction goals. Overall phosphorus reduction goals for adaptive management have been established for each of the eight TMDL stream reaches based on both the load allocations and percent reductions from the TMDL. These reductions will serve as one of the many metrics in monitoring progress and measuring success of the strategic implementation plan.

Prioritizing Nonpoint Areas

Prioritizing implementation based on nonpoint source loadings from the TMDL is not efficient given the large discrepancy in geographic sizes of these reaches. Even though reach 64 has the largest phosphorus reduction goal, other reaches may have areas contributing more phosphorus on an annual basis but are being masked given their smaller relative size. To ensure a more standardized approach in determining priority areas, LWRD has used data from the Montgomery Associates: Resource Solutions *Yahara WINs Extended SWAT Model* to create a high level (regional) comparison.

The *Yahara WINs Extended SWAT Model* used much of the same information and modeling approaches as in the Rock River TMDL, with the exception of updated data sources and a higher resolution spatial scale. This finer-scale analysis provides the ability to aggregate the data efficiently producing better and more informed results. Details on the *Yahara WINs Extended SWAT Model* can be found at http://www.madsewer.org/Portals/0/ProgramInitiatives/YaharaWINs/Resources/Yahara%20WINs%20SWAT%20Model%20Final%20Report%20Revised%20June%202014.pdf

Data from the *Yahara WINs Extended SWAT Model* was aggregated up to the HUC-12 watershed scale to provide a standardized spatial comparison to identify priority areas. Phosphorus and TSS loading rate (pounds/acre) maps were created to assist in identifying priority areas within the Yahara and Badfish Creek Watersheds. Priority has and will continue to be given to those HUC-12 watersheds with the highest loading rates. Figures 10 and 11 show generalized prioritization for phosphorus and TSS respectively. Figure 12 provides an example of how a select watershed (Door Creek Watershed) can be further broken down to the subwatershed level for prioritization purposes. As focused efforts are completed in high priority HUC-12 watersheds, emphasis will shift to lower priority watersheds. However, the adaptive management project will be flexible in advancing phosphorus and TSS reductions in any watershed where there is a resource need, willing landowners and available funds.

Inventorying Source Areas

Once a HUC-12 watershed has been selected as a priority area, a further evaluation will be conducted to identify sub areas (sub-HUC-12's) that are contributing more phosphorus than others. This supports the approach of prioritizing the most critical sites first in order to maximize phosphorus reductions and efficiency. County staff will then use their knowledge of the watershed in conjunction with evaluation tools (air photos, conservation plans, etc.) to identify and inventory known resource concerns. Staff will also identify and contact current landowners to aid in the conservation planning process.

Phase 2: Practice Implementation and Quantification

Phase 2 will involve the following two steps:

1. Conservation planning and practice implementation.
2. Quantification of phosphorus reductions as a result of conservation plan implementation.

Practice Implementation

To proceed with implementation, County staff will contact the corresponding landowner(s) of the highest ranked sub-HUC-12 areas with identified resource concerns to initiate the conservation planning process. This process consists of the steps shown in Figure 13.

A wide range of phosphorus-reducing practices are eligible for producers to select, providing them with flexibility in choosing practices that fit their operations. Practices can be broken down into three main categories;

- *Management "Soft" Practices*: This category includes a variety of agricultural management practices used to address nutrient and TSS loss typically from cropped fields such as nutrient management planning, crop rotations, changes in tillage, and cover crops. Soft practices refer to the fact that these practices are planned and implemented on land with changing management needs or may be limited in timing.

- *Structural "Hard" Practices*: This category includes a variety of agricultural management practices used to address nutrient and TSS loss from cropped fields and production sites. These may include grassed waterways, terraces, manure storage, or barnyard runoff controls. Hard practices refer to the fact that these practices require elements of engineering, design, construction and installation of permanent structures.

- *Innovative Practices*: This category can include a variety of new or innovative practices to be used as part of the management of cropped fields or livestock production sites that are not traditionally utilized or do not have technical standards. This may include harvestable buffers, easements, or alternative manure treatment systems.

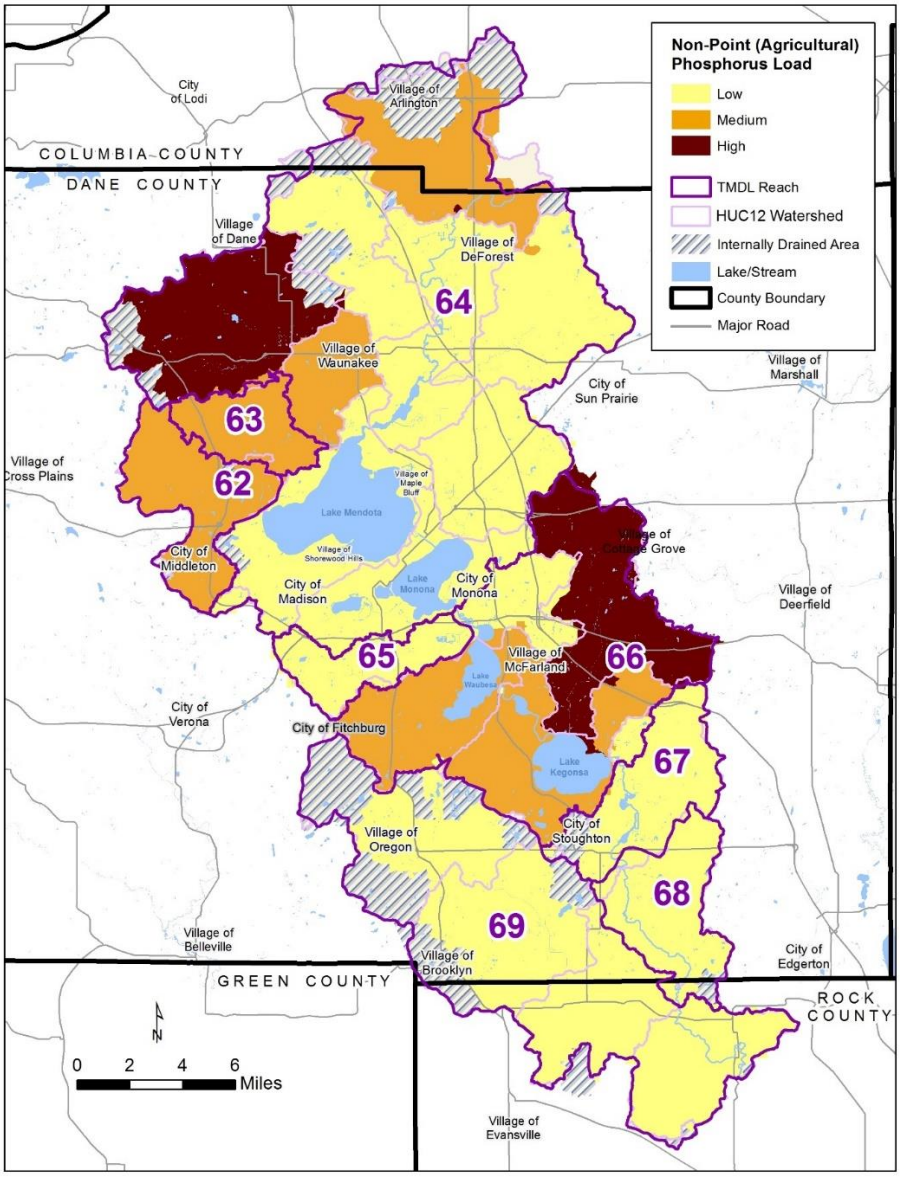


Figure 9: Relative Distribution of Nonpoint Phosphorus Loads by Stream Reach

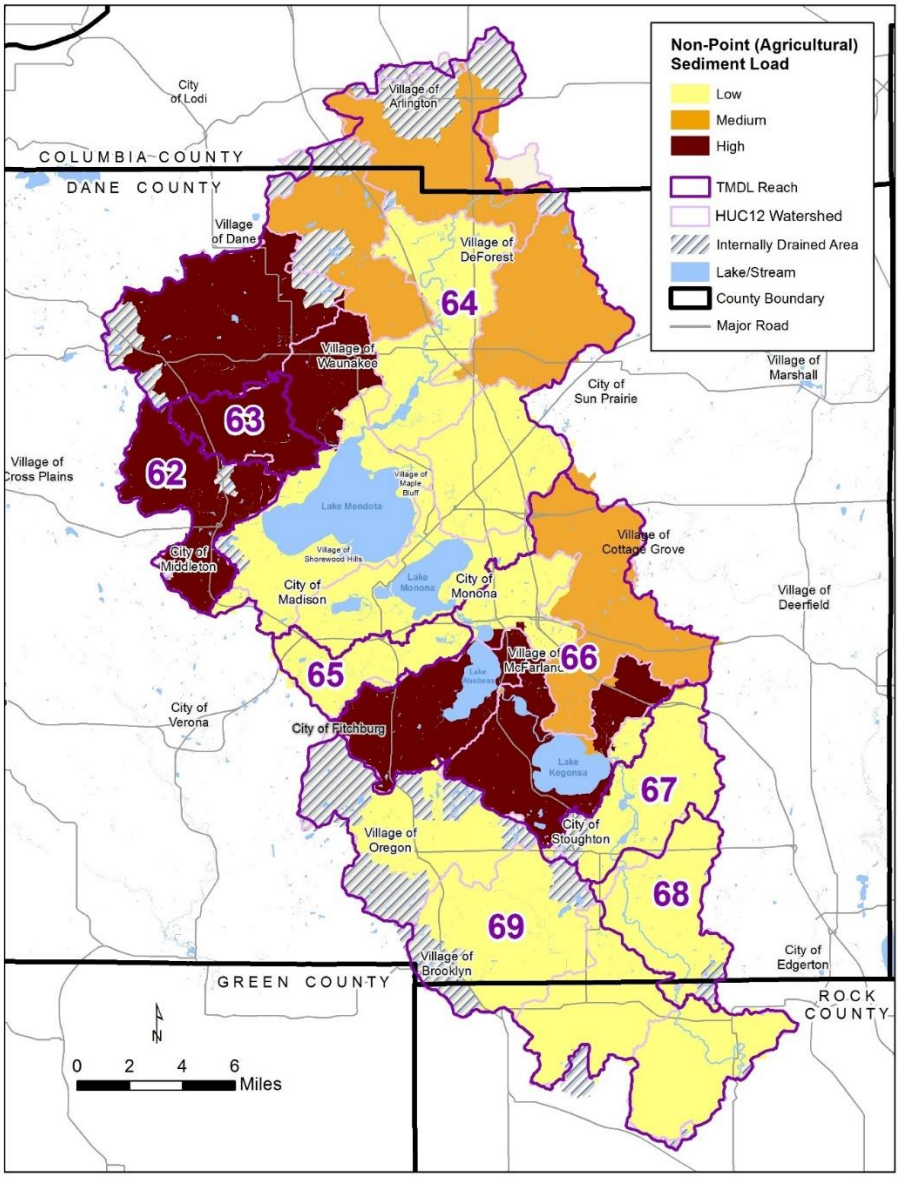


Figure 10: Relative Distribution of Nonpoint TSS Loads by Stream Reach

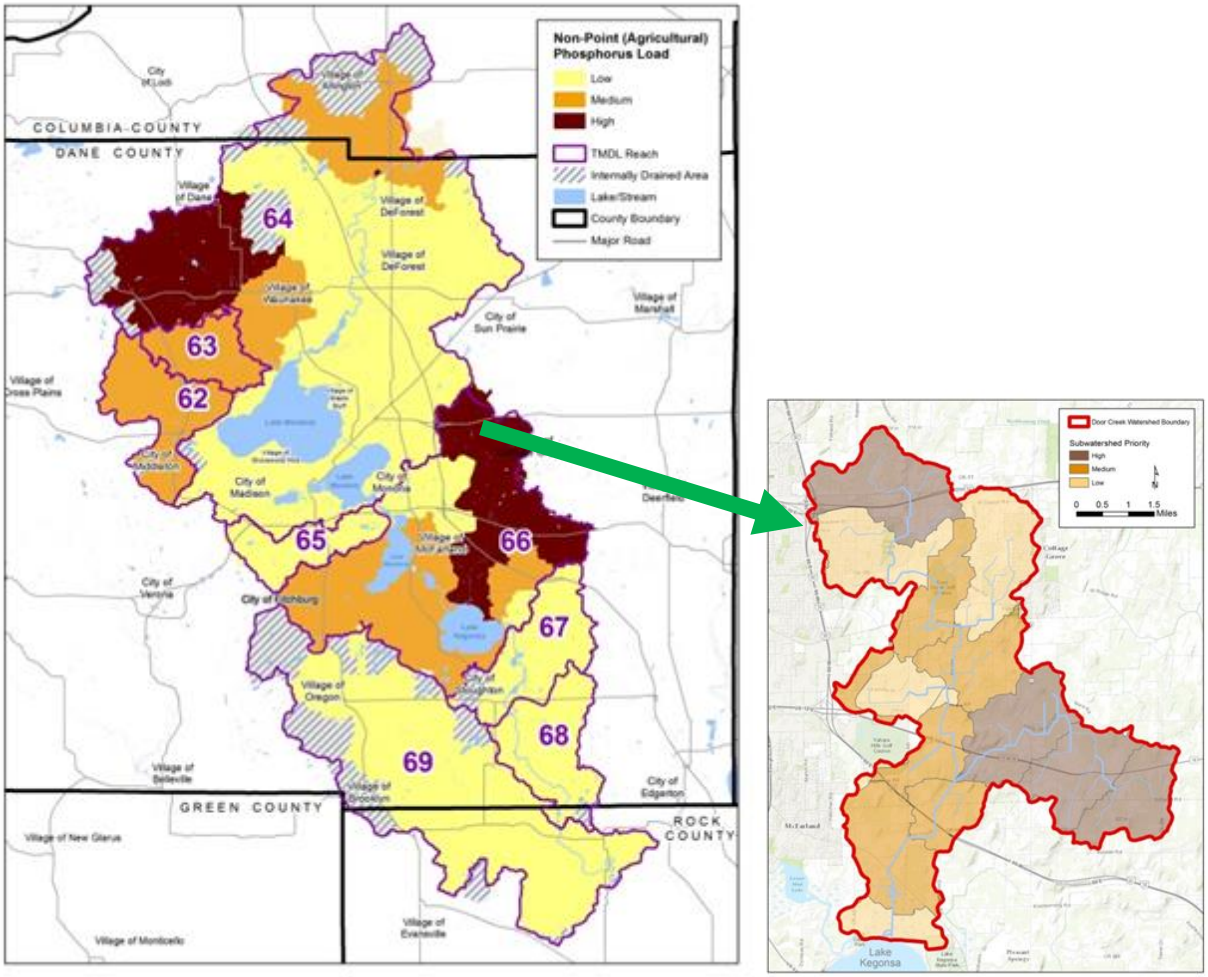


Figure 11: Door Creek Sub-watershed Prioritization

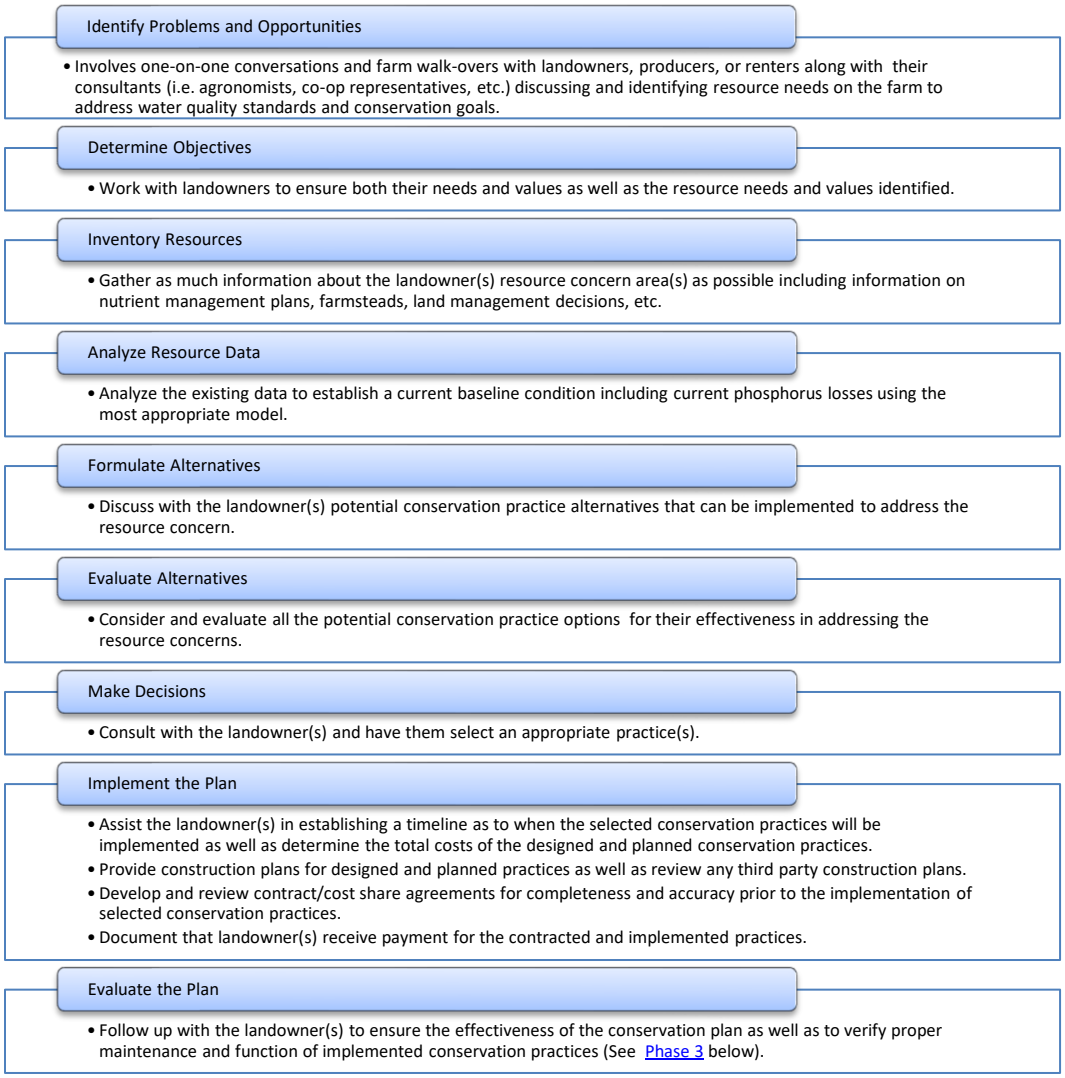


Figure 12: Conservation Planning Process

Quantification

The District, Dane County LWRD and DNR staff previously agreed on the models and/or methods that will be used to evaluate and verify corresponding phosphorus reductions. These models and/or methods include SNAP Plus, BARNY (barnyard runoff model), P8 (Urban Catchment Model) or use of calculations based on TSS Loss x Phosphorus Concentration (SL x PC). Figure 14 shows the agreed upon models and/or methods. New models or methods may emerge that are appropriate for use in quantifying reductions. Any new models or methods will be discussed with DNR and will be subject to DNR approval before they are used to quantify reductions in the adaptive management project.

Phase 3: Verification and Reporting

Phase 3 will involve the following steps:

- Verifying the status of installed phosphorus-reducing practices by conducting follow-up visits with landowners.
- Address operation and maintenance concerns.

- Update phosphorus load reduction modeling, when necessary.
- Developing reports summarizing activities associated with the adaptive management plan.

Verification

Dane County LWRD will verify the status of the installed and contracted practices that Dane County staff assisted with as part of the adaptive management program. At a minimum, practices will be verified once every four years. Verification includes reviewing all applicable practices associated with an implemented conservation system and may include reviewing the conservation plan, nutrient management plan, operation/maintenance plans, cropland practices, and production site practices.

Records and data for the practices, contracts, and phosphorus reductions implemented and managed through county programs associated with the adaptive management project will be recorded and maintained by Dane County LWRD. Dane County LWRD will conduct periodic quality control reviews of entered data to ensure the accuracy of the collected information. Practices will be recorded spatially using Geographic Information System (GIS) software along with LWRD's Conservation Planning System (CPS) software.

In order to manage workload between implementing new practices and verifying existing and previously installed conservation practices, Dane County LWRD will apply the following schedule for the verification of practices and conservation systems as part of adaptive management:

- In a four year rotation, Dane County LWRD will conduct status reviews in the Yahara Watershed by township. This schedule will be incorporated into LWRD's broader (county wide) verification procedures.
    - Year 1: Cottage Grove, Windsor, Burke, Rutland, Oregon
    - Year 2: Middleton, Dunkirk, Blooming Grove, Dunn, Albion, Berry
    - Year 3: Pleasant Springs, Fitchburg, Springfield, Vienna, Roxbury
    - Year 4: Westport, Madison, Dane, Sun Prairie, Bristol

- Status reviews may result in the need to address maintenance and repair concerns for already installed practices. These situations will be evaluated and addressed as they are discovered.

- While conducting status reviews, new resource concerns, practices, and/or landowners may be identified to participate in adaptive management. These will be added to existing inventory work identified in Phase 1.

As part of each status review the following steps will be used to ensure that all associated phosphorus reductions are valid and can continue to be reported and accredited to the adaptive management effort:

1. Conduct follow-up status review
2. Determine BMP status
3. Issue status determination to landowner
4. Take corrective measures as needed
5. Document that required corrective measures (if any) are completed
6. Update tracking system, including modeling, as needed

2024 Update

Other implementing partners like other county conservation departments (Rock County, Columbia County) and Yahara Pride Farms uses a similar verification systems. They all verify each practice at a minimum time frame on a rotational review schedule, including the review of nutrient management plans to confirm accuracy of phosphorus reduction calculations; and all steps listed as part of a status view are followed. The methodology for calculating phosphorus reductions in Snap+ was standardized in 2022 for all implementing partners to use the Wisconsin P Trade Report. In addition, photo documentation of practices installed will be used to verify implementation.

Yahara WINS tabulates and reports reductions annually by stream reach. This information is submitted to Yahara WINS in the form of annual reports from our implementing partners where the modeling reductions are calculated and implementation records are maintained.

Reporting and Measuring Progress

Measuring progress in relation to implementation will consist of assessing several different metrics. In addition to measuring yearly progress towards meeting annual phosphorus reduction goals, the following metrics will be captured annually as performance indicators:

- Number of landowners/operators contacted,
- Number of cost-share agreements signed,
- Number of one-on-one contacts made with landowners in the watershed,
- Planned and completed conservation practices,
- Pollutant load reductions and percentage of goal planned and achieved,
- Numbers of verification checks to make sure management plans (nutrient management, grazing management, etc.) are being followed by landowners,
- Status of nutrient management planning, and easement acquisition and development,
- Total amount of money on cost-share agreements, and
- Total amount of landowner reimbursements made

Units associated with each metric above will be summarized annually over the life the adaptive management project to monitor for potential trends and provide data to make informed decisions. Given the many unknowns that are associated with implementing conservation practices (e.g. willingness of landowner, commodity prices, weather, land tenure, etc.) this broad range of performance metrics will be used to measure progress and can inform whether adjustments are needed in terms of implementation approaches.

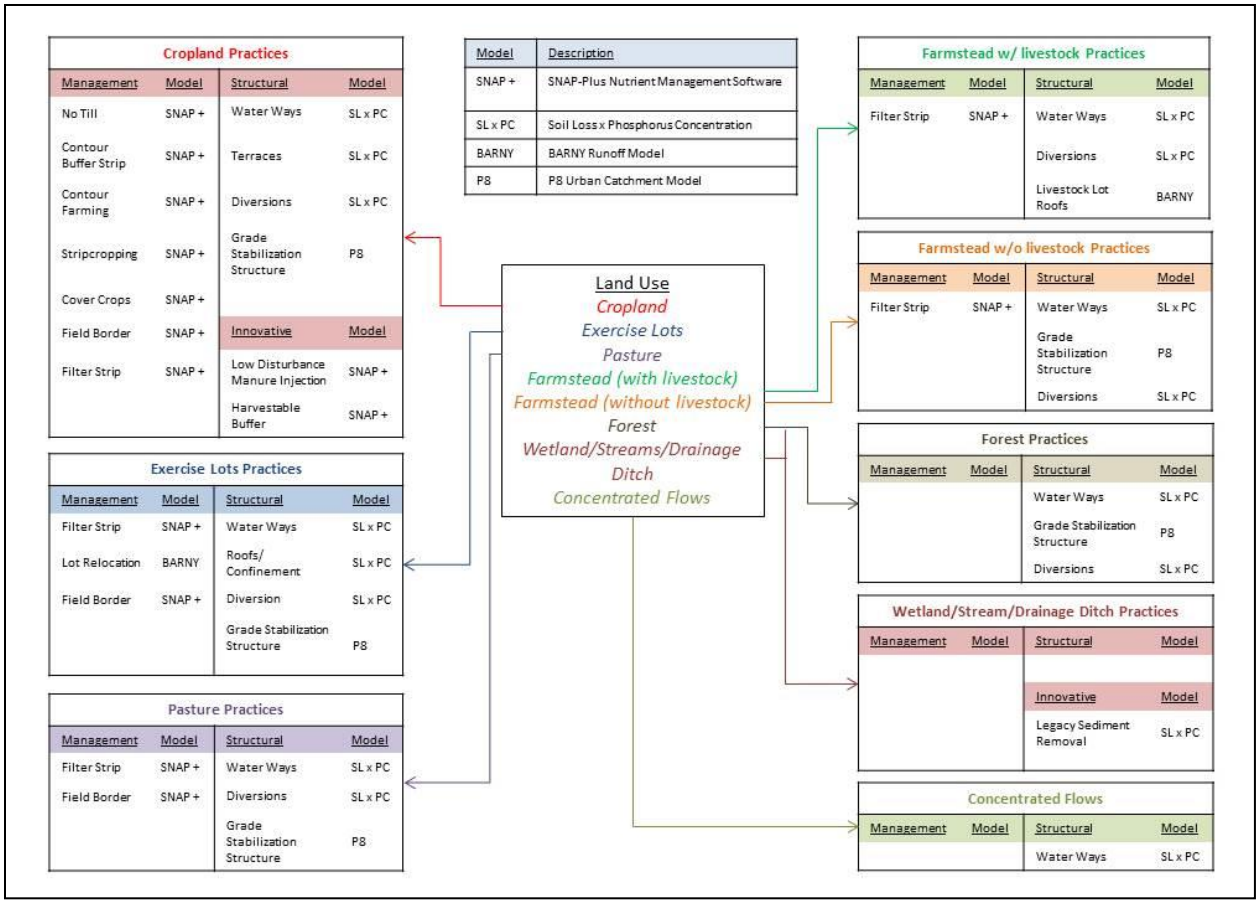


Figure 13: Phosphorus Reduction Calculation Models and/or Methods

IV. Water Quality Monitoring

DNR 9 Steps	
7	**This section meets DNR Adaptive Management Step 7: Measuring Success**

Objectives

Water quality monitoring is a required element of an adaptive management project and is used to determine progress toward meeting applicable water quality criteria. This water quality monitoring component builds off the water quality monitoring efforts already in place in the Yahara Watershed. Overarching objectives include:

- Demonstrating interim adaptive management progress toward meeting applicable numeric water quality criterion and TMDL requirements.
- Demonstrating ultimate compliance with adaptive management and TMDL requirements.
- Developing the necessary database to support delisting decisions for those stream segments located in the Yahara Watershed that are identified as impaired per the Rock River TMDL.
- Demonstrating the progress and effectiveness of BMPs through targeted monitoring.

The 2014 MOU states that compliance at the end of the adaptive management period shall be measured based on:

- Attainment of the phosphorus water quality criteria and TSS narrative standards through water quality monitoring.

- If phosphorus water quality criteria or TSS narrative standards have not been attained, compliance can be measured using effluent data and watershed modeling that uses similar assumptions as the TMDL to demonstrate that the sum total of the allocations have been achieved for each reach. If some, but not all, reaches are complying with the allocations of the TMDL, only those point sources in the complying reaches will be considered in compliance at the end of the adaptive management period. Point sources will only be deemed in compliance for pollutants for which the allocations have been achieved (i.e. for a specific reach, if allocations are attained for TSS but not phosphorus, the point source in that reach will only be deemed in compliance for TSS).

Guidance Considered

The following guidance documents were considered in developing the water quality monitoring component of the adaptive management plan:

- WisCALM-2014 Update
- Adaptive Management Technical Handbook-January, 2013
- Guidance for Implementing Water Quality Trading in WPDES Permits-August 2013

- Guidance for Implementing Wisconsin's Phosphorus Water Quality Standards for Point Source Discharges-January, 2012

The adaptive management technical handbook and WisCALM guidance indicate that the minimum sampling frequency to demonstrate compliance with numeric water quality criteria is monthly sampling during the growing season (May-October). Discussions with USGS and DNR staff highlighted the importance of analyzing at a greater frequency initially to gain better insight on the temporal variability, particularly during the spring runoff season. The Adaptive Management Technical Handbook states that monitoring by TMDL stream reach is required if the adaptive management action area is within a TMDL area. There are eight TMDL reaches located in the Yahara Watershed (reaches 62-69) as specified in the Rock River TMDL (see Figure 2).

NR 217 does not explicitly require stream flow monitoring for the purpose of demonstrating compliance with adaptive management requirements. The adaptive management technical handbook (guidance) states that both concentration and flow measurements should be collected. Since adaptive management as codified in NR 217 requires a demonstration that applicable numeric water quality criterion for phosphorus in NR 102.06 be met, in-stream monitoring would necessarily need to focus on concentration. This monitoring strategy will focus on water chemistry monitoring, and will be supplemented with flow monitoring at stream locations having existing USGS gaging stations. Flow information may be collected in other areas using portable flow meters.

The Rock River TMDL lists several stream segments located in the Yahara Watershed as being impaired. All impaired segments identify TP and TSS as the pollutants, with the exception of Dorn Creek (TSS only). The TMDL document notes that *"it is reasonable to expect that TMDL implementation actions that reduce TP to acceptable levels will also reduce TSS loads to an extent sufficient to achieve designated fish and other aquatic life uses*." As noted above, the applicable numeric water quality criteria for TP in NR 102 are concentration based. Thus, compliance with the TMDL will likely be based on meeting the applicable numeric water quality criterion for TP and demonstrating that habitat issues have been addressed, as evidenced by biological (macroinvertebrate and fish sampling) and habitat monitoring. DO monitoring and temperature will be important at select locations where temperature or DO problems have been documented. The proposed monitoring program reflects these considerations.

DNR staff has suggested that the monitoring program should be designed to support the potential transition from adaptive management to water quality trading. DNR released two draft guidance documents related to water quality trading for public comment (*Guidance for Implementing Water Quality Trading in WPDES Permits; Water Quality Trading How-To Manual, August 2013*). Neither document requires water quality monitoring, although both reference the need for effluent quality monitoring. With respect to quantifying phosphorus reductions in a trading program the "How To" manual states that modeling will likely be used to quantify the current pollution load as well as the reductions made from agricultural and urban management practices. The guidance goes on to identify several applicable models. While water quality monitoring is not a specific requirement for water quality trading, some level of water quality monitoring may be beneficial to support a trading program. It is anticipated that the monitoring approach outlined for adaptive management would be sufficient to support a water quality trading program.

Monitoring locations

Per the adaptive management technical handbook, in-stream TP concentrations will be monitored at or near the bottom of each stream reach in the Yahara Watershed. From a practical standpoint, consideration needs to be given to accessibility and safety considerations when selecting monitoring locations. Figure 15 shows "active" water quality monitoring locations in the Yahara Watershed, with active being defined as the site having been sampled for water chemistry at least once in the last two years. It is the intent to continue monitoring at these locations as part of the adaptive management project. While there is wide geographic distribution of sampling locations, additional sampling may be needed in a few TMDL stream reaches (e.g. in reaches 64 and 66). Yahara WINs will work with DNR staff to identify additional sampling locations.

Stream flow data will be collected at select locations within stream reaches that currently have operating USGS gaging stations. Consideration will be given to establishing new gaging stations (e.g. Nine Springs Creek) or making flow measurement using handheld flow meters where flow information is desirable but the location lacks an established gaging station. Biological monitoring locations will be determined with assistance from DNR biologists.

Additional focused/targeted monitoring locations will be identified as work on adaptive management proceeds. This monitoring will be necessary to help determine the effectiveness of management activities, quantify interim water quality improvements, and improve the accuracy of watershed modeling. In addition, edge of field monitoring will be considered at select locations.

Monitoring Parameters and Monitoring Frequency

Water quality monitoring will focus on both water chemistry and biology. Biological monitoring is not explicitly required for adaptive management, but will be important in the context of the TMDL.

The primary focus of the water chemistry sampling will be to characterize TP and TSS concentrations at established locations as identified above, with monthly samples being collected at approximately fixed intervals during the growing season of May through October. Additional water chemistry sampling and analysis may be done at the discretion of Yahara WINs. Additional sampling could occur during non-growing season months and/or during storm events to more fully characterize stream conditions and pollutant loads. Additional parameters could include analysis for OP-DRA, NH3-N, NO3+NO2, TKN, DO, Temperature and CLFYL-A. In addition, targeted monitoring may occur to document the effectiveness of phosphorus reduction practices. The location and frequency of additional targeted monitoring will be determined on a case-by-case basis and reflect input from DNR, USGS and others.

Biological monitoring (macroinvertebrate sampling and fish survey) may be conducted at the discretion of Yahara WINs and would be used to assess stream health. Sampling locations will be determined in consultation with DNR biologists. Macroinvertebrate sampling would occur at select locations, with samples being collected every two years in the fall. Fish surveys will be conducted every four years, with timing determined by DNR biologists. In both cases, locations would be selected in consultation with DNR biologists.

Quality Assurance Protocols

Water chemistry sample collection will be done by a combination of District staff, USGS staff and volunteer citizen monitoring coordinated by the Rock River Coalition. Citizen monitoring coordinated by the Rock River Coalition will follow DNR's citizen-based monitoring assurance protocols established through the Water Action Volunteers (WAV) program. A detailed methodology of WAV can be found here: http://watermonitoring.uwex.edu/wav/monitoring/methods.html. The MMSD Laboratory will perform all water chemistry analysis. The MMSD laboratory is a state and USGS certified laboratory and follows the quality assurance protocols under Wis. Admin Code § NR149. The full NR149 document can be found here: https://docs.legis.wisconsin.gov/code/admin_code/nr/100/149. Analytical protocols, limits of detection and limits of quantitation for the water chemistry parameters identified earlier in this section are provided in Appendix 2.

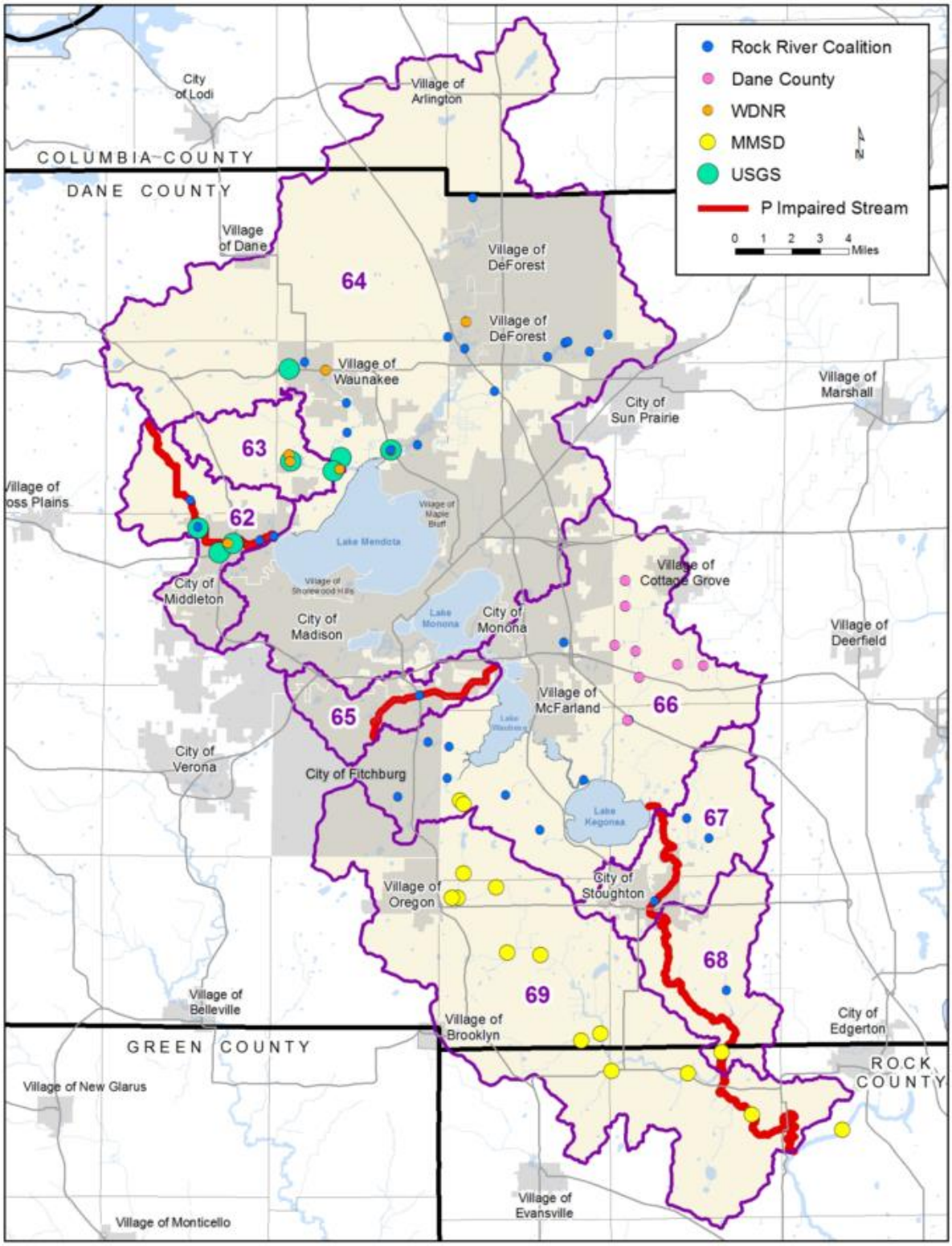


Figure 14: Active Water Quality Monitoring Locations in the Yahara Watershed. Compiled by Mike Sorge (DNR) and others using data from multiple sources. Map prepared by Dane County LWRD, January, 2017.

Optional biological monitoring and fish survey sampling will be coordinated by MMSD staff and may be conducted by a combination of District staff and use of contracted services. MMSD has contracted with Underwater Habitat Investigations LLC to assist in previous fish survey work, under the direction of Dave Marshall. MMSD has also contracted with the University of Wisconsin-Stevens Point to sort, identify and enumerate macroinvertebrate samples collected by District staff. This is the same laboratory that DNR uses for macroinvertebrate analysis.

Table 24 summarizes required and discretionary water quality monitoring activities. Required parameters and frequencies are shown in bold. As noted previously, minimum sampling frequency shall be monthly at approximately 30 day intervals.

	Water Chemistry	Biology	
Parameters	**TP, TSS**,CLFYL-A, NH3-N, NO3+NO2, TKN, OP-DRA, , DO, Temperature	Macroinvertebrates	Fish
Frequency	**Monthly during growing season (May-October)** Sampling during non-growing season months and event related sampling	Once every two years in the fall-exact timing per consultation with DNR biologists Higher frequency in areas where habitat restoration projects occur	Once every four years-exact timing per consultation with DNR biologists Higher frequency in areas where habitat restoration projects occur
Location	**At or near the bottom of each stream reach** At additional targeted locations to show progress	At locations agreed to by DNR biologists	At locations agreed to by DNR biologists
Primary Collection Responsibility	MMSD, USGS, , Rock River Coalition (volunteer citizen monitoring program)	MMSD, volunteer citizen monitoring program	MMSD, Underwater Habitat LLC or other consultants/contractors
Primary Analytical Responsibility	MMSD	Contract laboratory/ UW Stevens Point	Underwater Habitat LLC or other consultants/contractors

Table 24: Water Quality Monitoring Summary

2024 Update

Table 25 shows the specific locations of existing and proposed pour point compliance monitoring locations for the TMDL. Reach 69 was divided into two subunits (Fulton and Highway 59) to allow planning specific to the Badfish Creek watershed. Water quality monitoring at Fulton, including flow measurement and water sample collection, will be conducted by USGS on the Yahara River at Fulton. Water quality monitoring at Highway 59 will be conducted at station 8-B, an existing MMSD monitoring site located furthest downstream on Badfish Creek at Hwy. 59. Water chemistry samples are collected monthly May-October. Flow measurements will be added to the monitoring protocol for this site. MMSD is considering three options for measuring flow at Highway 59, including USGS flow gage, flow meter for measuring at the time of sampling, or extrapolate from existing flow gages in nearby streams similar to Badfish Creek. With one exception (pour point in Reach 66), monitoring is already occurring at these locations. A new monitoring location will be established at the pour point for Reach 66 based on input from DNR and USGS.

TMDL Reach	Pour Point Monitoring Location
62	**Pheasant Branch at Parmenter Street Bridge, SWIMS ID 133315** (Monitoring by USGS, Gage, 05427948) Long: -89° 30' 42 " Lat: 43° 06' 12 "
63	**Dorn Creek at Hwy M USGS Gage (Point 631), SWIMS ID 133067** Long: -89° 26' 32 " Lat: 43° 08' 25 " **and Six Mile Creek at Hwy M USGS Gage (Point 632), SWIMS ID 133312,** Long: -89° 26' 12 " Lat: 43° 08' 48"(Monitoring by USGS)
64	**Bridge Road off West Broadway (Monitoring by MMSD) – SWIMS ID 10040888** Long: -89° 20' 12" Lat: 43° 02' 59"
65	**Nine Springs Creek at Moorland Road (Monitoring by MMSD) – SWIMS ID 133086,** Long: -89° 20' 50.6" Lat: 43° 1' 50.8"
66	**Monitoring location Yahara River at Prospect Street – SWIMS ID 10040742** (Monitoring by Rock River Coalition), Long: -89° 13' 08" Lat: 42° 55' 14.8"
67	**Door Creek at MN Bridge, SWIMS ID 133067** (Monitoring by Rock River Coalition) Long: -89° 26' 32" Lat: 43 ° 08' 25"
68	**Yahara River at Stebbinsville Rd (upstream of confluence with Badfish Creek) MMSD Site 10Y** (Monitoring by MMSD) - **Point 681, SWIMS ID 133048:** Upstream: Long: -89 ° 10 ' 22.3 " Lat: 42 ° 50 ' 37.3 " **Yahara River downstream of confluence with Badfish Creek (Monitoring by USGS) - Point 682, Yahara River at Hwy 59 – Fulton USGS Gage, SWIMS ID 543226,** (Monitoring by USGS), Long: -89° 10 ' 19" Lat: 42° 49' 35"
69	**Yahara River at Fulton USGS Gage** (Monitoring by USGS) Long: -89 ° 10 ' 19 " Lat: 42 ° 49 ' 35 "
69	**Badfish Creek at Hwy. 59 (downstream),** MMSD Monitoring point BFC 8-b, Long: -89° 11’ 51” Lat: 42° 50’ 1”

Table 25: Pour Point Water Quality Monitoring Summary

2017 Original

Stream Reach	Pour Point Monitoring Location
62	**Pheasant Branch at Parmenter Street Bridge** (Monitoring by USGS) Long: -89 ° 30 ' 42 " Lat: 43 ° 06 ' 12 "
63	**Dorn Creek at Hwy M USGS Gage and Six Mile Creek at Hwy M USGS Gage**(Monitoring by USGS) Long: -89 ° 26 ' 32 " Lat: 43 ° 08 ' 25 "
64	**Bridge Road off of West Broadway** (Monitoring by MMSD) Long: -89 ° 26 ' 32 " Lat: 43 ° 08 ' 25 "
65	**Nine Springs Creek at Moorland Road** (Monitoring by MMSD) Long: -89 ° 20 ' 50.6 " Lat: 43 ° 1 ' 50.8 "
66	**New site-location to be established based on input from USGS and DNR** (Monitoring responsibility TBD) Long and Lat: TBD
67	**Door Creek at Hope Road** (Monitoring by Rock River Coalition) Long: -89 ° 26 ' 32 " Lat: 43 ° 08 ' 25 "
68	**Yahara River upstream and downstream of confluence with Badfish Creek** (Monitoring by MMSD) Upstream: Long: -89 ° 10 ' 22.3 " Lat: 42 ° 50 ' 37.3 " Downstream: Long: -89 ° 9 ' 6.6 " Lat: 42 ° 48 ' 42.4 "
69	**Yahara River at Fulton USGS Gage** (Monitoring by USGS) Long: -89 ° 10 ' 19 " Lat: 42 ° 49 ' 35 "

V. Communication

Effective communication is an essential component of the Yahara WINs Adaptive Management Plan. Overarching communication objectives include:

- Facilitate effective communication across previously existing phosphorus-reducing water quality programs in the Yahara Watershed
- Target six (6) key groups of stakeholders and/or interested parties
- Expand on previous successful communication in the *Yahara WINs* Pilot Project

Significant communications related to adaptive management have already occurred, primarily focused on information sharing with adaptive management partners, and engagement with DNR and EPA on regulatory related issues. Information sharing activities have been generally successful and have relied on a variety of approaches. These include use of newsletters, semiannual and annual reports, quarterly Yahara WINs meetings, presentations at meetings sponsored by partnering organizations, maintenance of a Yahara WINs website, and other similar activities.

Moving forward, communication efforts will focus on six key groups of stakeholders and/or interested parties. Each of these groups possesses a wide range of capabilities related to outreach, information and

education. The Yahara WINs Adaptive Management Plan will leverage these capabilities to increase public awareness and help promote behavioral changes necessary for implementation of phosphorus management practices. Figure 16 summarizes the communication approach that will be used for each of the six key groups of stakeholders and/or interested parties.

One challenge related to communication is that there are numerous programs underway in the watershed that have similar or complementary goals (e.g. Yahara WINs, Yahara CLEAN implementation, Yahara Pride initiatives, Clean Lakes Alliance initiatives, Mississippi River Basin Initiative/EQIP Program, and initiatives undertaken by the Dane County LWRD). In addition, there are multiple messengers and many messengers wear multiple hats. This may lead to confusion, resulting in potential delays with practice implementation. Specific attention will need to be given to coordinate messaging to minimalize the potential for confusion.

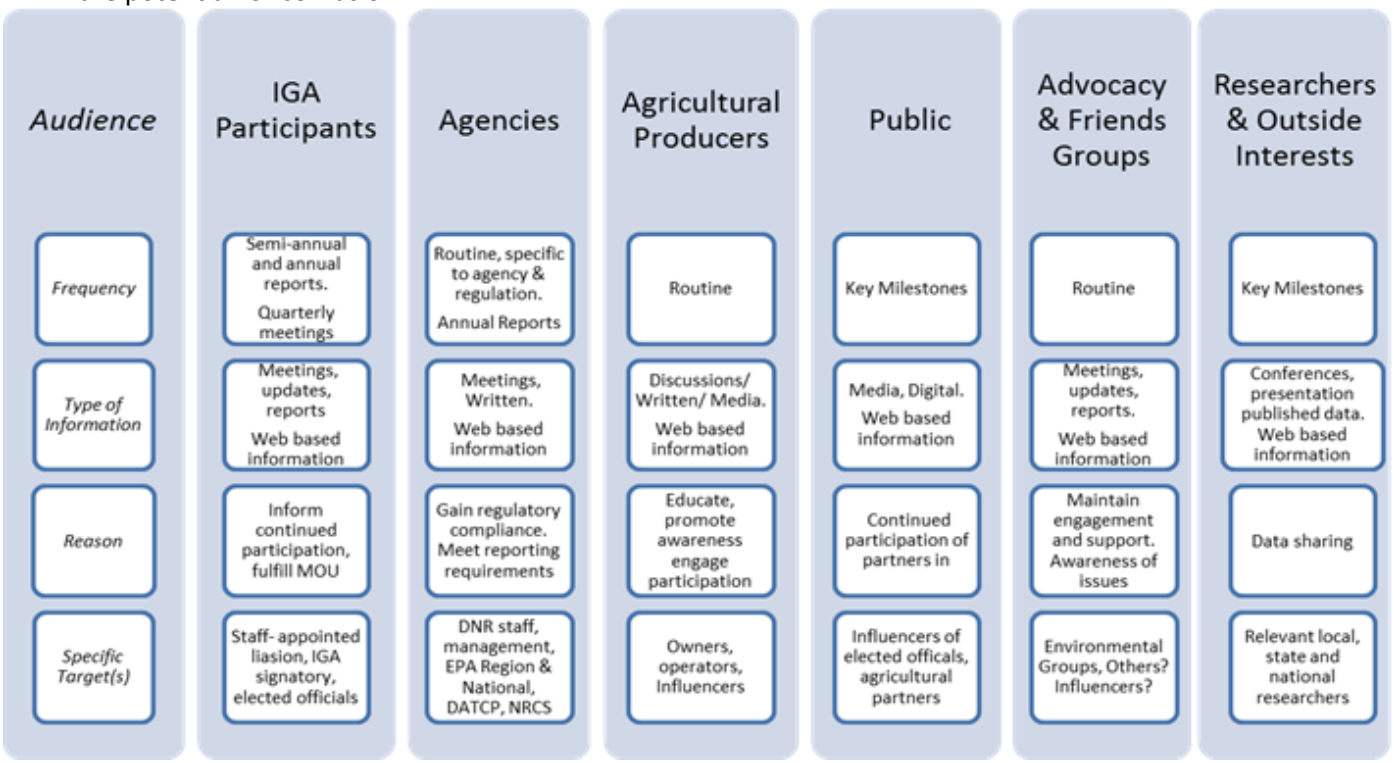


Figure 15: Summary of Communication Strategy prepared by MMSD staff

VI. Financial Security

DNR 9 Steps	
8	**This section meets DNR Adaptive Management Step 8: Financial security**

This section refers in part to information generated through the cost/implementation model for the adaptive management project, which was described in Section III of this plan. This spreadsheet-based model was developed by the MMSD and Dane County LWRD to estimate the cost associated with the

adaptive management plan. The preliminary cost estimate for the adaptive management project is approximately $94 million dollars over the 20-year implementation period. This estimate reflects updated stormwater modeling information for MS4s and phosphorus information for point sources based on the most recent five year averaging period on record (2011-2015). The above cost has not been adjusted for phosphorus reductions that the City of Madison anticipates achieving independent of the adaptive management project. If adjusted, the cost would be approximately $91 million dollars.

Based on output from the cost/implementation model, costs can be generally grouped into three main categories. These categories and the relative distribution of costs between the categories are shown below:

- Staff/Operational Cost: 32% ($30,320,000)
- Practice Costs 62% ($57,936,000)
- Water Quality Monitoring 6% ($5,669,000)

Staff and operational costs cover the cost associated with planning, designing, constructing and on-going verification of the practice following construction. Practice cost covers the actual cost of the practices which were estimated based on Dane County average costs and adjusted NRCS cost share rates. The practices used in the cost model are based on actual data of practices installed over the period of 2008 through 2012, with adjustments being made to shift to a higher percentage of structural practices, which generally have longer practice lives. Water quality monitoring costs were conservatively estimated and account for the installation of two new USGS gages (locations to be determined) during the life of the adaptive management project. A copy of the cost/implementation model is available upon request.

An Intergovernmental Agreement (IGA) has been developed for the adaptive management project that addresses a number of organizational issues, including how charges will be assessed to municipal members to support the adaptive management project. A copy of the IGA is included in Appendix 10. Cost allocations in the IGA are determined by multiplying the total adaptive management project cost by the fraction of the total pounds of required project phosphorus reduction needed by each member to meet its TMDL allocation based on current conditions. For example, if the required phosphorus reduction of an individual member is equal to 5 percent of the total pounds of phosphorus reduction from all sources in this adaptive management project, that member is assigned 5 percent of the total project cost.

IGA assessments adjusted based on updated phosphorus load reduction information for participating entities will cover approximately $29 million over the 20-year implementation period. Funding from a variety of other sources, including producer cost-share and funding from local, state and federal programs, is conservatively estimated at approximately $68 million dollars over the 20-year implementation period. Included in this estimate is a $12 million dollar initiative by Dane County to address legacy phosphorus in stream sediments. Based on the above financial information, the adaptive management effort is fully funded. In addition, it is worth noting that many agricultural producers are implementing phosphorus-reducing practices in the absence of cost-share dollars. For example, in 2015, Yahara WINs provided cost-sharing for 1,300 acres of cover crops as part of the Yahara Pride demonstration program, while another 3,400 acres of cover crops were planted without cost-share assistance. The combination of these types of activities, the fact that phosphorus reductions associated with the cost/implementation model are conservatively estimated, as are contributions and in-kind

support from groups like the Clean Lakes Alliance and others, provides reasonable assurance regarding the financial security of the adaptive management project.

Wastewater treatment plants participating in the adaptive management project are responsible for directly funding their portion of the phosphorus reductions under this adaptive management project. In other words, their portion is not being funded through other sources of funding

VII. Timeline and Milestones

DNR 9 Steps	
9	**This section meets DNR Adaptive Management Step 9: Implementation schedule with milestones**

Table 26 shows the estimated phosphorus load reductions by TMDL stream reach and WPDES permit term for the full-scale adaptive management project, assuming the project starts in 2017 as planned. These reductions are based on ramp-up periods used in the cost/implementation model, and are consistent with information previously presented in Table 20, with minor differences due to rounding. Load reductions will be adjusted either up or down based on factors previously discussed in this plan. Table 27 expresses the load reductions by TMDL stream reach and WPDES permit term as a percentage of the total required load reduction. The percentages were derived from the ramp-up period used in the cost/implementation model. Appendix 12 provides the detailed annual information used to develop Tables 26 and 27.

In practice, variations within a given year and stream reach should be expected. This is because there will be significant use of targeted efforts in this adaptive management project for purposes of efficiently focusing resources. Examples of targeted approaches used previously in the Yahara Watershed include the Lake Mendota Priority Watershed Project and projects funded under the Mississippi River Basin Initiative (MRBI) in the northwest part of the watershed. A current example is work that will be conducted under the Regional Conservation Partnership Project (RCPP) in the Door Creek subwatershed.

2024 Update

Table 26 was updated with the new load reduction goals over permit terms 2-4 to include the 5-year average TP load (2019-2023) and the additional TP load from Badger Mill Creek, reflecting MMSD's plans to consolidate its discharge to Badfish Creek.

Reach	Permit 1	Permit 2	Permit 3	Permit 4
	----------Annual P Reduction (lb)----------			
62	3,661	7,322	8,237	9,152
63	820	1,333	1,845	2,050
64	16,665	27,081	37,497	41,663
65	1,408	2,288	3,168	3,520
66	5,832	9,477	13,122	14,580
67	15	24	33	37

68	737	1,198	1,659	1,843
69	9,152	23,960	33,175	36,861
Total	38,290	72,682	98,735	109,706

Table 26: Anticipated Phosphorus Load Reductions (lb) by WPDES Permit Term.

2017 Original

Reach	Permit 1	Permit 2	Permit 3	Permit 4
	----------Annual P Reduction (lb)----------			
62	3,661	5,949	8,237	9,152
63	820	1,333	1,845	2,050
64	16,665	27,081	37,497	41,663
65	1,408	2,288	3,168	3,520
66	5,832	9,477	13,122	14,580
67	15	24	33	37
68	737	1,198	1,659	1,843
69	9,152	14,871	20,591	22,879
Total	38,290	62,221	86,152	95,724

Reach	Permit 1	Permit 2	Permit 3	Permit 4
	----------Percent of P Reduction Goal Achieved-------			
62	40	65	90	100
63	40	65	90	100
64	40	65	90	100
65	40	65	90	100
66	40	65	90	100
67	40	65	90	100
68	40	65	90	100
69	40	65	90	100
Total	40	65	90	100

Table 27: Anticipated Phosphorus Reduction Goal as Percentage of Total lb by WDPES Permit Term

Required phosphorus load reductions associated with MMSD, the Oregon WWTF and the Stoughton WWTF under current conditions are shown in Table 28. These loads would be offset consistent with the percent reduction milestones shown in Table 27. As noted earlier, wastewater treatment plants participating in the adaptive management project are responsible for directly funding their portion of the phosphorus reductions under this adaptive management project.

2024 Update

Table 28 was updated with the new MMSD minimum phosphorus reduction goal to include the 5-year average TP load (2019-2023) and the additional TP load from Badger Mill Creek, reflecting MMSD's plans to consolidate its discharge to Badfish Creek.

WWTF	Required Minimum Phosphorus Load Reduction (lb)
MMSD	16,771
Oregon	1,524
Stoughton	25
Total	18,320

Table 28: Required Phosphorus Load Reductions at Current Conditions.

2017 Original

WWTF	Required Minimum Phosphorus Load Reduction (lb)
MMSD	11,562
Oregon	1,524
Stoughton	25
Total	13,111

Appendix 1: 2014 Memorandum of Understanding Between MMSD and DNR Regarding Adaptive Management

Memorandum of Understanding

Between the Madison Metropolitan Sewerage District and the Wisconsin Department of Natural Resources

For the Yahara Watershed Adaptive Management Program

This Memorandum of Understanding (MOU) is effective this 11 day of Dec 2014 between the Wisconsin Department of Natural Resources (Department) and the Madison Metropolitan Sewerage District (District) collectively referred to as "the Parties."

1. **Purpose.**
   The purpose of this MOU is to outline the standards and procedures for implementing an adaptive management project in the Yahara Watershed pursuant to Wis. Admin Code §NR 217.18 and Wis Stat. § 283.13(7) to aid the District in developing a final adaptive management plan for review and approval by the Department.

2. **Adaptive Management Plan.**
   a. The District may submit an adaptive management plan to DNR, or may choose to comply with phosphorus requirements through alternative compliance options. The adaptive management plan will be developed following the "Adaptive Management Technical Handbook-A Guidance Document for Stakeholders" and will be consistent with the requirements in Wis. Admin Code §NR 217.18. If adaptive management is chosen as District's compliance option, the plan will be submitted to DNR in accordance with the compliance schedule in the District's next permit.

   b. The adaptive management plan will contain a water quality monitoring plan, address how interim progress toward meeting water quality criteria will be determined using both modeling and monitoring, and identify a process for how adjustments to the plan will be made, if necessary, to ensure adequate progress is being made to comply with applicable water quality criteria.

   c. The adaptive management project will be used by participating entities as the compliance strategy to meet phosphorus numeric water quality criteria and sediment (TSS) reductions required to achieve applicable narrative standards. The total maximum daily load (TMDL) for the Yahara watershed, contained within the Rock River Basin TMDL, was approved by EPA in September, 2011. The TMDL outlines anticipated modeled reductions needed to meet phosphorus water quality criteria and narrative sediment (TSS) standards.

3. **Determining Percentage Reductions During the Adaptive Management Project.**
   a. The 2011 Rock River TMDL determines phosphorus and sediment (TSS) allocations for nonpoint, MS4s, and other point sources with contributions to stream reaches located within the Yahara Watershed.

   b. The adaptive management project will be structured to meet water quality criteria and narrative standards within the Yahara Watershed, or the total phosphorus and sediment (TSS) allocations specified in the TMDL, as defined in paragraph 6a.

   c. For the purposes of demonstrating interim progress, percent reductions will be calculated for phosphorus and sediment (TSS) within each stream reach and compared to the percent reductions for these parameters listed in the TMDL. Reductions can also be expressed in units of pounds/year for phosphorus and tons/year for sediment (TSS) for each stream reach based on the modeling procedures set forth in paragraph 4.

   d. If one or more permitted MS4 or other point source with a discharge to a stream reach located in the Yahara watershed decides not to participate in the adaptive management project, it will be assumed that these entities will meet their TMDL requirements independently, and the target reductions for phosphorus and sediment (TSS) in the adaptive management project will be adjusted accordingly.

4. **Interim Progress: Measuring Load Reductions To Achieve Percentage Reduction Goals.**
   a. "TMDL baseline loading condition" means the phosphorus and sediment pollutant loads from which percent reductions identified in the TMDL are measured.

   b. When evaluating interim progress, phosphorus and sediment (TSS) percent reductions for nonpoint sources and MS4s identified in the TMDL will be determined by calculations using the best available modeling tools and in accordance with DNR code and guidance where applicable. Agricultural best management practices (BMPs) characterized as soft practices will be modeled at the field scale using SNAP-Plus or equivalent methodologies agreed upon by the parties. BMPS characterized as hard practices or stream bank stabilization projects will be modeled or measured using methods approved by DNR. Watershed level modeling (when appropriate) shall be conducted using SWAT. Urban BMPs will be modeled in accordance with the WDNR technical standards and guidance for NR 151 and TMDL modeling. Work shall be done in accordance with generally accepted engineering practices and shall document the pounds reduced as compared to phosphorus and sediment (TSS) loading conditions prior to the installation of the BMP. When existing regulatory requirements contained in NR 151 or existing DNR guidance do not address potential agricultural and urban BMPs or engineered treatment systems, other models or methods may be used as deemed appropriate and subject to approval by DNR.

c. When evaluating interim progress, phosphorus and sediment (TSS) percent reductions for point sources identified in the TMDL will be determined based on actual flow and concentration data as reported to DNR as required by WPDES permits.

d. Phosphorus and sediment (TSS) load reductions below the TMDL baseline loading condition may be counted when calculating progress with percent reductions identified in the TMDL for each reach:

   i. Current conditions for municipal and industrial point sources at the start of the adaptive management project will be determined based on actual flow and effluent phosphorus concentrations reported to DNR on discharge monitoring reports (DMRs) using the most recent five year average. The difference between the current conditions and the TMDL baseline may be counted toward the reduction goal for the applicable reach.

   ii. Conditions for nonpoint sources at the start of the adaptive management project will be determined using loads from the original Yahara Clean SWAT model (2010) that was updated in 2014 by extending the SWAT model to include the entire Yahara watershed. The Yahara Watershed SWAT model should be consistent with methodologies and assumptions used in the EPA approved TMDL. Any differences between the Yahara Watershed SWAT model and the TMDL modeling will be documented and submitted to the Department for approval.

      Revisions to the nonpoint loads generated by the Yahara Watershed SWAT model will be made to reflect the changes in nonpoint loads from both the installation of agricultural best management practices (BMPs) and any increases in loading from changes in agricultural management that have occurred since the time period covered in the Yahara Watershed SWAT model. Both the resulting load revisions and methodologies used to calculate the load revisions will be verified by the Dane County Land and Water Resources Department or other organizations approved by DNR.

   iii. Analysis for Municipal Separate Storm Sewer Systems (MS4s) will be consistent with the Department's "TMDL Guidance for MS4 permits: Planning, Implementation, and Modeling Guidance." If the current conditions discharge value from an MS4 is lower than the TMDL baseline loading condition for the MS4, then the difference may be counted toward the TMDL percent reduction goals in the applicable reach.

e. Municipal Separate Storm Sewer Systems (MS4s) participating in the adaptive management project will need to achieve a 40% sediment (TSS) reduction within

urban areas, consistent with baseline assumptions of the TMDL. MS4s not meeting the 40% sediment (TSS) control within a stream reach can satisfy the 40% control requirement by obtaining offsets from other MS4s with discharges to the same stream reach that have achieved greater than 40% sediment (TSS) control, provided that the resulting weighted average sediment (TSS) reduction for MS4s in that stream reach is equal to or greater than 40%.

f. If a best management practice (BMP) funded under the adaptive management pilot or a full scale adaptive management project subsequently becomes mandated by local, state or federal law, the phosphorus and sediment (TSS) reduction associated with that BMP will continue to be counted toward meeting reduction goals, as outlined in this MOU, so long as the BMP is properly maintained. BMPs with DNR, the Natural Resources Conservation Services, or the Department of Agriculture Trade and Consumer Protection technical standards shall be maintained according to the requirements in the corresponding technical standards. Verification of BMP maintenance shall be consistent with permit requirements.

g. Pollutant reductions cannot be double counted and used by more than one entity in percent reductions i.e. multiple parties cannot use the same load reductions to offset their required load reductions).

5. Reduction Credit for State Funded Nonpoint Reductions

Targeted Runoff Management (TRM) Grant funds and other sources of state funding may be available and used by nonpoint sources within the Yahara Watershed. However, TRM Grant funds may not be used to comply with the minimum phosphorus reduction specified in a WPDES permit, and TRM funds may not be used to demonstrate compliance with point source load reductions needed under water quality trading.

6. End of the Adaptive Management Period

a. Compliance at the end of the adaptive management period shall be measured based on:

i. Attainment of the phosphorus water quality criteria and TSS narrative standards through water quality monitoring.

ii. If phosphorus water quality criteria or TSS narrative standards have not been attained, compliance can be measured using effluent data and watershed modeling that uses similar assumptions as the TMDL to demonstrate that the sum total of the allocations have been achieved for each reach. If some, but not all, reaches are complying with the allocations of the TMDL, only those point sources in the complying reaches will be considered in compliance at the end of the adaptive management period. Point sources will only be deemed in compliance for pollutants for which the allocations have been achieved (i.e. for

a specific reach, if allocations are attained for TSS but not phosphorus, the point source in that reach will only be deemed in compliance for TSS).

b. If water quality monitoring shows compliance with applicable water quality criteria and standards, further reductions are not required within that reach to satisfy TMDL requirements so long as compliance with the water quality criteria is maintained over time and provided additional reductions are not required in that reach to meet downstream criteria.

c. If at the end of the adaptive management period the phosphorus and sediment (TSS) allocations identified in the TMDL have not been met for a stream reach, the entities participating in the adaptive management project will be responsible for taking additional steps to achieve compliance with phosphorus requirements in their WPDES permits. This could include converting to a water quality trading program that is consistent with applicable DNR guidance. Verifiable phosphorus and sediment (TSS) reductions achieved through the adaptive management project can be counted toward reductions in a water quality trading program provided the documentation is consistent with applicable DNR guidance.

7. **Modification of this MOU**

a. This MOU applies while an approved Adaptive Management Plan for the Yahara watershed remains in place and is implemented. This MOU may be modified by mutual agreement of the parties. This MOU does not replace the need for an adaptive management plan, nor does it supersede an approved adaptive management plan.

b. This MOU is subject to all applicable state and federal laws and regulations and shall be construed in accordance with those laws.

8. **Signatures**

For the Madison Metropolitan Sewerage District

By: _____ 11.26.14

D. Michael Mucha
Chief Engineer and Director

Date

For the Wisconsin Department of Natural Resources

By: _____ 12/11/14

Cathy Stepp
WDNR Secretary

Date

Appendix 2: MMSD Laboratory Analytical Methods, Limits, Limits of Detection and Limits of Quantitation for Water Quality Monitoring Conducted by the MMSD Laboratory

2024 Update

MMSD ANALYTICAL PROCEDURES LIST
updated 1/2025

Parameter		Method Description	Method Qualifier*	Corresponding SOP ID
TKN & TP/TKN Extr	47	TKN & TP/TKN Extr; EPA 600/R-93-100, Method 351.2 Total Kjeldahl Nitrogen - Block Digestion	C	TKN-6001
TP	48	TP; EPA 600/4-079-020, Method 365.4 Total Phosphorus - Block Digestion	C	TP-6002
NO2-N	56	NO2-N & NO3+NO2; EPA 600/R-93-100, Method 353.2 Nitrite by Automated Colorimetry	C	NO2NO3-6005
Cl, NO3-N, OP-DRI, SO4	59	Cl, NO3-N, OP-DRI, SO4; EPA 600/R-93-100 Method 300.0; Ion Chromatography	C	IC-3001
WEP	84	WEP; Pennsylvania State University Dept of Agriculture and Biological Engineering, Water Analysis Laboratory; Extraction procedure for Water Extractable Phosphorus	NA	WEP-6009
DO	89	DO; Std Methods 4500-O-G 2001; Dissolved Oxygen by Water-Saturated Air by Membrane Electrode	A	DO-2004
pH	90	pH; Std Methods 4500-H+, 2000, pH Electrometric	A	PH-1009
COND	91	COND; Std Methods 2510B-1997, Conductivity	A	COND-1008
TEMP	92	TEMP; Std Methods 2550B-2000, Temperature	A	TEMP-1010
CLFYL-A	94	CLFYL-A; Std Methods 18th Ed. Method 10200 H - 2001	A	CLFYL-1002
NH3-N	97	NH3-N; EPA Meth 600/R-93-100, Method 350.1 Ammonia by Automated Phenate Method	C	NH3-6003
Ortho P	98	OP-DRA; Std Methods 4500-P F-1999, Orthophosphorus by Automated Ascorbic Acid Method	A	OP-6007
TSS/FSS/VSS	112	TSS/FSS/VSS; Std Meth 2540-D&E-1997, Total Fixed and Volatile Suspended Solids	C	TSS-2004
NH3-N microdistillation	117	NH3-N Microdistillation; EPA 40 CFR Part 122,136 et al; March 2007	A	NH3MD-6010
Suspended Sediment	128	SSC - Suspended Sediment Content by USGS D 3977 – 97	NA	SSC- 2007

Method Qualifiers* **NA = Not Approved P = Pending Approval A = Approved C = Certified C-O = Certified, analyzed by outside lab**

2017 Original

MMSD ANALYTICAL PROCEDURES LIST — Updated 10/02/2015

Parameter		Method Description	Metho	Correspondin
TKN & TP/TKN Extr	47	TKN & TP/TKN Extr; EPA 600/R-93-100, Method 351.2 Total Kjeldahl	C	TKN-6001
TP	48	TP; EPA 600/4-079-020, Method 365.4 Total Phosphorus - Block Digestion	C	TP-6002
NO2-N	56	NO2-N & NO3+NO2; EPA 600/R-93-100, Method 353.2 Nitrite by	C	NP2-NO3-6005
Cl, NO3-N, OP-DRI, SO4	59	Cl, NO3-N, OP-DRI, SO4; EPA 600/R-93-100 Method 300.0 ION	C	IC-3001
WEP	84	WEP; WEP-6009; Extraction procedure for Water Extractable Phosphorus	NA	WEP-6009
DO	89	DO; Std Methods 4500-O-C- 2001 Azide Modification followed by 4500-O-	A	DO-2002
pH	90	pH; Std Methods 4500-H-2000, pH Electrometric	A	PH-1009
COND	91	COND; Std Methods 2510B-1997, Conductivity	A	COND-1008
TEMP	92	TEMP; Std Methods 2550-B-2000, Temperature	A	TEMP-1010
CLFYL-A	95	CLFYL-A; Std Methods 18th Ed, 10200-H Specrophotometric Determinatic	A	CLFYL-1002
NH3-N	97	NH3-N; EPA Meth 600/R-93-100, Method 350.1 Ammonia by Automated	C	NH3-6003
Ortho P	98	OP-DRA; Std Methods 4500-P-F-1999, Orthophosphorus by Automated	A	OP-6007
TSS/FSS/VSS	112	TSS/FSS/VSS; Std Meth 2540-D&E-1997, Total Fixed and Volatile	C	TSS-2004
NH3-N microdistillation	117	NH3-N Microdistillation; EPA 40 CFR Part 122,136 et al; March 2007	A	NH3MD-6010
Suspended Sediment	128	SSC - Suspended Sediment Content by USGS D 3977 – 97	NA	SSC- 2007

Method Qualifiers* **NA = Not Approved P = Pending Approval A = Approved C = Certified C-O = Certified, analyzed by outside lab**

2024 Update

Madison Metropolitan Sewerage District Lab Report
All results are reported in mg/L = PPM

	LOD	LOQ			LOD	LOQ
NO3+NO2	0.1	0.3	mg/L		0.18	0.601
NO3+NO2	0.15	0.5	mg/L	As of 8/4/2015		
OP-DRA	0.002	0.006	mg/L		0.009	0.03
OP-DRA	0.003	0.009	mg/L	As of 12/30/2014		
SSC	2		mg/L	✓		
TSS	2		mg/L	✓ no change		
TP	0.01	0.03	mg/L			
TP	0.02	0.066	mg/L	As of 12/11/2013	0.059	0.196
TP	0.02	0.07	mg/L	As of 8/1/2014		
TP	0.05	0.15	mg/L	As of 7/16/2015		
NH3-N	0.01	0.03	mg/L			
NH3-N	0.02	0.07	mg/L	As of 12/23/2013, confirmed 2/16/2015	0.06	0.2
NH3-N	0.04	0.14	mg/L	As of 8/4/2015		
TKN	0.10	0.32	mg/L	As of 12/11/2013		
TKN	0.12	0.4	mg/L	As of 8/1/2014	0.321	1.069
TKN	0.15	0.5	mg/L	As of 7/16/2015		

Value Codes/QA codes

"e" value denotes estimatated value
"b" value below detection limit
"q" value between detection limit and quantitation limit
"D" denotes duplicate range exceeded
"H" denotes holding time exceeded
"T" denotes matrix spike recovery above control limit
"U" denotes matrix spike below lower control limit
"Y" denotes other QA exceedance
"Z" denotes multiple QA exceedances

2017 Original

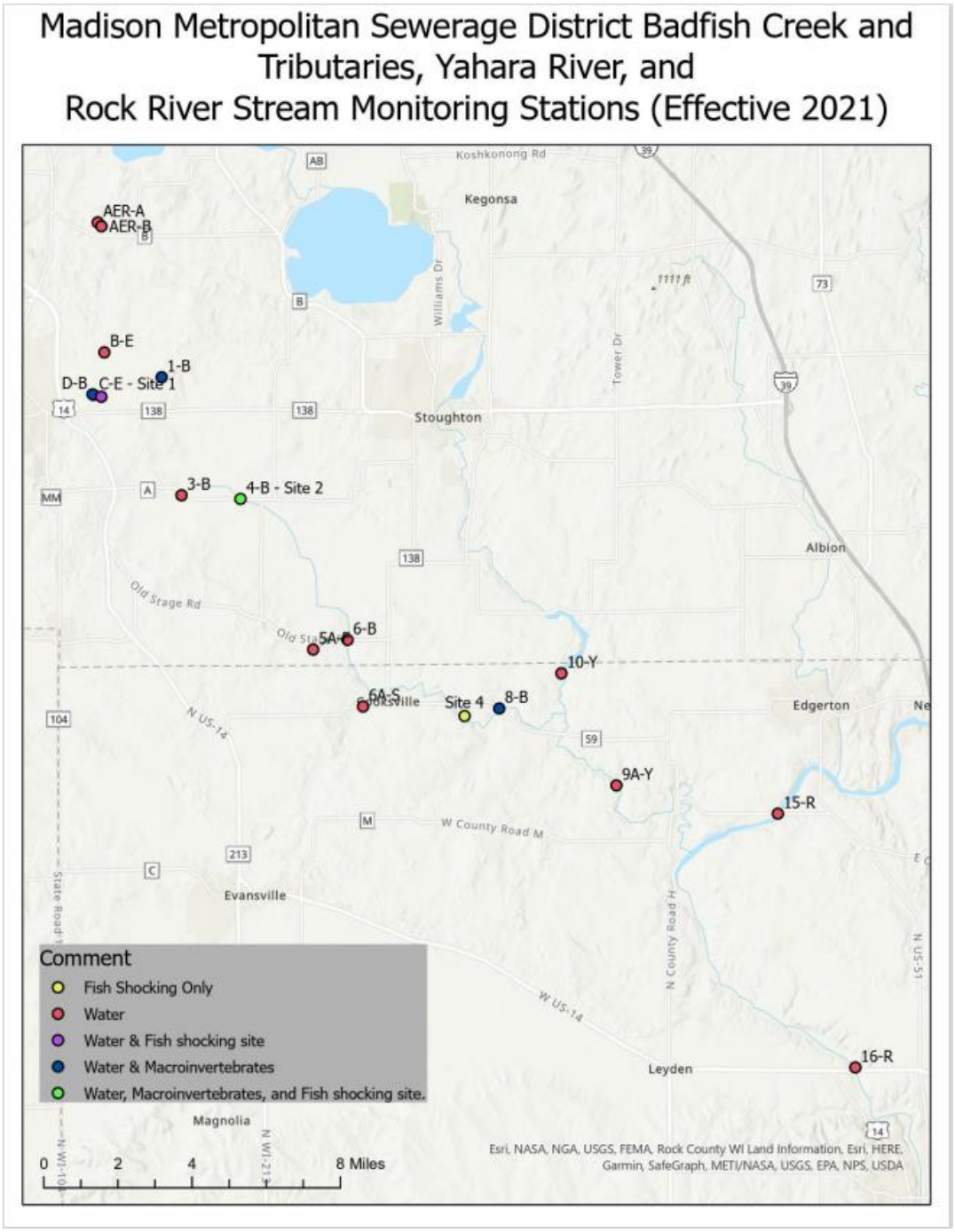
Madison Metropolitan Sewerage District Lab Report
All results are reported in mg/L = PPM

	LOD	LOQ		
NO3+NO2	0.1	0.3	mg/L	
NO3+NO2	0.15	0.5	mg/L	As of 8/4/2015
OP-DRA	0.002	0.006	mg/L	
OP-DRA	0.003	0.009	mg/L	As of 12/30/2014
SSC	2		mg/L	
TSS	2		mg/L	
TP	0.01	0.03	mg/L	
TP	0.02	0.066	mg/L	As of 12/11/2013
TP	0.02	0.07	mg/L	As of 8/1/2014
TP	0.05	0.15	mg/L	As of 7/16/2015
NH3-N	0.01	0.03	mg/L	
NH3-N	0.02	0.07	mg/L	As of 12/23/2013, confirmed 2/16/2015
NH3-N	0.04	0.14	mg/L	As of 8/4/2015
TKN	0.10	0.32	mg/L	As of 12/11/2013
TKN	0.12	0.4	mg/L	As of 8/1/2014
TKN	0.15	0.5	mg/L	As of 7/16/2015

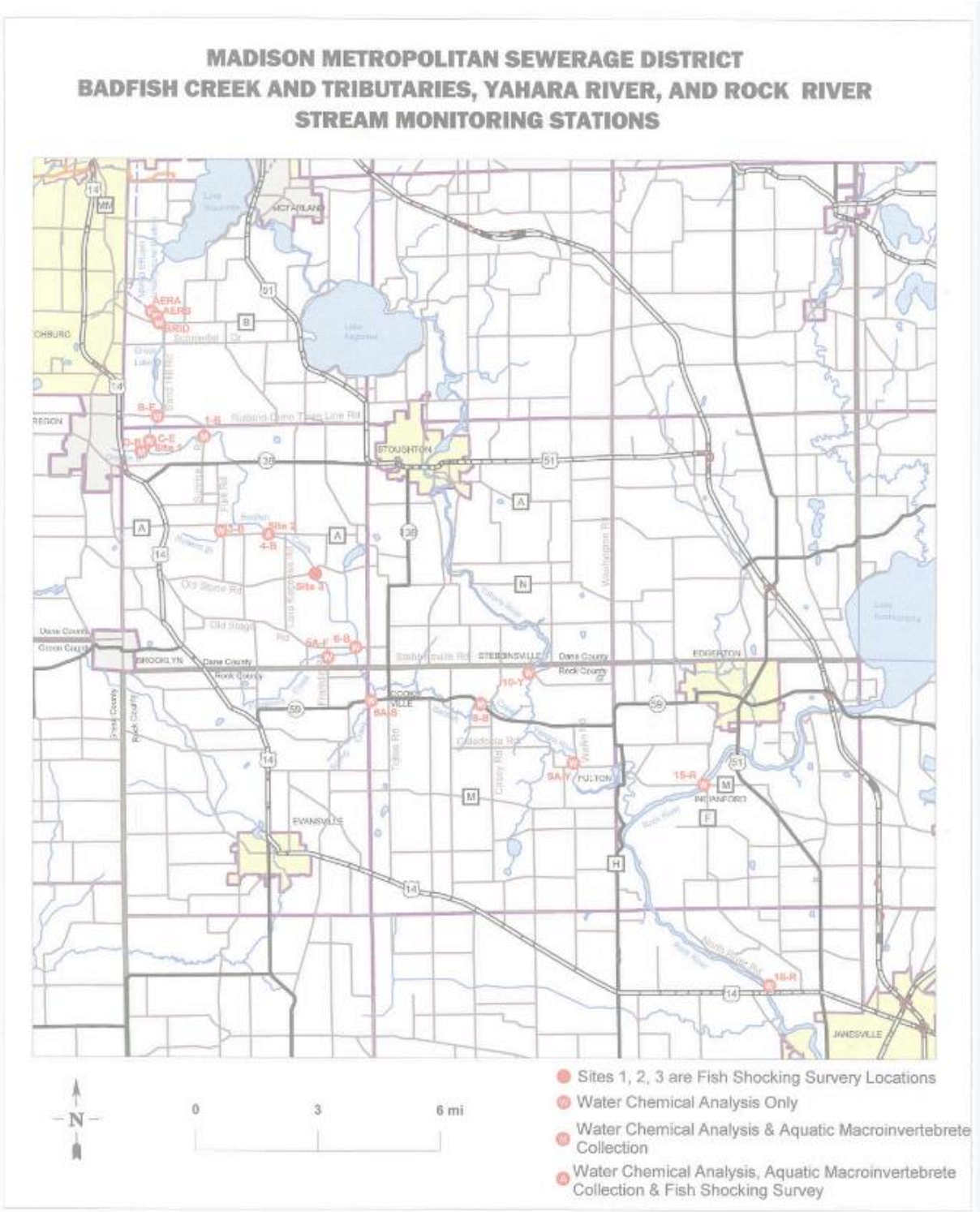
Value Codes/QA codes
"e" value denotes estimatated value
"b" value below detection limit
"q" value between detection limit and quantitation limit
"D" denotes duplicate range exceeded
"H" denotes holding time exceeded
"T" denotes matrix spike recovery above control limit
"U" denotes matrix spike below lower control limit
"Y" denotes other QA exceedance
"Z" denotes multiple QA exceedances

Appendix 3: Map Showing MMSD Water Quality Monitoring Locations on Badfish Creek

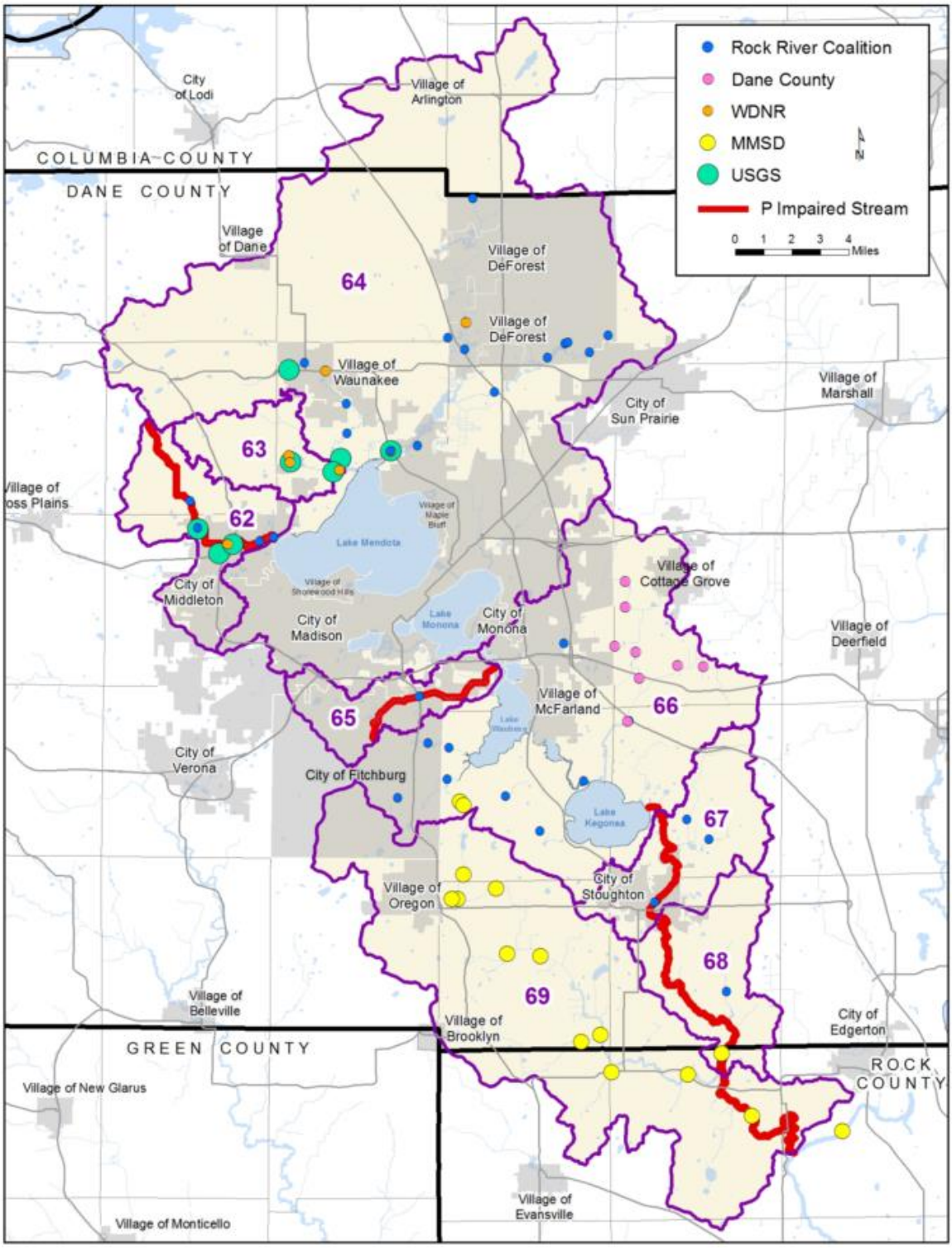
2024 Update



2017 Original



Appendix 4: Active Water Quality Monitoring Locations in the Yahara Watershed



Appendix 5: Major Soil Groupings in the Yahara Watershed by TMDL Stream Reach

Stream Reach	Soil Groupings	GIS Acres
62	McHenry-Kidder	5,438
	Ringwood-Plano-Griswold	288
	Rodman-Fox-Casco	8,674
63	McHenry-Kidder	831
	Ringwood-Plano-Griswold	5,067
	Rodman-Fox-Casco	2,221
64	McHenry-Kidder	34,022
	Ringwood-Plano-Griswold	70,068
	Rodman-Fox-Casco	38,972
65	McHenry-Kidder	5,014
	Ringwood-Plano-Griswold	490
	Rodman-Fox-Casco	3,148
66	McHenry-Kidder	29,226
	Ringwood-Plano-Griswold	6,041
	Rodman-Fox-Casco	20,851
67	McHenry-Kidder	3,657
	Ringwood-Plano-Griswold	4,406
	Rodman-Fox-Casco	6,429
68	McHenry-Kidder	591
	Ringwood-Plano-Griswold	2,880
	Rodman-Fox-Casco	10,561
69	McHenry-Kidder	34,197
	Pecatonica-Flagg	465
	Ringwood-Plano-Griswold	500
	Rodman-Fox-Casco	31,653
	Warsaw-Lorenzo-Dakota	64

McHenry series -- very deep, well drained soils formed in loess or other silty material and in the underlying loamy till on moraines and till plains. Slope ranges from 0 to 30 percent.

Kidder series -- very deep, well drained soils formed in thin loess and in loamy till or just in loamy till on moraines and drumlins. Slope ranges from 0 to 35 percent.

Ringwood series -- very deep, well drained soils formed in loess or other silty material and in the underlying loamy till on till plains. Slope ranges from 0 to 12 percent.

Plano series -- very deep, well drained soils on outwash plains, stream terraces, or till plains. These soils formed in loess or other silty material and in the underlying loamy stratified outwash or sandy loam till. Slope ranges from 0 to 12 percent.

Griswold series -- very deep, well drained soils formed in calcareous sandy loam till on till plains and moraines. Slope ranges from 0 to 20 percent.

Rodman series -- very deep, excessively drained soils that are shallow to calcareous, stratified sandy and gravelly outwash. The Rodman soils formed in sandy and gravelly outwash. They are on kames, eskers, moraines, outwash plains, and valley trains. Slope ranges from 2 to 70 percent.

Fox series -- very deep, well drained soils which are moderately deep to stratified calcareous sandy outwash. These soils formed in thin loess and in loamy alluvium or just in loamy alluvium overlying stratified calcareous sandy outwash on outwash plains, stream terraces, valley trains, kames, and glacial moraines. Slopes range from 0 to 35 percent.

Casco series -- very deep, somewhat excessively drained soils which are shallow to stratified calcareous sandy outwash. They formed in loamy alluvium underlain by calcareous stratified sandy outwash on outwash plains, outwash terraces, eskers, kames, and moraines. Slopes range from 0 to 70 percent.

Pecatonica series--well drained soils on till plains and moraines. They formed in a thin layer of loess or silty material and the underlying reddish paleosol that formed in loamy till. Slope ranges from 0 to 30 percent.

Flagg series--very deep, well drained soils on till plains and moraines. These soils formed in loess and late Sangamon paleosols formed in Illinoian till. Slope gradients range from 0 to 20 percent.

Warsaw series--well drained soils formed in loamy sediments and in the underlying gravelly outwash on outwash plains, terraces, kames, and valley trains. These are very deep soils that are deep or very deep to calcareous, stratified gravelly or very gravelly coarse sand and sand. Slope ranges from 0 to 15 percent.

Lorenzo series-- well drained soils formed in loamy outwash over calcareous sand and gravel. They are on outwash plains, stream terraces, kames, eskers, valley trains, and moraines. Slope ranges from 0 to 45 percent.

Dakota series--very deep, well drained soils formed in 50 to 100 centimeters of loamy alluvium and in the underlying sandy outwash. These soils are on outwash plains, stream terraces, and valley trains. Slope ranges from 0 to 18 percent.

Appendix 6: Point Source Phosphorus Loads by Stream Reach

2024 Update

Point source TP information was updated with new average date (2019-2023) for Oregon WWTP, Stoughton WWTP, and MMSD WWTP. MMSD WWTP was also updated to include the additional TP load from Badger Mill Creek.

Oregon WWTP

Year	Actual Flow (MGD)	TP Conc. (mg/L)	TP Load (lbs/yr)	TSS Conc. (mg/L)	TSS Load (tons/yr)
2019	1.98	0.72	4364	5.4	16.3
2020	1.74	0.71	3744	5.2	13.8
2021	1.3	0.89	3536	6.5	12.9
2022	1.17	0.51	1801	5.4	9.6
2023	1.18	0.47	1693	5.6	10.1
5 yr Annual Average (2019-2023)	1.47	0.66	3027	5.62	12.5

Stoughton WWTP

Year	Actual Flow (MGD)	TP Conc (mg/L)	TP Load (lbs/yr)	TSS Conc. (mg/L)	TSS Load (tons/yr)
2019	1.35	0.44	1823	7.6	15.5
2020	1.01	0.46	1397	6.3	9.7
2021	1.07	0.46	1479	8.5	13.8
2022	1.07	0.54	1754	11.8	19.1
2023	1.07	0.30	981	7.0	11.3
5 yr Annual Average (2019-2023)	1.11	0.44	1487	8.2	13.9

MMSD WWTP (Badfish and Badger Mill Combined)

Year	Actual Flow (MGD)	TP Conc. (mg/L)	TP Load (lbs/yr)	TSS Conc. (mg/L)	TSS Load (tons/yr)
2019	47.0	0.28	39442	4.9	347.8
2020	42.7	0.27	35600	4.5	294.4

2021	37.2	0.33	37654	5.0	283.7
2022	37.1	0.32	36508	5.4	303.1
2023	37.9	0.36	41630	6.5	371.9
5 yr Annual Average (2019-2023)	40.4	0.31	38167	5.2	320.2

2017 Original

Point Source TP information

Flow, concentration and load information from DNR PRESTO model (provided by Adam Freihoefer and Theresa Nelson)

Design flow from TMDL

Oregon WWTP **Design Flow 1.8 mgd**

Year	Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	1.6	1.05	5,144	5.3	12.9
2010	1.48	0.93	4,190	6.2	14.0
2011	1.31	0.79	3,150	6.6	13.2
2012	1.03	0.74	2,327	5.6	8.8
2013	1.3	0.94	3,720	6.9	13.6
2014	1.29	0.82	3,220	6.1	11.9
2015	1.16	0.65	2,297	4.8	8.4
5 year average (2011-2015)	1.218	0.788	2,943	6.0	11.2

Stoughton WWTP **Design Flow 1.65 mgd**

Year	Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	1.38	0.79	3,319	6.8	14.3
2010	1.25	0.77	2,930	6.0	11.4
2011	1.11	0.69	2,331	6.8	11.5
2012	0.916	0.55	1,538	5.1	7.1
2013	0.995	0.59	1,787	6.8	10.2
2014	0.95	0.51	1,477	6.3	9.11
2015	0.86	0.48	1,257	8.0	10.5
5 year average (2011-2015)	0.9662	0.564	1678	6.6	9.7

MMSD WWTP (Badfish Creek only) Design Flow 50 mgd

Year	Actual Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	41.31	0.29	36,468	4.0	251.5
2010	40.66	0.28	34,656	4.0	247.5
2011	38.30	0.30	34,977	4.7	274.0
2012	33.72	0.26	26,761	4.3	220.7
2013	39.20	0.22	26,252	4.4	259.8
2014	37.53	0.32	36,558	4.8	273.0
2015	35.71	0.37	40,247	4.4	241.3
5 year annual average (2011-2015)	36.89	0.29	32,959	4.5	253.8

DNR Nevin Fish Hatchery

Year	Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	2.25	0.06	438	1.6	5.5
2010	2.33	0.07	518	3.1	11.0
2011	2.32	0.04	311	2.2	7.8
2012	2.20	0.06	423	2.0	6.7
2013	2.20	0.06	422	1.3	4.4
2014	2.20	0.06	422	0.6	2.1
2015	2.13	0.07	467	1.0	3.3
5 year annual average (2011-2015)	2.21	0.06	409	1	4.8

* TP concentration based on 2012 concentration per DNR correspondence-no other data available from DNR

Middleton-Tiedeman Pond

Year	Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	0.26	0.66	517	89.5	35.4
2010	0.24	1.07	770	87.2	31.9
2011	0.14	0.55	233	86.6	18.5
2012	0.05	0.56	79	51.2	3.6
2013	0.23	0.42	294	36.6	12.8
2014	0.11	0.95	302	68.3	10.9
2015	0.11	0.40	137	77.9	13.0
5 year annual average (2011-2015)	0.13	0.58	209	64	11.8

MG&E (Bount Stree Combined Outfalls)

Year	Flow (mgd)	TP conc. (mg/l)	TP Load (lbs/yr)	TSS conc (mg/l)	TSS Load (tons/yr)
2009	0.09	0.11	32	4.1	0.6
2010	0.01	0.00	0	4.2	0.1
2011	0.08	0.00	0	3.7	0.5
2012	0.09	0.06	17	22.1	3.0
2013	0.01	0.06	2	6.6	0.1
2014	0.01	0.03	2	8.5	0.2
2015	0.01	0.03	1	4.4	0.1
5 year annual average (2011-2015)	0.04	0.04	4	9.1	0.8

Appendix 7: MS4 Phosphorus Loads by TMDL Stream Reach

Pounds of Phosphorus by Entity and Stream Reach

Entity	Information source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69		Total
Blooming Grove	Updated modeling			74		102					176
Bristol	TMDL			581							581
Burke	Updated modeling			172		0					172
Cottage Grove-Town	Updated modeling					1,530					1,530
Cottage Grove-Village	TMDL					401					401
DeForest	TMDL			1,178							1,178
Dunkirk	Updated modeling						46	28			74
Dunn	Updated modeling					72					72
Fitchburg	TMDL				2,104	591			284		2,979
Madison-City	Updated modeling	1,137		20,776	1,876	4,391					28,180
Madison-Town	TMDL			643	169						812
Maple Bluff	TMDL			255							255
Middleton-City	Updated modeling	1,579	9	722							2,310
Middleton-Town	Updated modeling	228									228
McFarland	Updated modeling					1,031					1,031
Monona	Updated modeling			667	82	369					1,118
Pleasant Springs	Updated modeling					32	30				62
Shorewood Hills	TMDL			311							311
Stoughton	TMDL					11	1,249	308			1,568
Sun Prairie	Updated modeling			935							935
Waunakee	Updated modeling			1,429							1,429
Westport	Updated modeling			237							237
Windsor	Updated modeling			1,852							1,852
UW	Back calculation using City of Madison			743							743
		2,944	9	30,575	4,231	8,530	1,325	336	284	48,234	48,234

Appendix 8: Detailed Phosphorus Load Reductions by Source and TMDL Reach

Category	Stream Reach	Reduction (lbs)
Agriculture	62	6,951
Agriculture	63	1,946
Agriculture	64	24,521
Agriculture	65	253
Agriculture	66	10,949
Agriculture	67	-
Agriculture	68	1,403
Agriculture	69	8,650
Background	62	180
Background	63	102
Background	64	1,143
Background	65	68
Background	66	1,196
Background	67	23
Background	68	193
Background	69	617
Non-permitted urban	62	221
Non-permitted urban	63	2
Non-permitted urban	64	1,200
Non-permitted urban	65	215
Non-permitted urban	66	143
Non-permitted urban	67	14
Non-permitted urban	68	-
Non-permitted urban	69	278

Required TP load reductions used to revise Adaptive Management Plan

MS4	Information source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69	Total
Blooming Grove	Updated modeling			38		28				66
Bristol	TMDL			412						412
Burke	Updated modeling					0				0
Cottage Grove-Town	Updated modeling					109				109
Cottage Grove-Village	TMDL					240				240
DeForest	TMDL			837						837
Dunkirk	Updated modeling						-	-		-
Dunn	Updated modeling					-				-
Fitchburg	TMDL				1,540	353			248	2,141
Madison-City	Updated modeling	773		10,011	1,079	1,127				12,990
Madison-Town	TMDL			457	124					581
Maple Bluff	TMDL			181						181
Middleton-City	Updated modeling	980	-	344						1,324
Middleton-Town	Updated modeling	47								47
McFarland	Updated modeling					302				302
Monona	Updated modeling			356	32	126				514
Pleasant Springs	Updated modeling					-	-			-
Shorewood Hills	TMDL			221						221
Stoughton	TMDL					7		222		229
Sun Prairie	Updated modeling			367						367
Waunakee	Updated modeling			398						398
Westport	Updated modeling			26						26
Windsor	Updated modeling			720						720
UW	Back calculation using City of Madison			431						431
		1,800	-	14,799	2,775	2,292	-	222	248	22,136

2024 Update

Point Source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69	Total
Stoughton							25		25
Oregon								1,524	1524
MMSD								16,771	16771
DNR - Fish Hatchery				209					209
Arlington									-
MG&E									-
Tiedeman									-
									-
Reach Total	**-**	**-**	-	**209**	-	-	**25**	**18295**	**18529**

2017 Original

Point Source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69	Total
Stoughton							25		25
Oregon								1,524	1,524
MMSD								11,562	11,562
DNR-Fish Hatch				209					209
Arlington									-
MG&E			-						-
Tiedeman			-						-
	-	-	-	209	-	-	25	13,086	13,320

Appendix 9: Detailed TSS Reductions by Source and TMDL Reach

Category	Stream Reach	Reduction (tons)
Agriculture	62	2,917
Agriculture	63	147
Agriculture	64	8,660
Agriculture	65	-
Agriculture	66	810
Agriculture	67	-
Agriculture	68	16
Agriculture	69	2,270
Background	62	-
Background	63	-
Background	64	-
Background	65	-
Background	66	-
Background	67	-
Background	68	-
Background	69	-
Non-permitted urban	62	13
Non-permitted urban	63	-
Non-permitted urban	64	115
Non-permitted urban	65	-
Non-permitted urban	66	-
Non-permitted urban	67	7
Non-permitted urban	68	-
Non-permitted urban	69	-

MS4	Information source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69	Total
Blooming Grove	Updated modeling			9		1				10
Bristol	TMDL			41						41
Burke	Updated modeling			-		0				0
Cottage Grove-Town	Updated modeling					48				48
Cottage Grove-Village	TMDL					22				22
DeForest	TMDL			84						84
Dunkirk	Updated modeling						-	-		-
Dunn	Updated modeling					-				-
Fitchburg	TMDL				135	32			6	173
Madison-City	Updated modeling	101		856	51	-				1,008
Madison-Town	TMDL			46	11					57
Maple Bluff	TMDL			18						18
Middleton-City	Updated modeling	105	-	51						155
Middleton-Town	Updated modeling	7								7
McFarland	Updated modeling					36				36
Monona	Updated modeling			42	5	17				64
Pleasant Springs	Updated modeling					-	-			-
Shorewood Hills	TMDL			22						22
Stoughton	TMDL					1		3		4
Sun Prairie	Updated modeling			47						47
Waunakee	Updated modeling			77						77
Westport	Updated modeling			4						4
Windsor	Updated modeling			82						82
UW	Back calculation using City of Madison			31						31
		213	-	1,409	202	157	-	3	6	1,990

Point Source	Reach 62	Reach 63	Reach 64	Reach 65	Reach 66	Reach 67	Reach 68	Reach 69	Total
Stoughton							0		0
Oregon								0	0
MMSD								0	0
DNR-Fish Hatch				0					0
Arlington									0
MG&E			0						0
Tiedeman			0						0
	0	0	0	0	0	0	0	0	0

Appendix 10: Intergovernmental Agreement (IGA) for a Full-scale Adaptive Management Project

INTERGOVERNMENTAL AGREEMENT FOR
AN ADAPTIVE MANAGEMENT PLAN
FOR THE YAHARA WATERSHED

WHEREAS, Wis. Stat. § 66. 0301, entitled "Intergovernmental cooperation," provides that any municipality (defined as including but not limited to any state agency, city, village, town, county, sanitary district, metropolitan sewerage district or sewer utility district) may contract with other municipalities for the furnishing of services, and the joint exercise of any power or duty required or authorized by law;

WHEREAS, the U.S. Environmental Protection Agency (EPA) has approved Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids (TSS) in the Rock River Basin (the "Rock River TMDL" or "TMDL"), which includes the Yahara Watershed as shown on Exhibit A;

WHEREAS, municipalities who own Publicly Owned Treatment Works (POTWs) and/or Municipal Separate Storm Sewer Systems (MS4s) in the Yahara Watershed are required to meet surface water quality standards and/or not exceed wasteload allocations for phosphorus and TSS pursuant to the provisions of Wis. Admin Code § NR 217 and/or the Rock River TMDL;

WHEREAS, Wis. Admin Code § NR 217. 18 allows sources holding a Wisconsin Pollutant Discharge Elimination System (WPDES) permit the option known as adaptive management which involves developing an Adaptive Management Plan involving point and nonpoint sources to achieve water quality standards and TMDL allocations;

WHEREAS, Wis. Stat. § 283. 13 (7) allows adaptive management to be used to address TMDL allocations for both phosphorus and TSS over four permit terms;

WHEREAS, in 2012 Madison Metropolitan Sewerage District (District) developed an adaptive management pilot project with other interested parties within the Yahara watershed as set forth in a Memorandum of Understanding for an Adaptive Management Pilot Project in the Yahara Watershed;

WHEREAS, on December 14, 2014, the District entered into a Memorandum of Understanding with the Wisconsin Department of Natural Resources (DNR) regarding the manner in which a full scale Adaptive Management Plan for the Yahara Watershed would be developed and evaluated;

WHEREAS, the District has committed to developing an Adaptive Management Plan to fulfill its phosphorus compliance obligations under its WPDES permit and fulfill the phosphorus TMDL obligations of other permittees;

WHEREAS, the undersigned municipalities within the Yahara Watershed, (Parties) wish to join together to jointly participate in the Adaptive Management Plan;

WHEREAS, the Parties desire to create an intergovernmental agreement and form a group known as "The Yahara Watershed Improvement Network (Yahara WINS) Group" or simply "the Group";

WHEREAS, the Parties desire to create a commission that will administer such participation, information gathering, projects and activities of the Group all as set forth in this Agreement;

WHEREAS, the Parties desire to implement this Agreement in a collaborative, cooperative, manner to advance the Adaptive Management Plan;

WHEREAS, the Parties to this Agreement anticipate that the Group will contract and work collaboratively with agricultural producers, non-governmental organizations, county agencies and other entities to advance the Adaptive Management Plan;

NOW THEREFORE, in consideration of the mutual covenants herein contained and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree to create this Intergovernmental Agreement for an Adaptive Management Plan for the Yahara Watershed ("Agreement") as follows:

1. GOALS OF THE GROUP.

The Parties hereby agree to cooperate to exercise their municipal powers jointly for:

a. Providing review and comments on the Adaptive Management Plan prepared by the District;

b. Contracting with consultants, legal counsel, and other parties to further the development, implementation and evaluation of the Adaptive Management Plan;

c. Coordinating or contracting with the DNR and other pertinent agencies, units of local government, and non-governmental organizations and entities to achieve the goals of the Adaptive Management Plan;

d. Pooling resources in accordance with the provisions of cost allocations in Exhibit B to achieve the goals of the Adaptive Management Plan.

e. Achieving compliance with WPDES permit requirements related to the Rock River TMDL.

2. MEMBERS OF THE GROUP

a. In General. The members of the Group ("Members") created by this Agreement are the Wisconsin municipalities (defined as including but not limited to any state agency, city, village, town, county, sanitary district, metropolitan sewerage district or sewer utility district) who own Publicly Owned Treatment Works (POTWs) and/or Municipal Separate Storm

Sewer Systems (MS4s) or municipalities who have land within areas served by the Adaptive Management Plan, and which have duly executed identical counterparts or copies of the Agreement pursuant to Section 3 ("Members" collectively and "Member" individually) on or before April 15, 2016.

b. Changes in Membership. Additional Wisconsin municipalities may become Members of the Group with the consent of a majority of the Members by becoming Parties to this Agreement on the condition that payments be made to cover their share of costs based on their phosphorus allocation for the years from the date of this Agreement to their membership date. Members may cease to be Members and Parties to this Agreement pursuant to Section 12.

c. Representative to the Group. All Group Members shall designate a representative and an alternate representative. A Member may remove or replace its representative to the Group at will, with or without cause, at any time. All designations of representatives, alternatives and replacements shall be made in writing, signed on behalf of the Member and delivered to the Secretary of the Executive Committee. Each Member's representative shall have the authority to act on the Member's behalf at meetings held under Section 5.

3. AUTHORITY OF MEMBERS TO PARTICIPATE.

a. This Agreement is entered into pursuant to authority granted under Wis. Stat. § 66. 0301. Each municipality identified in Section 2. a. that wants to become a member of the Group shall authorize participation in this Agreement by resolution or other binding action by the governing body or person authorized to act for such municipality.

b. By authorizing participation, each Member agrees to the terms and conditions of this Agreement, to the establishment of the Executive Committee created by this Agreement and to appoint a Member representative to the Group;

c. A copy of the document authorizing participation shall be sent to and be maintained on file with the Executive Committee.

4. POWERS OF THE GROUP

The Group, acting through Group Member Representatives, shall have the following powers:

a. To elect the members of the Executive Committee as set forth in Section 6.

b. To approve the five-year and annual budgets under Section 8.

c. To approve the bylaws proposed by the Executive Committee.

d. To share information and advise the Executive Committee on all matters including elements of the Adaptive Management Plan.

5. MEETINGS OF THE GROUP

a. The Group shall meet no less than four times per year.

b. A quorum shall be a majority of the Group Member Representatives and must include the representatives from the District and any other member who contributes at least one fifth of the allocated cost under Exhibit B. If a quorum is not present the members present may meet and share information, but no action may be taken.

c. Unless otherwise expressly provided by this Agreement, all votes of the Group Member Representatives shall be by a majority of the Group Member Representatives present at a meeting where there is a quorum.

d. All meetings shall be open meetings and require public notice in accordance with Wisconsin's open meeting laws. The Group shall encourage the participation of other interested parties including agricultural producers and nongovernmental entities.

6. EXECUTIVE COMMITTEE

a. Creation of Executive Committee. There is created a five member Executive Committee which will be a commission under Wis. Stat. § 66. 0301(2) and (3), to administer the joint activities of the Yahara WINS Group. This commission shall be formally referred to as THE YAHARA WINS EXECUTIVE COMMITTEE, and referred to in this Agreement as the "Executive Committee". This Executive Committee shall operate as a governmental body under Wis. Stat. § 19. 82(1).

b. Members of the Executive Committee. The Executive Committee shall be comprised of five Member representatives and two non-Member advisors.

(1) The Executive Committee members shall include a representative from the Madison Metropolitan Sewerage District and a representative from any Member, other than the District, who contributes at least one fifth of the allocated cost under Exhibit B. Of the remaining members, one must be from a city or village, one from a town, and one will be an at large position. Member representatives for the cities and villages participating in this agreement will vote to select their representative to the Executive Committee, and Member representatives for the towns participating in this agreement will vote to select their representative to the Executive Committee, and the Member representatives of the group as a whole will vote to select the at large representative.

(2) Recognizing the key collaborative roles played by Dane County and members of the agricultural community in the Adaptive Management Pilot Project and their

anticipated roles as this Agreement moves forward, Dane County and the Yahara Pride Farm Group may each appoint an advisor to the Executive Committee. The Executive Committee may in its discretion appoint additional advisors. The advisors shall be given notice of all Executive Committee meetings and may participate in such meetings as non-voting members.

c. Term. The term of the three elected members of the Executive Committee shall be for five year terms and the elected members may be reelected for one or more additional terms.

d. Purposes and Powers of the Executive Committee.

(1) To make, amend and repeal bylaws and rules related to the purpose and operation of the Group subject to approval by the Group.

(2) To invest funds not required for immediate disbursement in properties or securities as permitted by state law.

(3) To make and execute contracts and other instruments of any name or type necessary or convenient for the exercise of the powers granted herein, including contracts with engineers, legal counsel, administrative staff and other consultants.

(4) To accept contributions of capital from Members or third parties.

(5) To do all acts and things necessary or convenient for the conduct of its business and the general welfare of the Group and the Parties and to carry out the purposes and powers granted to it by this Agreement.

(6) To sue, and be sued, complain and defend in all courts, and also, appear in or before applicable governmental agencies administrative tribunals and legislative bodies.

e. No Compensation. The members of the Executive Committee shall serve without compensation, provided, however, that the Executive Committee shall have discretion to

reimburse members of the Executive Committee for reasonable expenses incurred for special services to the Executive Committee.

f. Quorum. A quorum shall be a majority of the members of the Executive Committee and must include the representative from the District and the representative of any Member (other than the District) who contributes at least one fifth of the allocated cost under Exhibit B. No action may be taken in the absence of a quorum.

g. Voting. The members of the Executive Committee shall vote upon matters in the following manner:

(1) Voting in General. Unless otherwise expressly provided by this Agreement, the bylaws, or some other subsequent action of the Executive Committee, all votes shall be by a majority of the members of the Executive Committee present at a meeting where there is a quorum.

(2) Voting on Matters Which May Affect WPDES Permit Compliance. The Executive Committee shall provide written notice to all Members of any Executive Committee proposed or recommended action potentially affecting any Member's WPDES permit, other than the development and implementation of the Adaptive Management Plan. Such actions include the following: (i) the development or implementation of terms and conditions of a WPDES permit; (ii) a violation of a WPDES permit, (iii) a WPDES permit modification or revocation (iv) a change in WPDES permit limits or compliance plan; or (v) any other action that could jeopardize a Member's WPDES permit compliance. Any Member so notified has 30 days from the date of the notice to provide a written objection to the Secretary of the Executive Committee to any such actions that affect its WPDES permit. In such a case, no final action may be taken by the Executive Committee without the further written consent of the objecting Member.

(h) Meeting. The Executive Committee shall meet no less frequently than quarterly. Additional meetings may be held at the request of any member of the Executive Committee.

7. OFFICERS.

a. Officers of the Executive Committee. The Officers of the Executive Committee are a President, a Vice-President, a Secretary, a Treasurer and such other Officers as the Executive Committee may designate. The President shall be the District representative. The Vice-President, Secretary, Treasurer and any other officers shall be elected by the members of the Executive Committee from among the members of the Executive Committee and shall serve five year terms.

b. Dual Signature Required. The signatures of two officers shall be required on all forms of approval for payment, and all legally binding documents executed in the name of the Executive Committee or the Group.

c. Duties. Unless otherwise determined by the Executive Committee, the duties of the officers shall include the following:

(1) President. The President shall be the principal executive officer of the Executive Committee, shall preside at all meetings of the Executive Committee and set the agenda.

(2) Vice-President. In the absence of the President, or in the event of his or her inability or refusal to act, the Vice-President shall perform the duties of the President.

(3) Secretary. The Secretary shall keep minutes of the meetings of the Executive Committee in one or more books provided for that purpose; see that all notices are duly given in accordance with this Agreement, or as required by law; and be custodian of the

Executive Committee's records. The Secretary shall take such actions as are prudent and necessary to maintain the public records at the offices of the District in accordance with Wisconsin's public records laws.

(4) Treasurer. The Treasurer shall have charge and custody of and be responsible for all funds and securities of the Group and shall have charge of the financial records of the Group. The Treasurer will work with District staff to set up a segregated account for the funds of the Group. The Treasurer shall take such actions as are prudent and necessary to maintain the public records at the offices of the District in accordance with Wisconsin's public records laws.

d. Removal. An officer other than the President may be removed from office with cause upon a majority vote of the members of the Executive Committee.

8. BUDGET

The Executive Committee shall prepare budget documents as follows:

a. Project Budget. The 20 year adaptive management cost to Members and the associated annual cost are listed in Exhibit B to this Agreement.

b. Five Year Budget. The Executive Committee shall break down the 20 year adaptive management costs into five year intervals corresponding with the estimated permit terms. The Five Year Budget shall be approved by a majority of the Member Representatives present in the meeting of the Group in which action on the Project Budget is taken. The Five Year Budget shall be updated no less than every five years and approved by the Group. Estimated project costs shall be allocated equally over the 20 year Adaptive Management Plan period to the extent practicable.

c. Annual Budget. The Executive Committee shall prepare a detailed annual budget of the estimated expenditures associated with the Adaptive Management Plan for the next calendar year, and present the annual budget to the Group for review no later than September 30th of each year. The annual budget shall be consistent with the Five Year Budget approved in Section 8 (b), and shall be approved by October 31st of each year by a majority of the Member Representatives of the Group present at the meeting in which action on the annual budget is taken. The Executive Committee shall send invoices to Members consistent with the annual cost shown in Exhibit B, subject to any revision consistent with Section 9 of this Agreement on or before December 15 of each year. The first invoice under this Agreement will be sent to Members on or before December 15, 2016 and will be for the calendar year 2017. Invoices will be sent to Members annually thereafter on or before December 15th of each year. Payments based on each annual invoice shall be made in two equal installments. The first installment shall be made on or before February 28th of each year and the second installment shall be made on or before June 30th of each year.

d. Funds for 2016 are based on a continuation of annual payments made by the participants to the Adaptive Management Pilot Project at the same funding level as 2015. The Executive Committee shall receive any such payments to further the purposes of this Agreement and subject to the audit and reporting requirements set forth in Section 10.

9. CHARGES TO MEMBERS.

a. Costs shall be allocated among Members as shown in Exhibit B, except as otherwise provided in this Section. Cost allocations in Exhibit B are based on phosphorus load reductions and are determined by multiplying the total adaptive management project cost by the fraction of the total pounds of required project phosphorus reduction needed by each Member to

meet its TMDL allocation under current conditions. For example, if the required phosphorus reduction of an individual member is equal to 5 percent of the total pounds of phosphorus reduction from all sources in this adaptive management project, that member is assigned 5 percent of the total project cost. For the purpose of Exhibit B, required phosphorus reductions were determined as follows:

(1) **Point Source Members**: For the purpose of this section, Point Source Members are those members who own or operate facilities identified in Appendices P, Q, R and S of the Rock River TMDL. The required phosphorus reduction is determined by subtracting the TMDL allocated phosphorus load from the current condition phosphorus load, with the current condition phosphorus load defined as the most recent five year average load (2010 thru 2014) using data obtained from the DNR. For all Point Source Members, the allocated phosphorus load is consistent with the allocation specified in the TMDL. For Point Source Members that own or operate POTWs, required phosphorus reductions also factor in the need to meet the interim concentration limits specified in Section 14 (b).

(2) **MS4 Members:** For the purpose of this section MS4 Members are those Members who own Municipal Separate Storm Sewer Systems as identified in Appendices T, U, and V of the Rock River TMDL, except that the University of Wisconsin-Madison shall also be considered an MS4 Member. The required phosphorus reduction for MS4 Members is determined by subtracting the TMDL allocated phosphorus load from the TMDL baseline phosphorus load.

b. Members shall commit to payment in accordance with the schedule in Exhibit B.

c. Notwithstanding Exhibit B, it is recognized that MS4 Members may update stormwater modeling consistent with the DNR guidance document titled “TMDL Guidance for MS4

Permits: Planning, Implementation and Modeling Guidance" (October 20, 2014). If the updated modeling is reviewed and approved by DNR, and shows a required annual phosphorus reduction that is different than what was used to develop the cost allocation in Exhibit B, the cost for that MS4 Member in Exhibit B will be adjusted as follows:

$$\text{Exhibit B Cost} \times \left[\frac{\text{Revised phosphorus reduction (lb/yr)}}{\text{Initial phosphorus reduction (lb/yr)}}\right] = \text{Revised Cost}$$

If the revised phosphorus reduction information is received by the Executive Committee on or before September 1st of any year, the revised cost will be applied to all years going forward. For example, if data is received on or before September 1, 2017 that results in a revised cost being calculated, that revised cost will be applied to annual payments beginning in 2018. Additionally, a true-up will be allowed at the end of every five year WPDES permit term to reflect practices that may have been added during that WPDES permit term that result in a revised phosphorus reduction and therefore a revised cost, provided those reductions are in excess of the baseline reductions in Section 14 (a). Revised costs would be calculated using the above formula and would be applied to annual payments going forward.

d. If an MS4 makes an initial payment in 2017 based on Exhibit B and subsequently submits information that results in a revised cost that is less than shown in Exhibit B, the amount of overpayment shall be credited to the MS4 over the next four year period in equal annual installments. If an MS4 makes an initial payment in 2017 based on Exhibit B and subsequently submits information that results in a revised cost that is greater than shown in Exhibit B, the underpayment shall be recovered from the MS4 over the next four year period in equal annual installments.

e. Notwithstanding Exhibit B, the costs for Point Source Members will be revised at the end of 2016 using the most recent five year phosphorus load averaging period if it is different than the averaging period used in developing the cost allocations in Exhibit B. The cost will be adjusted as follows:

$$\text{Exhibit B Cost} \times \left[\frac{\text{Revised phosphorus reduction (lb/yr)}}{\text{Initial phosphorus reduction (lb/yr)}}\right] = \text{Revised Cost}$$

The revised cost will be applied to the years going forward. Additionally, a recalculation of the phosphorus load will be made at the end of every five year WPDES permit term using the most recent five year average and will be used to calculate a revised cost, which will be applied to annual payments for the years going forward. The revised cost will be calculated using the formula in this section.

f. MS4 Members and Point Source Members participating in this agreement may choose to accomplish some of their TMDL required phosphorus reduction independently and therefore "purchase" only a portion of their required phosphorus reduction through adaptive management. In this case, the Exhibit B cost or the Revised Cost (whichever is applicable) will be adjusted by multiplying it by the fraction of the required phosphorus reduction that is purchased through adaptive management. For example if an MS4 Member or Point Source Member purchases ninety-five percent of its required phosphorus load through adaptive management, the cost would be revised as follows:

$$\text{Exhibit B Cost or Revised cost (whichever is applicable)} \times 0.95 = \text{Adjusted Cost}$$

g. MS4 Members and Point Source Members choosing to purchase only a portion of their required phosphorus reduction through adaptive management agree that they must have a plan in place to accomplish the portion not purchased. The plan should identify significant anticipated milestones. In addition, they agree to provide a summary to the Group at a frequency of at least once every two years specifying progress made in achieving the reductions not accomplished through adaptive management.

MS4 Members and Point Source Members shall specify at the time they execute this agreement the portion of their required phosphorus reduction, expressed in pounds per year, which they will accomplish independently. The adaptive management project costs will be reviewed at least 360 days prior to the end of a five-year WPDES permit term for which the Adaptive Management Plan is a permit condition. The costs may be adjusted based on this review and upon approval by a majority of the Members. Adjustments (if any) may result in either a lower or higher charge to members going forward. Adjustments (if any) in the charge to Members will be made at the start of the next five-year WPDES permit term and will be made proportional to the required phosphorus reduction of Members. Adjustments will be reflected in the Five Year Budget under Section 8.

10. AUDIT AND REPORTING

a. The Executive Committee shall arrange for a financial audit of the Group's financial records on an annual basis by an independent accounting firm using generally accepted accounting principles.

b. The Executive Committee shall prepare an annual report and provide it to all Members and to other government agencies as may be required. In addition to containing

financial information, the annual report shall describe activities undertaken and progress made over the preceding year with respect to implementation of the Adaptive Management Plan. The annual report shall review the effectiveness of the measures undertaken as part of the Adaptive Management Plan and to the extent possible document the amount of phosphorus reduced by each of the project elements implemented under this Adaptive Management Plan. The annual report shall be distributed to the Group and published on the Group's website by June 30th of each year.

11. LIABILITY OF THE EXECUTIVE COMMITTEE AND/OR GROUP.

a. In the event any costs or expenses are imposed on the Group or the Executive Committee as a result of any judicial or administrative proceeding or settlement thereof, and the liability is not directly attributable to the conduct of a specific Member or Members, the costs and expenses shall be treated as a cost of the Group to be allocated among all Members proportional to the phosphorus reduction associated with each Member as determined consistent with this Agreement.

b. If any costs or expenses are imposed on the Group or the Executive Committee as a result of any judicial or administrative proceeding or settlement thereof, and the liability is directly attributable to the conduct of a specific Member or Members, the costs and expenses shall be allocated among those Members whose actions caused the imposition of the costs or expenses to the Group or Executive Committee, in proportion to their responsibility as determined by the presiding official of the judicial or administrative proceeding, or if no such determination, by the Executive Committee. Any member of the Executive Committee who represents a Member with an interest in the determination shall recuse themselves from all participation on the Executive Committee as to that issue. Any Member not satisfied with the

decision of the Executive Committee can request the issue be resolved through mediation. The costs of mediation are to be borne equally by each Member to the mediation.

12. TERM OF AGREEMENT AND WITHDRAWAL.

a. The term of this Agreement shall begin on April 15, 2016 and will generally coincide with the term of the approved Adaptive Management Plan which is anticipated to be approximately 20 years from approval.

b. This Agreement shall terminate upon conclusion of the Adaptive Management Plan or termination of the Adaptive Management Plan if the Adaptive Management Plan is terminated by DNR. This Agreement may also be terminated at a duly noticed meeting of the Group, upon a two thirds vote by Member Representatives of the Group to terminate the Agreement, at least 270 days prior to the end of a WPDES permit term for which the Adaptive Management Plan is a permit condition. In no event shall termination become effective prior to the end of a WPDES permit term.

c. An individual Member may withdraw from the Agreement by providing notice at least 270 days prior to the end of a five-year WPDES permit term for which the Adaptive Management Plan is a permit condition, if the Member has paid its contribution for the five year WPDES permit period.

13. ADAPTIVE MANAGEMENT ADMINISTRATION

a. The Adaptive Management Plan shall be prepared by the District. The purpose of the Adaptive Management Plan when implemented is to fulfill the phosphorus TMDL obligations of Members, after accounting for baseline requirements that Members are required to

meet individually pursuant to Section 14, and after accounting for adjustments that may be made pursuant to Section 9. TSS reductions associated with phosphorus reduction practices will also be quantified as part of the Adaptive Management Plan. If this Agreement is in effect prior to the submittal of the Adaptive Management Plan to DNR by the District, then the District shall submit the Adaptive Management Plan to the Group for review and comment at least 60 days prior to District submittal to DNR.

b. Every five years as the WPDES permits come up for renewal, the District will prepare any amendment to the Adaptive Management Plan necessary to achieve the project goals and approval by the DNR. The District shall submit any Adaptive Management Plan amendments to the Group for review and comment at least 90 days prior to District submittal to DNR.

c. The District shall be responsible for administration and management of the Adaptive Management Plan and related activities, including contract management. The District will also serve as the primary contract laboratory for analysis of routine parameters (e. g. phosphorus, TSS, and nitrogen) from water samples collected as part of the adaptive management project, and can recover associated analytical costs from the Group.

14. ADAPTIVE MANAGEMENT PERMITTEE PROVISIONS

a. All MS4 Members participating in this Agreement are individually responsible for meeting the TMDL baseline conditions for sediment (TSS) and phosphorus control. The baseline condition for MS4 Members is 40% TSS control and 27% phosphorus control. These reductions must be achieved within each stream reach that they discharge to as identified in the TMDL. Trading with another MS4 member located within the same stream reach that has exceeded the baseline condition can be used to meet the baseline condition, but trade

agreements are the responsibility of the participating Members and are not addressed directly through this Agreement.

b. All POTWs participating in this Agreement are required to meet an annual average effluent phosphorus concentration of 0.6 mg/L by the end of the first full WPDES permit term following implementation of the DNR approved Adaptive Management Plan, and an annual average effluent concentration of 0.5 mg/L by the end of the second full WPDES permit term following implementation of the DNR approved Adaptive Management Plan.

c. In the event the Adaptive Management Plan is terminated by DNR prior to the end of the original term of the Adaptive Management Plan, or if at the end of the adaptive management period DNR determines that the phosphorus and sediment (TSS) allocations identified in the TMDL have not been met for a stream reach, Members will be individually responsible for taking any additional steps needed to achieve compliance with phosphorus and sediment (TSS) reduction requirements in their WPDES permits. This could include converting to a water quality trading program that is consistent with applicable DNR guidance. Verifiable phosphorus and sediment (TSS) reductions or "credits" achieved through the adaptive management project will be distributed to Members proportionate to the Charges to Members under Section 9 of this Agreement, but use in a water quality trading program is subject to applicable DNR guidance.

d. In the event municipal boundaries change during the term of this Agreement, as land transfers from one municipality to another, the associated phosphorus load reduction and the associated payment responsibility also transfers to the new municipality.

e. Upon completion or termination of the adaptive management project, any funds remaining in the segregated account for the Group following payment of all project

expenses, shall be returned to members of the Group in direct proportion to the contribution made by each member of the Group.

15. NONDISCRIMINATION

In the performance of services under this Agreement, the Parties agree not to discriminate against any employee or applicant because of race, religion, marital status, age color, sex handicap, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs, or student status.

16. MISCELLANEOUS

a. Municipal Liability. Nothing in this Agreement shall constitute a waiver of any limitations on municipal or state agency liability that may exist as a matter of law, including but not limited to limitations in Wis. Stat. ch. 893.

b. Counterparts. This Agreement may be executed in counterparts, and the signatures of each party on separate copies of the Agreement shall be fully effective to bind each of them to the Agreement with any other party that signs any separate copy of the Agreement.

c. Entire Agreement. This Agreement supersedes any prior studies, memoranda, letters or oral discussions or understandings about the participation of any of the Members in this joint project. This Agreement represents the entire agreement of the Parties as to organization and the goals of the Group.

d. Amendment or Modification. No amendment or modification may be made to this Agreement except in writing signed by a two thirds majority of all Members.

e. Choice of Law. This Agreement shall, in general, be governed by and construed in accordance with the laws of the State of Wisconsin.

f. Exclusive Benefit. This Agreement is for the exclusive benefit of the Parties and their successors in interest and shall not be deemed to give any legal or equitable right, remedy or claim to any other entity or person.

g. No Joint Venture. This Agreement does not establish or evidence a Joint Venture or partnership between the Parties. No Party is liable for another Party's actions as a result of entering into this Agreement.

h. Succession. All the terms, provisions and conditions herein contained shall inure to the benefit of and be binding upon the Parties and their respective successors and assigns, including future governing bodies of the respective Members.

i. Notice. Any notice required or given under this Agreement shall be effective if mailed by U. S. mail, postage prepaid, to the representatives at the addresses set forth after the signatures below, or any substituted address or representative as is filed with the Secretary of the Executive Committee.

IN WITNESS WHEREOF, the Parties, by their duly authorized representatives, have executed this Agreement on the dates set forth below:

By:

_____ _____

Date of Execution Municipality Name

_____

(Authorized Representative Signature)

_____

(Authorized Representative Typed Name)

_____

(Authorized Representative Title)

Address:

Exhibit A: Map of the Yahara Watershed

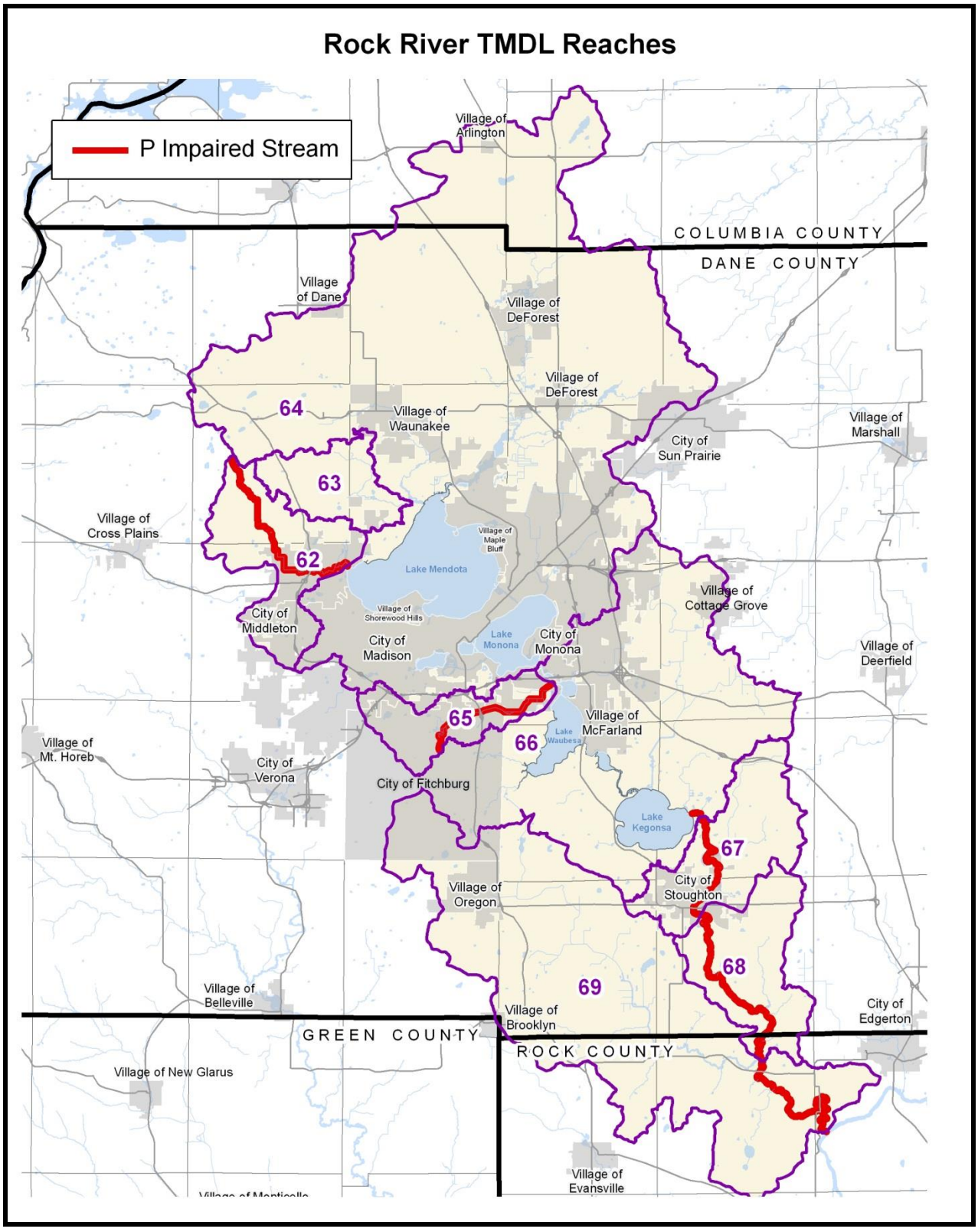


Exhibit B: Preliminary Cost Allocations
(Note: Section 9 outlines how preliminary costs can be adjusted)

Member	Required Phosphorus Reduction (lbs/yr)	Annual Adaptive Management Cost
Blooming Grove, Town	460	$23,000
Bristol, Town	412	$20,000
Burke, Town	1,139	$56,000
Cottage Grove, Town	635	$31,000
Cottage Grove, Village	240	$12,000
DeForest, Village	837	$41,000
DNR-Fish Hatch	209	$10,000
Dunkirk, Town	553	$27,000
Dunn, Town	703	$35,000
Fitchburg, City	2,141	$105,000
Madison, City	15,836	$779,000
Madison, Town	580	$29,000
Maple Bluff, Village	181	$9,000
McFarland, Village	736	$36,000
Middleton, City	2,370	$117,000
Middleton, Town	475	$23,000
MMSD (BFC) WWTP	10,444	$514,000
Monona, City	862	$42,000
Oregon WWTP	1,619	$80,000
Pleasant Springs, Town	432	$21,000
Shorewood Hills, Village	221	$11,000
Stoughton WWTP	109	$5,000
Stoughton, City	229	$11,000
Sun Prairie, City	634	$31,000
University of Wisconsin-Madison	431	$21,000
Waunakee, Village	1,091	$54,000
Westport, Town	940	$46,000
Windsor, Village	1,351	$66,000

Entities that executed the IGA

- City of Fitchburg
- City of Madison
- City of Middleton
- City of Monona
- City of Stoughton
- City of Sun Prairie
- Village of Cottage Grove
- Village of DeForest
- Village of Maple Bluff
- Village of McFarland
- Village of Waunakee
- Village of Windsor
- Village of Shorewood Hills
- Town of Blooming Grove
- Town of Cottage Grove
- Town of Dunn
- Town of Middleton
- Town of Westport
- UW-Madison
- Wisconsin Department of Natural Resources
- Madison Metropolitan Sewerage District
- Village of Oregon (WWTP)
- Stoughton Utilities (WWTP)

Appendix 11: Representative Letters of Support for Full-scale Adaptive Management Project

The Friends of Pheasant Branch Conservancy

Our Mission:
To restore, protect and promote the Pheasant Branch Conservancy and watershed for today and tomorrow

The Friends of Pheasant Branch Conservancy · P.O. Box 628242, Middleton WI 53562-8242 · pheasantbranch.org

David S. Taylor
Director of Ecosystem Services
Madison Metropolitan Sewerage District
1610 Moorland Road
Madison WI 53713

Dear Mr. Taylor,

The Friends of Pheasant Branch Conservancy (FOPBC) fully supports implementation of the full-scale adaptive management plan for the Yahara River Watershed. FOPBC is concerned about water quality in the greater Yahara Watershed as well as the Pheasant Branch Sub-Watershed, which impacts Pheasant Branch Creek, the flora and fauna of the Conservancy, and ultimately Lake Mendota. Pheasant Branch Creek is the second largest source of phosphorus in the Yahara chain of lakes, carrying stormwater from the City of Middleton and agricultural lands in the Town of Springfield through the Conservancy and into Lake Mendota.

In September 2015 the FOPBC board voted to become an "interested party" to the full-scale adaptive management project. Previously, in 2014, concerned about the lack of maintenance funds for City of Middleton stormwater facilities, FOPBC lead a referendum campaign for approval of a stormwater utility that passed by 65%. And in 2012, FOBC established a Watershed Committee for the purpose of understanding, supporting, advocating for and promoting the Pheasant Branch Watershed.

Sincerely,

Stefanie Brouwer

Stefanie Brouwer
Board Secretary
Chair of the Watershed Committee
Friends of Pheasant Branch Conservancy

Cc: Dagny Myrah, FOPBC President
FOPBC Watershed Committee

Wisconsin Land+Water Conservation Association

131 W. Wilson St. Suite #601 · Madison, Wisconsin 53703
(608) 441-2677 · Fax: (608) 441-2676 · www.wisconsinlandwater.org

David Taylor
Madison Metropolitan Sewerage District
1610 Moorland Road
Madison, WI 53713

Dear Dave:

It is our understanding that MMSD plans to move forward with a full scale adaptive management project in the Yahara watershed. The goal of this project will be to address the phosphorus and sediment reductions from all source categories identified in the Rock River TMDL. This effort would be done using a collaborative approach and involve broad reaching partnerships that bring rural and urban entities together working toward a common goal.

WI Land+Water represents all of Wisconsin's county land conservation committees (LCCs) and their professional staff whose mission is to protect and enhance soil and water resources in the state. Our membership works directly with farmers and others locally to address non-point source pollution concerns. We are particularly proud of the work done in Dane County by the LCC and their staff within the Dane County Land Conservation Division. Over the last 30 years they have established the trust of farmers and worked with them to install countless conservation practices which led to the improvement of waters and ultimately to the removal of a number of important streams from the state's impaired waters list. The Land Conservation Division's record of success in dealing with non-point source pollution makes them a compelling partner and we encourage your continued outreach to them.

WI Land+Water has been very impressed with the tremendous effort MMSD has made to engage the broad community of stakeholders in the private, governmental, and civic sectors that will be critical to the success of the full scale project. We fully support the MMSD effort to move forward with a full scale adaptive management project and will work with you in conjunction with our membership in Dane County to advance this collaborative effort.

Sincerely,

Jim VandenBrook
Executive Director

COLUMBIA COUNTY
Land & Water Conservation

608-742-9670
FAX: 608-742-9840
E-MAIL: land.conservation@co.columbia.wi.us
WEBSITE: www.co.columbia.wi.us

120 West Conant Street
P.O. Box 485
Portage, WI 53901

8/19/2015

Dave S. Taylor
Director of Ecosystems Services
Madison Metropolitan Sewerage District
1610 Moreland Road
Madison, WI 53713

Subject: MMSD/Yahara Wins Adaptive Management Project

Dear Dave,

The Columbia County Land & Water Conservation Department looks forward to evaluating and partnering on opportunities for phosphorus reduction in the Yahara Wins Adaptive Management Project Area. We recognize Land & Water Conservation Departments will likely play a role in the success of these projects. We look forward to further evaluation of opportunities to combine resources to help you work towards your project goals. Consider us a willing partner as we move closer towards implementation. The program opportunities are exciting and challenging all at the same time.

Sincerely,

Kurt R. Calkins
Director of LWCD
Columbia County

YLA
Yahara Lakes Association

October 26, 2015

David S. Taylor
Director of Ecosystem Services
Madison Metropolitan Sewerage District
1610 Moorland Rd
Madison, WI 53713

Hello Dave,

The Yahara Lakes Association (YLA) Board of Directors, at its meeting on Oct 22, 2015, unanimously voted to support Yahara WINs transition into a Full-scale Adaptive Management effort after the pilot is completed.

We feel that helping agricultural producers and others to implement conservation practices in the Yahara watershed to reduce phosphorus runoff is the single most important action to improve water quality in our lakes & rivers. This effort is spot on with YLA's advocacy for the vitality of the Yahara chain of lakes on behalf of its members and all others who use the lakes.

We are interested in hearing more about the 20 year Yahara WINS effort and invite you to make a 20 to 30 minute presentation to the Board at one of its meetings on 11/19/15, 1/14/16 or 3/10/16 held at the Greater Madison Chamber of Commerce offices between 11:30 a.m. – 1:00 p.m. Please confirm the date that works best for you with our coordinator at 608-239-1664 or info@yaharalakes.org.

Sincerely,

Joe Tisserand

Joe Tisserand
Yahara Lakes Association President

Yahara Lakes Association, Ltd.
P.O. Box 22
Waunakee, WI 53597
608.239.1664
www.yaharalakes.org
info@yaharalakes.org

150 East Gilman St. Suite 2600
Madison, WI 53703
Phone: 608-255-1000
www.cleanlakesalliance.com

CLA Community Board
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Stacey Neu,* V. Chair
Marilee Gorman,* Secretary
Stephen Ales
Lauren Azar
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Roger Bannerman
Lars Barber
Stefanie Brouwer
Sharon Corrigan
Katie Crawley
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Mary Ehrekrog
Jeff Endres*
Leslie Evon
Peter Foy
Matt Frank
Bob Karls
Fred Klancnik
Woody Knepprath
John Kothe*
Dea Larsen Converse
Tyler Leeper
Dave Merritt
Kamran Mesbah
Bob Miller
D. Michael Mucha
Stacey Neu*
Michael Nowicki
Randy Peterson*
Brian Potts*
Rebecca Power
Paul Robbins
Eric Schmidt
Scott Smith
Amy Supple
Joe Tisserand
Lyle Updike
Robert Weber
Jim Welsh
James Tye, Exec. Director

Friends of Clean Lakes Board
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TJ Blitz
Joanna Burish
Cory A. Buyo
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Glenn Reinl
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Mardi Stroud
Russ Tieman

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Bob Uphoff, V. Chair
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Dave Fahey
Mike Gerner
Will Hensen
Rob Klink
Walter Meinholz
Dave Taylor

*CLA Executive Board

August 4, 2015

Dave Taylor
Director of Ecosystem Services
Madison Metropolitan Sewerage District
1610 Moorland Road
Madison, WI 53713

Dear Mr. Taylor:

As a signatory on the Yahara WINs M.O.U. and a participant in the adaptive management pilot project with a seat on the Yahara WINs Strategic Planning Work Group, Clean Lakes Alliance fully supports the District in moving forward with full-scale, watershed-wide adaptive management.

Clean Lakes Alliance will continue to work as a partner in watershed adaptive management by building support community-wide for this collaborative and cost-effective approach for phosphorus reduction through education, outreach, and financial support.

Clean Lakes Alliance is a 501c3 not-for-profit organization dedicated to the improvement and protection of the lakes, streams and wetlands in the Yahara River watershed. Our primary focus is on achieving a 50% reduction in phosphorus-loading to the Yahara chain of lakes through cost-effective, strategic actions throughout the watershed.

We see the success of adaptive management as crucial to the success of our mission, and we commit to partnering with the District, local governments and area farmers in watershed adaptive management.

In partnership,

James Tye
Executive Director
Clean Lakes Alliance

August 6, 2015

David Taylor
Madison Metropolitan Sewerage District
1610 Moorland Road
Madison, WI 53713

Dear Dave:

It is our understanding that the Madison Metropolitan Sewerage District plans to move forward with a full scale adaptive management project in the Yahara River watershed. The goal of this project is to reduce phosphorus and sediment from all source categories identified in the Rock River TMDL. This effort has been impressively collaborative, involving partnerships that bring rural and urban entities together working toward a common goal.

We are impressed with the commitment shown by MMSD to cleaning up the Yahara River and the chain of lakes that comprise much of the Yahara basin in the Madison area. While all entities – urban governments and rural landowners – share responsibility for the quality of the water in the Yahara basin, it's been well established that a disproportionate share of the sediment and phosphorus in the Yahara system comes from agricultural land, and as a result of farming practices.

As the adaptive management project moves forward, we urge MMSD to insist on transparency and accountability on the part of those entities working to reduce pollution on farms in the Yahara watershed. To the extent that MMSD can influence those processes, we strongly urge you to do so.

Sincerely,

Denny Caneff
Executive Director

RIVER ALLIANCE of WISCONSIN
306 East Wilson Street, Suite #2W
Madison, WI 53703
608.257.2424
info@wisconsinrivers.org
wisconsinrivers.org

1 October 2015

Mr. Dave Taylor
Director of Special Projects
Madison Metropolitan Sewerage District
1610 Moorland Road
Madison WI 53713

Dear Mr. Taylor:

Wisconsin's Watershed Adaptive Management Option (AMO) is an innovative and creative way to improve water quality and meet the requirements of the federal Clean Water Act. It addresses a gap that has opened since the last major Clean Water Act amendments in the late 1980s. That gap is between what wastewater treatment plants and other regulated dischargers can do to remove pollutants by treating wastewater, and what must be done to maintain the fishable and swimmable waterways that are the purpose of the Act.

Sand County Foundation supports beginning an Adaptive Management Option project throughout the Yahara Lakes Watershed in 2017. The Foundation has been a major funder of the pilot project begun in 2012 in the Six Mile/Dorn Creek Yahara Lakes subwatershed north of Lake Mendota, thereby enabling cooperative agreements between Madison Metropolitan Sewerage District and the U. S. Geological Survey. The agreements led to scientifically sound water quality monitoring that generates accurate data on pollutant levels downstream of a major agricultural area and the Town of Waunakee.

Sand County Foundation believes a watershed-wide AMO project can reduce phosphorus pollution at significantly less cost, and in a much greater area of Madison's lakes and the Rock River basin, than can additional water treatment infrastructure alone. Success in an AMO project here could show an improved way forward for municipalities across the country that face water quality issues similar to those the Madison community is seeking to address.

Sincerely,

Brent M. Haglund

Brent M. Haglund, Ph.D.
Executive Chairman/CEO

131 W. Wilson Street, Suite 610 Madison, WI 53703 | 608.663.4605 | info@sandcountynet | sandcountynet

Appendix 12: Phosphorus Reduction Milestones by Year

2024 Update

					2024 Update Stream Reach					
	62	63	64	65	66	67	68	69 Fulton	69 Hwy 59	Total
	----------Pounds of P Reduction per Year----------									
Year										
2017	1830	513	8333	704	2187	13	369	4576		18,524
2018	1830	513	10416	704	2916	13	369	4576		21,336
2019	2746	615	12499	1056	4374	13	461	5720		27,483
2020	3203	718	14582	1232	5103	13	645	8008		33,503
2021	3661	820	16665	1408	5832	15	737	9152		38,290
2022	4118	923	18748	1584	6561	17	829	10296		43,076
2023	4576	1025	20832	1760	7290	19	922	11440		47,862
2024	2746	615	12499	1056	4374	11	553	11058		32,912
2025	3203	718	14582	1232	5103	13	645	662	12240	38,397
2026	3661	820	16665	1408	5832	15	737	756	13988	43,882
2027	6406	923	18748	1584	6561	17	829	851	15737	51,656
2028	4576	1025	20832	1760	7290	19	922	945	17486	54,853
2029	7322	1128	22915	1936	8019	20	1014	1040	19234	62,626
2030	5491	1230	24998	2112	8748	22	1106	1134	20983	65,824
2031	5949	1333	27081	2288	9477	24	1198	1229	22731	71,309
2032	8694	1435	29164	2464	10206	26	1290	1323	24480	79,082
2033	6864	1538	31247	2640	10935	28	1382	1418	26228	82,280
2034	7322	1640	33330	2816	11664	30	1474	1512	27977	87,765
2035	7779	1743	35414	2992	12393	31	1567	1607	29725	93,250
2036	8237	1845	37497	3168	13122	33	1659	1701	31474	98,735
2037	8694	1948	39580	3344	13851	35	1751	1796	33222	104,221
2038	9152	2050	41663	3520	14580	37	1843	1890	34971	109,706
2039	9152	2050	41663	3520	14580	37	1843	1890	34971	109,706
2040	9152	2050	41663	3520	14580	37	1843	1890	34971	109,706
2041	9152	2050	41663	3520	14580	37	1843	1890	34971	109,706

2017 Original

	Stream Reach								
	62	63	64	65	66	67	68	69	Total
	----------Pounds of P Reduction per Year----------								
Year									
2017	1830	513	8333	704	2187	13	369	4576	18,524
2018	1830	513	10416	704	2916	13	369	4576	21,336
2019	2746	615	12499	1056	4374	13	461	5720	27,483
2020	3203	718	14582	1232	5103	13	645	8008	33,503
2021	3661	820	16665	1408	5832	15	737	9152	38,290
2022	4118	923	18748	1584	6561	17	829	10296	43,076
2023	4576	1025	20832	1760	7290	19	922	11440	47,862
2024	5034	1128	22915	1936	8019	20	1014	12583	52,648
2025	5491	1230	24998	2112	8748	22	1106	13727	57,434
2026	5949	1333	27081	2288	9477	24	1198	14871	62,221
2027	6406	1435	29164	2464	10206	26	1290	16015	67,007
2028	6864	1538	31247	2640	10935	28	1382	17159	71,793
2029	7322	1640	33330	2816	11664	30	1474	18303	76,579
2030	7779	1743	35414	2992	12393	31	1567	19447	81,365
2031	8237	1845	37497	3168	13122	33	1659	20591	86,152
2032	8694	1948	39580	3344	13851	35	1751	21735	90,938
2033	9152	2050	41663	3520	14580	37	1843	22879	95,724
2034	9152	2050	41663	3520	14580	37	1843	22879	95,724
2035	9152	2050	41663	3520	14580	37	1843	22879	95,724
2036	9152	2050	41663	3520	14580	37	1843	22879	95,724

	62	63	64	65	66	67	68	69
Year	Percent Progress Toward P Reduction Goal							
2017	20%	25%	20%	20%	15%	35%	20%	20%
2018	20%	25%	25%	20%	20%	35%	20%	20%
2019	30%	30%	30%	30%	30%	35%	25%	25%
2020	35%	35%	35%	35%	35%	35%	35%	35%
2021	40%	40%	40%	40%	40%	40%	40%	40%
2022	45%	45%	45%	45%	45%	45%	45%	45%
2023	50%	50%	50%	50%	50%	50%	50%	50%
2024	55%	55%	55%	55%	55%	55%	55%	55%
2025	60%	60%	60%	60%	60%	60%	60%	60%
2026	65%	65%	65%	65%	65%	65%	65%	65%
2027	70%	70%	70%	70%	70%	70%	70%	70%
2028	75%	75%	75%	75%	75%	75%	75%	75%
2029	80%	80%	80%	80%	80%	80%	80%	80%
2030	85%	85%	85%	85%	85%	85%	85%	85%
2031	90%	90%	90%	90%	90%	90%	90%	90%
2032	95%	95%	95%	95%	95%	95%	95%	95%
2033	100%	100%	100%	100%	100%	100%	100%	100%
2034	100%	100%	100%	100%	100%	100%	100%	100%
2035	100%	100%	100%	100%	100%	100%	100%	100%
2036	100%	100%	100%	100%	100%	100%	100%	100%

Appendix 13: Additional Information for Stoughton Wastewater Treatment Plant Requiring Tertiary Treatment to Meet Future Phosphorus Limits

(Provided by Strand Engineering)

Stoughton WWTP Tertiary Treatment Information

Received via email on December 14, 2015 from Jane M. Carlson, P.E., ENV SP
Strand Associates, Inc.

Table 1 shows the total maximum daily load (TMDL)-based effluent limits in the Stoughton WWTP WPDES permit along with the effluent total phosphorus (TP) concentrations that would be required at the design average flow of 1.65 mgd. Stoughton presently uses biological phosphorus removal (BPR) to meet its interim limit of 1.3 mg/L and has a chemical phosphorus removal (CPR) backup system.

Month	Monthly Average TP Effluent Limit Load (lb./day)	Monthly Average TP Effluent Concentration (mg/L)[1]
January	4.3	0.31
February	5.6	0.41
March	4.9	0.36
April	5.3	0.39
May	5.2	0.38
June	5.3	0.39
July	5.1	0.37
August	4.6	0.33
September	4.9	0.36
October	4.1	0.30
November	4.0	0.29
December	3.9	0.28

[1]Calculated at design average flow of 1.65 mgd. Not included in WPDES Permit.

The Wisconsin Department of Natural Resources (DNR) 2012 *Guidance for Implementing Wisconsin's Phosphorus Water Quality Standards for Point Source Discharges* states, "…if the calculated WQBEL is 0.40 mg/L or less as a monthly average, that limit cannot be achieved without the addition of filtration or equivalent technology." Furthermore, Wisconsin

Administrative Code Chapter NR 217 implicitly suggests limits are "stringent" when they are less than 0.3 mg/L, since s. NR 217.14 allows s. NR 271.13 effluent limits to be expressed as an annual (or, in practice, 6-month) average when they are less than or equal to 0.3 mg/L. The recently published *Substantial and Widespread Adverse Social and Economic Impacts of Wisconsin's Phosphorus Regulations*, by the Wisconsin Department of Administration and DNR, October 6, 2015, assumes single-stage tertiary filtration will be required for WWTPs that have effluent TP limits in the 0.1 to 0.5 mg/L range.

A presentation on phosphorus removal technology update at the 2014 Wisconsin Government Affairs Seminar by Samuel Jeyanayagam, PhD, P.E., BCEE indicated reliable removal of TP to less than 0.5 mg/L requires some form of tertiary treatment in addition to BPR and/or CPR. This is related to the importance of removing effluent TSS which can contain up to 12 percent TP. A presentation on low effluent phosphorus limits at the 2010 Wisconsin Government Affairs Seminar by Glen T. Daigger, PhD, P.E., BCEE, NAE, indicated that effluent TP is highly variable, even at the best performing WWTPs. Dr. Daigger noted the reliability of achieving effluent limits is very dependent upon the averaging period for the limit (i.e., it is much easier to meet a particular TP limit expressed as an annual average than a monthly average), and that low effluent phosphorus generally requires multi-stage treatment or membrane filtration. Copies of these presentations and additional references are available upon request.

As alluded to in the Daigger presentation., WWTP design must target effluent concentrations that are lower than WPDES limits to provide a margin of safety for variably in weather, flow rates, and wastewater characteristics. As an example, a 2008 Municipal Environmental Group survey found WWTPs that were designed to meet a 1 mg/L monthly average limit or higher had annual average effluent phosphorus concentrations of 0.6 mg/L.

Stoughton Utilities believes tertiary treatment (filtration or an equivalent technology) will be required to consistently and reliably meet the TMDL TP limits, for the above general reasons and for the following specific reasons:

- For 11 months of the year the phosphorus limits will be less than 0.4 mg/L, and for three months of the year the limits will be less than or equal to 0.3 mg/L at 1.65 mgd design average flow.
- Stoughton's internal planning indicates the design average flow of 1.65 mgd may be exceeded as early as 2026. The projected 2035 design average flow is 2.10 mgd which would result in effluent phosphorus limits in the range of 0.22 to 0.32 mg/L.
- Although some WWTPs in the state may be able to achieve phosphorus concentrations less than 0.4 mg/L without tertiary treatment, Stoughton's WWTP may be less able to do so because of:
    - Smaller size of WWTP, with a smaller and less sophisticated staff focusing on operation and maintenance not theory or innovation
    - Use of biological phosphorus removal (BPR) which is less stable and consistent than chemical phosphorus removal and can result in a higher phosphorus content in the effluent TSS
    - Potential for industrial customers to discharge compounds that inhibit BPR, compounding the issue of a less consistent effluent quality

- Providing for a margin of safety, a professional engineer designing a system to meet a 0.28 mg/L TP limit might target a design monthly average effluent concentration closer to 0.2 mg/L, which would certainly require tertiary treatment.