Mississippi River–Sartell

November 2020

Mississippi River –Sartell Watershed Restoration and Protection Strategy Report

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT

Authors

Kaitlyn Taylor, Tetra Tech
Jennifer Olson, Tetra Tech
Ryan Birkemeier, Tetra Tech
Phil Votruba, MPCA

Contributors/acknowledgements

Amanda Guertin, Gerry Maciej, Chuck Rau – **Benton Soil and Water Conservation District**

Melissa Barrick, Shiela Carlton – **Crow Wing Soil and Water Conservation District**

Mary Degiovanni, Ashley Kaisershot – **City of Sartell**

Noah Czech, Lisa Vollbrecht – **City of St. Cloud**

Lance Chisholm, LeaAnn Nouis, Shannon Wettstein – **Morrison Soil and Water Conservation District**

Galen Gruber, Addison March – **Morrison County Environmental Services**

Cole Loewen – **Stearns County Environmental Services**

Greg Berg, Dennis Fuchs, Ben Ruley – **Stearns Soil and Water Conservation District**

Jason Weinerman, Brad Wozney – **Minnesota Board of Water and Soil Resources**

Eric, Altena, Lucas Borgstrom, Nicola Blake-Bradley, Jason Carlson, David Depaz, Mark Hauck, Reid Northwick, Nick Proulx – **Minnesota Department of Natural Resources**

Dereck Richter, Karen Voz – **Minnesota Department of Health**

Chad Anderson, Jordan Donatell, Rhonda Adkins, Sagor Biswas, Nicole Blasing, Anthony Dingmann, Chuck Johnson, Andrew Frank, Kourtney Frank, Andrea Plevan, Paul Schrieber – **Minnesota Pollution Control Agency**

Tim Terrill – **Mississippi Headwaters Board**

Kristen Blann, Leah Hall, Todd Holman – **The Nature Conservancy**

Bob Guggenberger – **Two Rivers Lake Association**

Nicole Ellingson, Steve Karel – **United States Fish and Wildlife Service**

Local Partner Team Participants

Editing and graphic design

PIO staff – Stephen Mikkleson
Administrative Staff – Jinny Fricke, Celine Lyman

Cover photo credit: Kaitlyn Taylor, Tetra Tech and Big Watab Lake Association (Big Watab Lake – Stearns County)

Document number: wq-ws4-78a

Contents

1. Watershed background and description 1

2. Watershed conditions 3

2.1. Condition status 5

2.2. Water quality trends 12

2.3. Stressors and sources 27

2.4. TMDL summary 43

2.5. Protection considerations 45

3. Prioritizing and implementing restoration and protection 57

3.1. Civic engagement 58

3.2. Targeting of geographic areas 64

3.3. Restoration and protection strategies 72

3.4. Climate protection co-benefit of strategies 134

4. Monitoring plan 135

5. References and further information 138

6. Appendices 140

Figures

Figure 1. Land cover in the MRSW (Cropland Data Layer 2018). 2
Figure 2. Impaired waters in the MRSW. 4
Figure 3. WPLMN sampling locations. 14
Figure 4. TSS, TP, and NO_3+NO_2-N flow weighted mean concentrations and loads for the Mississippi River at Royalton, Minnesota, 2007-2016 (Figure 31 in the monitoring and assessment report, MPCA 2019a). 15
Figure 5. TSS, TP, and NO3+NO2-N flow weighted mean concentrations and loads for the Mississippi River at Sartell, Minnesota, 2007-2016 (Figure 32 in the monitoring and assessment report, MPCA 2019a). 16
Figure 6. 2007-2016 Average annual TSS, TP, and NO3-NO2-N flow weighted mean concentrations by major watershed (Figure 30 in the monitoring and assessment report, MPCA 2019a). 17
Figure 7. Little Rock Lake Watershed monitoring stations. 19
Figure 8. Little Rock Lake watershed BMPs (Image from Benton SWCD). 20
Figure 9. Nitrate concentrations in Little Rock Lake watershed, 2006–2008 vs. 2016–2018. 21
Figure 10. Mean annual flows monitored at Little Rock Creek near Rice (H15029001), 1998–2018, with the pre-implementation (2006–2008) and post-implementation (2016–2018) periods highlighted. 21
Figure 11. Total Kjeldahl nitrogen concentrations in Little Rock Lake watershed, 2006–2008 vs. 2016–2018. 22
Figure 12. Total phosphorus concentrations (June–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018. 23
Figure 13. Total suspended solids (April–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018. 23
Figure 14. Biochemical oxygen demand (June–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018. 24
Figure 15. Little Rock Lake Secchi depth (June–September); site 05-0013-00-204. 25
Figure 16. Little Rock Lake total phosphorus surface concentrations (June–September); site 05-0013-00-204. 25
Figure 17. Little Rock Lake chlorophyll-*a* surface concentrations (June–September); site 05-0013-00-204. 26
Figure 18. Stream AUIDs assessed in the MRSW Stressor Identification Report. 31
Figure 19. Sources of phosphorus in the MRSW (Tetra Tech 2018). 32
Figure 20. Upland loading rates of TP (lb/ac/yr) by HSPF model catchment. 33
Figure 21. Sources of sediment in the MRSW (Tetra Tech 2018). 34
Figure 22. Upland loading rates of TSS (tons/ac/yr) by HSPF model catchment. 35
Figure 23. Sources of Nitrogen in the MRSW (Tetra Tech 2018). 36
Figure 24. TN yield (lb/ac/yr) by HSPF model catchment. 37
Figure 25. Primary livestock types in the MRSW. 39
Figure 26. Phosphorus loading (kilograms) from WWTF in the MRSW 2000 to 2019 (MPCA Healthier Watersheds). 42
Figure 27. TSS loading kilograms) from WWTF in the MRSW 2000 to 2019 (MPCA Healthier watersheds). 43
Figure 28. Protection priority waterbodies identified in the MRSW. 48
Figure 29. Drinking water supply management areas (DWSMA) for surface water sources. 51
Figure 30. DWSMA vulnerability (MDH). 52
Figure 31. Water withdrawals by type within the MRSW (MPARS 2016). 53
Figure 32. Active status permitted high capacity withdrawals in 2016 (Figure from MPCA 2019a). 54
Figure 33. Total annual groundwater withdrawal in the MRSW (1997-2016) (Figure from MPCA 2019a). 54

Figure 34. Little Rock Creek Area (Image from Minnesota DNR). 55
Figure 35. Pollution sensitivity of near surface materials (Image from MPCA 2019a). 56
Figure 36. Targeted geographic area: HSPF subwatersheds with high TP, TSS, and TN upland loading rates in the MRSW. 66
Figure 37. Targeted geographic area: High quality and nearly/barely macroinvertebrate biological communities in the MRSW. 67
Figure 38. Targeted geographic area: High quality and at-risk fish biological communities in the MRSW. 68
Figure 39. Targeted geographic area: Areas of concern identified by local partner team members in the MRSW. 69
Figure 40. Targeted geographic area: Areas marked as important land and water resources during the February 2020 public meetings, northeastern portion of watershed. 70
Figure 41.Targeted geographic area: Areas marked as important land and water resources during the February 2020 public meetings, southwestern portion of watershed. 71
Figure 42. Little Rock Lake Subwatershed (0701020105). See Table 15 for corresponding restoration and protection strategies. 79
Figure 43. Two Rivers Subwatershed (0701020101). See Table 16 for corresponding restoration and protection strategies. 85
Figure 44. Spunk Creek Subwatershed (0701020102). See Table 17 for corresponding restoration and protection strategies. 96
Figure 45. Skunk River Subwatershed (0701020103). See Table 18 for corresponding restoration and protection strategies. 101
Figure 46. Platte River Subwatershed (0701020104). See Table 19 for corresponding restoration and protection strategies. 107
Figure 47. Watab River Subwatershed (0701020106). See Table 20 for corresponding restoration and protection strategies. 119
Figure 48. City of Sartell Subwatershed (0701020107). See Table 21 for corresponding restoration and protection strategies. 126
Figure 49. Station #1: Where in the watershed? Northeastern portion of the watershed. Attendees were asked to place a star on the map marking their home. Note, yellow arrows were added later to better show location of stars. 145
Figure 50. Station #1: Where in the watershed? Southwestern portion of the watershed. Attendees were asked to place a star on the map marking their home. Note, yellow arrows were added later to better show location of stars. 146
Figure 51. Results from Station #2: Love your watershed—northwestern portion of the watershed. Attendees were asked to mark a heart sticker on natural areas within the watershed that they care about. 147
Figure 52. Results from Station #2: Love your watershed—southwestern portion of the watershed. Attendees were asked to mark a heart sticker on natural areas within the watershed that they care about. 148
Figure 53. Written results from Station #2: Love your watershed sheet 1. Attendees were given the option to write down why the location they chose was important to them. 149
Figure 54. Written results from Station #2: Love your watershed sheet 2. Attendees were given the option to write down why the location they chose was important to them. 150

Tables

Table 1. Land cover (Cropland Data Layer 2018). 1
Table 2. Assessment status of stream reaches in the MRSW. 6
Table 3. Assessment status of lakes in the MRSW. 11
Table 4. Long-term water clarity trends in the MRSW. Information provided by MPCA 2019a. 13
Table 5. WPLMN sites in the MRSW. 13
Table 6. Summary of pre- and post-implementation stream water quality trend evaluation. 27
Table 7. Summary of aquatic life impairments and stressors in the MRSW (Table 1 of stressor identification report, MPCA 2019b). 28
Table 8. Point sources (NPDES or SDS permitted) in the MRSW. 40
Table 9. Summary of TMDLs within the MRSW. 44
Table 10. Priority streams for protection as identified in the statewide interagency effort. 46
Table 11. Priority lakes for protection as identified in statewide interagency effort. 46
Table 12. Priority sources in the Source Water Protection Plan for the City of St. Cloud, Minnesota. 49
Table 13. Priority waterbodies for Streams County as determined by SWCD and County staff. 65
Table 14. Watershed wide strategy types (in alphabetical order) and example BMPs for the MRSW. 72
Table 15. Restoration and protection strategies for the Little Rock Creek Subwatershed (0701020105). 80
Table 16. Restoration and protection strategies for the Two River Subwatershed (0701020101). 86
Table 17. Restoration and protection strategies for the Spunk Creek Subwatershed (0701020102) 97
Table 18. Restoration and protection strategies for the Skunk River Subwatershed (0701020103) 102
Table 19. Restoration and protection strategies for the Platte River Subwatershed (0701020104) 108
Table 20. Restoration and Protection Strategies for the Watab River Subwatershed (0701020106) 120
Table 21. Restoration and protection strategies for the City of Sartell–Mississippi River Subwatershed (0701020107) 127
Table 22. Issue and Concerns Survey results from February 2020 Public meeting and local partner team members. Surveyed were asked to select their top three issues and/or concerns in the Mississippi River–Sartell Watershed. 151

Key terms and abbreviations

Assessment Unit Identifier (AUID): The unique waterbody identifier for each river reach comprised of the U.S. Geological Survey (USGS) eight-digit HUC plus a three-character code unique within each HUC.

Aquatic life impairment: The presence and vitality of aquatic life is indicative of the overall water quality of a stream. A stream is considered impaired for impacts to aquatic life if the fish Index of Biotic Integrity (IBI), macroinvertebrate IBI, dissolved oxygen, turbidity, or certain chemical standards are not met.

Aquatic recreation impairment: Streams are considered impaired for impacts to aquatic recreation if fecal bacteria standards are not met. Lakes are considered impaired for impacts to aquatic recreation if total phosphorus and either chlorophyll-a or Secchi disc depth standards are not met.

Hydrologic Unit Code (HUC): A HUC is assigned by the USGS for each watershed. HUCs are organized in a nested hierarchy by size. For example, the Upper Mississippi River Basin is assigned a HUC-4 of 0701 and the Mississippi River–Sartell watershed is assigned a HUC-8 of 07010201.

Impairment: Waterbodies are listed as impaired if water quality standards are not met for designated uses including aquatic life, aquatic recreation, and aquatic consumption.

Index of Biotic Integrity (IBI): A method for describing water quality using characteristics of aquatic communities, such as the types of fish and invertebrates found in the waterbody. It is expressed as a numerical value between 0 (lowest quality) to 100 (highest quality).

Protection: This term is used to characterize actions taken in watersheds of waters not known to be impaired to maintain conditions and beneficial uses of the waterbodies.

Restoration: This term is used to characterize actions taken in watersheds of impaired waters to improve conditions, eventually to meet water quality standards and achieve beneficial uses of the waterbodies.

Source (or pollutant source): This term is distinguished from ‘stressor’ to mean only those actions, places or entities that deliver/discharge pollutants (e.g., sediment, phosphorus, nitrogen, pathogens).

Stressor (or biological stressor): This is a broad term that includes both pollutant sources and nonpollutant sources or factors (e.g., altered hydrology, dams preventing fish passage) that adversely impact aquatic life.

Total Maximum Daily Load (TMDL): A calculation of the maximum amount of a pollutant that may be introduced into a surface water and still ensure that applicable water quality standards for that water are met. A TMDL is the sum of the wasteload allocation for point sources, a load allocation for nonpoint sources and natural background, an allocation for future growth (i.e., reserve capacity), and a margin of safety as defined in the Code of Federal Regulations.

Acronyms and abbreviations

1W1P	One Watershed, One Plan
AFO	animal feeding operation
AUID	assessment unit identification
BOD	biological oxygen demand
BMP	best management practice
BWSR	Board of Water and Soil Resources
CCA	certified crop advisor
CDL	Cropland data layer
DO	dissolved oxygen
DNR	Minnesota Department of Natural Resources
DWSMA	drinking water supply management area
EQuIS	environmental quality information system
EPA	U.S. Environmental Protection Agency
FWMC	flow weighted mean concentration
GRAPS	groundwater restoration and protection strategy
HSPF	Hydrological Simulation Program FORTRAN
HUC	hydrologic unit code
IBI	index of biotic integrity
IWM	intensive watershed monitoring
Lb/ac/yr	pounds per acre per year
LID	low impact development
mg/L	milligram per liter
µ/L	microgram per liter
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
MRSW	Mississippi River–Sartell Watershed
MS4	municipal separate storm sewer system
NO_3+NO_2-N	nitrate plus nitrite nitrogen
NPDES	national pollutant discharge elimination

SDS	state disposal system
SID	stressor identification
SSTS	subsurface sewage treatment system
SWCD	soil and water conservation district
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TP	total phosphorus
TSS	total suspended solids
WPLMN	Watershed Pollutant Load Monitoring Network
WRAPS	watershed restoration and protection strategy
WWTP	wastewater treatment plan
WWTF	wastewater treatment facility

Executive summary

The Mississippi River – Sartell Watershed (MRSW) is located in central Minnesota as part of the Upper Mississippi River Basin and spans approximately 1,020 square miles. The watershed is composed of portions of Morrison, Benton, and Stearns counties and also contains smaller sections of Crow Wing, Mille Lacs, and Todd counties. The MRSW consists of 879 total river miles, and includes 43 named stream assessment units. There are 232 lakes within the watershed covering a total of 13,319 acres.

The MRSW lies within the southern portion of the Northern Lakes and Forests ecoregion, which is dominated by nutrient-poor glacial soils, extensive sandy outwash plains, and broad lacustrine basins, and the northern portion of the North Central Hardwood Forests ecoregion, which is comprised of mainly rolling glacial till plains, lacustrine basins, outwash plains, and rolling moraines. The sand plain regions located along the Mississippi River are some of the most intensively cultivated lands within the watershed. The high infiltration rates of the soils within the sand plain regions result in groundwater that is highly sensitive to pollution from surface sources. The diverse surface water resources within this watershed provide important recreational opportunities and economic benefits to citizens and visitors.

Land use is predominantly agricultural (corn, soybean, and alfalfa crops), followed by forested, grassland and pasture, and wetlands. Agricultural land is highly irrigated in the MRSW, with several high capacity wells located in the central portion of the watershed. Areas of forests and wetlands are clustered in the northern portion of the watershed in Crow Wing County and the northeast corner of Morrison County. Forest and wetlands are also found clustered around lakes and in the headwaters of streams. Only 6% of the watershed is developed for urban uses. Major developed areas include the cities of Sartell, Rice, Royalton, Pierz, Avon, and Albany. The City of Saint Cloud is located downstream of the watershed along the Mississippi River. The Mississippi River serves as the sole drinking water supply for the city of St. Cloud and is a major drinking water supply for the Twin Cities Metro Area.

The Mississippi River is the main body of water in the MRSW. Bisecting the watershed, the Mississippi River enters the watershed in Morrison County and flows south through the center of the MRSW as it receives water from several tributaries. The majority of these tributaries are characterized by flowing streams with riffle habitat. The main stem Mississippi River experiences one of its largest changes in topography in the state of Minnesota as it flows through the MRSW, dropping six and a half feet per river mile. Lakes are predominantly located in the northeastern and southwestern portions of the watershed.

Water quality conditions of the MRSW are important to the downstream receiving waters and drinking water supplies for Saint Cloud and the Twin Cities. Several of the waterbodies within the MRSW are not meeting water quality standards and are impaired. Despite these impairments, several streams and lakes are demonstrating improving trends in water clarity in the watershed.

Mississippi River, Morrison County – River Mile 955 (photo courtesy of DNR).

Beginning in 2016, the MPCA undertook an intensive watershed monitoring (IWM) effort of the surface waters in the MRSW. Overall the biological communities found throughout the watershed are in fair to good condition. However, of the 50 stream reaches evaluated for aquatic recreation and/or aquatic life within the MRSW:

- Sixteen of those reaches are not meeting water quality standards for aquatic life use due to pollutants including phosphorus, nitrate, and dissolved oxygen (DO), or nonpollutant stressors including issues related to longitudinal connective, temperature, habitat, and streamflow alteration.
- Twenty-four reaches are not meeting the aquatic recreational use standard due to *E. coli* or Fecal Coliform. The Platte River (07010201-545) supports the only exceptional biological community in the MRSW with several sensitive fish and macroinvertebrate species present.

Fifty-one lakes were evaluated for aquatic recreation and 17 for aquatic life within the MRSW. Three of those lakes were found not to meet the aquatic recreational use standard due to phosphorus or nutrients, and two were found not to meet the aquatic life use standard for unknown stressors. Numerous lakes do not have sufficient data at this time to make a formal assessment for these uses. Overall, where long-term water quality information is available, increasing water quality clarity trends are found in 10 lakes and three streams with decreasing trends noticed in four lakes.

Total maximum daily load (TMDL) studies were developed concurrently to the MRS WRAPS effort for 15 *E. coli* impaired stream segments and two phosphorus impaired lakes, Two Rivers Lake and Platte Lake. These studies identify known and likely sources of the pollutants and reductions needed to bring these waterbodies back into compliance with state standards. Previous TMDLs were developed for Little Rock Lake for nutrients in 2012, the Upper Mississippi River for bacteria, and Little Rock Creek for DO, nitrate, temperature, and fish bioassessment impairments.

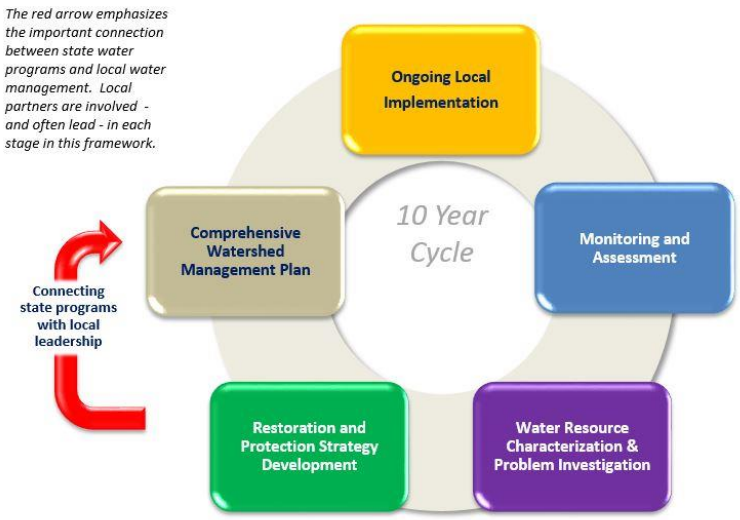
To assess the causes of aquatic life impairments in the assessed streams, a stressor identification (SID) study was completed by the MPCA in 2019. The study noted potential stressors found throughout the MRSW: habitat degradation due to livestock access to the stream and riparian corridors; stressful riparian land uses (i.e. uses causing erosion); and dams and improperly installed culverts, which can

create a loss of stream connectivity. The study recommends that wherever possible, work should be done cooperatively with landowners to reduce livestock access to streams and/or reduce erosion issues. The SID study revealed some systemic issues in the MRSW, for example, streamflow alteration was found to be the cause of at least six aquatic life impairments.

Restoration strategies in the MRS WRAPS focus on addressing *E. coli* bacteria impairments in several stream reaches, eutrophication and excess nutrients in lakes, and biological impairments summarized in the SID study. Strategies to address sources of *E. coli* to streams include feedlot management practices, manure management, septic system maintenance and upgrades, pasture management, and stormwater control measures in urbanized areas. Restoration practices for phosphorus reduction to impaired lakes include internal lake and shoreline management, cover crops and living cover, tillage management, nutrient and fertilizer management, buffers, pasture management, and septic system maintenance and upgrades. Strategies to address biologically impaired streams were developed based on recommendations and assessments from the SID study and include activities such as re-meandering streams using natural design principals, reconnecting flood plains, dam and culvert removal or modification, and instream and riparian habitat creation. All waters in the MRSW require protection in some capacity, including those listed as impaired and those with insufficient data. However, to better focus the overall implementation of the WRAPS and future planning efforts, it is important to prioritize areas for protection. Protection considerations were given for high value and high quality waters and waters at risk of impairment.

What is the WRAPS Report?

Minnesota has adopted a watershed approach to address the state's 80 major watersheds. The Minnesota watershed approach incorporates **water quality assessment, watershed analysis, public participation, planning, implementation, and measurement of results** into a 10-year cycle that addresses both restoration and protection.



The watershed approach process facilitates a more cost-effective and comprehensive characterization of multiple waterbodies and overall watershed health, including both protection and restoration efforts. A key aspect of this effort is to develop and utilize watershed-scale models and other tools to identify strategies for addressing point and nonpoint source pollution that will cumulatively achieve water quality targets. For nonpoint source pollution, this report informs local planning efforts, but ultimately the local partners decide what work will be included in their local plans. This report also serves as the basis for addressing the U.S. Environmental Protection Agency's (EPA) Nine Minimum Elements of watershed plans, to help qualify applicants for eligibility for Clean Water Act Section 319 implementation funds.

As part of the watershed approach, the Minnesota Pollution Control Agency (MPCA) developed a process to identify and address threats to water quality in each of these major watersheds. This process is called Watershed Restoration and Protection Strategy (WRAPS) development. WRAPS reports have two parts: impaired waters have strategies for restoration, and waters that are not impaired have strategies for protection. Waters not meeting state standards are listed as impaired and TMDL studies are developed for them. The findings and the outcomes from the TMDLs are incorporated into WRAPS.

Purpose	• Support local working groups and jointly develop scientifically-supported restoration and protection strategies to be used for subsequent implementation planning • Summarize watershed approach work done to date including the following reports: • *Mississippi River-Sartell Watershed Monitoring and Assessment Report* • *Mississippi River-Sartell Watershed Biotic Stressor Identification* • *Mississippi RIver-Sartell Watershed Total Maximum Daily Load* • *Little Rock Lake Excess Nutrients Total Maximum Daily Load and Implementation Plan* • *Upper Mississippi River Basin Bacteria Total Maximum Daily Load and Implementation Plan* • *Little Rock Creek Total Daily Maximum Load and Implementation Plan*
Scope	• Impacts to aquatic recreation and impacts to aquatic life in streams and lakes • Groundwater and drinking water impacts
Audience	• Local working groups (local governments, SWCDs, watershed management groups, etc.) • State agencies (MPCA, DNR, BWSR, etc.)

1. Watershed background and description

The MRSW spans approximately 1,020 square miles in central Minnesota. The watershed is composed of portions of Morrison, Benton, and Stearns counties and also contains smaller sections of Crow Wing, Mille Lacs, and Todd counties.

Crane Meadows National Wildlife Refuge offers ideal habitat for many wildlife species within the watershed (most notably Sandhill Cranes) while helping to protect water quality. Photo courtesy of Beau Liddell, www.ImagesByBeaulin.com

The MRSW lies within the southern portion of the Northern Lakes and Forests ecoregion, which is dominated by nutrient-poor glacial soils, extensive sandy outwash plains, and broad lacustrine basins, and the northern portion of the North Central Hardwood Forests ecoregion, which is comprised of mainly rolling glacial till plains, lacustrine basins, outwash plains, and rolling moraines. The sand plain regions located along the Mississippi River are some of the most intensively cultivated lands within the watershed. The high infiltration rates of the soils within the sand plain regions result in groundwater that is highly sensitive to pollution from surface sources. The diverse surface water resources within this watershed provide important recreational opportunities and economic benefits to citizens and visitors.

Land use is predominantly agricultural (corn, soybean, and alfalfa crops), followed by forested, grassland and pasture, and wetlands (Table 1 and Figure 1). Other crops in the watershed include dry beans, potatoes, rye, spring wheat, strawberries, and oats (CDL 2018). Agricultural land is highly irrigated in the MRSW, with several high capacity wells located in the central portion of the watershed. Areas of forests and wetlands are clustered in the northern portion of the watershed in Crow Wing County and the northeast corner of Morrison County. Forest and wetlands are also found clustered around lakes and the headwaters of streams. The Crane Meadows National Wildlife Refuge, an important stop for migratory birds, is an approximately 13,500-acre refuge located in Morrison County near Little Falls, Minnesota. The refuge was established in 1992 and features a unique sand plain wetland complex that provides critical habitat for waterfowl, shorebirds, sandhill cranes, and many other species.

Table 1. Land cover (Cropland Data Layer 2018).

Land cover	Percent
Corn & Soybeans	26%
Forest	21%
Grass/Pasture	18%
Wetlands	14%
Alfalfa	9%
Developed	6%
Other Crops	3%
Open Water	3%

Only 6% of the watershed is developed for urban uses. Major developed areas include the city of Sartell along the main stem Mississippi River in the southern portion of the watershed, and other cities including Rice, Royalton, Pierz, Avon, and Albany. The city of Saint Cloud is located downstream of the watershed along the Mississippi River. The Mississippi River serves as the sole drinking water supply for the city of St. Cloud and a drinking water supply for the Twin Cities Metro Area.

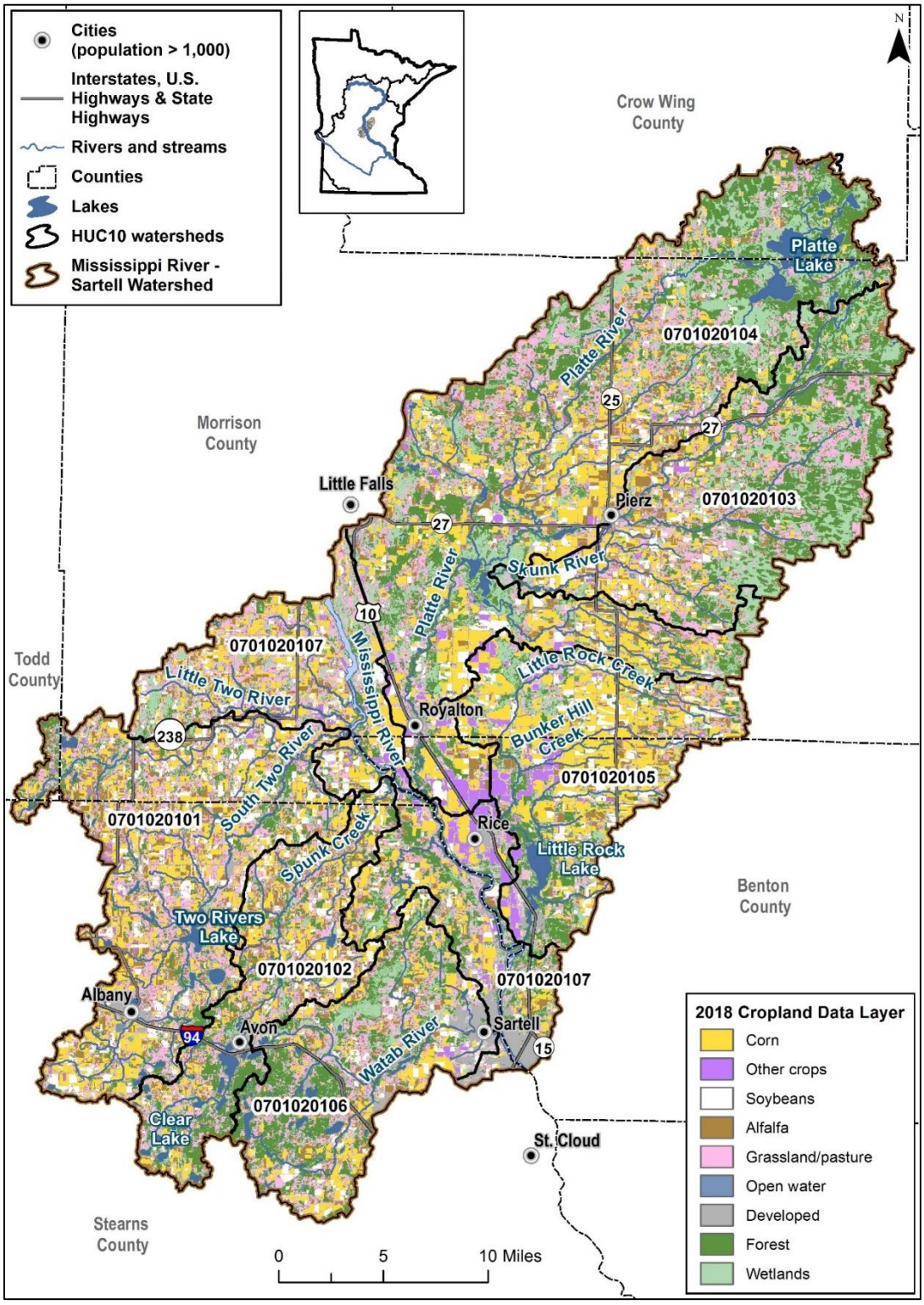


Figure 1. Land cover in the MRSW (Cropland Data Layer 2018).

2. Watershed conditions

The Mississippi River is the main body of water in the MRSW. Bisecting the watershed, the Mississippi River enters the watershed in Morrison County and flows south through the center of the MRSW and the drainage areas of several of its tributaries. The majority of these tributaries are characterized by flowing streams with riffle habitat. Lakes are predominantly located in the northeastern and southwestern portions of the watershed. The main stem Mississippi River experiences one of its largest change in topography in the state of Minnesota as it flows through the MRSW, dropping six and a half feet per river mile.

Water quality and conditions of the MRSW are important to the downstream receiving waters and drinking water supplies for Saint Cloud and the Twin Cities. Several of the waterbodies within the MRSW are not meeting water quality standards and are impaired (Figure 2). Despite these impairments, several streams and lakes are demonstrating improving trends in water clarity in the watershed.

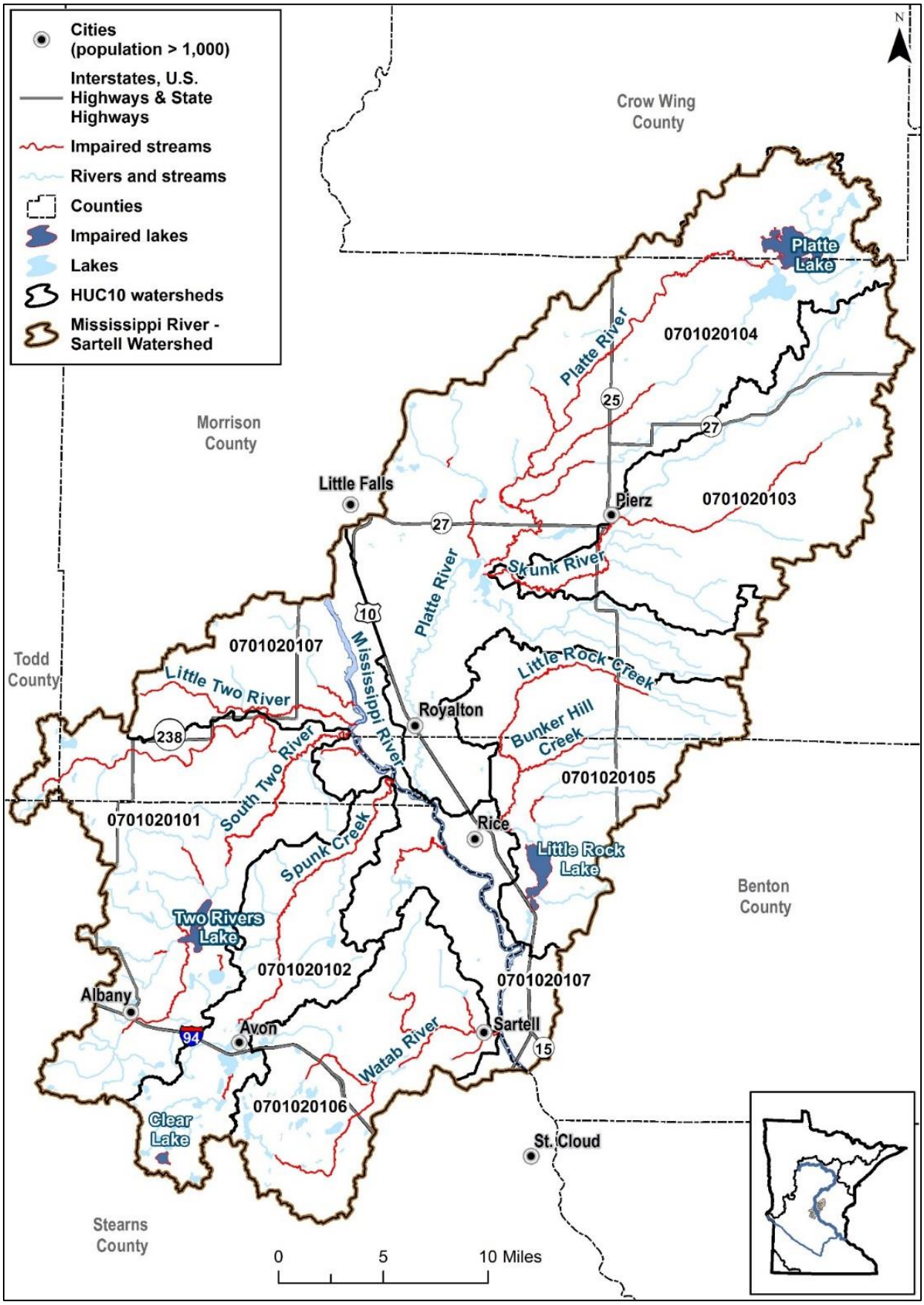


Figure 2. Impaired waters in the MRSW.

2.1. Condition status

Beginning in 2016, the MPCA undertook an IWM effort of the surface waters in the MRSW. The MPCA assesses the water quality of streams and lakes based on each waterbody's ability to support a variety of uses, including aquatic life, aquatic recreation, drinking water, and aquatic consumption. Data from waterbodies are compared to state standards and targets. Waterbodies that do not meet the targets are considered to be impaired and require restoration; waterbodies that meet targets are considered to be fully supporting and are the focus of protection efforts. Waters that are not yet assessed continue through a process of data collection and evaluation and can be candidates for protection work. The Mississippi River–Sartell Watershed Monitoring and Assessment Report (MPCA 2019a) summarizes each waterbody's ability to support aquatic life (e.g., fish and macroinvertebrates) and aquatic recreation (e.g., fishing and swimming). Findings from this report are summarized below.

Some of the waterbodies in the MRSW are impaired by mercury; however, this report does not cover toxic pollutants. For more information on mercury impairments, see the statewide mercury TMDL at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/statewide-mercury-tmdl-pollutant-reduction-plan.html.

2.1.1. Streams

The *Mississippi River - Sartell Monitoring and Assessment Report* (MPCA 2019a) evaluated 50 stream reaches for aquatic recreation and/or aquatic life within the MRSW (Table 2). Sixteen of those reaches are not meeting water quality standards for aquatic life use, and 24 reaches were found not to meet the aquatic recreational use standard. Numerous stream reaches did not have sufficient data to be assessed for beneficial uses.

Success Story: Upper Mississippi River Assessment and Delisting

Separate from the IWM effort, the MPCA began monitoring large rivers in 2013, starting with the Upper Mississippi River from its headwaters to St. Anthony Falls in Minneapolis. Biology and chemistry data were collected in 2013 and 2014 as part of the Upper Mississippi River Assessment to determine if the river was meeting state water quality standards. The segment of the Mississippi River, 07010201-631, which runs from the confluence with the Swan River just south of Little Falls to the confluence with the Sauk River in Sauk Rapids, was found to be fully supporting of aquatic life use (fish and macroinvertebrates) and aquatic recreation.

Prior to the large river assessment, this Mississippi River segment was listed on the Minnesota 303(d) impaired waters list due to elevated levels of *E. coli* bacteria. After the completion of the assessment, this Mississippi River segment was determined to be meeting aquatic life and recreation standards, and was delisted for *E. coli* bacteria in 2016. Practices implemented by partners within and upstream of the MRS watershed greatly helped contribute to this success story. The Upper Mississippi River Monitoring and Assessment study is available here: https://www.pca.state.mn.us/featured/upper-mississippi-river-what-protect-what-fix.

Table 2. Assessment status of stream reaches in the MRSW.

HUC-10 subwatershed	AUID (Last 3 digits)	Stream	Reach description	Aquatic life indicators									Aq. life use	Aq. rec. use
				Fish Index of Biotic Integrity (IBJI)	Macroinvertebrate IBI	Dissolved oxygen	Turbidity/TSS	Secchi tube (transparency)	Chloride	pH	Ammonia	Eutrophication		Bacteria
Two River (0701020101)	523	Two River	North & South Two R to Mississippi R	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	SUP	IMP
	532	South Two River	Schwinghammer Lk to Two River Lk	-	-	EXS	IF	MTS	MTS	MTS	-	IF	IMP	SUP
	524	North Two River	Headwaters (Mary Lk 77-0019-00) to South Two R	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IF	SUP	IMP
	542	South Two River	T125 R31W S21, south line to T125 R31W S23, east line	-	-	MTS	-	-	-	MTS	-	-	-	IMP
	580	Unnamed Creek	Unnamed Cr to Two Rivers Lk	-	-	IF	MTS	IF	MTS	MTS	-	IF	IF	IMP
	610	Unnamed Creek	Pelican Lk to Little Mud Lk outlet	-	-	-	MTS	MTS	-	-	-	MTS	IF	IF
	612	Unnamed Creek	Unnamed Cr to Unnamed Cr	-	-	MTS	IF	IF	MTS	MTS	-	IF	IF	IMP
	613	Krain Creek	Unnamed Cr to Unnamed Cr	MTS	MTS	MTS	IF	MTS	MTS	MTS	IF	IF	SUP	IMP
	628	Unnamed Creek	Headwaters to Pelican Lk	-	-	-	IF	MTS	-	-	-	IF	IF	IMP
	632	Unnamed Creek	Headwaters to Unnamed Cr	NA	MTS	IF	IF	IF	-	IF	-	IF	SUP	-
	643	South Two River	River St to Two R	EXS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IF	IMP	IMP

HUC-10 subwatershed	AUID (Last 3 digits)	Stream	Reach description	Aquatic life indicators									Aq. life use	Aq. rec. use
				Fish Index of Biotic Integrity (IB)I)	Macroinvertebrate IBI	Dissolved oxygen	Turbidity/TSS	Secchi tube (transparency)	Chloride	pH	Ammonia	Eutrophication		Bacteria
Spunk Creek (0701020102)	525	Spunk Creek	Lower Spunk Lk to Mississippi R	MTS	MTS	MTS	IF	MTS	MTS	MTS	MTS	IF	SUP	IMP
	561	Spunk Branch	Kalla Lk to Upper Spunk Lk	-	-	NA	MTS	MTS	MTS	MTS	-	MTS	IF	IMP
Skunk River (0701020103)	520	Skunk River	Headwaters (Skunk Lk 49-0007-00) to Hillman Cr	MTS	MTS	IF	IF	IF	-	IF	IF	IF	SUP	-
	521	Skunk River	Hillman Cr to Platte R	MTS	MTS	MTS	IF	IF	MTS	MTS	MTS	IF	SUP	IMP
	633	Unnamed Creek	Unnamed Cr to Skunk R	MTS	MTS	IF	IF	IF	-	IF	IF	IF	SUP	-
	636	Unnamed Creek	Headwaters to Hillman Cr	MTS	MTS	IF	IF	IF	-	IF	IF	IF	SUP	-
	637	Unnamed Creek	Unnamed Cr to Skunk R	MTS	MTS	IF	IF	IF	-	IF	IF	IF	SUP	-
	639	Hillman Creek	370th Ave to Skunk R	MTS	MTS	MTS	MTS	MTS	MTS	IF	MTS	IF	SUP	IMP
Platte River (0701020104)	507	Platte River	Headwaters (Platte Lk 18-0088-00) to Skunk R	EXS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IMP	IMP
	545	Platte River	Unnamed Cr (above RR bridge) to Mississippi R	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IF	SUP	IF
	546	Platte River	Rice-Skunk Lakes Dam to Unnamed Cr (above RR bridge)	MTS	-	IF	IF	IF	-	IF	IF	IF	SUP	-
	618	Rice Creek	Pelkey Lk to Rice Lk	MTS	EXS	IF	IF	IF	-	IF	IF	IF	IMP	-

HUC-10 subwatershed	AUID (Last 3 digits)	Stream	Reach description	Aquatic life indicators									Aq. life use	Aq. rec. use
				Fish Index of Biotic Integrity (IB)I)	Macroinvertebrate IBI	Dissolved oxygen	Turbidity/TSS	Secchi tube (transparency)	Chloride	pH	Ammonia	Eutrophication		Bacteria
	621	Unnamed Creek	Unnamed Cr to Unnamed Cr	MTS	MTS	IF	IF	IF	-	IF	IF	IF	SUP	-
	622	Unnamed Creek	Unnamed Ditch to Unnamed Cr	MTS	NA	IF	IF	IF	-	IF	-	IF	SUP	-
	634	Unnamed Creek	Unnamed Cr to Platte R	EXS	MTS	IF	IF	IF	-	IF	IF	IF	IMP	-
Platte River (0701020104 (continued)	645	Little Mink Creek	-94.119 46.014 to Platte R	MTS	EXS	IF	IF	IF	-	IF	IF	IF	IMP	-
	646	Big Mink Creek	Headwaters to 235th Ave	-	-	EXS	MTS	MTS	-	IF	-	IF	IF	IMP
	647	Big Mink Creek	235th Ave to Platte R	MTS	EXS	-	-	-	-	-	-	-	IMP	-
	651	Unnamed Creek	-94.26 46.016 to Unnamed Cr	EXS	EXS	IF	IF	IF	-	IF	IF	IF	IMP	-
Little Rock Creek (0701020105)	511	Bunker Hill Creek	T38 R30W S6, north line to Little Rock Cr	EXS	EXS	MTS	MTS	IF	MTS	IF	MTS	IF	IMP	IF
	512	Bunker Hill Creek	Headwaters to T39 R30W S31, south line	-	-	IF	-	-	IF	IF	IF	IF	IF	-
	539	Zuleger Creek	Unnamed Cr to Unnamed Cr	EXS	EXS	IF	IF	IF		IF	IF	IF	IMP	-
	541	Zuleger Creek	Unnamed Cr to Little Rock Lk	-	-	IF	IF	IF	IF	IF	IF	IF	IF	IF
	547	Little Rock Creek	Headwaters to T39 R30W S27, north line	-	-	IF	-	-	IF	IF	IF	-	IF	-

HUC-10 subwatershed	AUID (Last 3 digits)	Stream	Reach description	Aquatic life indicators									Aq. life use	Aq. rec. use
				Fish Index of Biotic Integrity (IBI))	Macroinvertebrate IBI	Dissolved oxygen	Turbidity/TSS	Secchi tube (transparency)	Chloride	pH	Ammonia	Eutrophication		Bacteria
	550	Sucker Creek	Mayhew Cr to Little Rock Lk	-	-	IF	IF	IF	IF	IF	IF	IF	IF	IF
	588	Unnamed creek (Little Rock Creek Tributary)	T38 R31W S4, west line to Unnamed Cr	-	-	IF	-	-	IF	IF	IF	-	IF	-
	603	Unnamed Creek	Unnamed Cr to T39 R31W S28, east line	-	-	IF	-	-	IF	IF	IF	-	IF	-
Little Rock Creek (0701020105) (continued)	652	Little Rock Creek	T39 R30W S22, south line to T38 R31W S23, west line	EXS	MTS	EXS	IF	MTS	IF	MTS	MTS	IF	IMP	-
	653	Little Rock Creek	T39 R31W S22, east line to T38 R31W S28, east line	EXS	EXS	EXS	IF	IF	MTS	MTS	MTS	MTS	IMP	IMP
Watab River (0701020106)	528	Watab River	Rossier Lk to Mississippi R	EXS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IMP	IMP
	529	Watab River, North Fork	Headwaters (Stump Lk 73-0091-00) to S Fk Watab R	MTS	MTS	MTS	MTS	IF	MTS	MTS	IF	MTS	SUP	IMP
	537	County Ditch 12	Unnamed Cr to Watab R	MTS	MTS	MTS	MTS	MTS	MTS	MTS	IF	MTS	SUP	IMP
	554	Watab River, South Fork	Little Watab Lk to Watab R	EXS	MTS	MTS	MTS	MTS	MTS	MTS	IF	MTS	IMP	IMP
	564	County Ditch 13	Bakers Lk to Watab R	-	-	EXS	MTS	MTS	MTS	MTS	-	MTS	IMP	IMP
	616	County Ditch 16	Headwaters to Watab R	-	-	IF	IF	IF	MTS	MTS	-	MTS	IF	IMP
	516	Little Two River	Headwaters to Mississippi R	MTS	MTS	MTS	MTS	MTS	-	IF	IF	MTS	SUP	IMP

HUC-10 subwatershed	AUID (Last 3 digits)	Stream	Reach description	Aquatic life indicators									Aq. life use	Aq. rec. use
				Fish Index of Biotic Integrity (IB)I)	Macroinvertebrate IBI	Dissolved oxygen	Turbidity/TSS	Secchi tube (transparency)	Chloride	pH	Ammonia	Eutrophication		Bacteria
City of Sartell-Mississippi River (0701020107)	569	Hazel Creek	Unnamed Ditch to Mississippi R	EXS	MTS	IF	IF	IF	-	IF	IF	IF	IMP	-
	630	Hay Creek	Unnamed Cr to Mississippi R	MTS	MTS	MTS	IF	MTS	-	IF	IF	IF	SUP	IMP
	649	Stony Creek	-94.31 45.728 to Mississippi R	MTS	MTS	NA	MTS	MTS	MTS	MTS	IF	IF	SUP	IMP

Abbreviations for Indicator Evaluations: - = No Data, **NA** = Not Assessed, **IF** = Insufficient Information, **MTS** = Meets criteria, **EXS** = Exceeds criteria, potential impairment.

Abbreviations for Use Support Determinations: **NA** = Not Assessed, **IF** = Insufficient Information, **IMP** = does not meet the water quality standard and is therefore impaired, **SUP** = Found to meet the water quality standard.

2.1.2. Lakes

The *Mississippi River - Sartell Monitoring and Assessment Report* (MPCA 2019a) evaluated 51 lakes for aquatic recreation within the MRSW. (Table 3). Three of those lakes were found not to meet the aquatic recreational use standard and two were found not to meet the aquatic life use standard. Numerous lakes did not have sufficient data to assess for this use.

Table 3. Assessment status of lakes in the MRSW.

HUC-10 subwatershed	Lake ID	Lake	Assessment method	Aquatic life use	Aquatic recreation use
Two River (0701020101)	73-0118-00	Pelican	Deep Lake	SUP	SUP
	73-0136-00	Pine	Deep Lake	IF	SUP
	73-0138-00	Two Rivers	Deep Lake	IMP	IMP
	73-0177-00	North	Shallow Lake	IF	IF
	73-0190-00	Bear	Deep Lake	IF	IF
	73-0191-00	Fish	Shallow Lake	IF	IF
	73-0204-00	Gravel	Deep Lake	IF	IF
	73-0330-00	Unnamed	Shallow Lake	IF	IF
	49-0140-00	Cedar	Deep Lake	SUP	SUP
	77-0019-00	Mary	Deep Lake	SUP	IF
Spunk Creek (0701020102)	73-0097-00	Kreigle	Deep Lake	IF	SUP
	73-0098-00	Pitts	Shallow Lake	IF	SUP
	73-0099-00	Minnie	Deep Lake	IF	SUP
	73-0100-00	Kalla	Deep Lake	IF	SUP
	73-0117-00	Big Spunk	Deep Lake	SUP	SUP
	73-0122-00	Ochotto	Deep Lake	IF	SUP
	73-0123-00	Lower Spunk	Deep Lake	SUP	SUP
	73-0127-00	Linneman	Shallow Lake	IF	SUP
	73-0128-00	Middle Spunk	Deep Lake	SUP	SUP
	73-0129-00	Minnie	Shallow Lake	IF	SUP
	73-0166-00	Koop	Deep Lake	IF	SUP
	73-0172-00	Clear	Deep Lake	IMP	SUP
Platte River (0701020104)	49-0020-00	Coon	Shallow Lake	IF	IF
	49-0025-00	Rice	Shallow Lake	IF	IF
	49-0026-00	Skunk	Shallow Lake	IF	IF
	49-0030-00	Pelkey	Shallow Lake	IF	IF
	49-0033-00	Popple	Shallow Lake	IF	IF
	18-0008-00	Twenty Two	Shallow Lake	IF	IF
	18-0009-00	Erskine	Shallow Lake	SUP	IF
	18-0011-00	Bass	Deep Lake	IF	IF
	18-0014-00	Bulldog	Deep Lake	IF	IF
	18-0016-00	Rock	Deep Lake	IF	IF
	18-0088-00	Platte	Deep Lake	SUP	IMP
	18-0422-00	Unnamed	Shallow Lake	IF	IF

HUC-10 subwatershed	Lake ID	Lake	Assessment method	Aquatic life use	Aquatic recreation use
	49-0005-00	Peavy	Deep Lake	SUP	SUP
	49-0015-00	Long	Deep Lake	SUP	SUP
	49-0016-00	Sullivan	Deep Lake	SUP	SUP
	49-0019-00	Round	Deep Lake	SUP	SUP
	49-0024-00	Pierz	Deep Lake	SUP	SUP
Little Rock Creek (0701020105)	05-0013-00	Little Rock	Shallow Lake	IF	IMP
Watab River (0701020106)	73-0064-00	Kraemer	Deep Lake	IF	IF
	73-0070-00	Watab	Deep Lake	IF	SUP
	73-0071-00	Lower Watab	Shallow Lake	IF	SUP
	73-0072-00	Rossier	Deep Lake	IF	IF
	73-0092-00	Sagatagan	Deep Lake	IF	IF
	73-0096-00	Schuman	Deep Lake	IF	SUP
	73-0101-00	Schmid	Deep Lake	IF	SUP
	73-0102-00	Big Watab	Deep Lake	SUP	SUP
	73-0104-00	Island	Deep Lake	SUP	SUP
	73-0125-00	Achman	Shallow Lake	IF	SUP
	73-0126-00	Anna	Shallow Lake	IF	SUP

Abbreviations for Use Support Determinations: **IF** = Insufficient Information, **IMP** = does not meet the water quality standard and is therefore impaired, **SUP** = Found to meet the water quality standard.

2.2. Water quality trends

The Mississippi River - Sartell Monitoring and Assessment Report (MPCA 2019a) evaluated long term trends in water clarity as well as annual nitrogen, phosphorus and sediment pollutant loads calculated as part of the Watershed Pollutant Load Monitoring Network (WPLMN). WPLMN is a long-term statewide river monitoring network initiated in 2007 and designed to obtain pollutant load information from 199 river monitoring sites throughout Minnesota. The program utilizes state and federal agencies, universities, local partners, and MPCA staff to collect water quality and flow data to calculate nitrogen, phosphorus, and sediment pollutant loads.

WLPMN monitoring sites span three ranges of scale:

- **Basin** – major river main stem sites along the Mississippi, Minnesota, Rainy, Red, Des Moines, Cedar and St. Croix rivers
- **Major Watershed** – tributaries draining to major rivers with an average drainage area of 1,350 square miles (8-digit HUC scale)
- **Subwatershed** – major branches or nodes within major watersheds with average drainage areas of approximately 300-500 square miles

In addition, a pre- and post- implementation water quality analysis was completed on Little Rock Lake and on three streams in the Little Rock Lake watershed for the purposes of this WRAPS report. This

analysis evaluated progress that has been made since data were collected for the Little Rock Lake watershed TMDL in 2006 through 2008.

Summaries of these water quality trend efforts are provided in the following subsections.

2.2.1. Long-term trends

Recent data analysis conducted by the MPCA in the *Mississippi River–Sartell Monitoring and Assessment Report* (2019a) indicates increasing water clarity (measured by Secchi tube - streams, Secchi disc - lakes) trends at the Mississippi River near Royalton, and Spunk Creek downstream of Spunk Lake while no stream sites had decreasing water clarity. Ten lakes within the watershed were also found to have increasing trends in water clarity: Cedar, Kalla, Sullivan, Pierz, Rossier, Big Watab, Pelican, Lower Spunk, Middle Spunk, and Pine lakes; four lakes were found to have declining trends in water clarity: Platte, Long, Kraemer, and Linneman. Table 4 provides a summary of these trend analysis findings.

Table 4. Long-term water clarity trends in the MRSW. Information provided by MPCA 2019a.

	Streams	Lakes
Number of sites with increasing trend	3	10
Number of sites with decreasing trend	0	4
Number of sites with no trend	4	15

2.2.2. Watershed Pollutant Load Monitoring Network

There are four WPLMN sites located in the MRSW (Table 5 and Figure 3). The Mississippi River at Royalton and Sartell are “basin” sites, which are monitored year-round, while the Platte River site is a “subwatershed” site and monitored seasonally from ice out through October 31. Approximately 25 to 35 water quality samples are collected at each WPLMN monitoring site per year. Annual pollutant loads are calculated for the basin sites, with results shown below in flow weighted mean concentration (FWMC) and total mass for total suspended solids (TSS), total phosphorus (TP), and nitrate plus nitrite nitrogen (NO3+NO2-N) for the two basin sites (Figure 4 and Figure 5). In general, FWMCs for all parameters are lower for the MRSW than for watersheds in southern and northwestern Minnesota (Figure 6).

The Mississippi River at Sauk Rapids WPLMN site (W15009002) is located just downstream of the MRSW. As such, water quality data and trends evaluated at this site are representative of the entire MRSW. A recent trends analysis by the MPCA WPLMN staff of water quality samples at the Mississippi River at Sauk Rapids sampling location found a significant increase in instream nitrate+nitrite concentrations, and a significant decrease in instream phosphorus concentrations from 2008 to 2018. There was no significant trend in TSS.

Table 5. WPLMN sites in the MRSW.

Site type	Stream name	DNR/MPCA site ID
Basin	Mississippi River at Royalton, MN	E15001002
Basin	Mississippi River at Sartell	W15009003
Basin	Mississippi River at Sauk Rapids	W15009002
Subwatershed	Platte River near Royalton	H15030001

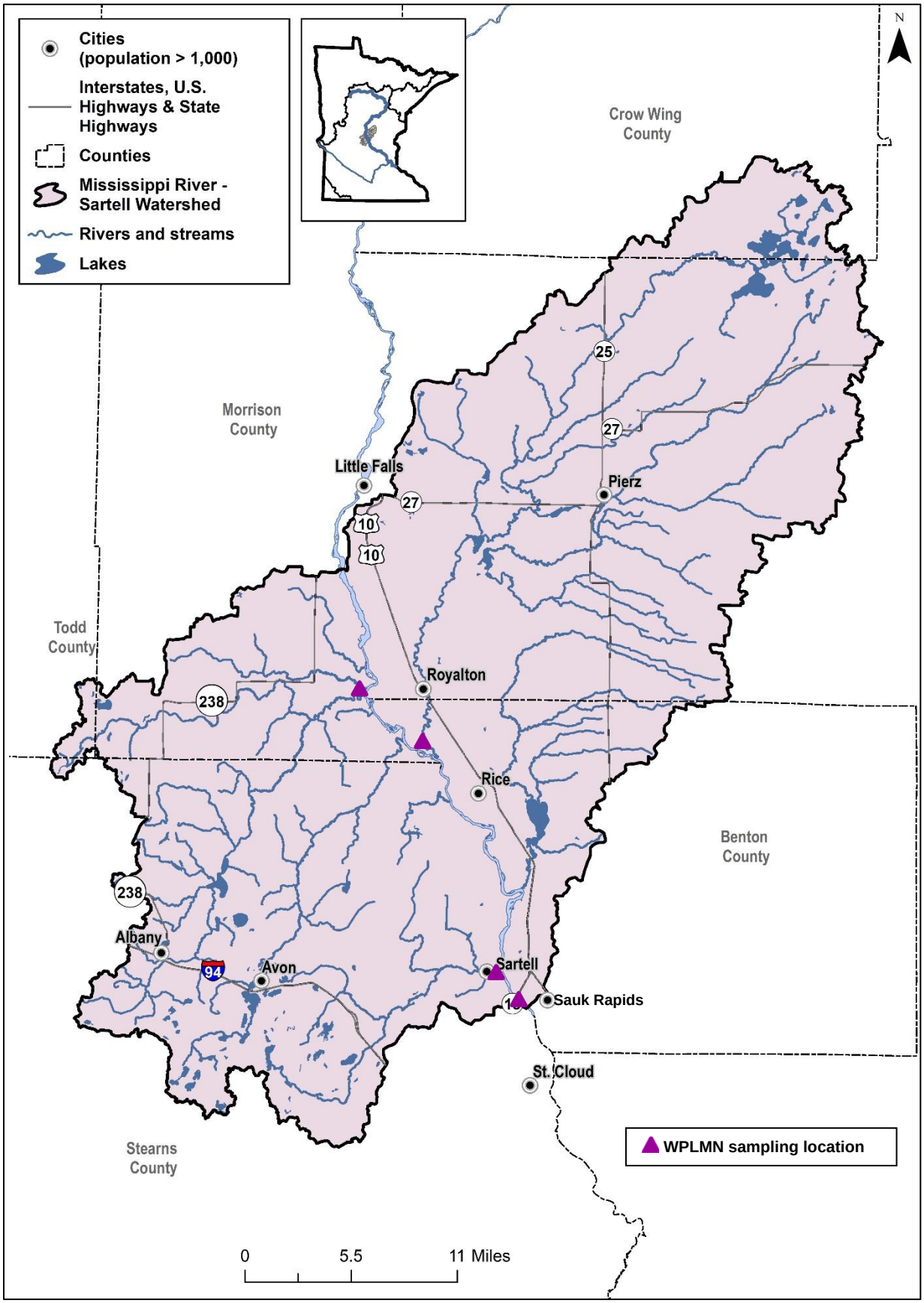


Figure 3. WPLMN sampling locations.

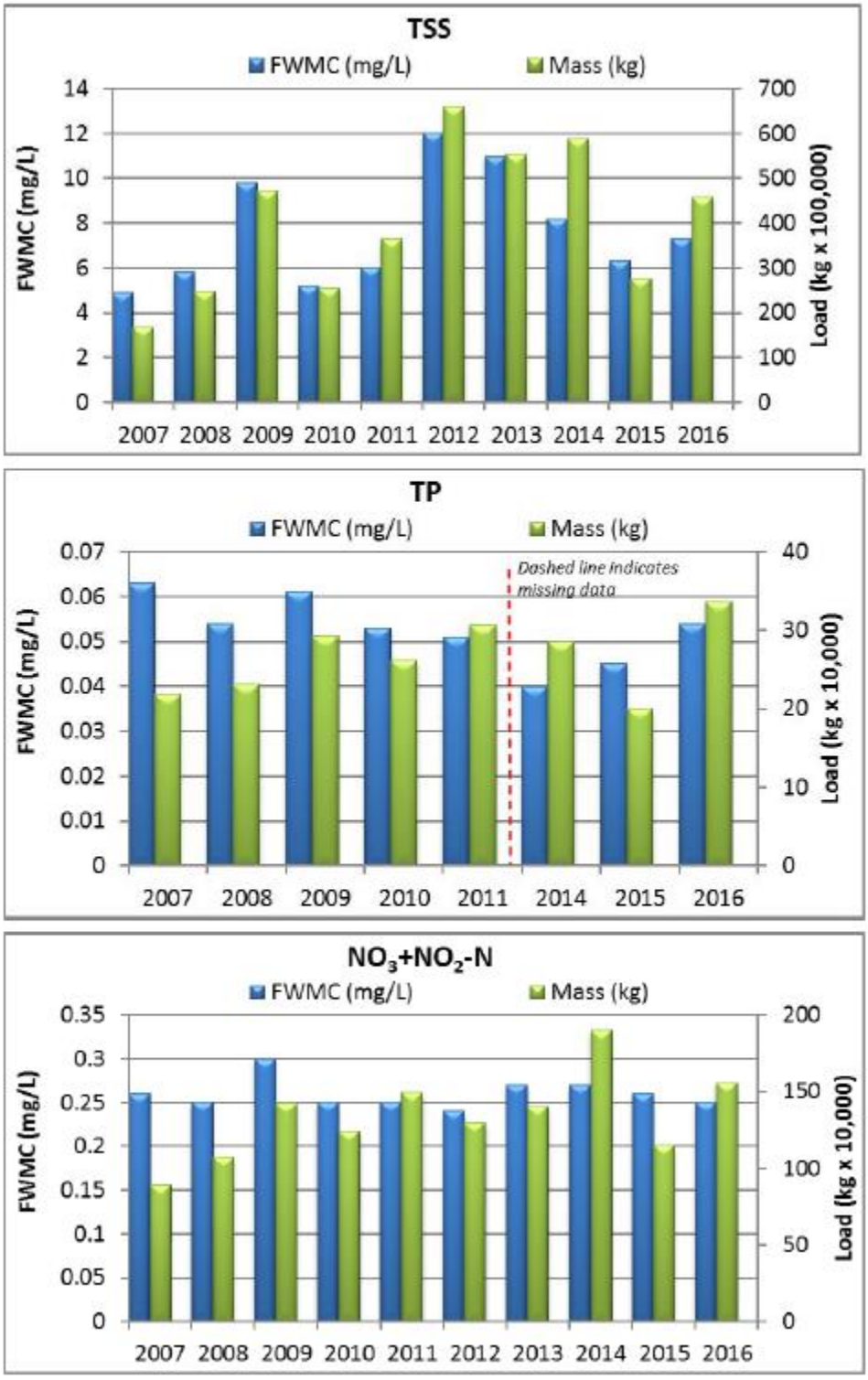


Figure 4. TSS, TP, and NO_3+NO_2-N flow weighted mean concentrations and loads for the Mississippi River at Royalton, Minnesota, 2007-2016 (Figure 31 in the monitoring and assessment report, MPCA 2019a).

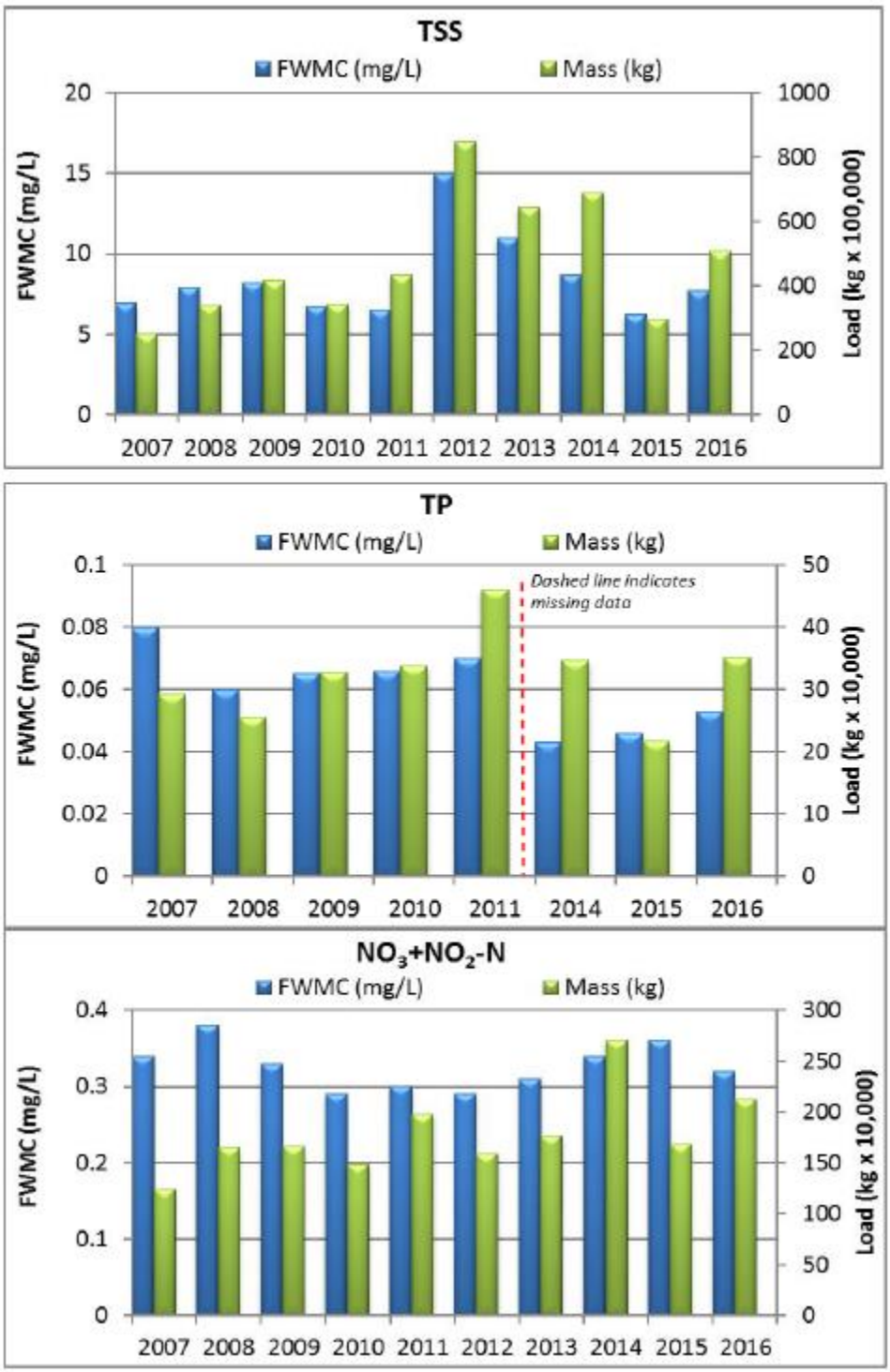


Figure 5. TSS, TP, and NO3+NO2-N flow weighted mean concentrations and loads for the Mississippi River at Sartell, Minnesota, 2007-2016 (Figure 32 in the monitoring and assessment report, MPCA 2019a).

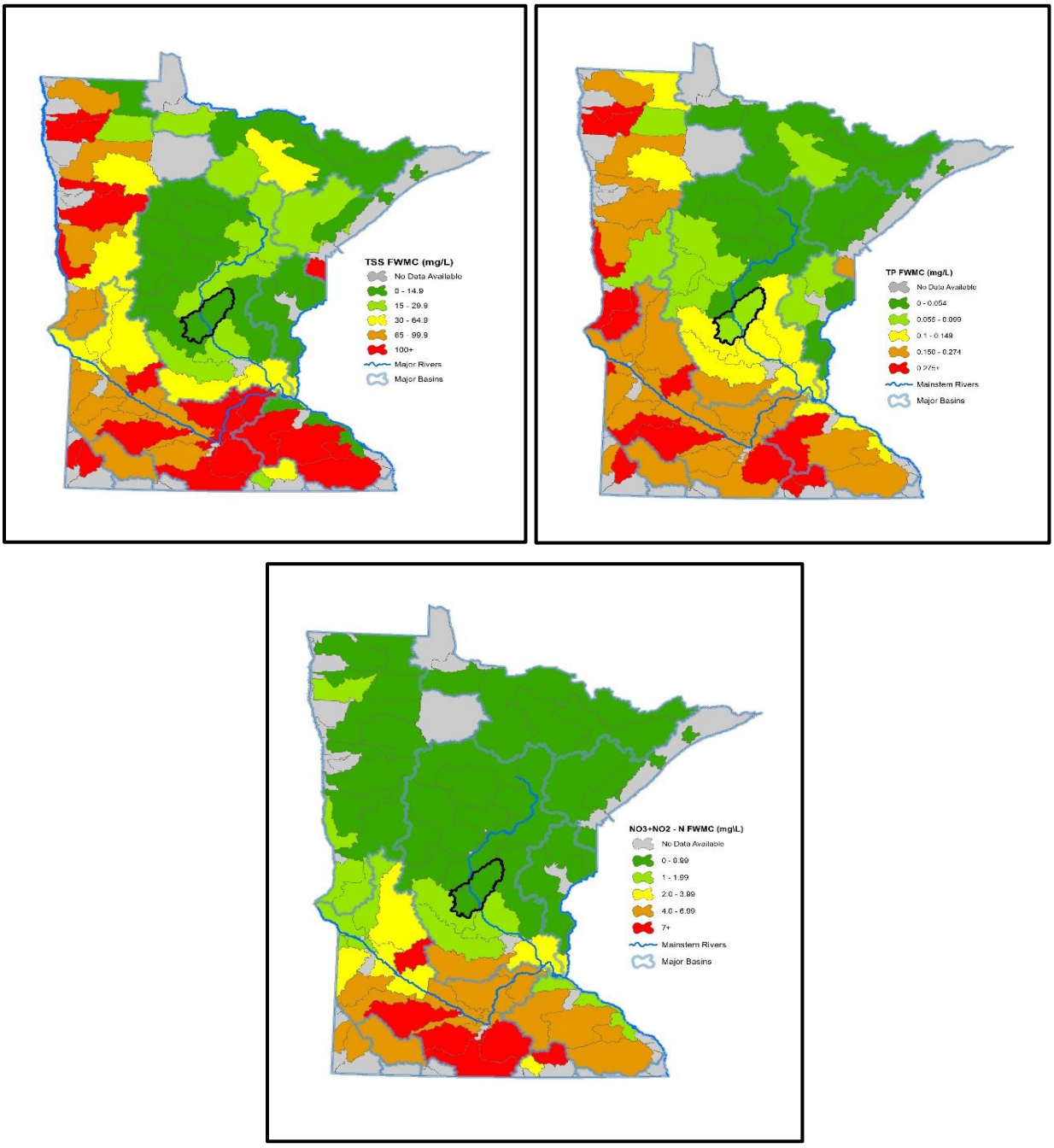


Figure 6. 2007-2016 Average annual TSS, TP, and NO3-NO2-N flow weighted mean concentrations by major watershed (Figure 30 in the monitoring and assessment report, MPCA 2019a).

2.2.3. Little Rock Lake Watershed: Pre- and post-implementation periods

A water quality analysis was completed on Little Rock Lake and on three streams in the Little Rock Lake watershed (Figure 7) to evaluate progress that has been made since data were collected for the Little Rock Lake watershed TMDL in 2006 through 2008 (Benton SWCD 2015). A fourth stream, Zuleger Creek, was not included in the analysis because measuring its flow is difficult and as a result water quality data were not collected or available for comparison.

Data collected from 2006 through 2008 are considered “pre-implementation,” and data collected from 2016 through 2018 are considered “post-implementation.” Data provided by Benton SWCD for 2016 through 2018 were combined with data from the MPCA’s Environmental Quality Information System (EQuIS) database from 2006 through 2008 and 2018.

Benton and Morrison SWCDs have been working cooperatively to promote and install best management practices (BMPs) resulting in the installation of over 85 (as of 2018) BMPs since the TMDL was completed for excess nutrients in 2012 (Figure 8). These 85 practices work to reduce and filter watershed runoff through practices such as filter strips and wetland restorations, reduce erosion and sedimentation through practices such as cover crops and water and sediment control basins, and reduce the amount of nutrients and fecal bacteria reaching surface waters through manure and nutrient management practices and septic system replacements. In addition to these 85 BMPs, the Minnesota Buffer Law requires 700 parcels in the watershed (598 in Benton County and 102 in Morrison County) to maintain a permanent vegetated buffer along public waters and drainage systems.

Differences between the pre- and post-implementation periods cannot be solely attributed to BMP implementation because factors other than implementation of BMPs, such as climate and land use changes and river flow also influence water quality. Effective BMP implementation, however, likely made positive contributions between the pre-implementation and post-implementation periods. Installed BMP are provided in Figure 8.

Severe Blue-Green algae bloom on Little Rock Lake 2007. Photo from Benton SWCD.

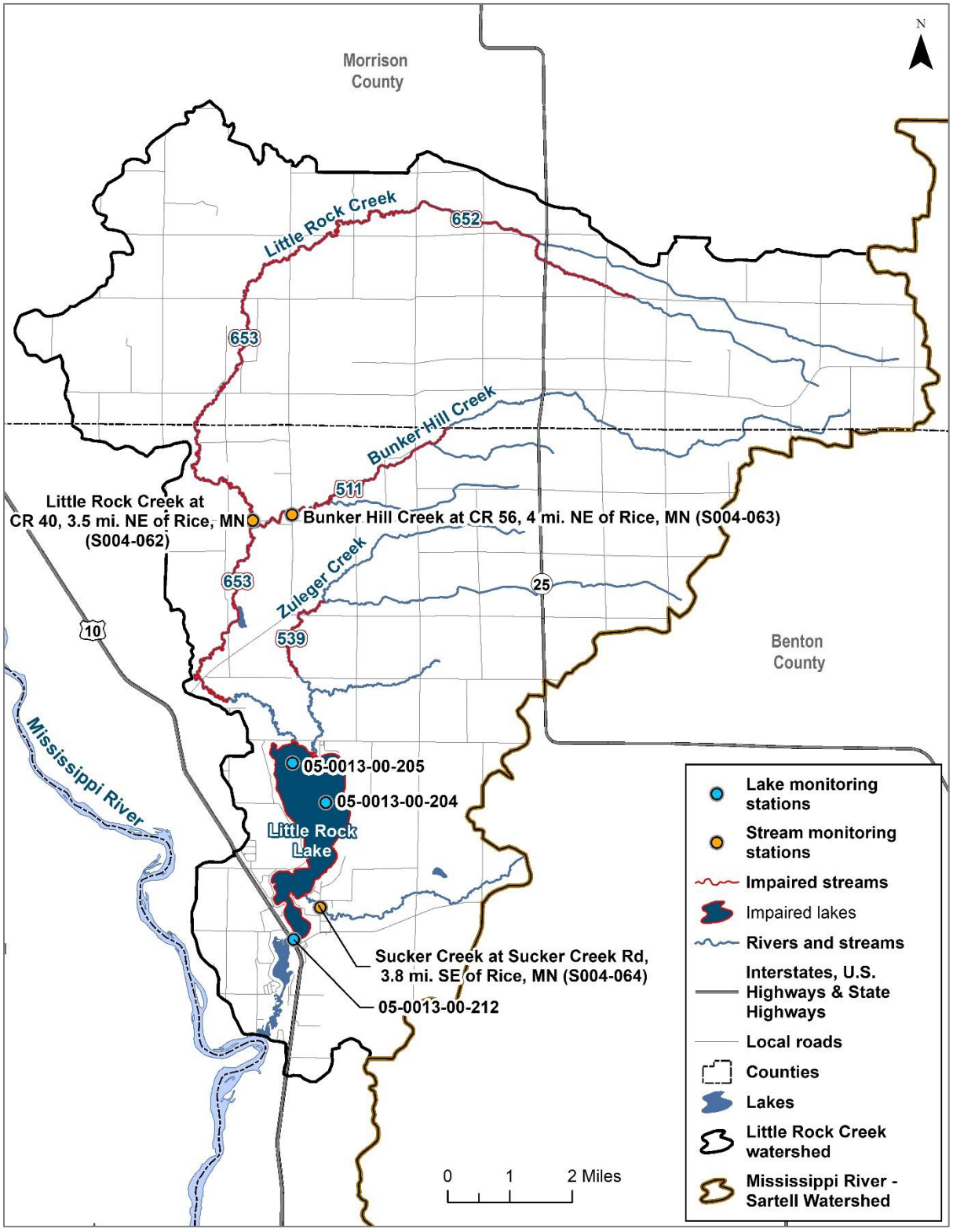


Figure 7. Little Rock Lake Watershed monitoring stations.

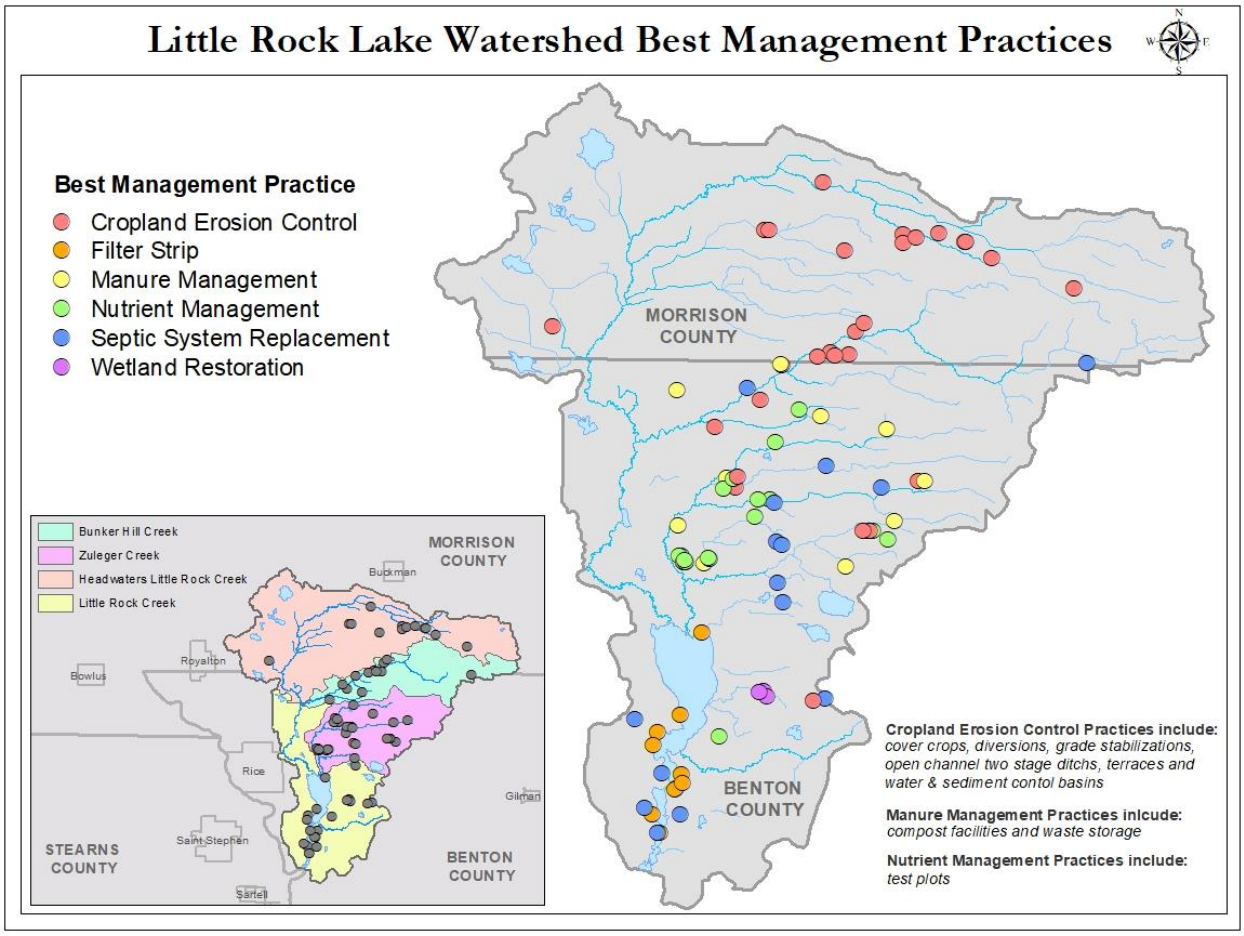


Figure 8. Little Rock Lake watershed BMPs (Image from Benton SWCD).

Streams

Nutrient concentrations, oxygen demand, and sediment concentrations were evaluated in the three focus streams—Little Rock Creek, Bunker Hill Creek, and Sucker Creek.

Nitrate concentrations decreased on average in Little Rock Creek (Figure 9). Although a statistically significant trend was not detected in Bunker Hill Creek, the maximum observed nitrate concentration decreased from 15 mg/L in 2006 through 2008 to 9.6 mg/L in 2016 through 2018, with no samples exceeding the standard in the latter period. A trend was not observed in Sucker Creek; however, concentrations are lower in that creek compared to Bunker Hill and Little Rock Creek, with a maximum observed nitrate concentration of 1.7 mg/L.

The patterns in nitrate concentrations are likely at least in part due to lower stream flows on average in the pre-implementation period compared to the post-implementation period (Figure 10). Nitrate is diluted as stream flows increase and therefore, all other things being equal, would be expected to be lower under the higher flows of the post-implementation period.

Total Kjeldahl nitrogen (TKN) represents organic nitrogen and ammonia-nitrogen (does not include nitrate). TKN concentrations decreased on average in Bunker Hill and Sucker Creek (Figure 11). Although a significant trend was not detected in Little Rock Creek, the maximum observed TKN concentration decreased from 8 mg/L in 2006 through 2008 to 3 mg/L in 2016–2018. The maximum observed TKN

concentration decreased in Bunker Hill Creek from 11 mg/L in 2006 through 2008 to 3 mg/L in 2016 through 2018.

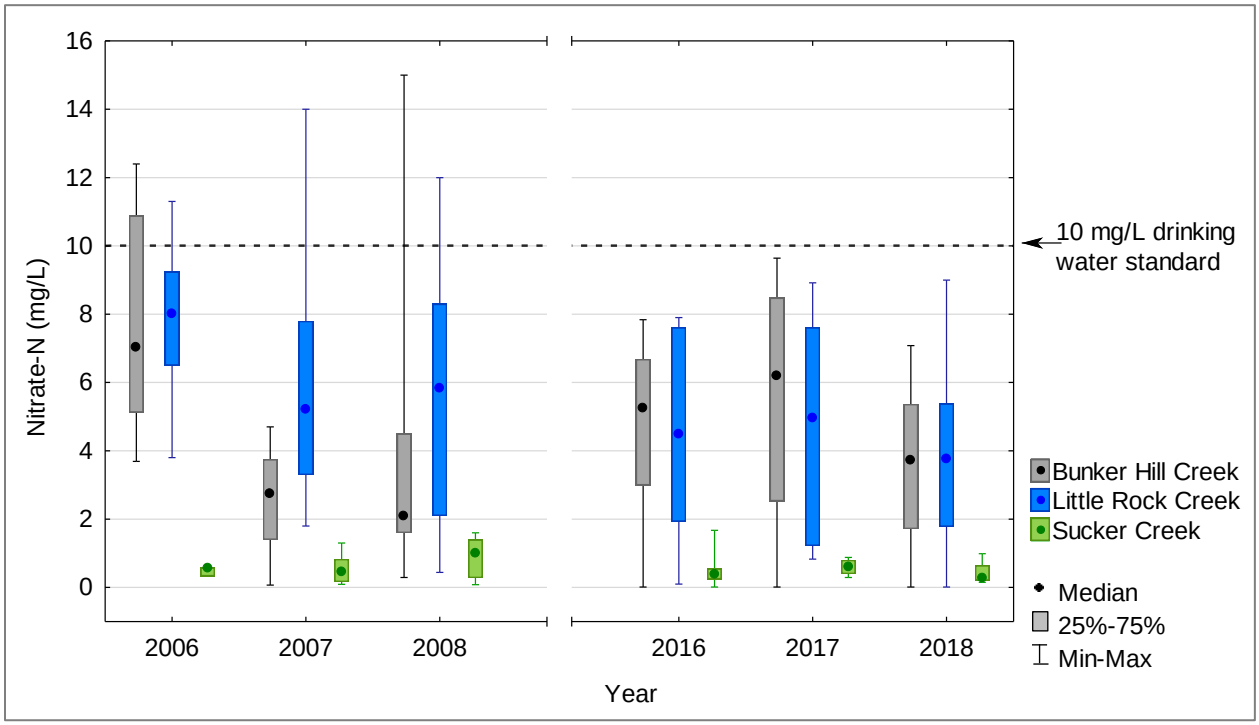


Figure 9. Nitrate concentrations in Little Rock Lake watershed, 2006–2008 vs. 2016–2018.
Nitrate data from EQuIS are nitrate plus nitrite-nitrogen, and nitrate data from Benton SWCD are labeled nitrate nitrogen. Because nitrite concentrations in surface waters are typically low, these two datasets were assumed to be comparable and were combined for this analysis.

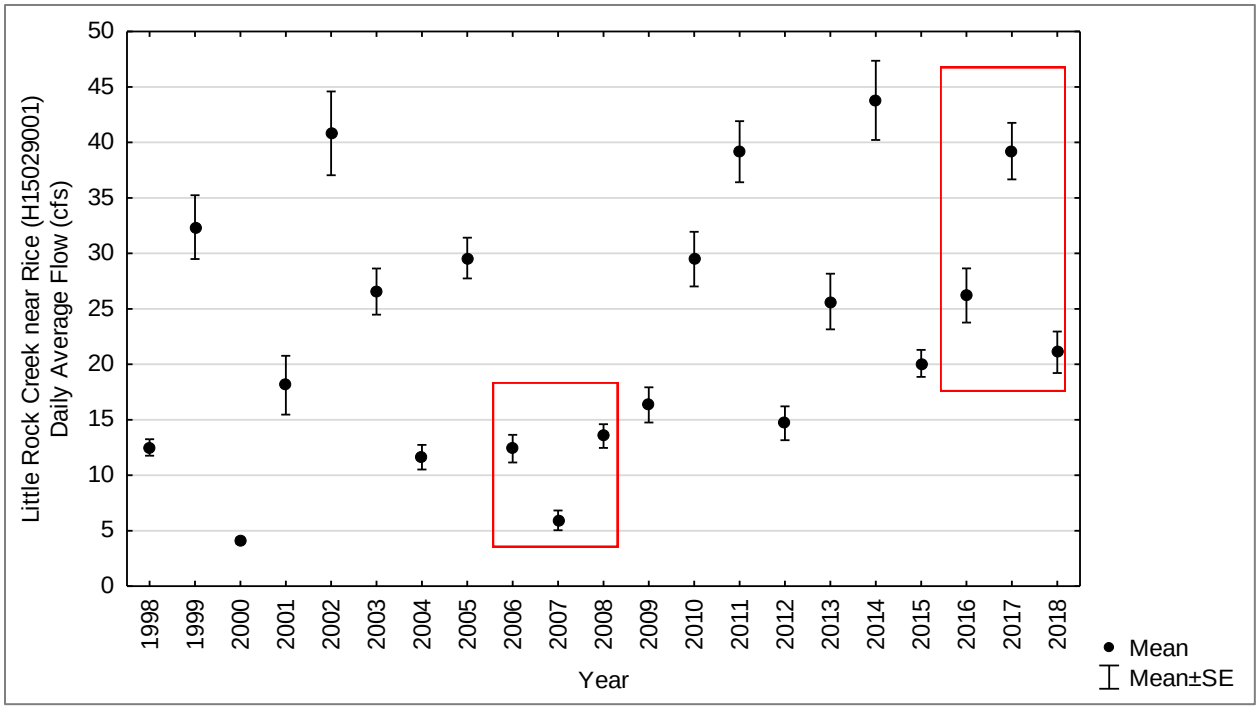


Figure 10. Mean annual flows monitored at Little Rock Creek near Rice (H15029001), 1998–2018, with the pre-implementation (2006–2008) and post-implementation (2016–2018) periods highlighted.

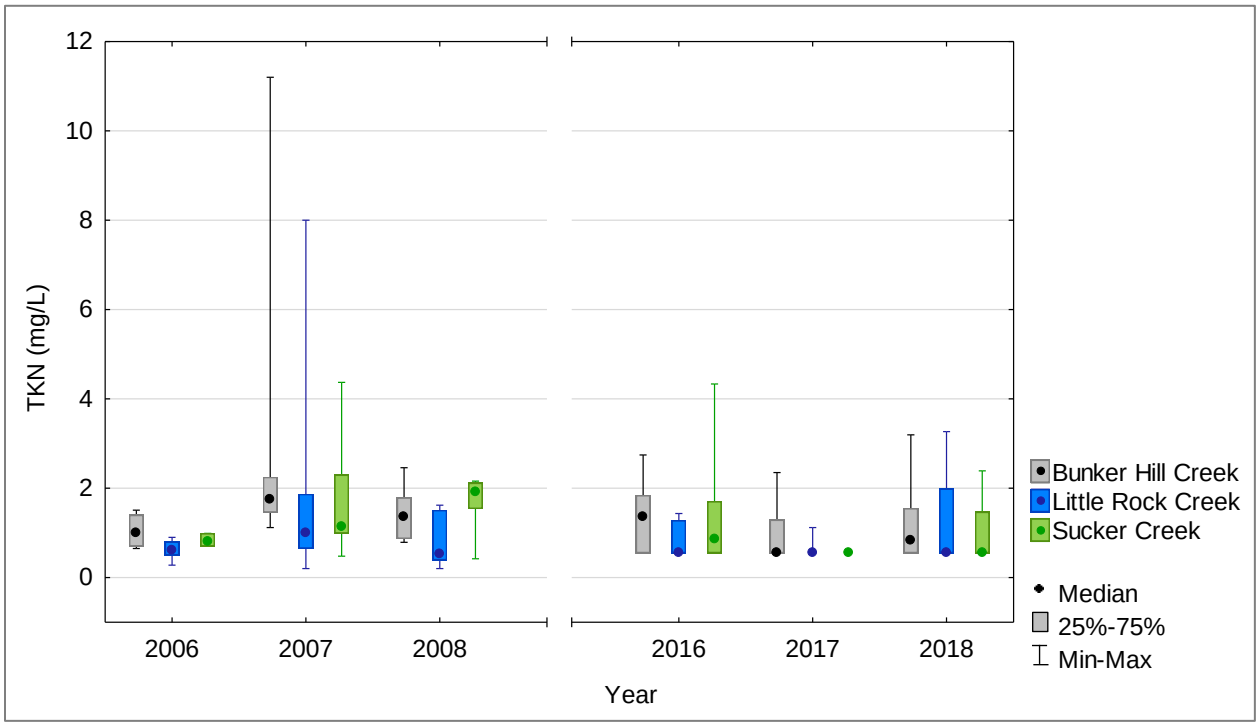


Figure 11. Total Kjeldahl nitrogen concentrations in Little Rock Lake watershed, 2006–2008 vs. 2016–2018.

TP concentrations did not show statistically significant changes in the three streams (Figure 12). TSS increased in Bunker Hill Creek and Little Rock Creek (Figure 13). Because TSS is primarily transported during higher flows, the increase in TSS is likely at least in part due to the higher flows in the post-implementation period.

Less data are available for biochemical oxygen demand (BOD_5) during the pre-implementation period. BOD did not show statistically significant changes in the three streams (Figure 14).

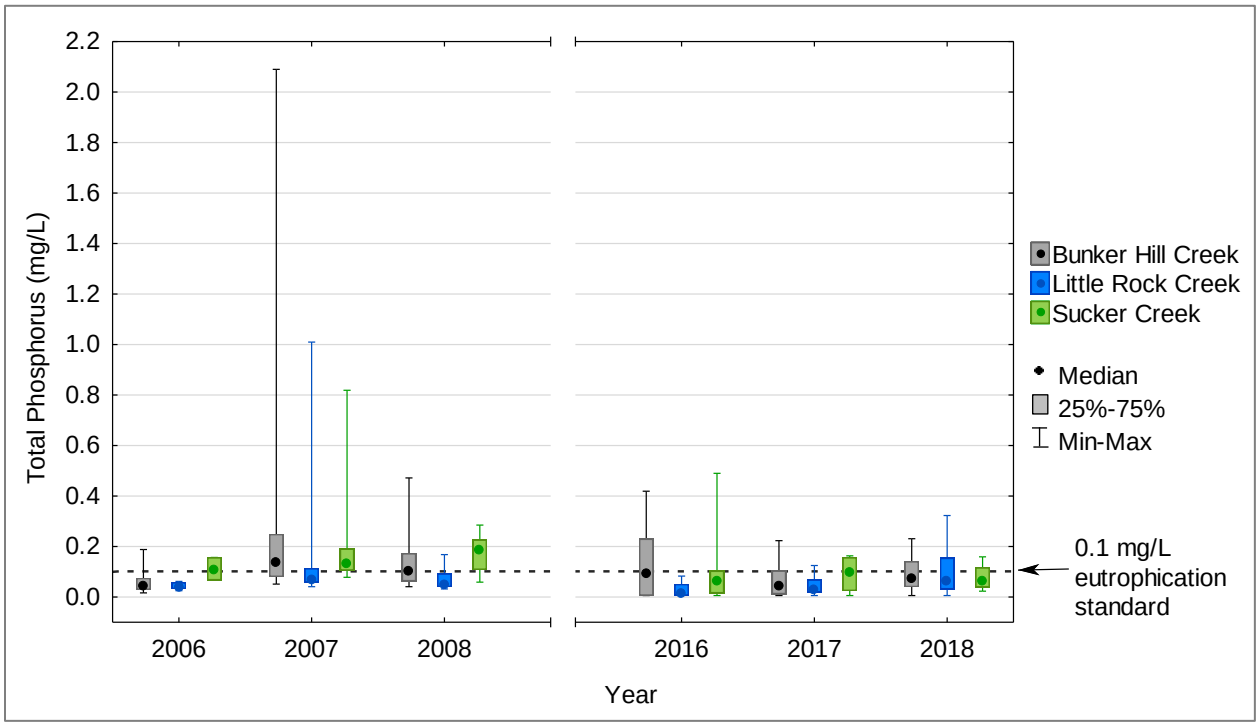


Figure 12. Total phosphorus concentrations (June–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018.

When determining eutrophication impairment, both the causal indicator (i.e., phosphorus) and a response indicator (i.e., chlorophyll-*a*, BOD, diel DO flus, or pH) must be violated. The eutrophication standard is compared to the June through September average concentrations (MPCA 2017).

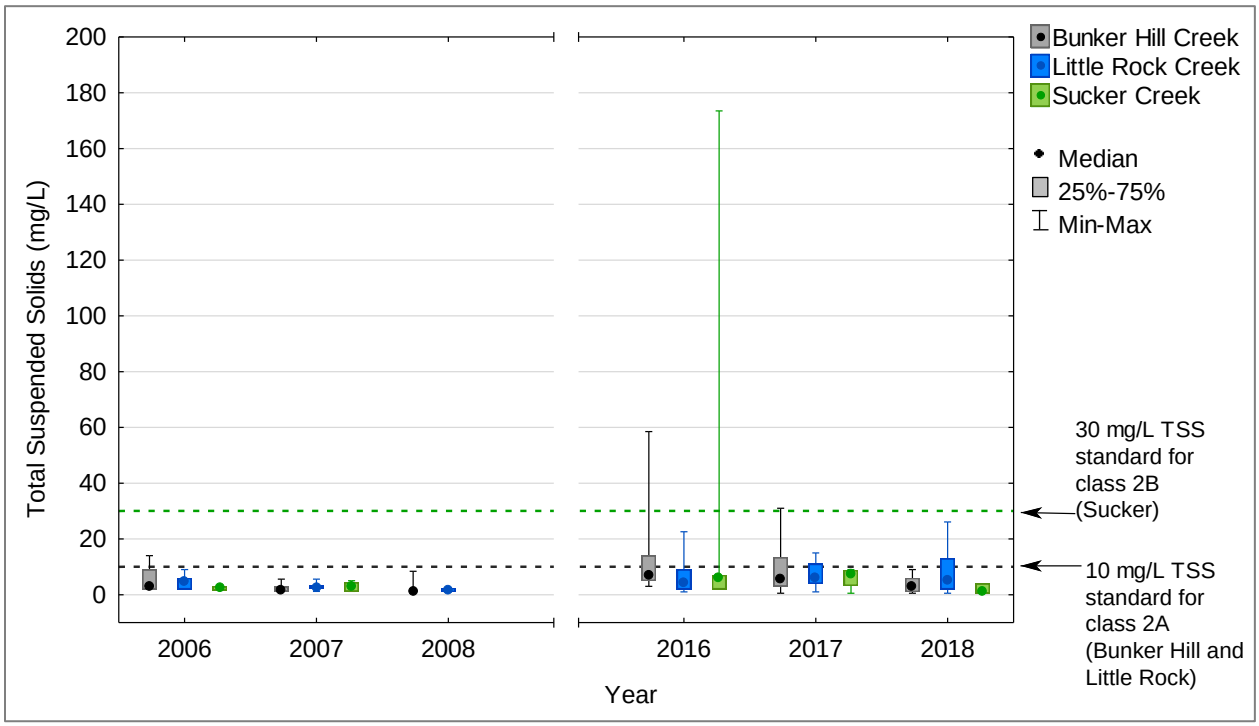


Figure 13. Total suspended solids (April–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018.

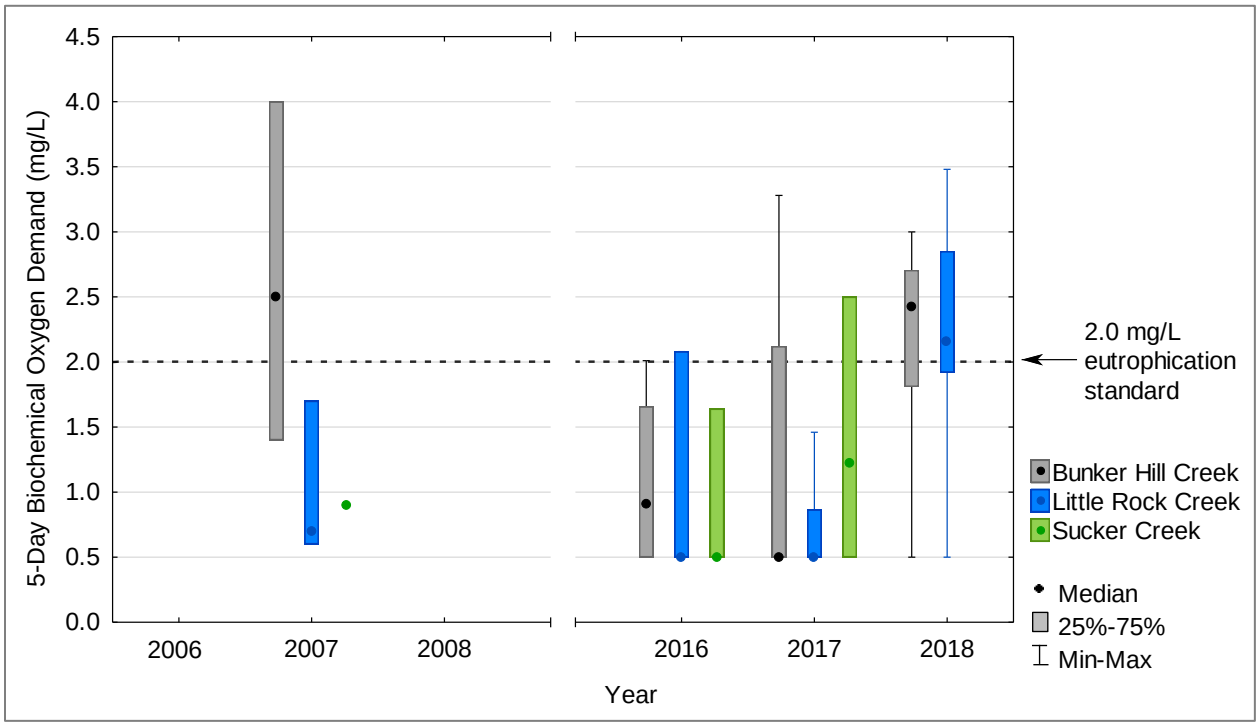


Figure 14. Biochemical oxygen demand (June–September) in Little Rock Lake Watershed, 2006–2008 vs. 2016–2018.

One outlier is excluded from this figure and the statistical analysis: 96 mg/L BOD on 6/15/2016 at Sucker Creek.

Little Rock Lake

Data from site 05-0013-00-204 were used for the comparison of pre- and post-implementation conditions, because data were collected at this site during both time periods. Lake water quality data were not collected in 2018; therefore, the post-implementation period data set for the lake is 2016–2017. There were no statistically significant changes in lake water quality between the two time periods. The lack of statistically significant differences does not necessarily imply that water quality conditions have not improved, but rather that there are not enough data to detect a difference. Based on visual inspection of the data, water transparency in 2017 was on average the deepest that it had been since 2003 (Figure 15). Transparency was poor in 2006 through 2008, and there is more evidence of deeper transparencies in later years.

Phosphorus and chlorophyll-*a* concentrations increase in the early years, after which they appear to decrease (Figure 16 and Figure 17). The maximum phosphorus and chlorophyll-*a* concentrations in the post-implementation period were all lower than the maximum concentrations in the pre-implementation period.

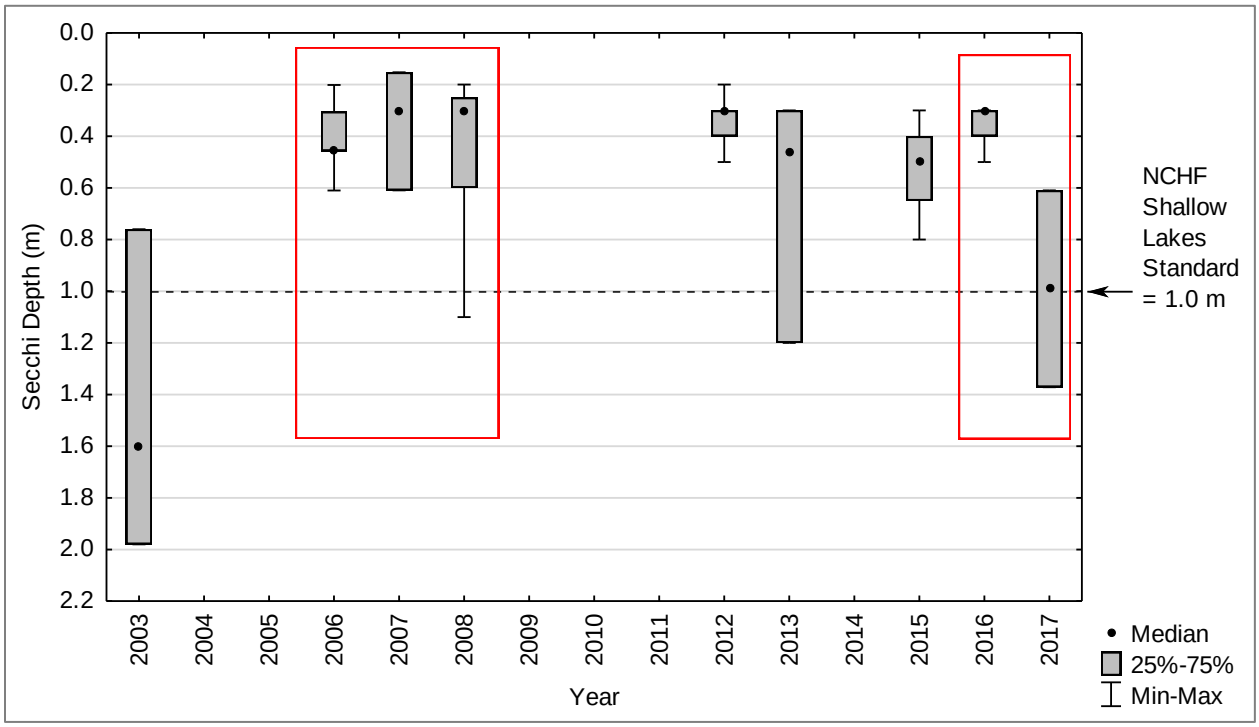


Figure 15. Little Rock Lake Secchi depth (June–September); site 05-0013-00-204.
Pre-implementation (2006–2008) and post-implementation (2016–2017) periods are highlighted.

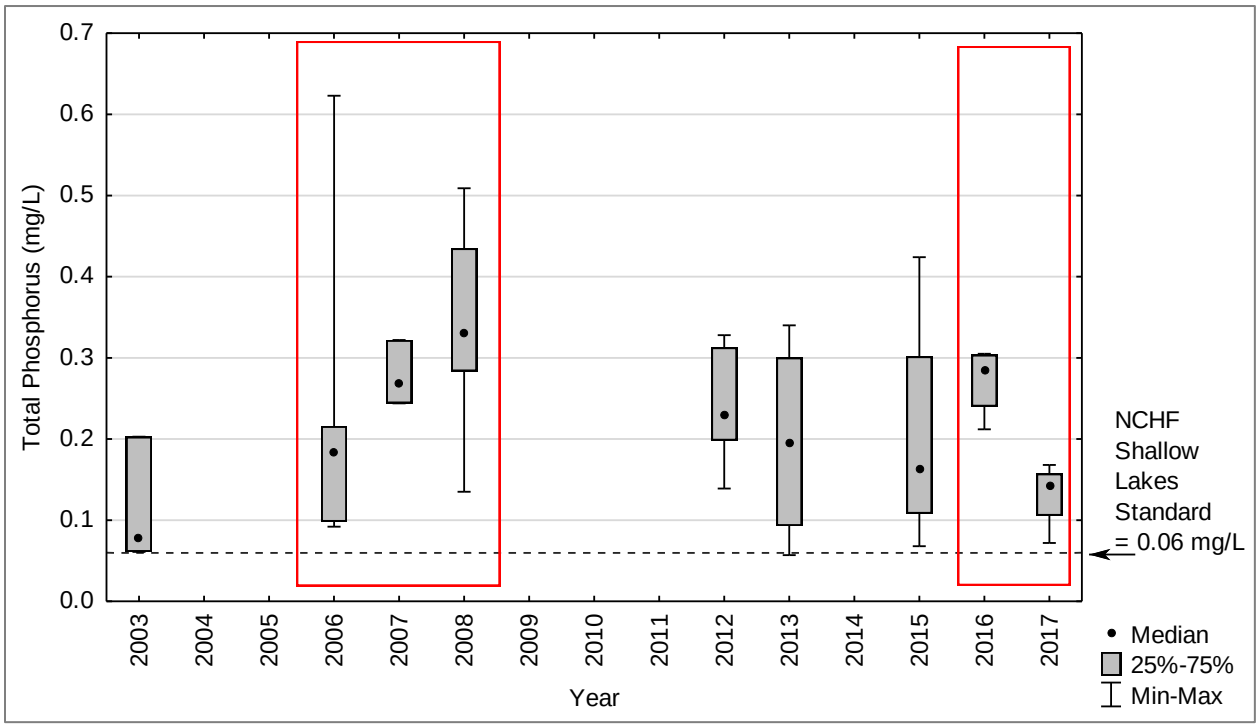


Figure 16. Little Rock Lake total phosphorus surface concentrations (June–September); site 05-0013-00-204.
Pre-implementation (2006–2008) and post-implementation (2016–2017) periods are highlighted.

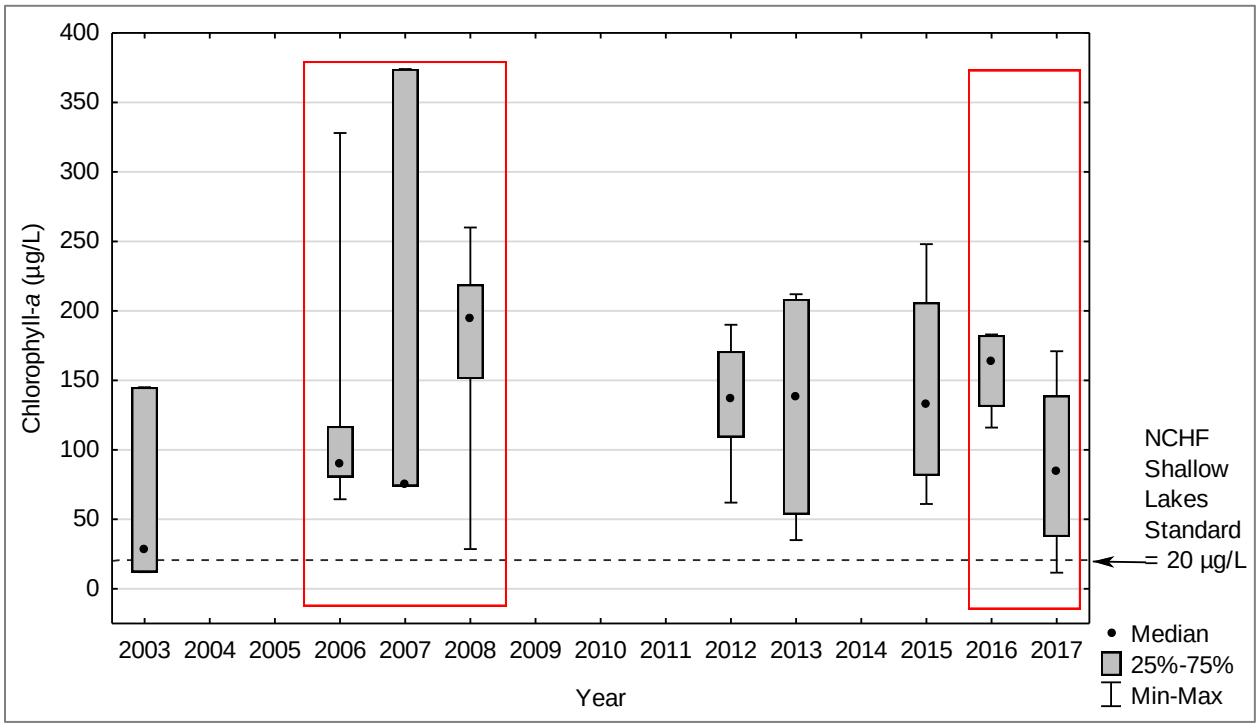


Figure 17. Little Rock Lake chlorophyll-*a* surface concentrations (June–September); site 05-0013-00-204.
Pre-implementation (2006–2008) and post-implementation (2016–2017) periods are highlighted.

Discussion

Changes in water quality were observed in the Little Rock Lake watershed in the TMDL post-implementation period (2016 through 2018) relative to the pre-implementation period (2006 through 2008). Statistically significant (using a Student's t-test $p<0.05$) reductions in nitrogen and increases in TSS in streams were observed (Table 6). However, these results are confounded with differences in flow during the two time periods—flows on average were lower in the pre-implementation period than in the post-implementation period (Figure 10). Higher flows in the post-implementation period could explain the lower nitrate concentrations in Little Rock Creek and the higher TSS in Little Rock Creek and Bunker Hill Creek. Because flows have such a strong influence on water quality, differences in water quality between the two periods could be attributed to the differences in flow or other environmental factors not evaluated here.

The lake data suggest improvements in water quality; however, the differences were not statistically significant. The lack of statistically significant differences does not necessarily imply that water quality conditions have not improved, but rather that there are not enough data to detect a difference.

Since the completion of this analysis, a lake drawdown was conducted on Little Rock Lake and is expected to have positive impacts to its water quality. In addition to continued implementation of the 2012 TMDL, Benton SWCD plans to continue monitoring the Little Rock Creek, Bunker Hill Creek, and Sucker Creek stations into the foreseeable future including collecting chemistry samples for nitrate, BOD, TKN, chlorophyll-*a*, and TSS as well as temperature, pH, DO, and flow measurements.

Table 6. Summary of pre- and post-implementation stream water quality trend evaluation.

Each pre- and post-implementation comparison was evaluated with a Student's t-test ($p<0.05$). Data were log transformed where the transformed data better met the assumptions of the t-test.

Parameter	Bunker Hill Creek (Site S004-063)	Little Rock Creek (Site S004-062)	Sucker Creek (Site S004-064)
Nitrate	–	Decrease	–
TKN	Decrease	–	Decrease
Total Phosphorus	–	–	–
Biochemical Oxygen Demand	–	–	–
Total Suspended Solids	Increase	Increase	–

"–" no statistically significant change

2.3. Stressors and sources

In order to develop appropriate strategies for restoring or protecting waterbodies, the stressors and/or sources impacting or threatening the waterbodies must be identified and evaluated. Stressors to waterbodies with either fish or macroinvertebrate impairments are determined through a biological SID process. SIDs evaluate both pollutant and nonpollutant-related (e.g., altered hydrology, fish passage, habitat) factors as potential stressors. If a nonpollutant stressor is linked to a pollutant (e.g., habitat issues driven by TSS or low DO caused by excess phosphorus), a TMDL is required. Nonpollutant stressors are not subject to load quantification and therefore do not require TMDLs. Waters determined to be stressed by degraded habitat and other nonpollutant stressors are not addressed by TMDLs but are still priorities for restoration efforts.

Different from stressors, sources of pollutants are determined through a pollutant source assessment. A pollutant source assessment for pollutant related TMDLs is provided in the MRSW TMDL Report (Tetra Tech 2020). A full pollutant source assessment was conducted for the MRSW for pollutants of concern and is provided below.

2.3.1. Stressors of biologically-impaired stream reaches

Stressors of biologically impaired stream reaches were determined in the Mississippi River - Sartell Watershed Stressor Identification Report (Figure 18, MPCA 2019b). Primary stressors analyzed included temperature, longitudinal connectivity, streamflow alteration, lack of habitat, suspended sediment, nutrients (nitrate toxicity/eutrophication) and low DO. Ammonia, herbicides, insecticides, metals and unspecified toxins were minimally assessed due to time and data limitations. The most common stressors identified in the SID report are lack of habitat, streamflow alteration, and low DO. Streamflow alteration, resulting from changes in land use, vegetation and precipitation was often an indirect driving factor behind habitat and DO (Table 7).

The Minnesota Department of Natural Resources (DNR) is currently developing a SID for Two Rivers Lake (73-0138-00) and Clear Lake (73-0172-00). Draft results of the SID for the two lakes were shared at public meetings throughout the MRS WRAPS development. Final results and any applicable implementation strategies from the SID report can be used to support the MRS WRAPS report and in the subsequent 1W1P for the area.

Table 7. Summary of aquatic life impairments and stressors in the MRSW (Table 1 of stressor identification report, MPCA 2019b).

CS = Conclusive Stressor, I = Inconclusive, MS = Minor Stressor (stressor is present, but is not primary cause of impairment)
FIBI = Fishes Index of Biotic Integrity, MIBI = Macroinvertebrate Index of Biotic Integrity
Denotes Morrison County
Denotes Stearns County
Denotes Benton County

WID (07010201-###)	Impairment indicator	Temperature	Longitudinal connectivity	Streamflow alteration	Lack of habitat	Suspended sediment	Nitrate toxicity	Eutrophication	Low dissolved oxygen	Metals-iron
Trib to Platte (-634)	FIBI		CS						CS	I
Big Mink Cr (-647)	MIBI			I	CS	I	I	I	CS	I
Little Mink Cr (-645)	MIBI			I	CS	I	I	I	CS	I
Platte R (-507)	FIBI		CS		MS/I					
Rice Cr (-618)	MIBI			I		I		I	CS	
Unnamed Cr (-651)	FIBI & MIBI		CS	CS	CS				I	
Hazel Cr (-569)	FIBI		CS	I			I			
South Two R (-643)	FIBI			I	CS	I		I	I	
Watab R, South Fork (-554)	FIBI		CS	I	CS				I	I
Watab R (-528)	FIBI			CS	CS	I				
Little Rock Cr (-652)	FIBI		MS	CS	CS	I	I	I	I	
Little Rock Cr (-653)	FIBI & MIBI	CS	MS	CS	CS	I	CS	I	CS	
Bunker Hill Cr (-511)	FIBI & MIBI	CS	MS	CS	CS	I	CS	I	I	
Zuleger Cr (-539)	FIBI & MIBI	I	MS	CS	CS	I	I	I	I	

Excerpts of the summaries provided for each assessment unit identification (AUID) analyzed in the SID report (MPCA 2019b) are included below.

- **Unnamed Creek (Tributary to Platte River) (634).** Longitudinal connectivity appears to be a primary stressor of the fish community. Low DO is also a stressor; however it is likely due to the natural phenomenon from groundwater inputs and riparian wetlands. Metals, specifically iron and possibly manganese, are suspected stressors to aquatic life at the biological station, but remain inconclusive until more data become available. Streamflow alteration does not appear to be a direct stressor, although a historical beaver dam may have affected the quality and availability of some habitat.
- **Big Mink (647).** Of the potential stressors investigated, lack of habitat (primarily productive riffle habitat) and low DO were conclusively determined to be stressors to the macroinvertebrate community. The cause of low DO levels in unknown at this time. Eutrophication and suspended sediments are inconclusive stressors, both of which may be interrelated and driven by streamflow alteration. Iron and nitrate toxicity are also inconclusive stressors.
- **Little Mink (645).** Of the potential stressors investigated, low DO and degraded habitat due to excess fine bedded sediment were conclusively determined to be stressors to the aquatic life. Metals, particularly iron, in the stream is a suspected, though inconclusive, stressor. Streamflow alteration, a result of stream channelization, may be driving or exacerbating the low DO and excess sediment, but is also inconclusive at this time. Total phosphorus (TP) and nitrate toxicity were determined to be inconclusive stressors.
- **Platte River (507).** The cause of the poor fish index of biotic integrity (FIBI) scores were not conclusively determined, with the exception of the Platte River Dam impeding fish passage into

16UM117 and lack of habitat at 10EM102. The stressors at the other locations with failing FIBI scores were inconclusive. For instance, lack of habitat is a potential stressor at 16UM123, but more data are needed to be conclusive. And, low DO is a suspected stressor at 16UM117. Another potential stressor to the fish community is the wetland-like and eutrophic condition of the Rice-Skunk Lakes area that may be deterring some sensitive fish species from moving into this segment

- **Rice Creek (618).** Low DO is the primary stressor to aquatic life. It is unclear if the low DO is naturally occurring due to the wetland conditions of the watershed, and/or if anthropogenic activity, such as ditching and nutrient input, has affected the water chemistry of Rice Creek. Therefore, streamflow alteration (due to channelization) and eutrophication are inconclusive stressors.
- **Unnamed Creek (651).** Streamflow alteration, as a result of the watershed channelization, fallen trees, and eroding streambanks, is degrading habitat and is the primary stressor to aquatic life. In addition, the culvert at 173rd Street is impeding fish passage. It is unknown to what degree the low DO occurring downstream in Rice Creek (-618) is responsible for the low FIBI scores.
- **Hazel Creek (569).** Longitudinal connectivity is the greatest stressor to the fish community in Hazel Creek, a result of an improperly installed culvert under Great River Road. Lack of streamflow is also a stressor, but it is unclear whether or not the intermittent nature of the stream is due to anthropogenic activity. Nitrate toxicity is an inconclusive, though suspected, stressor.
- **South Two River (643).** The most likely stressor of the fish community is a lack of habitat complexity and quality coarse substrate. It is unclear if the poor habitat at both monitoring sites is a direct result of anthropogenic activity. Four stressors were inconclusive: eutrophication, low DO, suspended sediment, and streamflow alteration.
- **Watab River, South Fork (554).** Of the potential stressors investigated, longitudinal connectivity was conclusively determined to be a stressor to the fish community. At 07UM101, lack of habitat is also a conclusive stressor, and low flow magnitude is an inconclusive stressor, both possibly driven by streamflow alteration. Streamflow alteration, as a result of the watershed land use and channelization of the stream near 07UM101, is currently an inconclusive stressor and suspected to be driving the lack of habitat and low flow at 07UM101. Other inconclusive stressors are iron and low DO at 16UM081.
- **Watab River (528).** Of the potential stressors investigated, lack of habitat was conclusively determined to be a stressor to the fish community. Habitat degradation is being driven by streamflow alteration and geomorphic instability of the Watab River. Suspended sediment was found to be an inconclusive stressor.
- **Little Rock Creek (652).** The primary stressor to aquatic life is streamflow alteration and lack of habitat. The change in streamflow pattern has degraded and even eliminated habitat by causing bank erosion and channel incision. Longitudinal connectivity is also a stressor to some fish as a result of the frequently hypereutrophic conditions of Little Rock Lake and the Sartell WMA dam height, which varies and can block fish entering this segment from upstream and downstream

waters. Stressors found to be inconclusive are suspended sediment, nitrate toxicity, eutrophication, and low DO.

- **Little Rock Creek (653).** Of the stressors investigated, those confirmed include high temperature, lack of connectivity, streamflow alteration, lack of habitat, low DO, and nitrate toxicity. Inconclusive stressors are high TSS and TP (eutrophication). The primary stressor is streamflow alteration, which is driving the warm temperatures, lack of connectivity, lack of habitat, and likely the low DO.
- **Bunker Hill Creek (511).** Of the stressors investigated, those confirmed were high temperatures, connectivity barriers, streamflow alteration, lack of habitat, and nitrate toxicity. Inconclusive stressors were suspended sediment, eutrophication, and low DO.
- **Zuleger Creek (539).** Of the stressors investigated, those confirmed were longitudinal connectivity, streamflow alteration, and lack of habitat, although streamflow alteration is driving the habitat degradation.

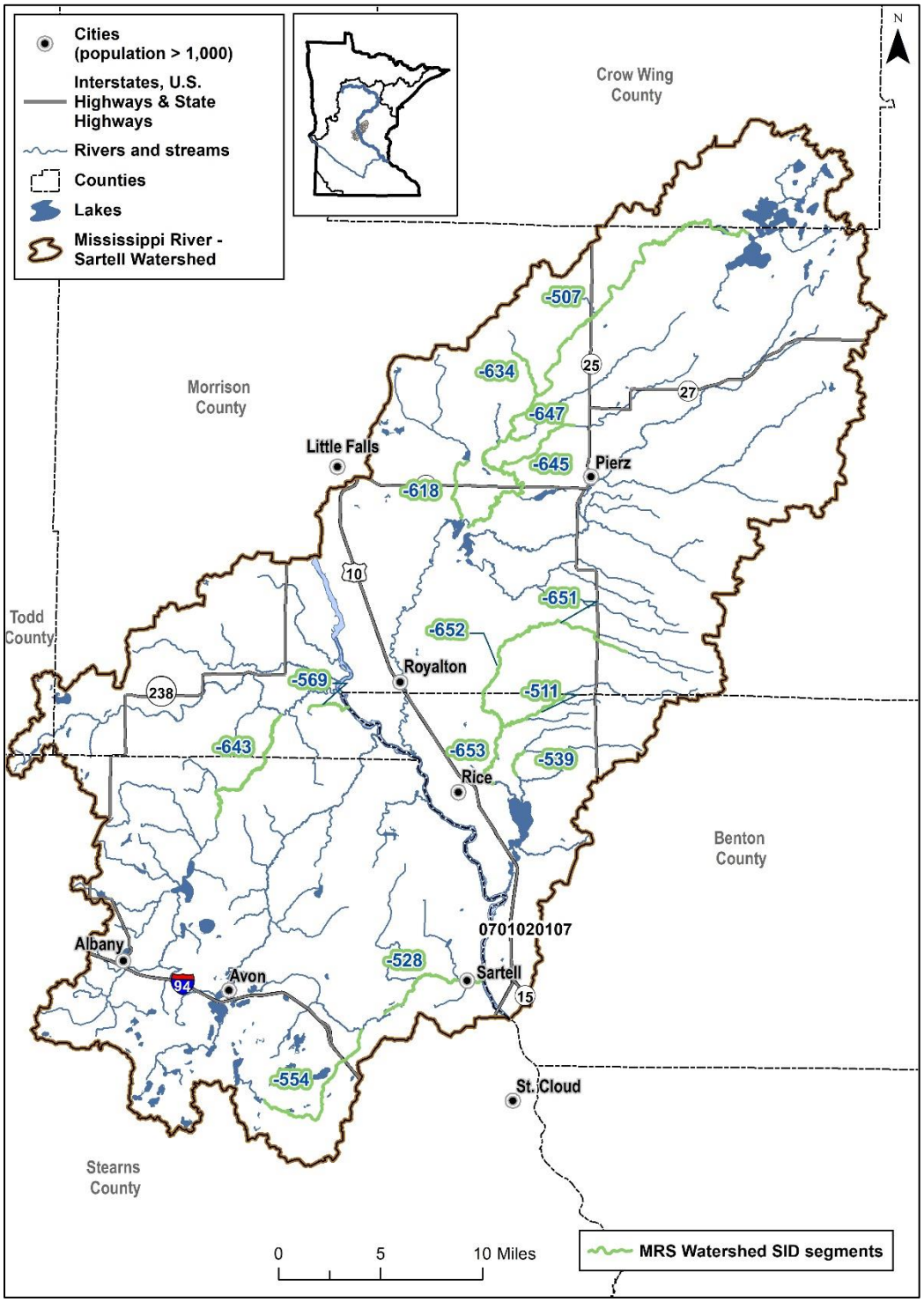


Figure 18. Stream AUIDs assessed in the MRSW Stressor Identification Report.

2.3.2. Pollutant sources

Sources of phosphorus, nitrogen, and sediment in the MRSW were quantified with MPCA's Hydrologic Simulation Program–Fortran (HSPF) model application of the MRSW (Figure 19, Figure 21, and Figure 23). HSPF is a comprehensive model of watershed hydrology and water quality that allows the integrated simulation of point sources, land and soil contaminant runoff processes, and in-stream hydraulic and sediment-chemical interactions. The results provide hourly runoff flow rates, sediment

concentrations, and nutrient concentrations, along with other water quality constituents, at the outlet of any modeled subwatershed. Model documentation contains additional details about the model development and recalibration (Tetra Tech 2018).

HSPF was also used to quantify upland loading rates of phosphorus, sediment and nitrogen by subwatershed within the MRSW (Figure 20, Figure 22, and Figure 24). Within each subwatershed, the upland areas are separated into multiple land use categories. Simulated loads from upland areas represent the pollutant loads that reach the modeled stream or lake; the loading rates do not represent field-scale soil loss estimates. Note that modeled streams do not typically include ditches, ephemeral streams, or small perennial streams. The model evaluated both permitted and nonpermitted sources including watershed runoff, near-channel, and wastewater point sources. Sources of *E. coli* were not quantified with the HSPF model. Therefore, a more qualitative approach was used to determine potential sources of *E. coli* in the watershed.

Phosphorus

HSPF modeling results indicate that cropland sources account for 66% of the phosphorus load in the MRSW, followed by point sources at 15% (Figure 19). Upland loading rates for phosphorus are provided by model catchment in Figure 20.

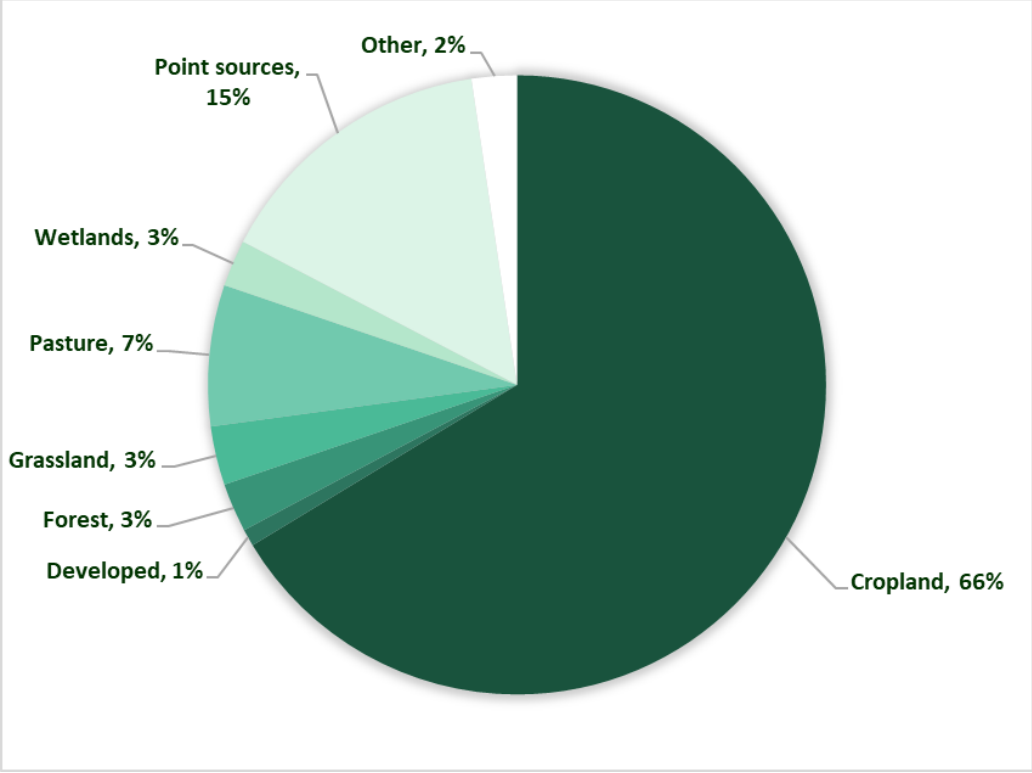


Figure 19. Sources of phosphorus in the MRSW (Tetra Tech 2018).
Note: "Other" includes direct atmospheric deposition, septic systems, and feedlots.

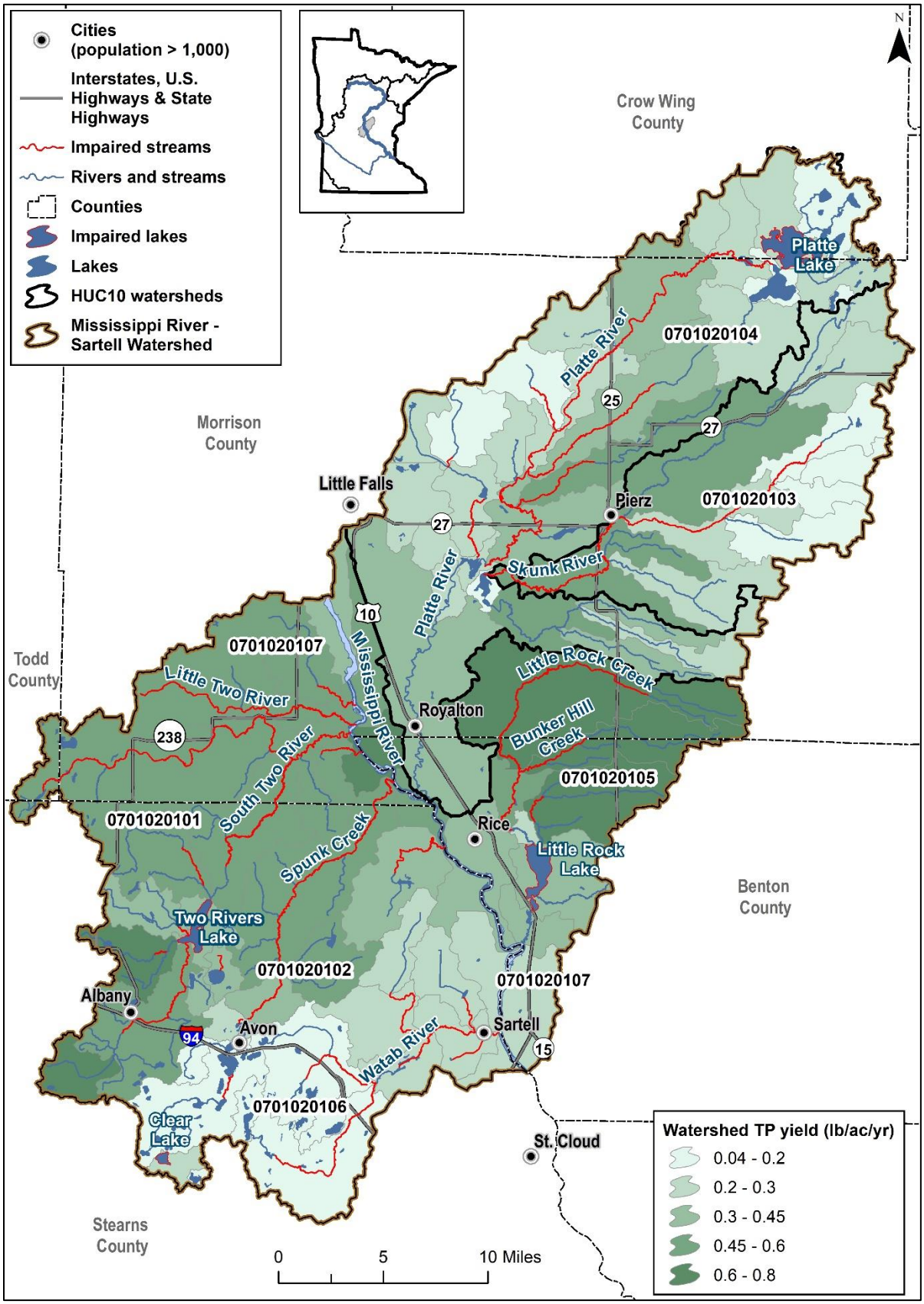


Figure 20. Upland loading rates of TP (lb/ac/yr) by HSPF model catchment.

Sediment

HSPF modeling results indicate that cropland sources account for 83% of the sediment load in the MRSW (Figure 21). Upland loading rates for sediment are provided by model catchment in Figure 22. The highest sediment yielding watersheds are in the upper Little Rock Creek watershed and in the area surrounding the city of Albany.

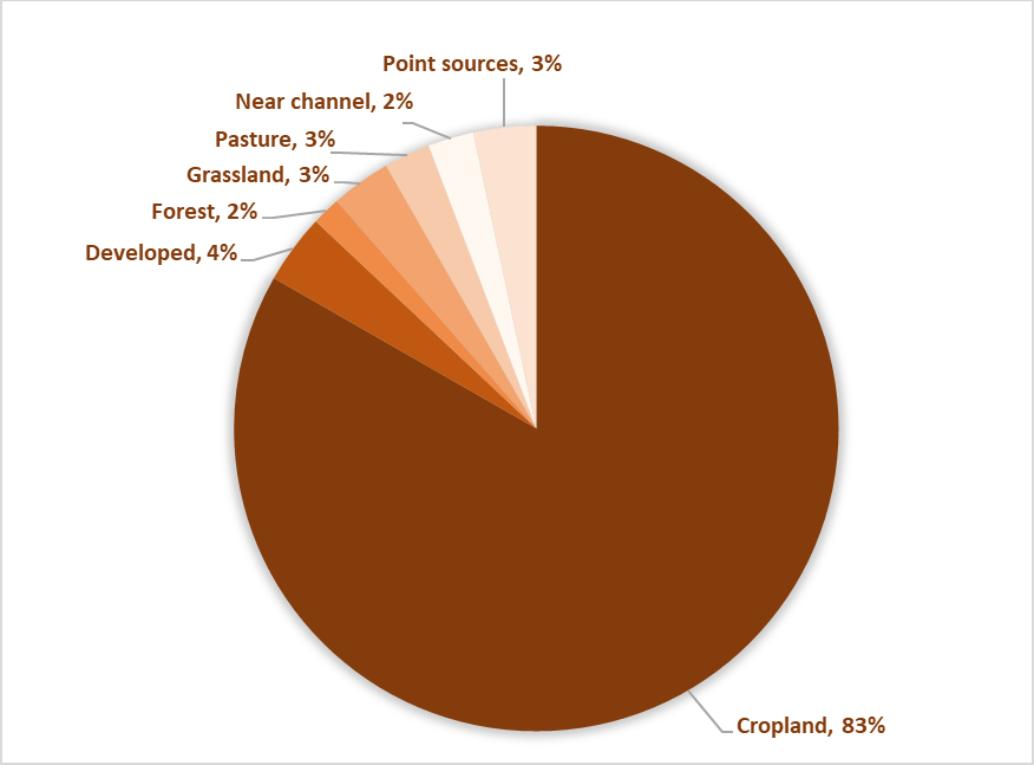


Figure 21. Sources of sediment in the MRSW (Tetra Tech 2018).

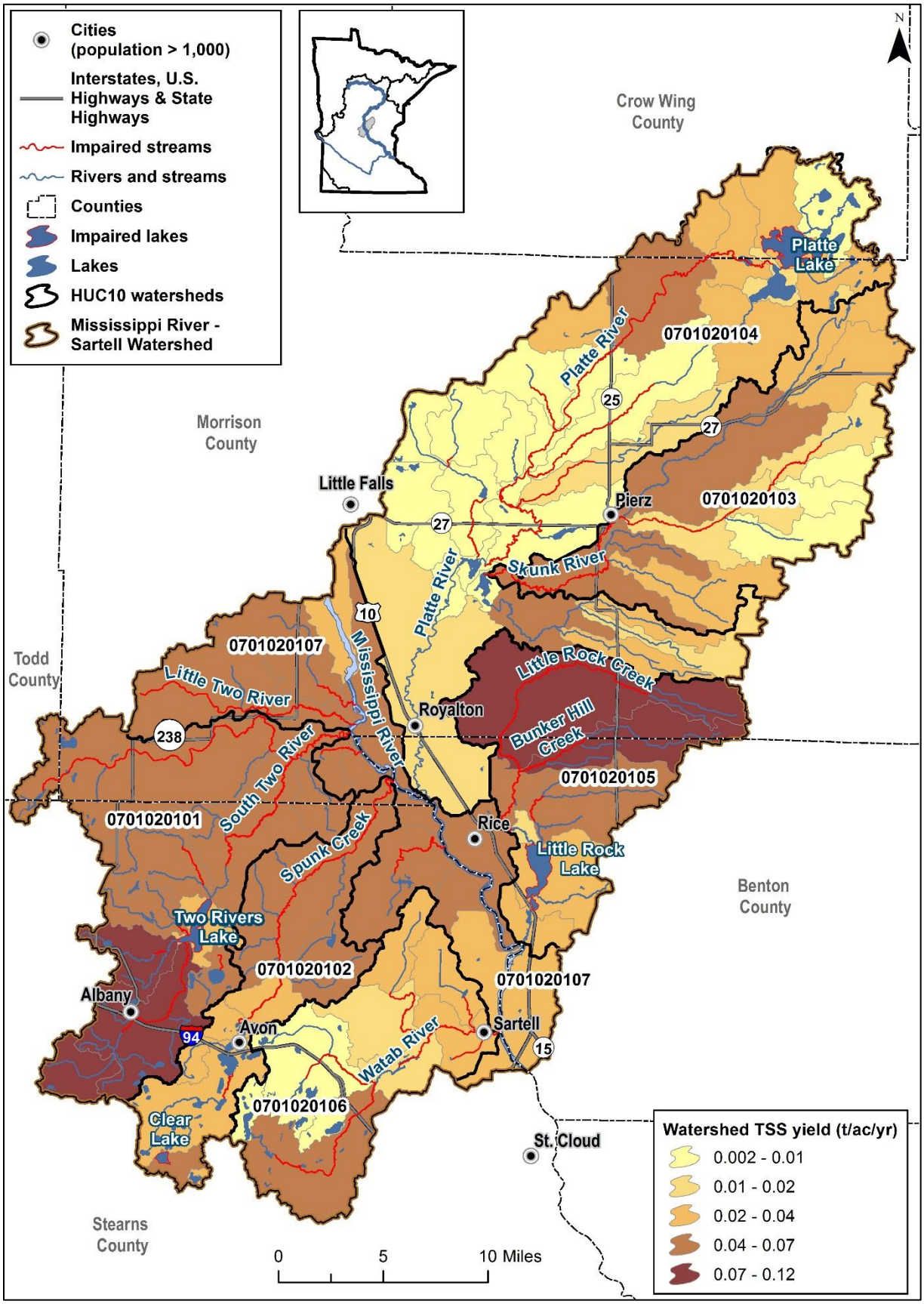


Figure 22. Upland loading rates of TSS (tons/ac/yr) by HSPF model catchment.

Nitrogen

HSPF modeling results indicate that, similar to sediment and phosphorus, the predominant source of nitrogen in surface runoff is from cropland sources, which contribute 41% of the total nitrogen to the watershed. Cropland sources are followed by point sources at 18%, and grassland, pasture, and wetlands at 10% each (Figure 23). Upland loading rates for nitrogen are provided by model catchment in Figure 24.

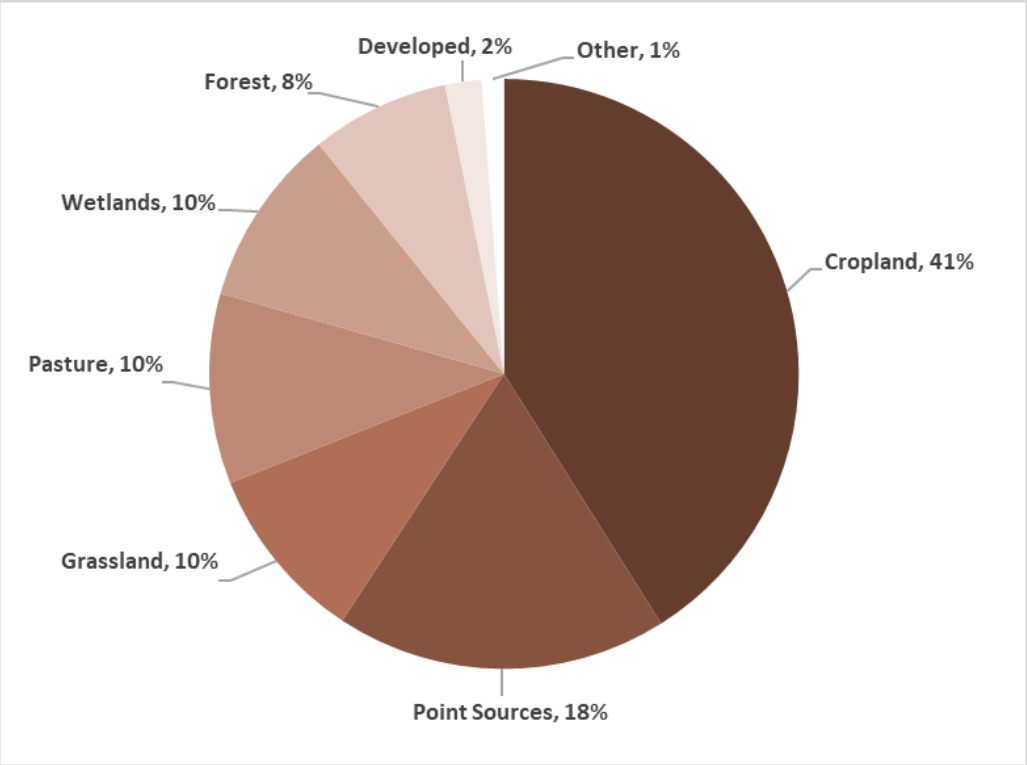


Figure 23. Sources of Nitrogen in the MRSW (Tetra Tech 2018).
Note: "Other" includes direct atmospheric deposition, septic systems, and feedlots.

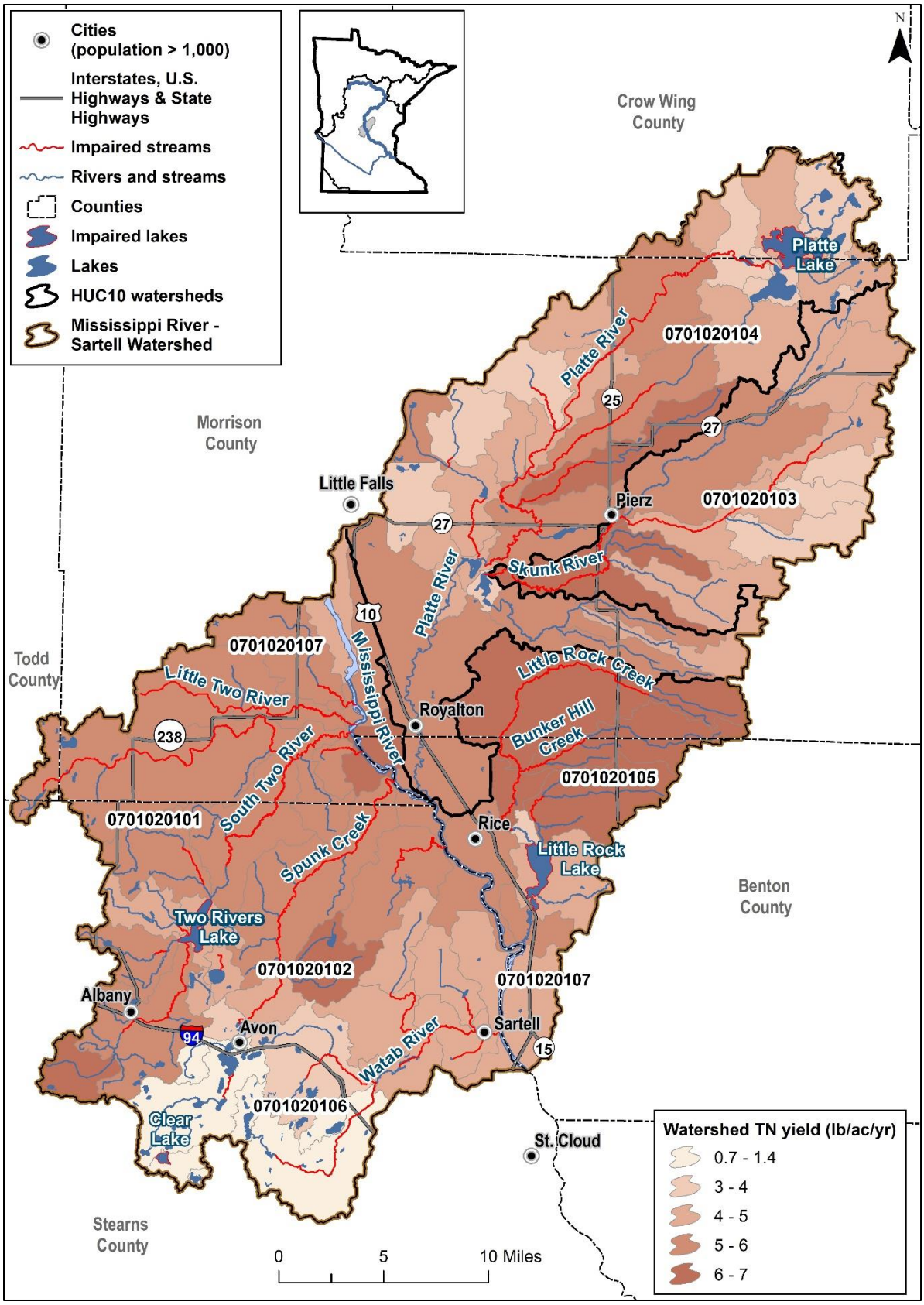


Figure 24. TN yield (lb/ac/yr) by HSPF model catchment.

E. coli

The TMDL study (Tetra Tech 2020) identifies feedlots and waste from livestock as the predominant sources of *E. coli* to impaired streams in the MRSW. The TMDL describes sources as follows:

- Animal waste from animal feeding operations (AFOs) can be delivered to surface waters from failure of manure containment or runoff from the AFO itself. Waste from livestock is a source of concern when feedlots are numerous and/or are located close to surface waterbodies. In addition, improperly treated or improperly applied manure that is applied to agricultural fields can be a source of *E. coli* to surface water.
- Permitted and nonpermitted stormwater runoff is considered a source of *E. coli* for streams that flow through developed areas. Waste from wildlife and pets is considered with stormwater runoff because waste from these sources is delivered to surface waters through stormwater runoff.
- Effluent from wastewater treatment plants in *E. coli*-impaired subwatersheds is typically below the *E. coli* standard and is not considered a significant source.
- Subsurface sewage treatment systems (SSTS) that are classified as imminent threats to public health and safety, or SSTS that discharge untreated sewage to the land surface or directly to streams, are illegal systems and can contribute *E. coli* to surface waters. Imminent threats to public health and safety do not make up a large percentage of total SSTSs in the watershed. However, they should be addressed as they pose a threat to human and environmental health and are a potential source of *E. coli*.

All animal operations, registered and nonregistered, have a potential to contribute *E. coli*. Likelihood of this contribution is based on management of animal areas and manure. The MPCA Data Desk provided the feedlot locations and numbers and types of animals in registered feedlots. For ease of comparison, animal counts were converted into animal units. Per Minn. R. ch. 7020, "animal unit" means a unit of measure used to compare differences in the production of animal manure that employs as a standard. Cattle, poultry, and swine facilities are common throughout the watershed. These facilities have animal units per facility ranging from less than 100 to over 2,100 (Figure 25).

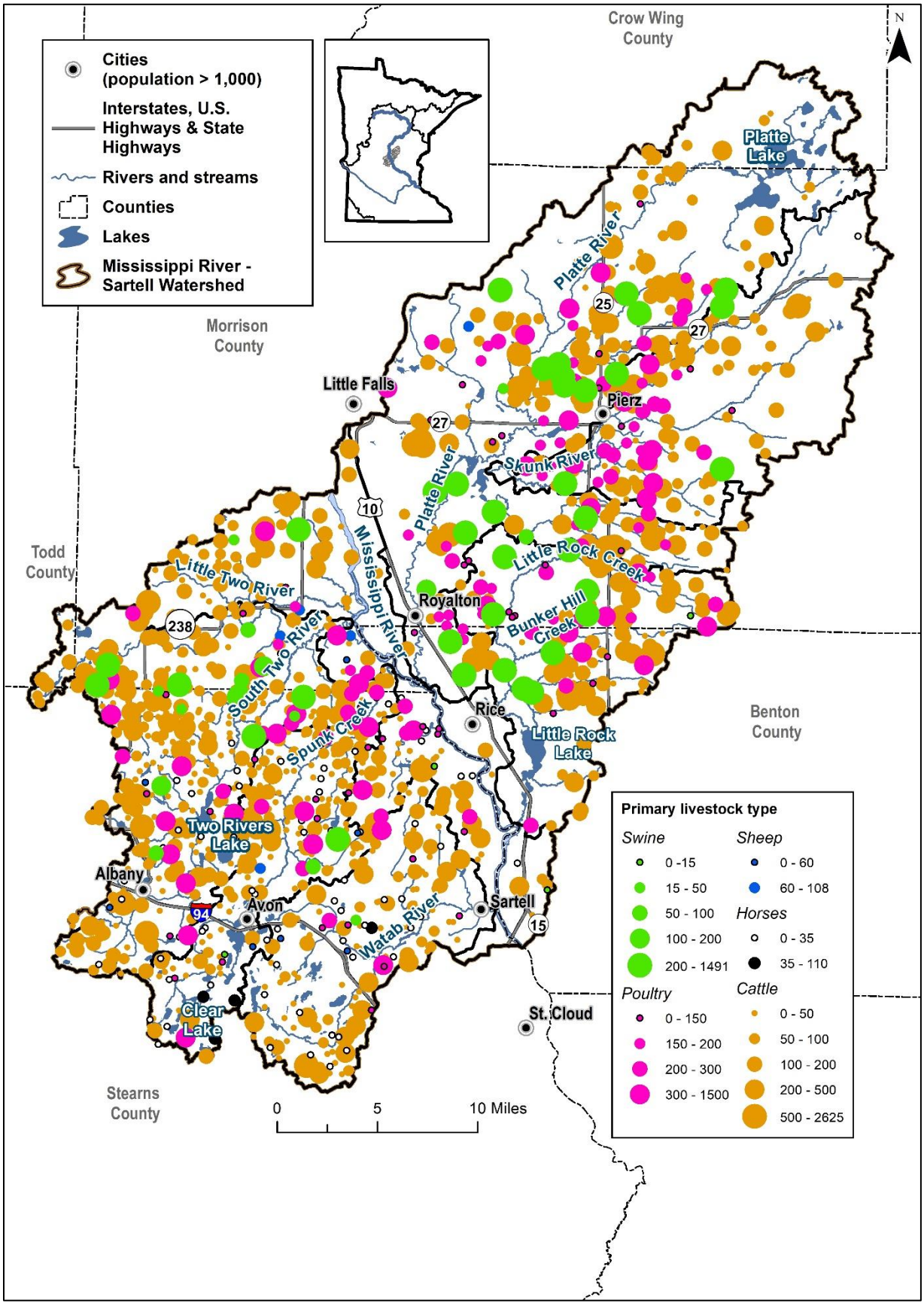


Figure 25. Primary livestock types in the MRSW.

NPDES/SDS Permitted Sources

Entities that are permitted under the National Pollutant Discharge Elimination System (NPDES) or State Disposal System (SDS) within the MRSW are provided in Table 8. NPDES/SDS permitted entities within the MRSW include municipal and industrial wastewater, stormwater (municipal, industrial and construction), and AFOs. The name and location of these permitted facilities can be found at https://www.pca.state.mn.us/data/whats-my-neighborhood.

Table 8. Point sources (NPDES or SDS permitted) in the MRSW.

HUC-10 subwatershed	Point source	
	Type	Permit #
Two River (0701020101)	Municipal wastewater	MN0020575
		MN0020923
		MN0023710
	Municipal stormwater	MS400068
	Animal feeding operation	MN0069787
	Industrial stormwater	MNR050000
	Construction stormwater	MNR100001
Spunk Creek (0701020102)	Municipal wastewater	MN0047325
	Municipal stormwater	MS400068
	Animal feeding operation	MN0069311
	Industrial stormwater	MNR050000
	Construction stormwater	MNR100001
Skunk River (0701020103)	Municipal wastewater	MNG580211
	Industrial wastewater	MNG490133
	Animal feeding operation	MNG440542
		MNG440897
		-- [a]
		-- [a]
	Industrial stormwater	MNG490000 and MNR050000
	Construction stormwater	MNR100001
Platte River (0701020104)	Municipal wastewater	MN0020460
	Industrial wastewater	MNG490039
	Municipal stormwater	MS400227
	Animal feeding operation	MNG440722
		MNG440723
		-- [a]
		-- [a]
	Industrial stormwater	MNG490000 and MNR050000
	Construction stormwater	MNR100001
Little Rock Creek (0701020105)	Municipal wastewater	MN0065391
	Municipal stormwater	MS400067
		MS400161
		MS400180

HUC-10 subwatershed	Point source	
	Type	Permit #
		-- [a]
	Animal feeding operation	-- [a]
	Industrial stormwater	MNR050000
	Construction stormwater	MNR100001
Watab River (0701020106)	Municipal wastewater	MN0022411
	Industrial wastewater	MN0046035
	Municipal stormwater	MS400048
		MS400052
		MS400068
		MS400125
		MS400143
		MS400157
		MS400159
		MS400180
	Industrial stormwater	MNG490000, MNR050000 and MNRNE0000
	Construction stormwater	MNR100001
City of Sartell-Mississippi River (0701020107)	Municipal wastewater	MN0056481
		MN0066109
		MN0067733
		MNG580053
	Industrial wastewater	MNG255084
		MNG490003
	Municipal stormwater	MS400048
		MS400052
		MS400067
		MS400068
		MS400118
		MS400143
		MS400153
		MS400159
		MS400161
		MS400180
		MS400227
	Animal feeding operation	MNG440799
	Industrial stormwater	MNG490000, MNR050000 and MNRNE0000
	Construction stormwater	MNR100001

a. NPDES permit # not provided in MPCA database.

Pollutant loading from wastewater treatment facilities

The MPCA tracks estimated and observed pollutant load calculations from wastewater treatment facilities (WWTF) over time through the *Healthier watersheds: Tracking the actions taken* website (https://www.pca.state.mn.us/water/wastewater-treatment-plant-progress). Figure 26 and Figure 27 provide the pollutant loading values for WWTF within the MRSW from 2000 to 2019 according to the Healthier watersheds site for phosphorus, and TSS. Nitrogen loading is not recording on the Healthier Watersheds Tracking system.

Pollutant loading values shown in the below figures are a mix of observed data and values estimated based on previously reported values. The loads are considered accurate but are based on calculations and not raw data. Loads are derived by multiplying the monthly average concentration and monthly total flow. These calculated loads are used for research and planning purposes and may vary slightly from discharge monitoring reports due to calculation methods. Note, in 2005, new rules expanded monitoring requirements for facilities and is therefore used as a baseline for loading rates. Since 2005, TP loading from WWTF has decreased 90%, TSS has decreased 91%, and biological oxygen demand has decreased 29% in the MRSW.

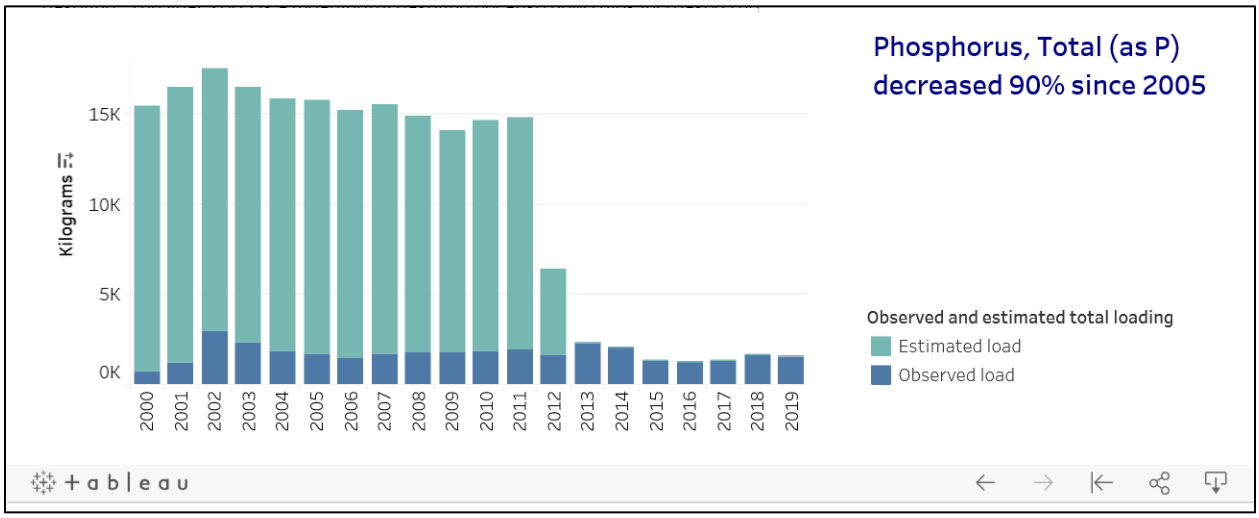


Figure 26. Phosphorus loading (kilograms) from WWTF in the MRSW 2000 to 2019 (MPCA Healthier Watersheds).

Note: permitted discharger Verso Paper Company was no longer active in 2012 and their permit was terminated in 2013. This is reflected in the sudden drop in phosphorus from 2011-2013.

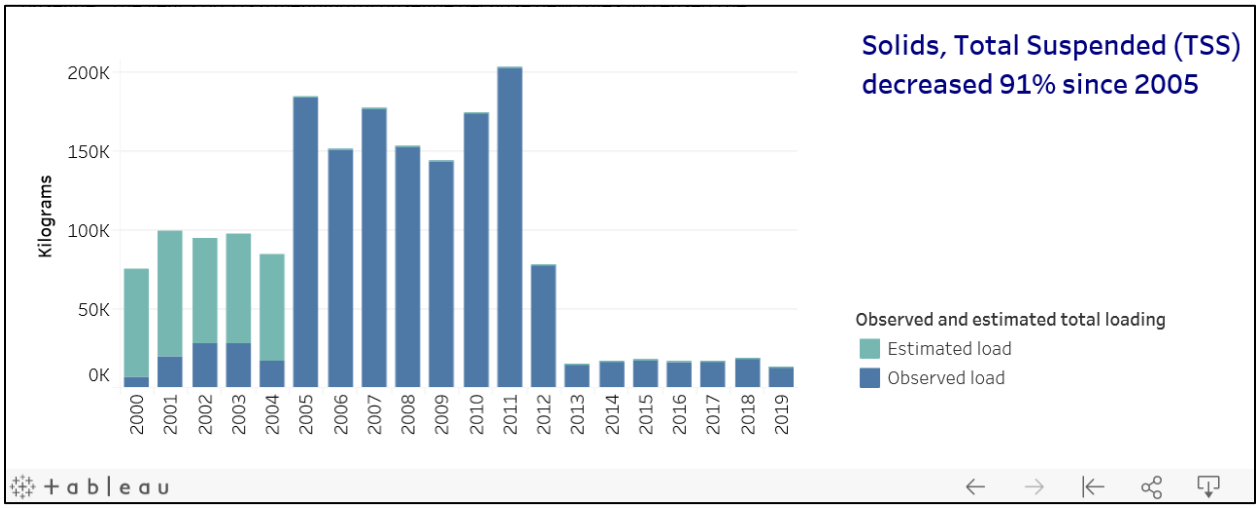


Figure 27. TSS loading kilograms) from WWTF in the MRSW 2000 to 2019 (MPCA Healthier watersheds). Note, permitted discharger Verso Paper Company was no longer active in 2012 and their permit was terminated in 2013. This is reflected in the sudden drop in sediment from 2011-2013.

2.4. TMDL summary

The Clean Water Act and EPA regulations require that TMDLs be developed for waters that do not support their designated uses (fishable, swimmable, consumable). A TMDL is a plan to restore and maintain water quality standards in waters that are not currently meeting them. Waterbodies with impairments determined to be caused from a pollutant are addressed with the development of a TMDL; waterbodies determined to be impaired from a nonpollutant stressor do not require the development of a TMDL. Table 9 provides a summary of the existing TMDLs within the MRSW. TMDLs within the watershed include:

- **Little Rock Lake Nutrient TMDL, 2012.** The Little Rock Lake TMDL was developed to address a nutrient impairment for Little Rock Lake. Algal toxin (microcystin) samples collected during a large blue green algae bloom during the summer of 2007 were determined to be a "high health risk" level according to World Health Organization standards. Due to severity of the algae bloom, Little Rock Lake was put on the draft 2008 Impaired Waters List. TMDL development was led by Benton SWCD (Benton SWCD 2011).
- **Upper Mississippi River Bacteria TMDL Study & Protection Plan, 2014.** The Upper Mississippi River Bacteria TMDL describes the reduction in pollutant loading for 22 stream reaches that have impaired aquatic recreation due to *E. coli*, nine of which are located within the Mississippi River–Sartell Watershed (MPCA 2014).
- **Little Rock Creek TMDL, 2017.** The Little Rock Creek TMDL addresses the impaired segment (-548) on Little Rock Creek for DO, nitrate, temperature and fish bioassessment impairments. This effort was led by the Benton SWCD (Benton SWCD 2015).
- **Mississippi River–Sartell TMDL, 2020.** The Mississippi River–Sartell TMDL addresses 15 stream reaches that have impaired aquatic recreation due to *E. coli,* and two lakes that have impaired aquatic recreation due to nutrient/eutrophication biological indicators (Tetra Tech 2020).

In addition, several waterbodies within the MRSW have aquatic consumption impairments due to high levels of mercury in fish tissue. Because the focus of the watershed condition assessment is the aquatic life, aquatic recreation, and limited resource value designated uses, the aquatic consumption impairments are not addressed here. For more information on mercury impairments, see the *Minnesota Statewide Mercury Total Maximum Daily Load* (MPCA 2007).

Table 9. Summary of TMDLs within the MRSW.

HUC-10	Water-body	AUID [a]/ Lake ID	Year added to List	Affected use	Pollutant or stressor	Year TMDL plan approved
Two River (0701020101)	Two River	523	2014	Aquatic Recreation	*E. coli*	2014
	North Two River	524	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	South Two River	542	-- [b]	Limited Resource Value	*E. coli*	anticipated 2020
	South Two River	543[c]	2014	Aquatic Recreation	*E. coli*	2014
	Unnamed creek	580	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Unnamed creek	612	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Krain Creek	613	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Unnamed creek	628	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
Spunk Creek (0701020102)	Spunk Creek	525	2008	Aquatic Recreation	Fecal Coliform	2014
	Spunk Branch	561	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
Skunk River (0701020103)	Hillman Creek	639	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
Platte River (0701020104)	Platte River	507	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Big Mink Creek	646	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
Little Rock Creek (0701020105)	Little Rock Creek	548[c]	2002	Aquatic Life	Lack of cold water assemblage	2017
			2010		Dissolved oxygen	2017
	Little Rock Creek	653	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Little Rock	05-0013-00	2008	Aquatic Recreation	Nutrient/eutrophication biological indicators	2012
Watab River (0701020106)	Watab River	528	2014	Aquatic Recreation	*E. coli*	2014
	Watab River, North Fork	529	2014	Aquatic Recreation	*E. coli*	2014
	County Ditch 12	537	2014	Aquatic Recreation	*E. coli*	2014

HUC-10	Water-body	AUID [a]/ Lake ID	Year added to List	Affected use	Pollutant or stressor	Year TMDL plan approved
	Watab River, South Fork	554	2014	Aquatic Recreation	*E. coli*	2014
	County Ditch 13	564	2014	Aquatic Recreation	*E. coli*	2014
	County Ditch 16	616	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
City of Sartell-Mississippi River (0701020107)	Little Two River	516	2014	Aquatic Life Aquatic Recreation	*E. coli*	2014
	Hay Creek	630	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020
	Stony Creek	649	-- [b]	Aquatic Recreation	*E. coli*	anticipated 2020

a. The AUIDs begin with 07010201; the values in this column are the last 3 digits of the AUID.
b. Expected to be listed on the 2020 303(d) impaired waters list.
c. South Two River (543) and Little Rock Creek (653) were not evaluated in the *Mississippi River-Sartell Monitoring and Assessment Report* and therefore not included in Table 2. The two segments remain on the impaired waters list.

2.5. Protection considerations

All waters in the MRSW require protection in some capacity, including those listed as impaired and those with insufficient data. It is important to prioritize areas for protection, however, to better focus implementation of the WRAPS. For example, waters that are particularly threatened or vulnerable may be considered at risk for further degradation and impairment and prioritized for protection efforts. Alternatively, or in addition, unique and high value resources that exhibit the highest biological, cultural, and social significance in the region may also be prioritized for protection in order to ensure their continued high quality. This section provides an overview of existing information that can be used when considering protection efforts during WRAPS implementation.

2.5.1. Statewide River and Stream Protection Prioritization

An interagency effort among the MPCA, DNR, and Board of Water and Soil Resources (BWSR 2018) was conducted to develop a protection prioritization process for streams in Minnesota that are currently meeting water quality standards for fish and macroinvertebrate communities—i.e., streams that are fully supporting aquatic life. Streams that are impaired for aquatic life use were not included. More information on the prioritization effort is available: https://www.pca.state.mn.us/sites/default/files/wq-ws1-29.pdf.

Protection prioritization was based on 1) the results of water quality assessments, 2) the level of protection already in place in the watershed, and 3) the level of risk posed from the contributing watershed and nearshore areas. While all streams require protection, top priority, or "priority A" streams are summarized in Table 10 and Figure 28. A full list of streams evaluated during this process and their individual scores is provided in Appendix A.

The "community nearly impaired" column indicates if the fish and/or macroinvertebrate community Index of Biological Integrity (IBI) scores are on average within five points of the assigned threshold (and therefore close to impairment). Riparian risk is based on road density and disturbed land use within the riparian area. Current protection level is based on percentage of public and easement protected land in the subwatershed.

Table 10. Priority streams for protection as identified in the statewide interagency effort.

HUC-10 subwatershed	Stream name (AUID)	Community nearly impaired	Riparian risk	Current protection level
Two River (0701020101)	Two River (523)	one	high	med/low
	North Two River (524)	neither	high	low
	Krain Creek (613)	one	high	low
	Unnamed creek (632)	one	med/high	low
Spunk Creek (0701020102)	Spunk Creek (525)	one	med/high	med/low
Skunk River (0701020103)	Skunk River (521)	neither	high	low
	Unnamed creek (636)	one	med/high	low
	Unnamed creek (637)	neither	high	low
Platte River (0701020104)	Platte River (545)	neither	high	med/low
	Platte River (546)	one	high	med/low
	Unnamed creek (621)	neither	high	med/low
	Unnamed creek (622)	one	med/high	med/low
Watab River (0701020106)	Watab River, North Fork (529)	one	med/high	low
	County Ditch 12 (537)	neither	high	low
	Hay Creek (630)	neither	high	med/low
	Stony Creek (649)	neither	high	low

2.5.2. Statewide Lake Protection Prioritization

The same interagency effort also prioritized Minnesota lakes for protection (MPCA, DNR, BWSR 2018). The effort developed goals for lakes that are currently meeting water quality standards, identified unimpaired lakes that are at greatest risk, and developed a preliminary priority ranking for protection efforts. While all lakes require protection, top priority, or "priority A" lakes, represent those that are at the greatest risk of impairment and are summarized in Table 11 and Figure 28. A full list of lakes evaluated during this process, their target TP concentrations, and their individual scores are provided in Appendix A.

Protection prioritization for lakes was based on numerous parameters including lake's sensitivity to increased phosphorus loading, proximity to the water quality standard, the percent of disturbed land use in the watershed, lake size, existing phosphorus levels, and whether the lake shows a declining trend in water clarity. A selection of these parameters are provided in the below table.

Table 11. Priority lakes for protection as identified in statewide interagency effort.

HUC-10 subwatershed	Lake name (ID)	Disturbed land use (%)	Mean total phosphorus (µg/L)	Water clarity trend
Two River (0701020101)	Cedar (49-0140-00)	37%	14.8	Improving trend
	Pelican (73-0118-00)	33%	22.8	Improving trend
South Two River (0701020102)	Ochotto (73-0122-00)	81%	12.6	No evidence of trend
	Kreigle (73-0097-00)	16%	10.9	No evidence of trend

HUC-10 subwatershed	Lake name (ID)	Disturbed land use (%)	Mean total phosphorus (µg/L)	Water clarity trend
	Middle Spunk (73-0128-00)	65%	19.0	Improving trend
	Koop (73-0166-00)	60%	26.1	Insufficient data
Platte River (0701020104)	Peavy (49-0005-00)	6%	10.5	Insufficient data
	Long (49-0015-00)	21%	19.5	No evidence of trend
	Pierz (49-0024-00)	55%	18.5	No evidence of trend
Watab River (0701020106)	Kraemer (73-0064-00)	12%	33.6	Declining trend
	Sagatagan (73-0092-00)	15%	31.3	No evidence of trend
	Big Watab (73-0102-00)	13%	15.1	Improving trend
	Island (73-0104-00)	17%	14.8	Insufficient data
	Achman (73-0125-00)	25%	17.5	Insufficient data
	Anna (73-0126-00)	59%	18.7	Insufficient data

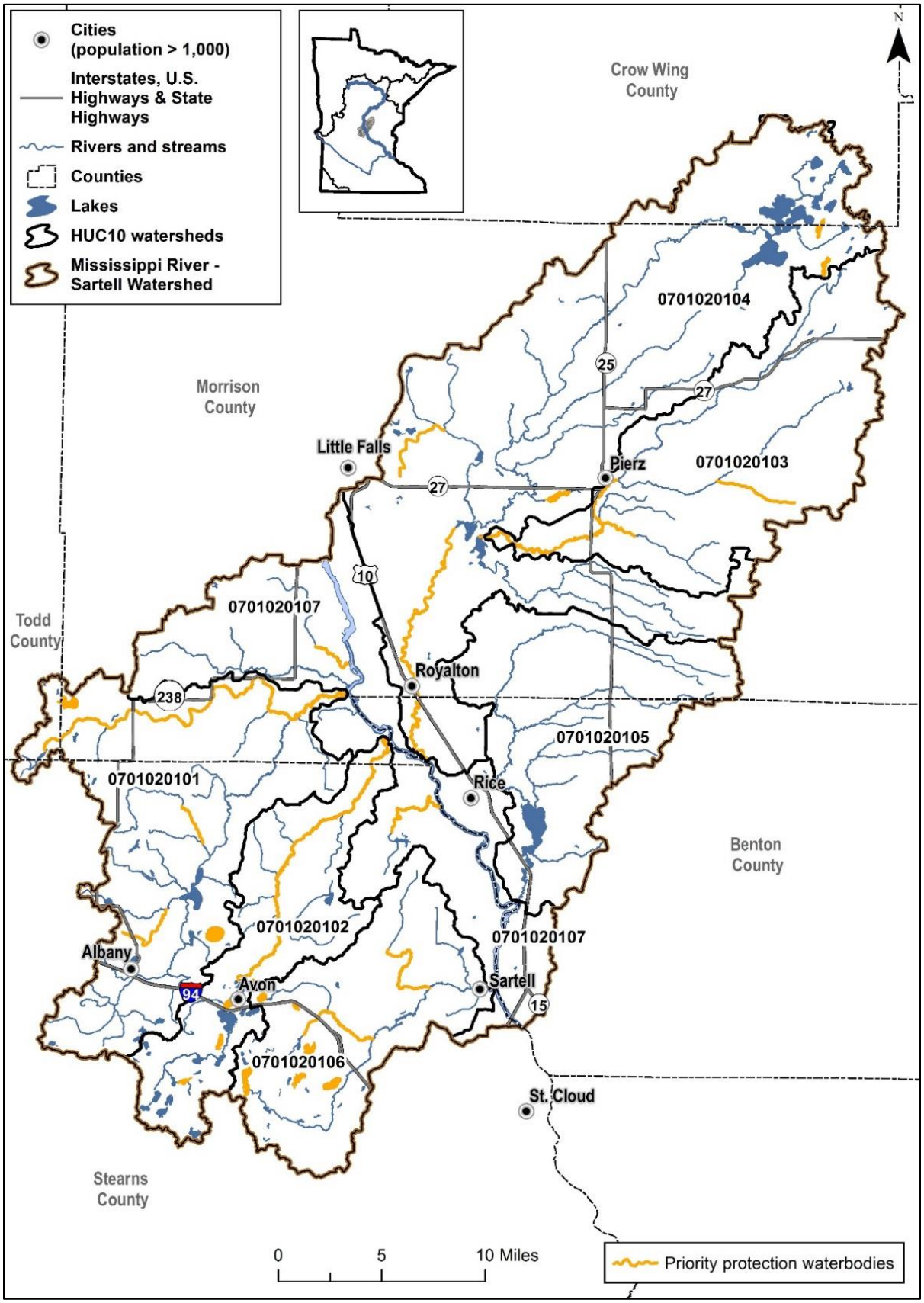


Figure 28. Protection priority waterbodies identified in the MRSW.

2.5.3. Drinking water protection and priority

Residents living within and downstream of the MRSW receive their drinking water from both surface and groundwater sources. As such, it is important to consider all sources of drinking water in protection activities.

The Mississippi River serves as the drinking water supply for the St. Cloud Water Treatment Facility and the Minneapolis Water Treatment and Distribution Services. Approximately 21 billion gallons of water are pumped from the Mississippi River by the Minneapolis Water Treatment and Distribution Services each year. The Mississippi River is also one of the main water supplies for the St. Paul Regional Water Services. As such, restoration and protection of this vital drinking water source is crucial to maintaining public health and safety for many Minnesota residents in addition to keeping the cost of drinking water treatment low. Recognizing the importance of protecting such a large supply of drinking water for the state, St. Cloud, Minneapolis and Saint Paul worked collaboratively to prepare three surface water source water protection plans as part of the Upper Mississippi River Source Water Protection Project. Each plan includes (1) a delineated source water protection area and priorities areas, (2) an inventory of potential point and nonpoint contaminant sources, and (3) a description of management strategies and objectives for implementation.

Priority areas in source water protection plans are delineated based on time of travel for a potential contaminant to reach the intake point and help guide management decisions based on the calculated potential risk to the drinking water source (acute or chronic). A portion of the MRSW is located within the City of St. Cloud Source Water Protection Plan's "Priority Area A" and the remaining area of the watershed lies within "Priority Area B" (Figure 29). In the St. Cloud source water protection plan, Priority Area A is delineated based on an eight-hour travel time of potential contaminants of concern to the intake point. Management in Priority Area A protects users from acute health concerns that could also require closing the intakes. Management in Priority Area B protects water users from chronic health effects. Management in Priority Area B also protects users from contaminants such as pathogens that may be usually found at treatable levels in the source water, but occasionally present an acute health concern. In addition, priority contaminant sources within the City of St. Cloud source water protection area were inventoried, assessed by their ability to influence the surface water intakes, and prioritized for implementation strategies (Table 12).

Table 12. Priority sources in the Source Water Protection Plan for the City of St. Cloud, Minnesota.

High priority sources (known contaminants)	Medium priority sources (potential contaminants)	Low priority sources (permitted and regulated)
• Improper manure management/storage sights • Known stormwater discharge sites • Cropland sediment runoff • Streambank erosion • Transportation corridors • Hazardous waste clean-up sites • Failing septic systems • Leaking underground storage tanks	• Gravel and mining • Residential lawn management • Above ground storage tanks • Agriculture chemical and pesticide applicators • NPDES permits • Underground storage tanks • Vehicle salvage yards	• Wells • Permitted feedlots • Permitted hazardous waste generators • Permitted registered storage tanks • Permitted solid waste sites

In addition, the Minnesota Department of Health (MDH) has developed a ranking system for groundwater sources that supply drinking water to determine vulnerability. The MDH defines drinking water supply management area (DWSMA) vulnerability as an assessment of the likelihood for potential contaminant sources to contaminate a public water supply well based on the aquifer's inherent geologic sensitivity and the chemical and isotopic composition of the groundwater. DWSMA vulnerability is provided in Figure 30.

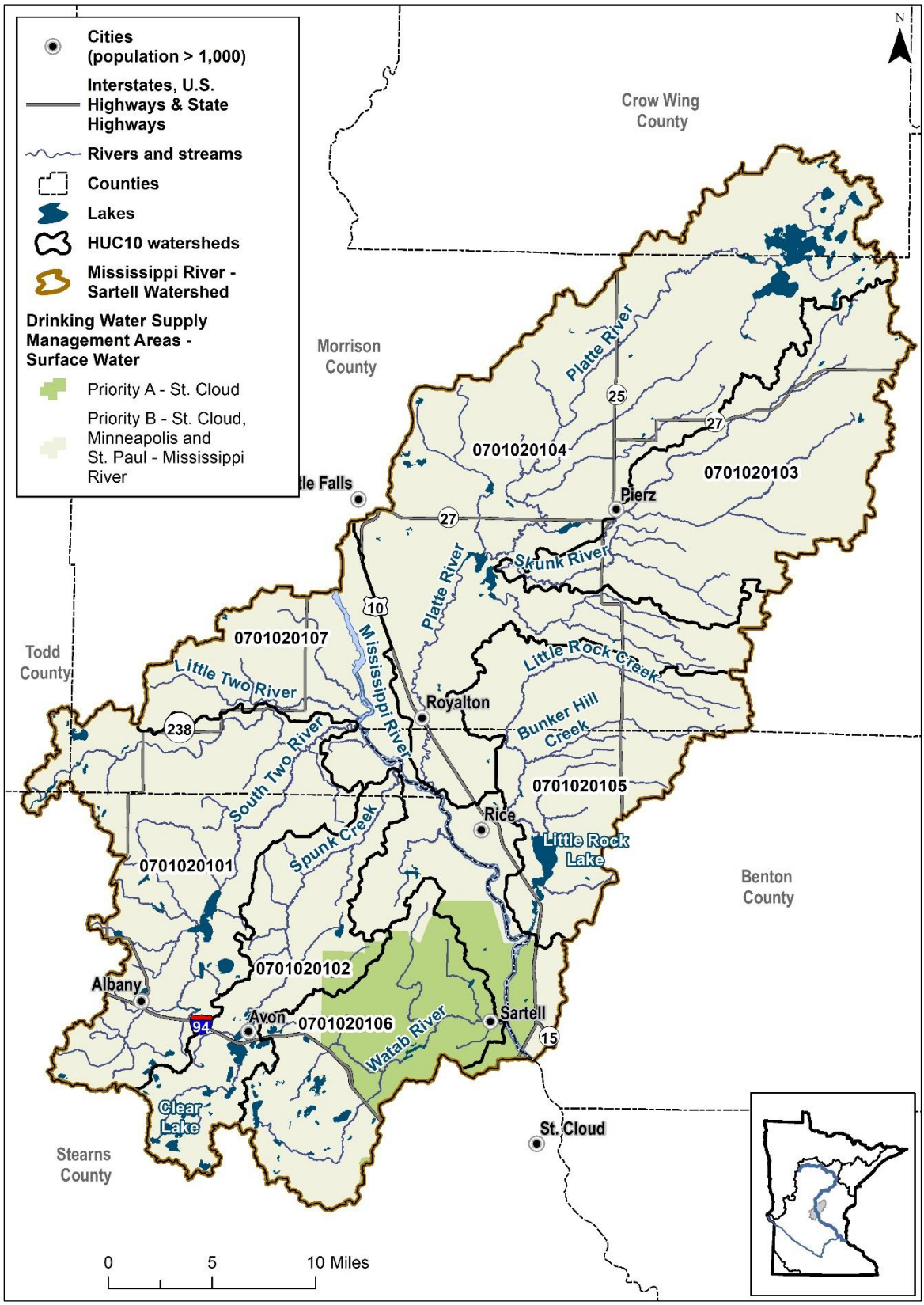


Figure 29. Drinking water supply management areas (DWSMA) for surface water sources.

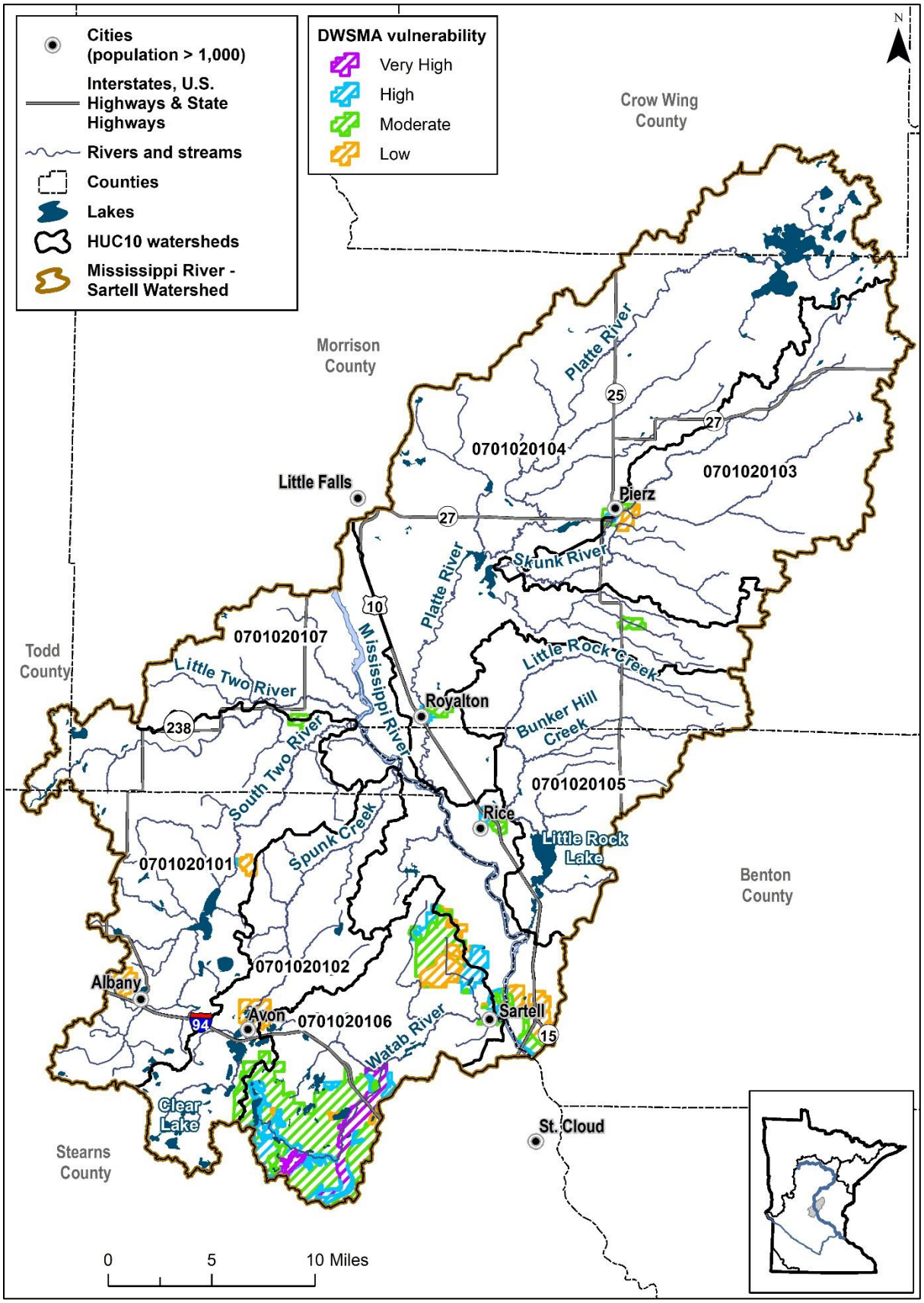


Figure 30. DWSMA vulnerability (MDH).

2.5.4. Groundwater protection considerations

While groundwater is not traditionally addressed by a WRAPS report, groundwater protection should also be considered when determining protection strategies in the MRSW as there is a strong connection between surface and groundwater sources in this watershed. These considerations will be further expanded upon in forthcoming planning efforts.

Groundwater protection will be fully addressed in a Groundwater Restoration and Protection Strategy (GRAPS) report for the MRSW. The MDH coordinates the GRAPS program. Similar to the WRAPS, many state agencies work together to gather data and create GRAPS reports for each watershed in Minnesota. GRAPS reports contain maps and data describing groundwater conditions in the watershed. The reports identify local groundwater concerns and outline strategies and programs to address them.

High capacity water withdrawals

The DNR permits all high capacity water withdrawals in the state where the pumped volume exceeds 10,000 gallons per day or one million gallons per year. Permit holders are required to track water use and report back to the DNR annually. According to the 2016 DNR permitting and reporting systems, the vast majority of water withdrawals in the MRSW are used for agricultural irrigation, 76.4% (MPARS 2016). Water supply is the second highest use of high capacity water withdrawal at 19.9% (Figure 31).

High capacity water withdrawals in the MRSW are a mix of ground and surface water withdrawals as seen in Figure 32; however, groundwater withdrawals have exhibited an increasing trend since 1997 (Figure 33). In addition to an increase in groundwater withdrawals, the DNR also reports an increase in agricultural irrigation, non-crop irrigation, and water supply over the most recent 20 years. For more information on the water permitting and reporting system (MPARS) see: https://www.dnr.state.mn.us/mpars/index.html.

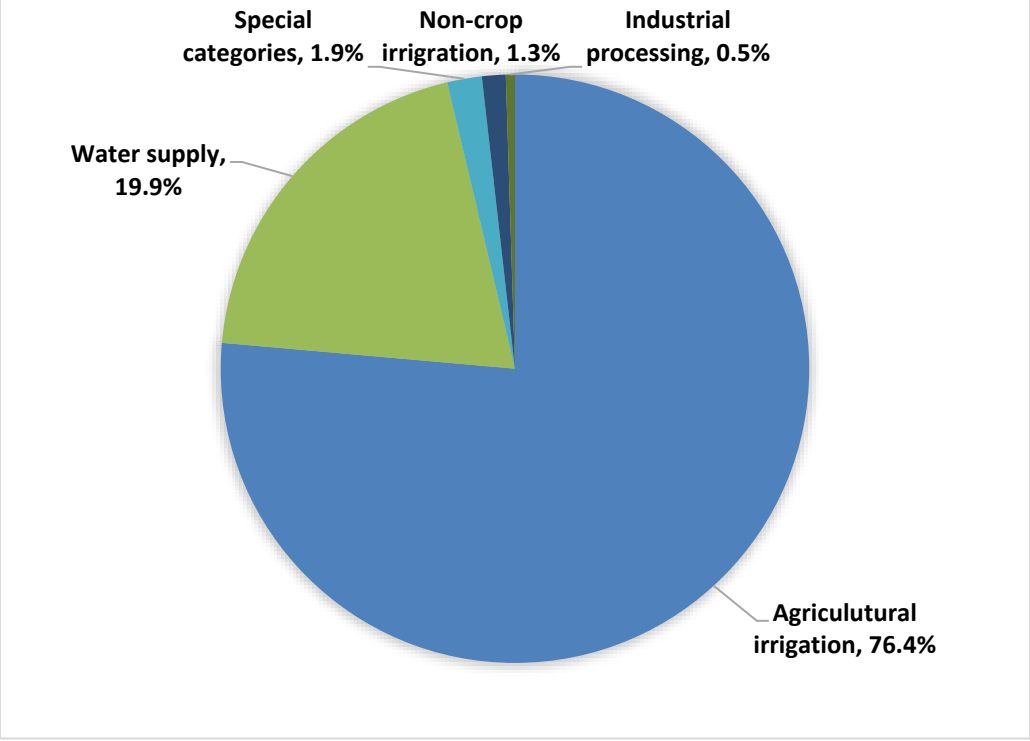


Figure 31. Water withdrawals by type within the MRSW (MPARS 2016).

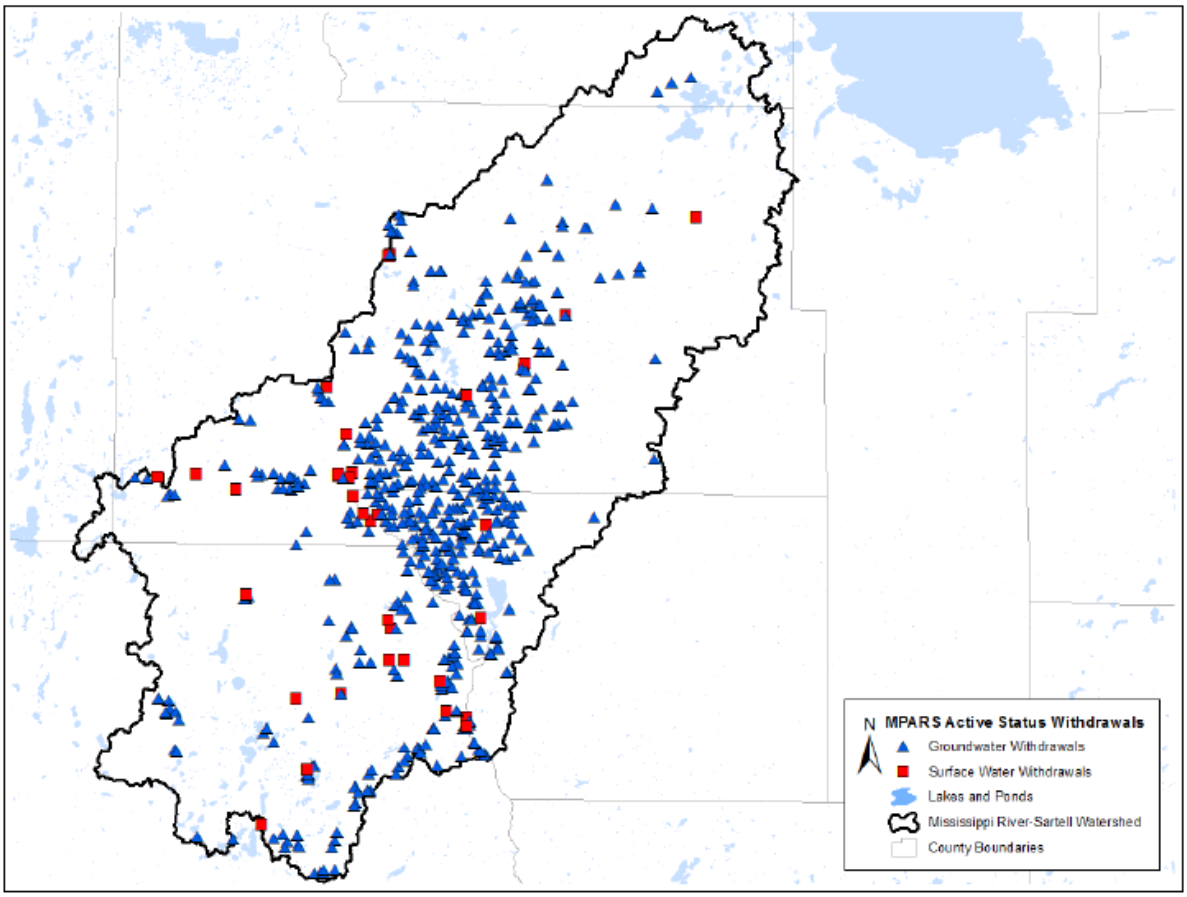


Figure 32. Active status permitted high capacity withdrawals in 2016 (Figure from MPCA 2019a).

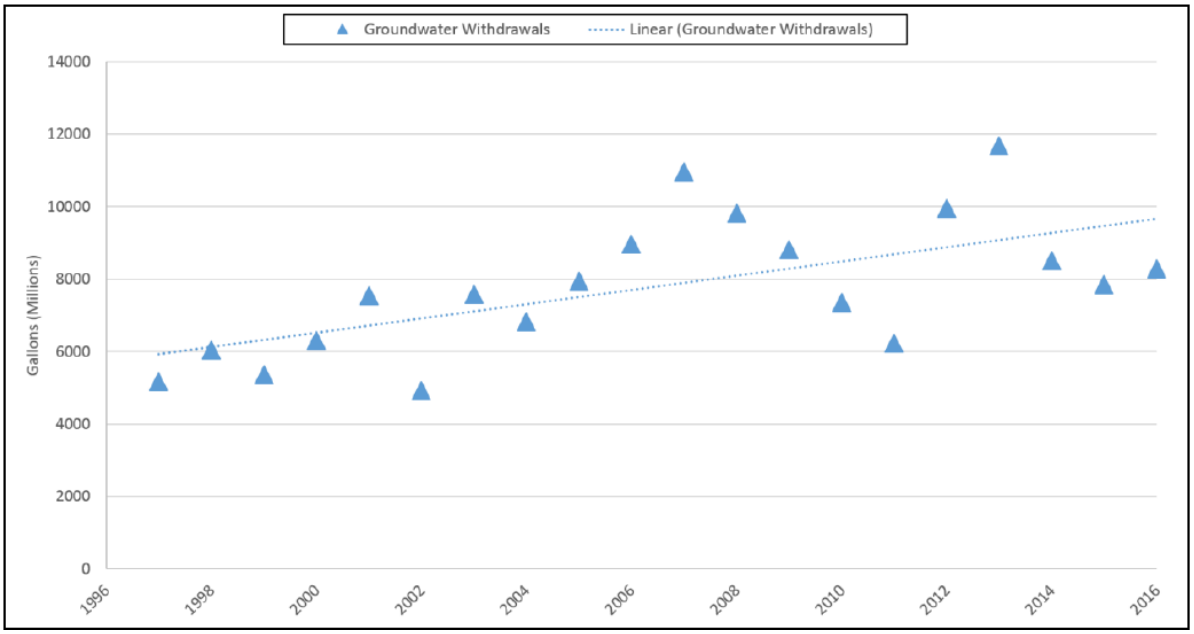


Figure 33. Total annual groundwater withdrawal in the MRSW (1997-2016) (Figure from MPCA 2019a).

Sustainable use of groundwater in the Little Rock Creek Area: A DNR Action Plan

In response to indications that groundwater use is affecting stream flows in Little Rock Creek, the DNR established an action plan for the Little Rock Creek Area (Figure 34) over concerns that total permitted groundwater use in the area is not sustainable and may have a negative impact on Little Rock Creek, an important coldwater trout stream.

The DNR has met with residents, permitted water users, and local government leaders in the Little Rock Creek Area since 2016 to discuss, analyze, and plan for the sustainable and continued use of groundwater in the area. Through those discussions, the DNR developed an action plan. The plan includes a variety of actions the DNR will take through 2022, designed to ensure a sustainable groundwater supply while protecting Little Rock Creek.

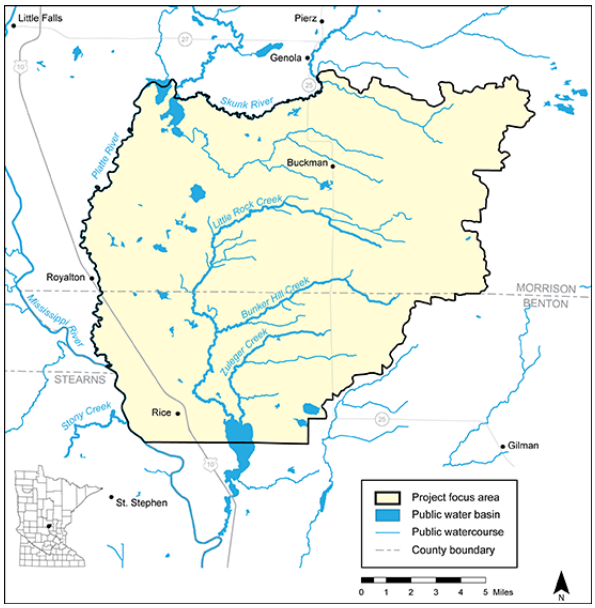


Figure 34. Little Rock Creek Area (Image from Minnesota DNR).

On November 17, 2017, the DNR released the public review version of the *Sustainable Use of Groundwater in the Little Rock Creek Area: A Draft Action Plan*. Actions outlined in this draft plan and eventual final version are important for protection considerations in the MRS WRAPS.

More information on the Little Rock Creek Area Action Plan for groundwater use is available at the following website: https://www.dnr.state.mn.us/waters/groundwater_section/sustainability/lrc/index.html.

Groundwater pollution sensitivity

The DNR completed a statewide evaluation of pollution sensitivity of near-surface materials. Results of this evaluation can be used to estimate pollution vulnerability of groundwater within 10 feet of the land surface. The MPCA 2019a estimates that the MRSW has primarily low to moderate groundwater pollution sensitivity overall; however, a large swatch of high pollution sensitivity is seen along the Mississippi River corridor, due to the presence of sand and gravel quaternary geology (Figure 35). Clear overlap exists between areas of high groundwater pollution sensitivity and the presence of high capacity wells provided in Figure 32.

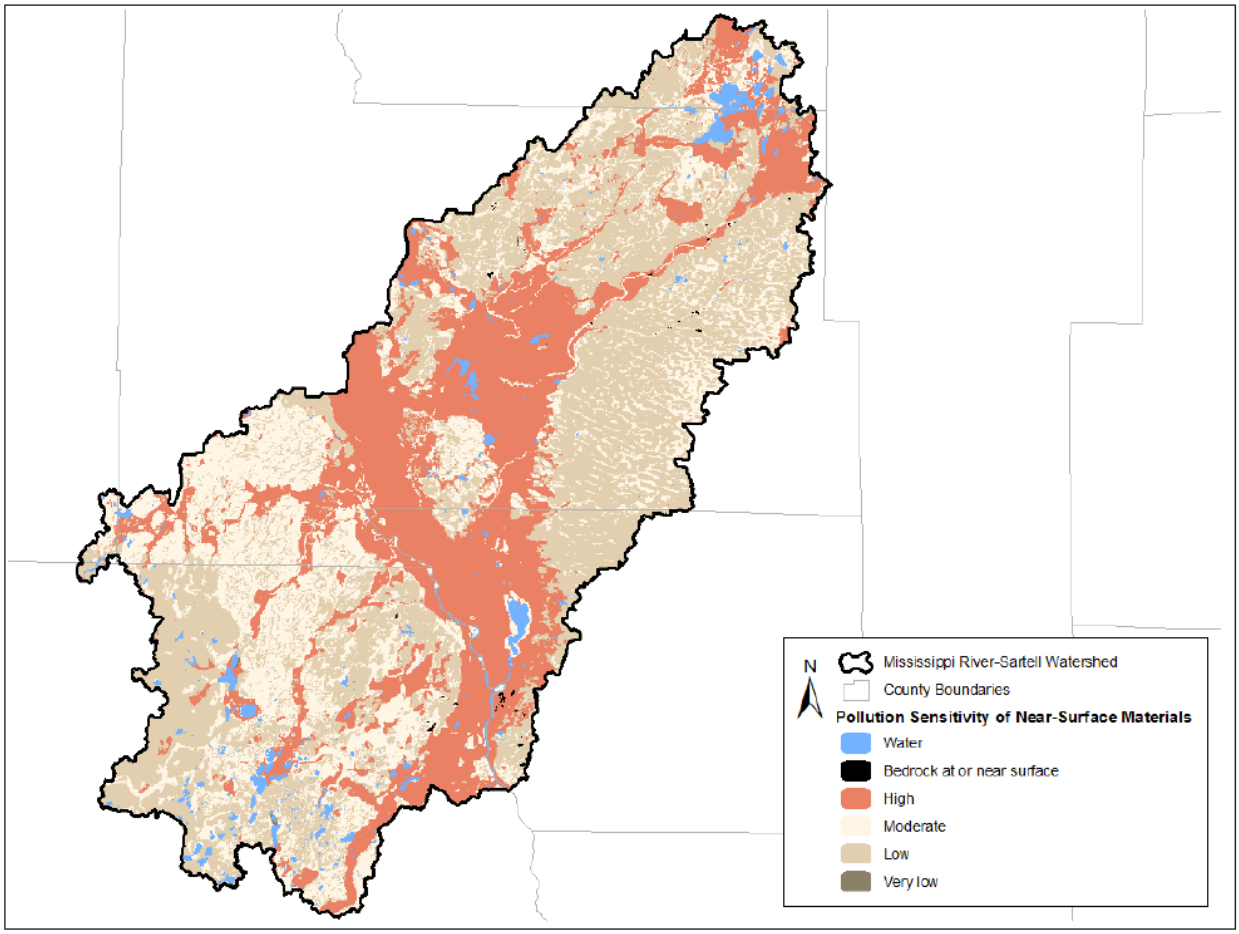


Figure 35. Pollution sensitivity of near surface materials (Image from MPCA 2019a).

3. Prioritizing and implementing restoration and protection

The Clean Water Legacy Act requires that WRAPS reports: identify impaired waters and waters in need of protection; identify biotic stressors causing impairments or threats to water quality; summarize TMDLs, watershed modeling outputs, and resulting pollution load allocations and identify areas with high pollutant-loading rates; and contain strategies that are capable of cumulatively achieving needed pollution load reductions for point and nonpoint sources, including identifying water quality parameters of concern, current water quality conditions, water quality goals, strategies, and targets by parameter of concern, and strategies and an example of the scale of adoptions with a timeline to meet water quality restoration or protection goals.

This section of the report provides the results of such prioritization and strategy development. The implementation strategies, including associated scales of adoption and timelines, provided in this section are the result of watershed modeling efforts and professional judgment based on what is known at this time and, thus, should be considered approximate. Furthermore, many strategies are predicated on needed funding being secured. As such, the proposed actions outlined are subject to adaptive management—an iterative approach of implementation, evaluation and course correction.

Implementation partners

Because many of the nonpoint source strategies outlined in this section rely on voluntary implementation by landowners, land users, and residents of the watershed, it is imperative to create social capital (trust, networks, and positive relationships) with those who will be needed to voluntarily implement BMPs. Thus, effective ongoing civic engagement is fully a part of the overall plan for moving forward. Achieving the goals of this WRAPS will require partnerships and collaboration, in addition to financial resources. Governmental units with primary implementation responsibility include the following entities:

- MPCA
- MDA
- DNR
- MDH
- BWSR
- U.S. Fish & Wildlife Service
- Natural Resources Conservation Service
- Counties (Morrison, Benton, Stearns, Crow Wing, Todd, Mille Lacs)
- Soil and Water Conservation Districts (SWCD)
- Municipalities

These and other agencies will work with private landowners and other project partners to support implementation of the strategies and actions in this WRAPS. In addition, many other partners are anticipated to participate with implementation including:

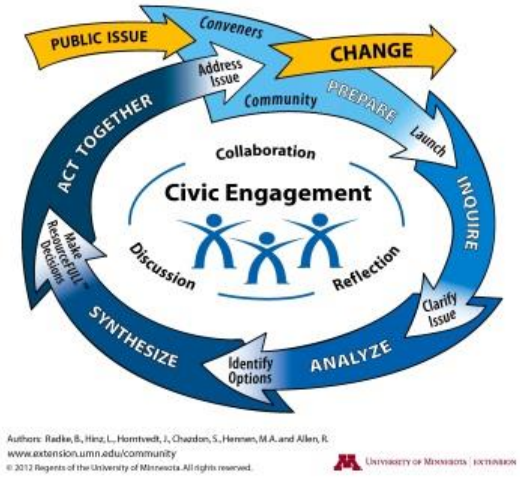
- Nonprofits (e.g., Trout Unlimited, The Nature Conservatory)
- Chambers of Commerce
- Agricultural Organizations (e.g., Minnesota Soybean Growers, local farmer cooperatives)
- Universities

- Business owners

Local lake and river associations, and clubs can provide the grassroots energy and organization to help support WRAPS implementation and can play an integral part in civic engagement activities. The following local associations are active in the MRSW:

- Little Rock Lake Association
- Friends of Two Rivers Lake
- Avon Area of Lakes Association
- Big Watab Lake Association
- Pelican Lake Association
- Kramer Lake Association
- Upper Spunk Lake Association
- Watab Lake Association
- St. Joe Rod and Gun Club
- Stearns County Coalition of Lake Associations

3.1. Civic engagement



A key prerequisite for successful strategy development and on-the-ground implementation is meaningful civic engagement. This is distinguished from the broader term 'public participation' in that civic engagement encompasses a higher, more interactive level of involvement. The MPCA has coordinated with the University of Minnesota Extension Service for years on developing and implementing civic engagement approaches and efforts for the watershed approach. Specifically, the University of Minnesota Extension's definition of civic engagement is "Making 'resourceFULL' decisions and taking collective action on public issues through processes that involve public discussion, reflection, and collaboration." Extension defines a resourceFULL decision as one based on diverse sources of information and supported with buy-in, resources (including human), and competence. Further information on civic engagement is available at: http://www.extension.umn.edu/community/civic-engagement/. The MRSW is predominantly composed of privately owned land. As such, civic engagement with private landowners is important to the successful watershed restoration and protection efforts.

3.1.1. Upper Mississippi–Brainerd/Sartell Watersheds Civic Engagement Cohort

An Upper Mississippi–Brainerd/Sartell Watersheds Civic Engagement Cohort was sponsored by the MPCA in 2016–2017. This Cohort was provided through a partnership with the University of Minnesota Extension, which provided training. The Cohort complemented the efforts of the MRS WRAPS project through professional training and development of interested watershed partners in becoming civic engagement leaders in their respective watersheds. While the regular training sessions concluded in February 2017, the ongoing goal was to continue communications among Cohort members to help

sustain the system of civic engagement support and information that was developed through the training sessions.

The goals of the Upper Mississippi–Brainerd/Sartell Watersheds Civic Engagement Cohort included:

- Explore and apply civic engagement research, skills, and practices in watershed restoration and protection efforts.
- Expand leadership confidence, capacity, and connections.
- Build a system of support through fellow cohort participants.
- Learn from other cohort participants.
- Reflect and collaborate to further authentic community engagement in the watersheds.

3.1.2. Mississippi River–Sartell Communication Plan

In November of 2017 a communication plan was developed for the Mississippi River–Sartell TMDL and WRAPS development. This communication plan was intended to serve as a working document that first outlined the major steps and actions needed to effectively communicate with key target audiences and among core team members. Local partners may use the plan as a guide for more specific and targeted messaging and incorporate plan elements into their existing communication activities.

The communication plan also identifies the numerous existing organizations involved with education and outreach in the project area and their multiple efforts. Ongoing events include conservation and farm tours for residents and elected officials; creation of materials for homeowners, construction contractors, etc.; conservation events like “Take the Day Off,” a collaboration between the Minnesota River Renaissance, Benton and Stearns SWCD, and County Parks with Minnesota DNR that offers participants hands-on instruction in a variety of outdoor activities, education on land use impacts to our natural resources, and an increased awareness of the Mississippi River in central Minnesota; annual tree sales; and groundwater well testing demonstrations and kits.

Notable actions taken during implementation of the communication plan include a monthly civic engagement email, the creation of a Facebook page dedicated to the MRS WRAPS effort, and the continuation of existing communication efforts by local partners. Monthly emails contained information on the events held the previous month, upcoming events, and useful materials for partners to use in their own outreach efforts.

The communication plan is provided in Appendix B. It is an adaptive plan and can be refined and updated as implementation progresses in the watershed.

Elements of the MRSW Communication Plan

Element 1: Goals and Objectives. These are the goals and objectives for involvement and education to support the WRAPS.

Element 2: Partnering Organizations and Communication Subcommittee. This element lists the organizations with potential engagement with the WRAPS and its education, and recommends the formation of a subcommittee to lead initiatives.

Element 3: Key Audience Characterization. This element identifies the priority audiences for each phase of the WRAPS process and provides details on how these audiences will receive information, other existing communication channels, and potential concerns.

Element 4: Tailored Messages. Using information from Element 2, this element identifies messages to help raise awareness, encourage involvement, and promote implementation support. The objective is to create messages for the key target audiences that will resonate and achieve a result.

Element 5: Effective Formats. The information about communication channels in Element 3 will also help to identify effective formats for conveying the messages developed under Element 4.

Element 6: Efficient Delivery Mechanisms. Not all key target audiences get or want their information in the same manner. Some audiences might obtain their information through agency or association newsletters. Others might prefer to attend a meeting or go to a website to learn more. The communication identifies a range of possible delivery mechanisms for distributing the formats with tailored messages to key target audiences.

Element 7: Evaluation Measures. Evaluating the success of the communication plan will be one way to also help measure the success of the WRAPS process. Tracking which stakeholders have played a role in the process and how their perceptions, awareness, and involvement has changed over time will help anticipate who will support implementation recommendations to improve water quality.

3.1.3. Local Partner Team meetings and input

The local partner team for the MRS WRAPS included representatives from the MPCA, DNR, BWSR, TNC, counties, SWCDs, and lake associations. The local partner team met and communicated regularly throughout the WRAPS development.

- April 2017 WRAPS Kick off Meeting in Rice, MN
- February 2018 conference call
- April 2018 Professional Judgement Group meeting to discuss water quality assessments in Little Falls, MN
- November 2018 conference call
- July 2019 Local Partner Team meeting in Little Falls, MN
- September 2019 conference call
- December 2019 Local Partner Team meeting in Little Falls, MN
- June 25th 2020 Microsoft Teams conference video call to discuss full draft WRAPS report

The local partner team provided input throughout WRAPS development. Specifically, local partner team members participated in large format mapping exercises to identify potential areas of concern and opportunity in the watershed, provided guidance on targeted geographic area selection, selected and

modified restoration and protection strategies as needed, and took a survey to identify their top issues and concerns in the watershed. Based on survey results, row crop agriculture, feedlots, source water protection, and altered hydrology were the top issues and concerns for the local partner team. Full survey results are expanded upon in Appendix C. Input received from the local partner team has been incorporated throughout the WRAPS report.


Participants at the April 2017 Kick-off meeting (left) and the July 2019 Local Partner Team meeting (right).

3.1.4. Watershed events and programs

In addition, local partners working in the MRSW held and participated in numerous events throughout the planning process through a variety of programs. These events encourage public interest in water quality, restoration, and protection activities, among others. This public interest in integral to a successful WRAPS report.

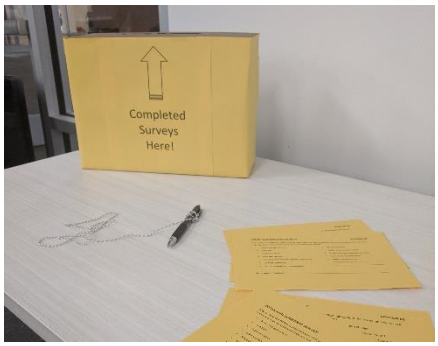
- April 2017, Biological and Water Chemistry Monitoring presentations to local organizations by MPCA
- August 2018, Watershed Outreach Day in Rice, Minnesota
- September 2018, Secchi Social in Walker, Minnesota
- Annual County Fairs 2017-2019
- March 2019, Water is Life Workshop at St. John's University
- April 2019, MPCA attendance at the Local Water Plan Task Force meeting for Morrison County
- July 2019, MPCA attendance at Stearns County SWCD Staff meeting to discuss TMDL, WRAPS and 1W1P
- July 2019, Stearns County Shoreline and Watershed Practices Tour
- August – October 2019, Little Rock Lake Draw Down and previous community meetings
- September 2019, Conservation Tour in Benton
- November 2019, MPCA attendance at the Benton County Water Resource Advisory Committee meeting

- December 2019, Sustainable Use of Groundwater in the Little Rock Creek Area—Stakeholder meeting
- December 2019, Minnesota Coalition of Lake Associations meeting. Presentations by BWSR and MPCA
- Ongoing, Mississippi River Headwaters Board Aquatic Invasive Species social media campaign
- January 2020, Stearns County Shoreland Training presentations by MPCA and Benton SWCD
- February 2020, Public Meetings in Royalton and Sartell
- March 2020, Stearns County Farmers Fair

Little Rock Lake drawdown 2019 (left, photo from DNR) and the Secchi Social in Walker, Minnesota 2018 (right).

3.1.5. Public Participation and Public notice for comments

Residents of the MRSW were provided the opportunity to give input on the WRAPS prioritization and targeting effort at two public meetings on February 25, 2020, at the Royalton American Legion, and on February 27, 2020, at the Sartell Community Center. Invitations were sent out via a press release, Facebook event invites, and email lists. Attendees of the public meeting were asked to participate in a series of interactive stations set up for them to provide input on the watershed planning process. Several local news reporters were in attendance at the meetings and a write up on the event "Watershed health requires citizen input" was published in The Newsleader. Descriptions of each public meeting station and a brief summary of input received is provided below.



START: State of the watershed. Approximately 45-minute-long presentations were given by the MPCA Project Manager Phil Votruba followed by a question and answer session. The presentation covered the history of the Mississippi River and MRSW, the current water quality and impairments within the watershed, the WRAPS, TMDL, and other applicable planning documents, and next steps.

Station #1: Where in the watershed. Attendees were asked to place star marking their home on large format maps. Attendees live throughout the watershed however there was a higher concentration of homes in and near the city of Sartell, around Little Rock lake, and within the Two Rivers HUC10. Fewer attendees live in the northeastern portion of the watershed. Marked maps from Station #1 are provided in Appendix C.

Station #2: Love your watershed. Attendees were asked to place a heart sticker on natural areas that are important to them. Hearts were placed throughout the watershed. Identified areas include lake shores, parks and areas along the Mississippi River, Little Rock Lake and within the Two Rivers Watershed. Some attendees marked their homes with hearts. Marked maps are provided in Appendix C.

Station #3: Issues and concerns. A total of 20 surveys were submitted between the two events. This survey was previously completed by the local partner team. Row crop agriculture, feedlots, and irrigation and groundwater levels were the three most voted issues and concerns. Local partner team members also selected row crop and feedlots as their top issues and concerns; however, public meeting attendees more often selected issues related to lakes and urban areas than the local partner team members. This difference may be due to the geographic location of public meeting attendees along lake shores and within communities. Full survey results for the public meetings and the local partner team are provided in Appendix C.

Station #4: **Chat with a local water resource expert.** Meeting attendees were able to meet and talk with local water resource experts working in the watershed. Water resource experts from Benton, Stearns, and Morrison SWCDs, Stearns County, MPCA, and the Crane Meadows Wildlife Refuge were available at this station.

An opportunity for public comment on the draft WRAPS report was provided via a public notice in the *State Register* from September 14, 2020 through October 14, 2020. There were two comment letters received and responded to as a result of the public notice.

3.2. Targeting of geographic areas

The primary purpose of this section is to provide information to support the selection of priority or critical areas for implementation within the MRSW. Three different considerations were used when selecting targeted geographic areas for the MRSW: pollutant load contributions, high quality and at-risk aquatic life, and issues and concerns of the local partner team. County level prioritization, if available, was also included in this section. Information provided in this section can be used to guide targeting efforts in forthcoming planning efforts, such as the future 1W1P.

Areas of disproportionate pollutant loading rates

Upland loading rates of phosphorus, sediment and nitrogen loading were area-weighted by HSPF model catchment and ranked from high to low. Ranks for each pollutant were totaled and ranked from high to low again to calculate a combined pollutant loading rank. Model catchments with the highest overall pollutant loading rank are identified in Figure 36 and can be targeted for restoration actives.

High quality and nearly/barely impaired biological communities

Figure 37 and Figure 38 summarize the IBI data for the MRSW. The gold markers, “High quality (> upper confidence limit)”, indicate stream sample locations that are comfortably meeting fish or macroinvertebrate IBI targets for their use (general or exceptional) and can be targeted for protection efforts. The blue markers, “Nearly (> threshold)”, indicate stream sampling locations with IBI scores that are close to the targets and are considered threatened of becoming impaired. These streams can be targeted for implementation activities because they are potentially vulnerable to impairment in the future. The pink markers, “Barely (< threshold)”, represent stream sampling locations that have IBI scores indicating impairment, but that are higher than the lower confidence limit. These locations can be targeted for implementation activities as they represent the “low hanging fruit” opportunities where not much improvement is needed in IBI scores to remove segments from the impaired waters list.

It is possible that some of the lower scoring monitoring sites are due to physical barriers downstream or application of a target that is not reflective of the stream condition.

Issues and concerns identified by Local Partner Team members

Key areas of concern were identified by local partner team members during large map work sessions for the development of the MRS WRAPS Report. These areas were digitized and provided in Figure 39.

Water and land resources valued by the public

During the public meetings in February of 2020, attendees were asked to place a heart sticker on the locations of natural resources and water bodies that are important to them (**Figure** 40 and Figure 41). These areas can be targeted for implementation activities aimed at public engagement and awareness such as educational campaigns, demonstration projects, and others.

County-level prioritization

Stearns County and Stearns County SWCD staff developed guidance for prioritization of water resource projects within their county to better coordinate between offices. The general guidance for prioritization is as follows:

- Priority should be placed on locations/waterbodies in which implementation of activities will generate the greatest return-on-investment as measured by either pollutant reductions, increases in biological metrics (e.g., IBIs), or another metric that is agreed upon.
- Priority should be placed on projects with multiple benefits. For example, a project that will provide additional benefits such as habitat improvements, source water protection or water quality improvements may be deserving of higher prioritization compared to a project that provides only water quality improvements.
- Previously-completed prioritization efforts should be incorporated as much as possible.
- Many implementation activities will rely on volunteer participation. Therefore, priority should also be given to projects that have a willing landowner or partner.

Stearns County and Stearns County SWCD staff also compiled a list of lakes and streams in which to prioritize implementation efforts within Stearns County. Table 13 summarizes the priority surface waters for Stearns County in the MRSW.

Table 13. Priority waterbodies for Streams County as determined by SWCD and County staff.

Waterbody	Rationale/notes
All the Spunks, Big Watab and Kreigle Lakes	• These lakes are highly recreational waters whose drainage areas are experiencing development pressure • There are several protection efforts already in place with willing participants • Active lake associations on Middle Spunk and Big Watab lakes
Pelican and Kraemer Lakes	These lakes have the potential for agriculture pressure to lead to degradation.
Two Rivers Lake	• Lake is highly recreational with a drainage area impacts by agricultural runoff and drainage from tiles • Active lake association
Spunk Creek, Watab River, Two Rivers (impaired stream segments)	These streams have segments impaired for *E. coli.*

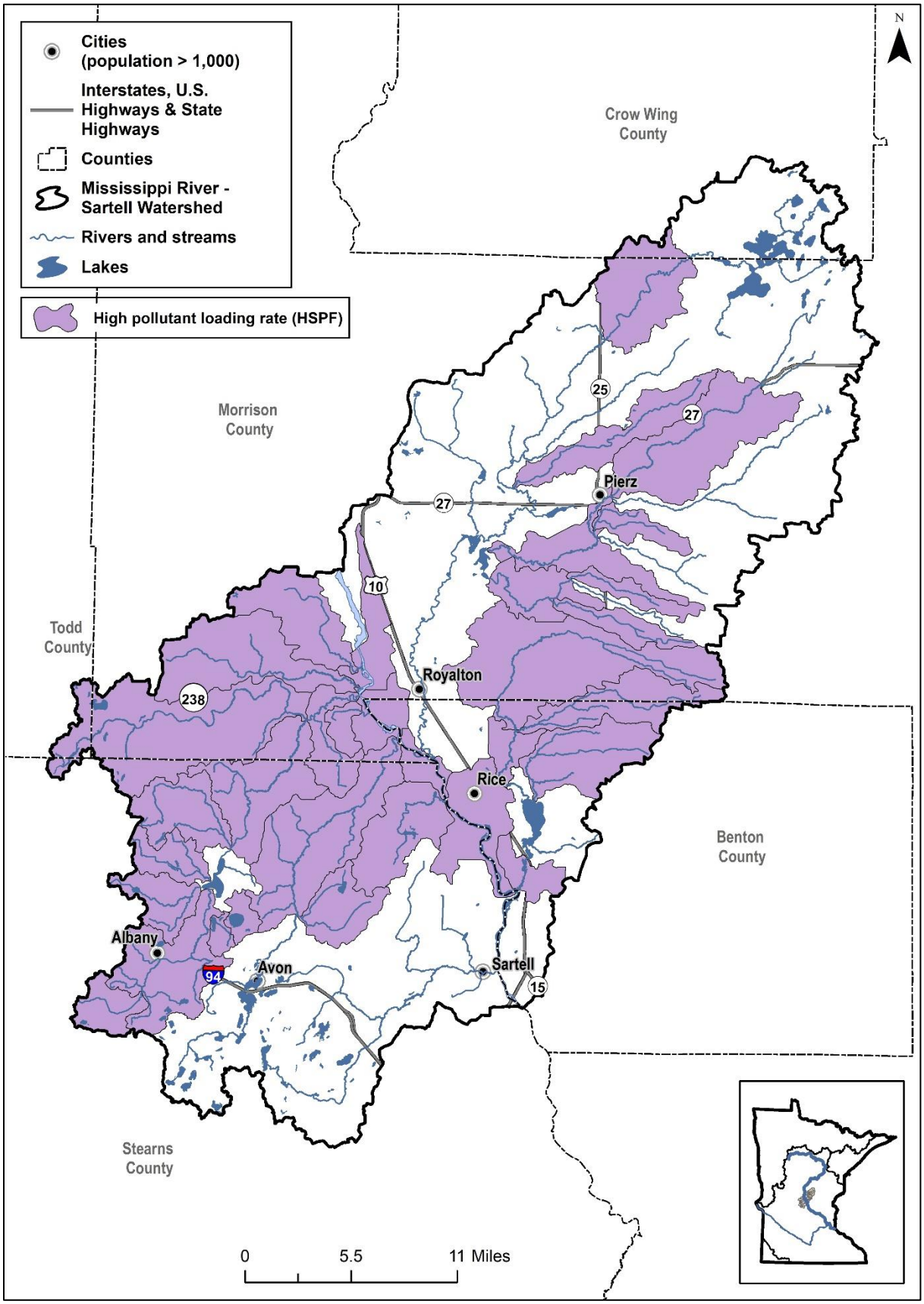


Figure 36. Targeted geographic area: HSPF subwatersheds with high TP, TSS, and TN upland loading rates in the MRSW.

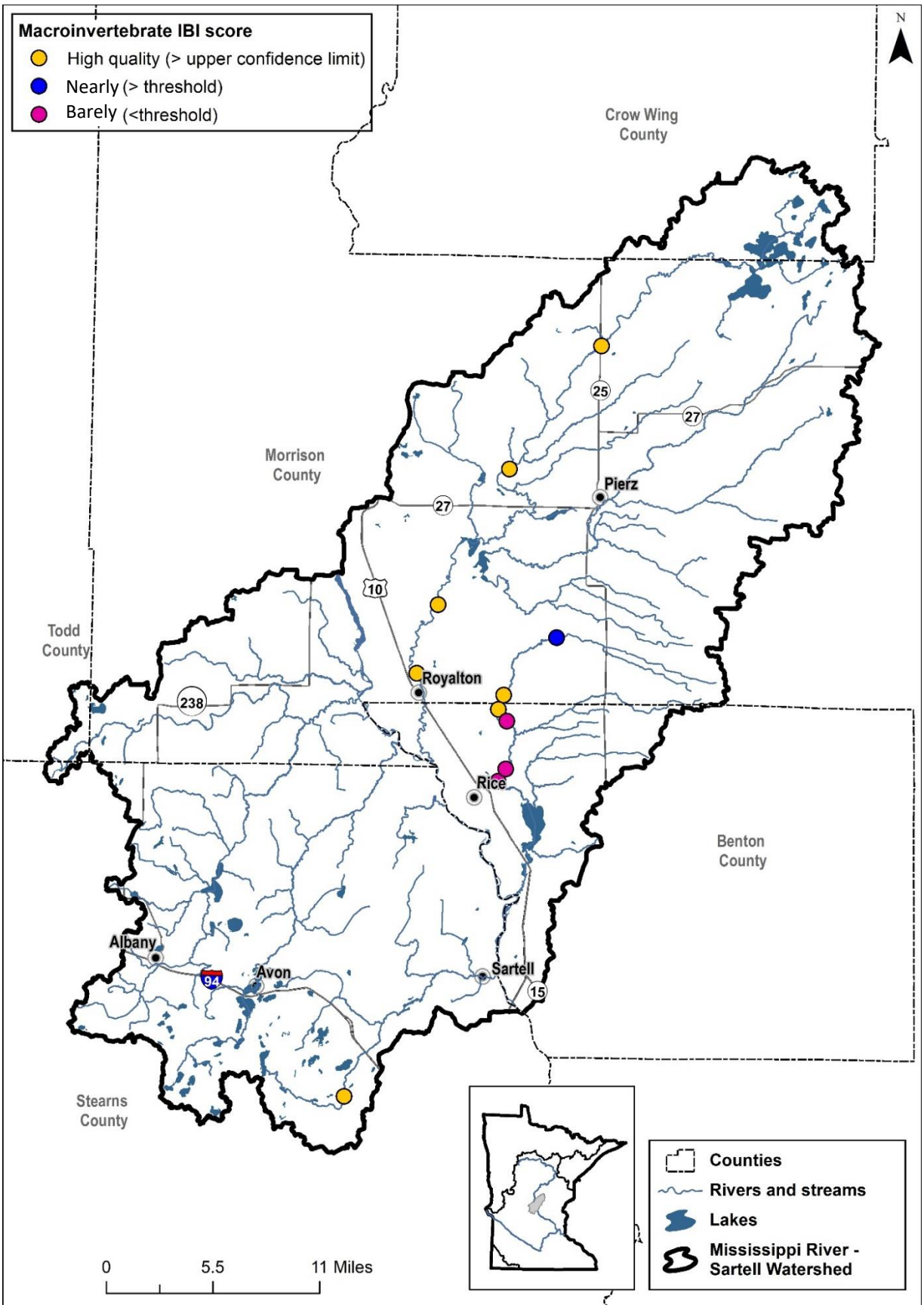


Figure 37. Targeted geographic area: High quality and nearly/barely macroinvertebrate biological communities in the MRSW.

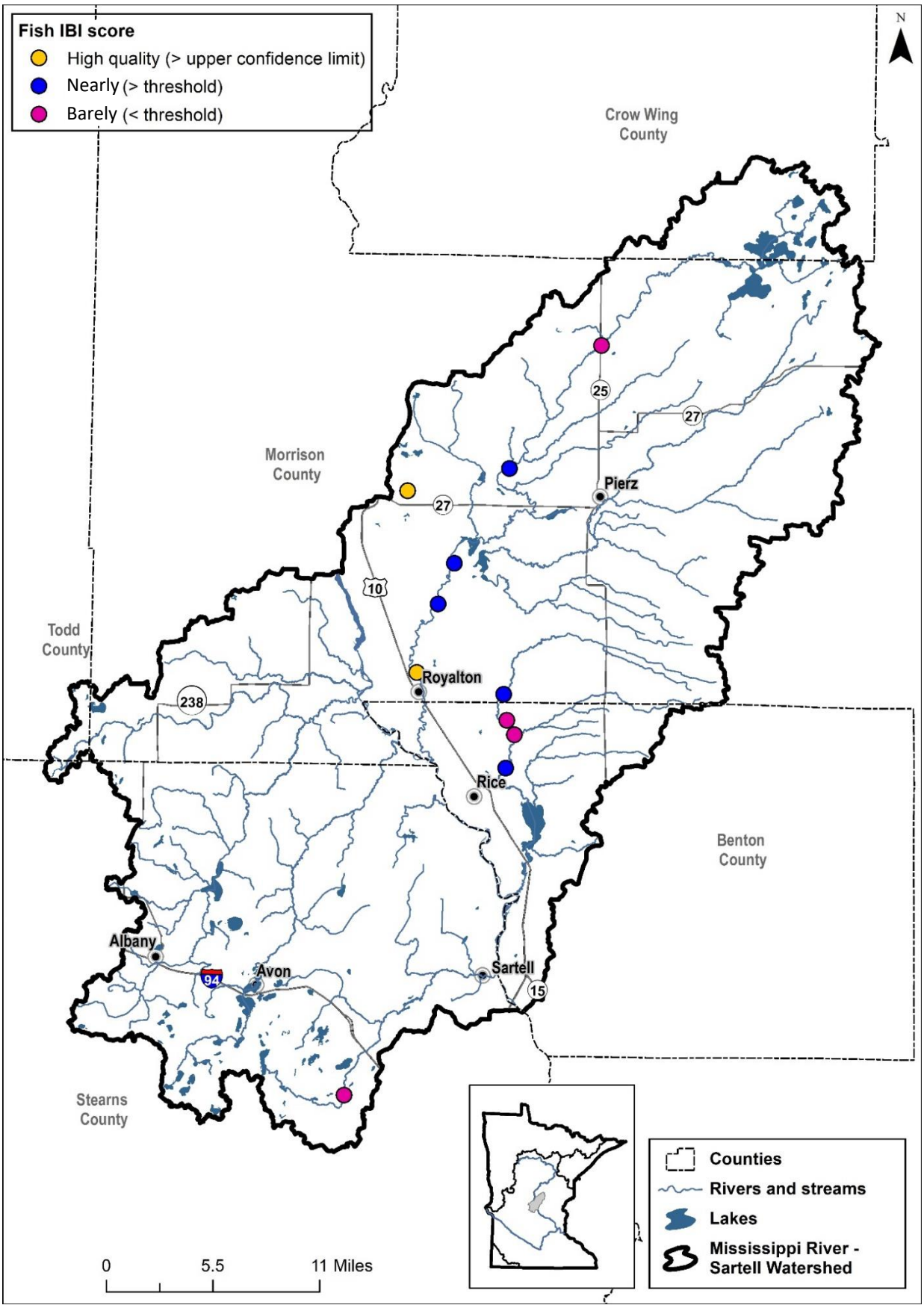


Figure 38. Targeted geographic area: High quality and at-risk fish biological communities in the MRSW.

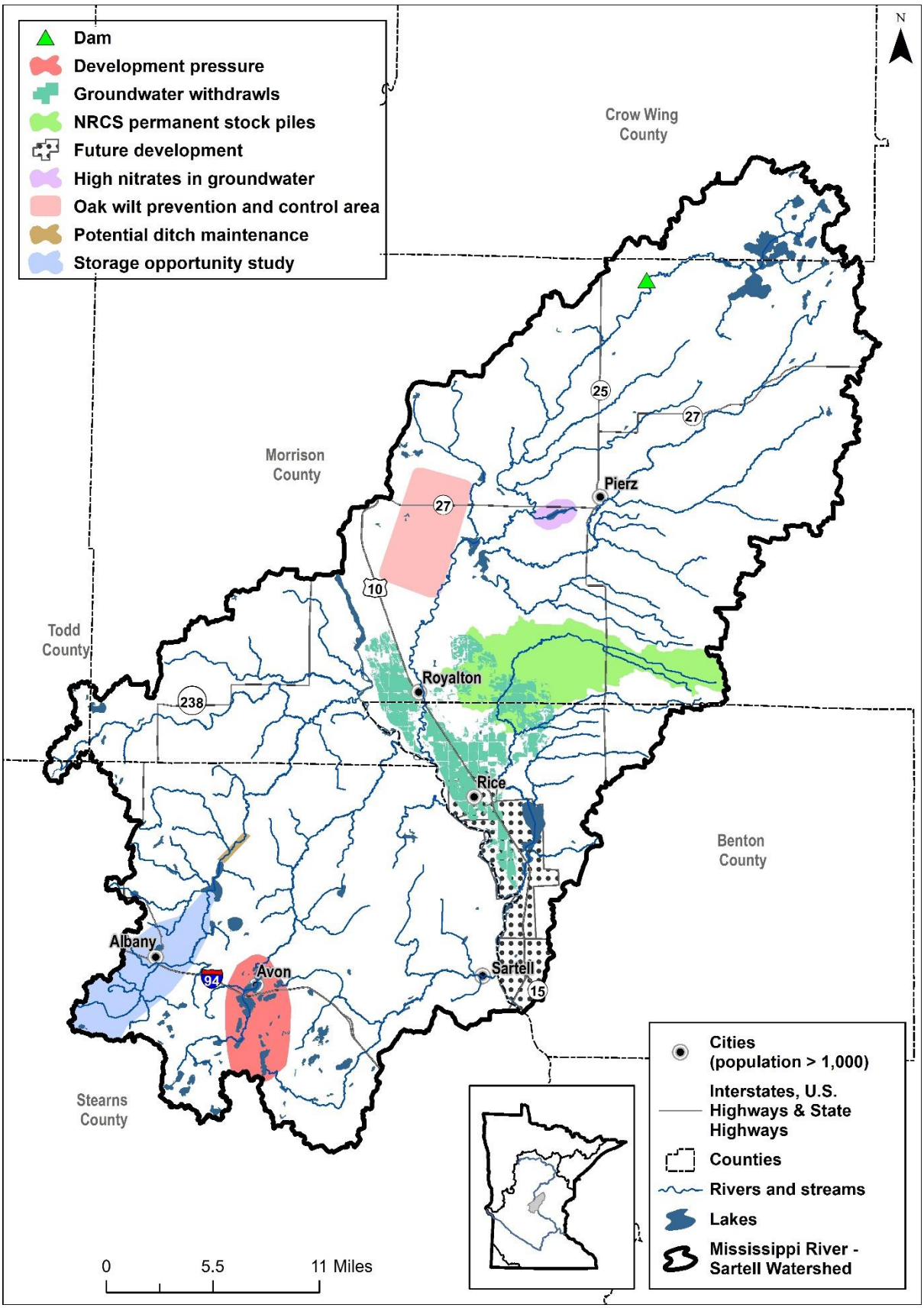


Figure 39. Targeted geographic area: Areas of concern identified by local partner team members in the MRSW.

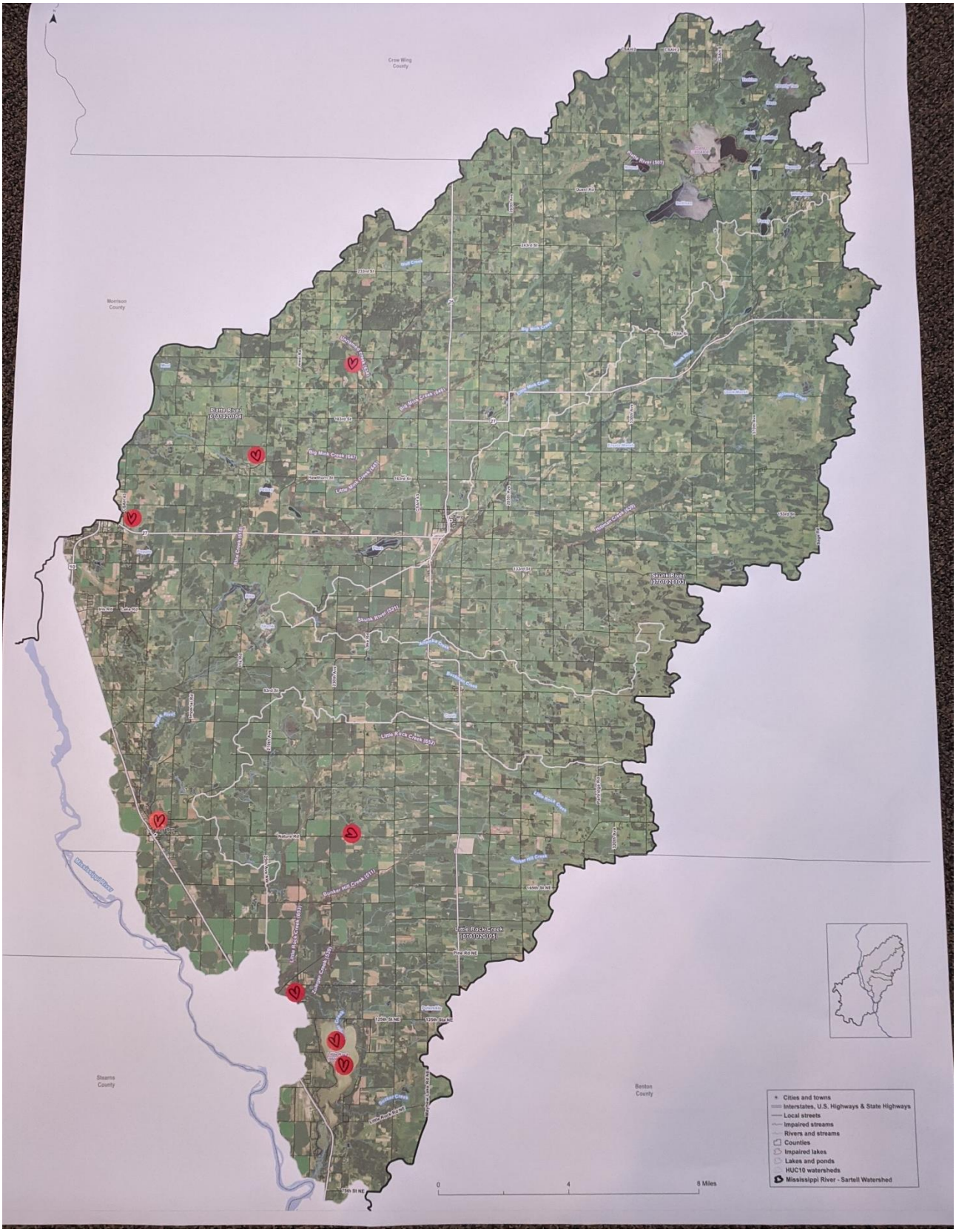


Figure 40. Targeted geographic area: Areas marked as important land and water resources during the February 2020 public meetings, northeastern portion of watershed.

Figure 41.Targeted geographic area: Areas marked as important land and water resources during the February 2020 public meetings, southwestern portion of watershed.

3.3. Restoration and protection strategies

This section provides a summary of implementation strategies for both restoration and protection in the MRSW. The WRAPS strategy tables provide examples of the types of changes for both restoration and protection needed to achieve water quality goals in the MRSW. When appropriate, the table references existing plans for implementation strategies. Rather than reiterate and duplicate previous work, the strategy tables focus on and highlight new information in the project that can be used to expand existing restoration and protection efforts through the adaptive management process.

The strategies implemented in the MRS WRAPS will maximize the impacts of BMPs whenever possible in order to achieve multiple benefits in water quality, soil health, flood management, habitat improvement, and others.

Subsequent local planning steps (i.e., the 1W1P) can take these general examples and describe more specific planning elements for each, such as intended projects and efforts, resource needs, who will be involved, and project timeframes. The WRAPS strategy tables are organized first by watershed wide strategies (Section 3.3.1) that are applicable to all waterbodies within the watershed, followed by strategy tables at the HUC-10 watershed level (Section a).

3.3.1. Watershed wide strategies

A list of general watershed wide strategies is provided in Table 14. Watershed wide strategies were created based on strategies and BMPs provided in the WRAPS template (July 2018) and modified by local partner input. These strategies represent the recommended strategies for the entire HUC-8 watershed and are not limited to impaired waters. Note that this list is not meant to be exhaustive, but to instead provide a fairly comprehensive overview of example BMPs, tools, and plans that are recommended for implementation in the MRSW. This list can be further refined based on location specific conditions and during future planning efforts (e.g., the 1W1P process).

Table 14. Watershed wide strategy types (in alphabetical order) and example BMPs for the MRSW.

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
Agricultural tile drainage water treatment and inlet protection	Prioritize wetland restoration, construction for drainage treatment
	Incorporate usage of tile line bioreactors where appropriate in the watershed
	Expand education programs to promote usage and acceptance of tile line bioreactors where appropriate in the watershed
	Map drain tiles, outlets, and intakes for future conservation. Develop tiling inventory and maintain
	Understand and account for cumulative impacts of new and existing tile systems on water quality and quantity
	Prioritize support for drainage practices which provide multiple benefits and will be adopted
	Promote alternative tile intake practices
	Controlled drainage practices

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
Buffers - field edge	Updated ordinances to increase buffers
	Increase acreage of field borders to complement existing conservation management systems.
	Promote upland buffer restoration
	Saturated buffers
	Promote vegetated buffers
Changing rotations to less erosive crops	Develop plan for crediting nutrients on nontraditional crops
	Precision agriculture
	Agricultural certification
	Promote Forever Green program that encourages cover crops, perennial vegetation and providing markets for alternative crops
	Increase educational opportunities for farmers, including subsidies for certified crop advisors (CCAs)
Converting land to perennials	Increase conservation cover through perennials
	Conservation crop rotation with perennials
	Enhance protection for converted land through conservation easements and reforestation efforts
	Increase enrollment in Conservation Reserve Program
	Implement new perennial cover options
	Explore new and innovative conservation practices
Cover crops for living cover in fall/spring	Increase late-season cover plantings with corn and soybeans to reduce sediment loss, improve nutrient uptake
Designed erosion control and trapping	Filter strip
	Add field wind breaks in critical areas (e.g., along highways and other open spaces)
	Grassed waterway
	Contour Buffer Strips
	Contour farming
	Water and sediment control basins in coordination with upland treatment practices
	Minnesota Agricultural Water Quality Certification Program
	Stripcropping
	Sediment basin
Drainage ditch modifications	New in-ditch grade stabilization structures to reduce erosion in county ditches
	Inventory ditches to identify areas of high density, consider a ditch density study
	Incorporate multipurpose drainage
Drinking water management	Conservation crop rotation with small grains in 10-year time frame of capture zone

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
	Implement source water protection planning to watershed planning
	Complete GRAPS and update Geologic Atlas, as needed
Feedlot runoff controls	Feedlot runoff reduction/treatment
	Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state
	Feedlot manure/ runoff storage addition and compliance inspections for participating farms
	Increase rainwater diversion practices
	Improve inter-agency coordination of feedlot inspections and record keeping requirements
	Feedlot relocation/ retirement
	Promote practices that reduce stocking density
	Total confinement facilities (concreted and roofed)
	Feed storage in silos/grain bins or on impervious surfaces
	Storage of process wastewater in tank/manure pits
	Improved record keeping and mapping of existing risks
	Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered
Habitat and stream connectivity management	Conduct or expand upon county culvert inventories to identify connectivity issues, beginning in upland areas
	Wildlife habitat management (upland and aquatic habitat)
	Develop rebate program for integrated pest management
	Modify and replace dams culverts and fish passage barriers
	Properly site and position culverts to allow for aquatic organism passage
	Protection of vulnerable ecosystems and habitats
Lake management	Create minimum impact design standards for future development along lakeshores
	Develop and implement shoreline ordinance updates
	Native shoreline restoration
	Educate residents to increase awareness of BMPs and low impact development (LID) for future developments
	Encourage formation of lake association or similar homeowner and lake user organization

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
Nutrient management (cropland)	Increase staffing, local capacity, and regional coordination for manure and nutrient management inspections
	Reduced application/ application on select sites
	Nutrient Management - rate, form, placement, timing. Including reduced application, wetland stream avoidance, improve practices of application timing (e.g., no fall nitrogen application)
	Soil testing prior to fertilizer application/plantings
	Provide resources to CCAs regarding soil health practices such as an underwritten CCA program and subsidies
	Continue the development of new mapping and data collection tools for measuring land application rates, especially on small farms.
	Develop free nitrate testing program or clinic
	Whole farm planning
	Encourage small and non-NPDES sites to develop manure management plans
	Prioritize context for manure/ fertilizer incorporation and injection, as weather allows.
	Improve record keeping practices
Pasture management	Conversion of conventional pasture to prescribed rotational grazing
	Support pasture improvement and silvopasture
	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations
	Promote practices that reduce stocking density
	Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells
Tillage/ residue management	Improve residue management in contour areas
	Conservation tillage
	Incentivize adoption of no-till practices
Rural water storage and irrigation water conservation	Improve practices of tile water storage for re-use on crops
	Develop set-aside water storage area program
	Irrigation water management
Septic system improvements	Improve SSTS compliance inspections

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
	SSTS ordinance development and updates, Stearns County has a local example
	Improve failing SSTSs
	Ordinance development and improved regulation of SSTS sludge land application
	Conduct risk assessment of SSTS
Stream restoration and stabilization	Re-meander channelized stream reaches in select areas
	Develop and implement shoreline ordinance updates
	Increased education of benefits of streambank restoration to discourage variances from ordinance
	Educate residents to increase awareness of BMPs and LID for future developments
	Promote natural channel design principles for stream restorations
	Promote critical area plantings
	Restore floodplains and reconnect with channel
	Implement the Mississippi Headwaters Board Comprehensive Plan for zoning protection: https://www.mississippiheadwaters.org/files/regmanagement/2019%20final%20draft%20mhb%20comp%20plan.pdf
Urban stormwater runoff control	Prioritize wetland restoration, construction for treatment of urban runoff
	Create long-term education and outreach plan for stormwater management. Topics can include impacts of different stormwater BMPs, lawn maintenance alternatives, and street sweeping
	Develop BMP guidebook for residents
	Develop reverse fee system to fund and incentivize local stormwater BMPs
	Increase all stormwater practices to meet TMDL and permit conditions and tie TMDL compliance into stormwater planning, as appropriate
	Create enhanced spill response, emergency response plan
	Continue to improve outreach and education plan for increasing stormwater BMP/LID, including development of demonstration projects
	Plan for climate change impacts in future stormwater planning efforts
	Improve urban irrigation water management via smart irrigation, or similar

Watershed wide strategies for the MRSW [a]	
Strategy type	**EXAMPLE best management practices, tools, and plans**
	Promote bioretention, bioinfiltration basins, rain gardens, and constructed stormwater ponds
	Enhance chloride and road salt management including; direct engagement with salt applicators, increased monitoring and mapping to determine key issues; and free clinics and/or testing for private application of salt and water softeners.
	Promote MPCA's Smart Salting Certification program for property managers and applicators
	Consider rebate program for water softener replacement
	Educate private citizens on proper salt application and water softener upgrades
	Regulate or limit impervious surfaces and allowable mitigation in new development
	Identify nonbuildable areas due to erosion and potential level of impact of new development, limit new development in these areas
	Stormwater Retrofit analysis
	Improve stormwater ordinances in rural communities and subdivisions including bluff definitions and regulations of topographic and vegetative alterations
	Develop supplemental street sweeping plan

a. This list is not meant to be exhaustive but to instead provide a fairly comprehensive overview of example BMPs, tools, and plans that are recommended for implementation in MRSW. This list can be further refined based on location-specific conditions and during future planning efforts (e.g., the One Watershed, One Plan process (1W1P).

3.3.2. Restoration and protection strategies by subwatershed

The following sections outline the contents of the MRS WRAPS restoration and protection strategy tables by subwatershed (HUC10) and are organized by strategy table column.

Waterbody and location

Waterbody-specific rows are provided for all impaired segments and segments with specific protection strategies recommended by the local partner team or previous water quality studies. Strategies for impaired waterbodies, or restoration strategies, are shown in light red cells. Watershed-wide strategies, or strategies applicable to the entire subwatershed are shown in the white cells at the top of each table. Current water quality conditions were determined using water quality information from previous TMDLs and results from the MPCA's intensive monitoring efforts in the MRSW.

Water quality goals

Waterbody-specific goals are set for the individual impairments in the watersheds. Final water quality goals for pollutant-impaired streams are provided in TMDL documents (Benton SWCD 2011, Benton SWCD 2015, MPCA 2014, Tetra Tech 2020). Final water quality goals for biota impairments were

determined using the applicable fish biocriteria (mIBI and/or fIBI score) necessary to obtain the aquatic life use goals for each waterbody. Goals for biota impairments are supported by the SID report. Measures of implementation progress for specific waterbodies are not required to be included in WRAPS reports, and were determined by local partner team members.

Strategies to achieve final water quality goals

Final water quality goals include maintaining current conditions for unimpaired waterbodies and meeting water quality standards for those waterbodies that are impaired.

Waterbody-specific restoration and protection strategies are provided in Table 15 through Table 21 by individual HUC-10 subwatersheds. Corresponding maps for each HUC10 are provided in Figure 42 through Figure 48. Waterbody-specific strategies were developed using the information provided by local partner team members, recommended strategies in Table 14, and from information provided in Mississippi River–Sartell TMDL (Tetra Tech 2020), the Little Rock Lake and Creek Watershed Protection Improvement Plan (Benton SWCD 2013), the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016), the Mississippi River–Sartell Watershed Stressor Identification Report (MPCA 2019a), and the Action Plan for Sustainable Groundwater Use in the Little Rock Creek Area (DNR 2018) for impaired stream reaches and lakes in the watershed.

Example BMP scenarios for phosphorus, DO, and nitrogen-related BMPs were determined using information from existing reports, or as provided in the HSPF-SAM recommended removal efficiencies. A similar tool to estimate scale of adoption specific to *E. coli* related BMPs in Minnesota is not currently available, therefore a qualitative approach based on previous TMDL sources assessments was used to determine scales of adoption for *E. coli* BMPs. Strategies for many of the biota impairments were also done in a qualitative fashion because they do not have a specific pollutant load reduction from a TMDL, or the stressor (e.g., degraded habitat) does not have an associated pollutant. Adaptive management can be used to determine scale of adoption necessary to achieve *E. coli* reductions and address nonpollutant-based, biological stressors.

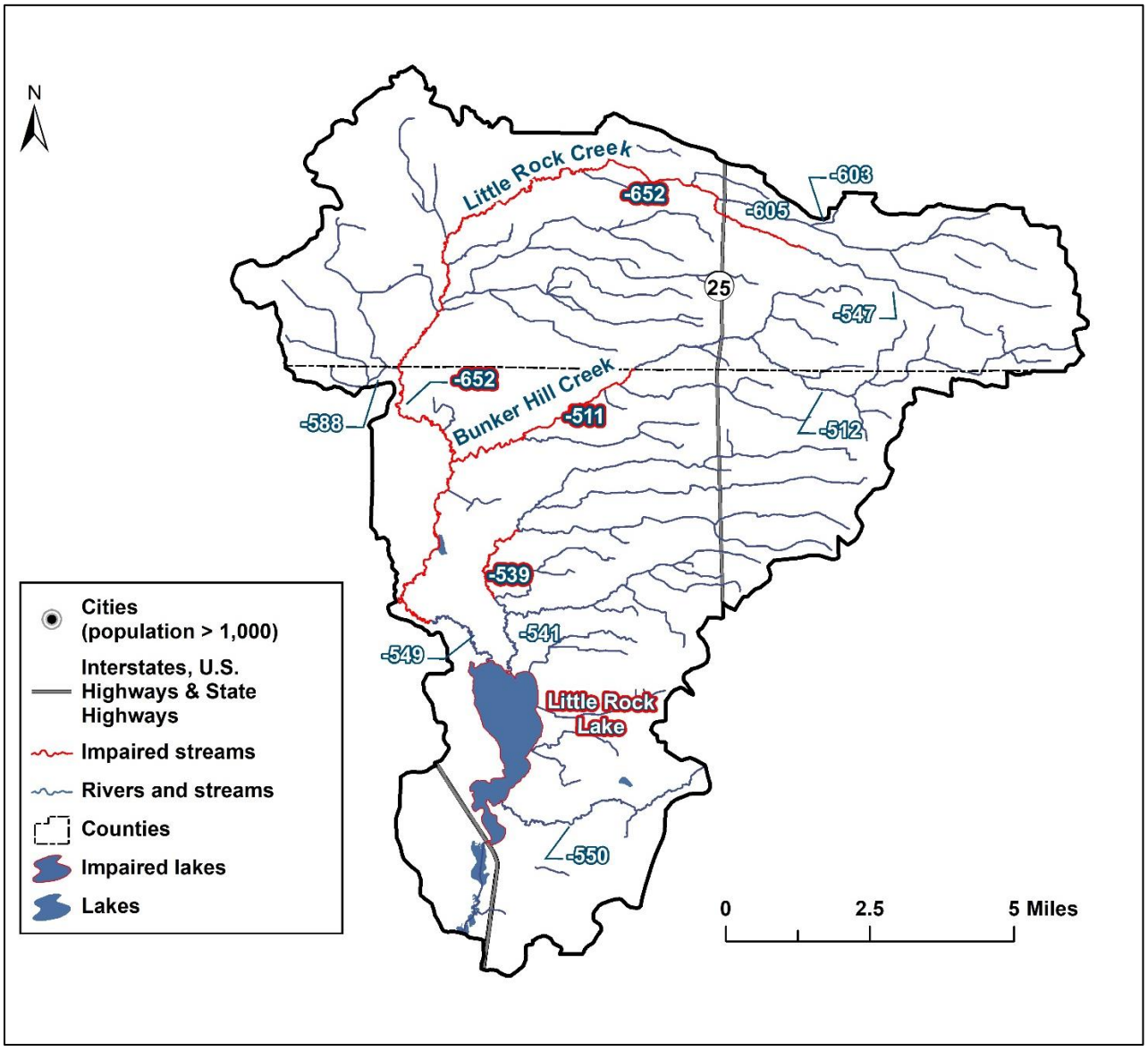


Figure 42. Little Rock Lake Subwatershed (0701020105). See Table 15 for corresponding restoration and protection strategies.

Table 15. Restoration and protection strategies for the Little Rock Creek Subwatershed (0701020105).

Little Rock Creek (0701020105)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
All	Benton, Morrison	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
				Implement the 5-year action plan for sustainable groundwater use in the Little Rock Creek Area (DNR 2018)							
				Urban stormwater control			Regulate or limit impervious surfaces and allowable mitigation in new development				See Figure 39 for areas of future development
							Identify nonbuildable areas due to erosion and potential level of impact of new development, limit new development in these areas				
							Improve stormwater ordinances in rural communities and subdivisions including bluff definitions and regulations of topographic and vegetative alterations				
Bunker Hill Creek (-511)	Benton, Morrison	Temperature, connectivity, streamflow alteration, habitat	fIBI 15 - 16; mIBI 13 - 30	TBD during 1W1P	fIBI 35; mIBI 32	Stream restoration and stabilization	Re-meander channelized tributaries to Bunk Hill Creek using natural stream design	-	-	-	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 81 of the stressor identification report.
							Addressed undercut banks and incised channel condition	-	-	-	
						Habitat and stream connectivity management	Riparian tree planting to provide shade	-	-	-	
		Nitrate	See Figure 7 of WRAPS		33% and 19% reduction under most and mid-range flow conditions, respectively	Implement the Little Rock Creek TMDL recommendations (SWCD 2015)					

Little Rock Creek (0701020105)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Zuleger Creek (-539)	Benton, Morrison	Longitudinal connectivity, streamflow alteration, habitat	fIBI 26; mIBI 35	TBD during 1W1P	fIBI 42; mIBI 37	Stream restoration and stabilization	Address channel widening and streambank erosion using natural design	-	-	-	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 81 of the stressor Identification report.
						Habitat and stream connectivity management	Reintroduce woody debris and coarse substrate to improve habitat	-	-	-	
							Modify or replace CR12 crossing for fish passage	-	-	-	
Little Rock Creek (-652)		Streamflow alteration, habitat	fIBI 15-22		fIBI 42	Stream restoration and stabilization	Addressed undercut banks and incised channel condition	-	-	-	
						Habitat and stream connectivity management	Restore floodplain	-	-	-	
							Restore riffle and pool habitat	-	-	-	
Little Rock Creek (-653)		DO	Total oxygen consumption load: 327.5 kg/day		52% reduction in total oxygen demand	Implement the Little Rock Creek TMDL recommendations (Benton SWCD 2015)					Carry forward impairment from 07010201-548.
		Temperature, streamflow alteration, habitat	fIBI 5 - 40; mIBI 9 - 71		fIBI 35; mIBI 43; 1% reduction in thermal loading	Habitat and stream connectivity management	Address embedded coarse substrate throughout stream system	-	-	-	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 81 of the SID.
							Addressed undercut banks and incised channel condition	-	-	-	

Little Rock Creek (0701020105)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Little Rock Creek (-653) (continued)	Benton, Morrison	*E. coli*	Maximum monthly geomean: 1,344 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 91% reduction	Feedlot runoff controls	Address permanent manure stockpiles within the Little Rock Creek watershed to ensure proper runoff controls and maintenance.				See Figure 39 for permanent stock pile areas. Carry forward impairment from 07010201-548.
							Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	

Little Rock Creek (0701020105)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Little Rock Creek (-653) (continued)	Benton, Morrison	*E. coli*	Maximum monthly geomean: 1,344 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 91% reduction	Feedlot runoff controls (continued)	Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	

Little Rock Creek (0701020105)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Little Rock Creek (-653) (continued)	Benton, Morrison	*E. coli*	Maximum monthly geomean: 1,344 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 91% reduction	Pasture management (continued)	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
		Nitrate	4.4 – 11.6 mg/L NOX from 2105-2016 intensive monitoring		47% and 29% reduction under dry and low flow conditions, respectively	Implement the Little Rock Creek TMDL recommendations (Benton SWCD 2015)					
Little Rock Lake (05-0013-00)		Nutrients	186 ppm from 1991-2009 monitoring data		53%; 99 lb/year reduction	Implement the Little Rock Lake TMDL recommendations (Benton SWCD 2011 and 2013)					--

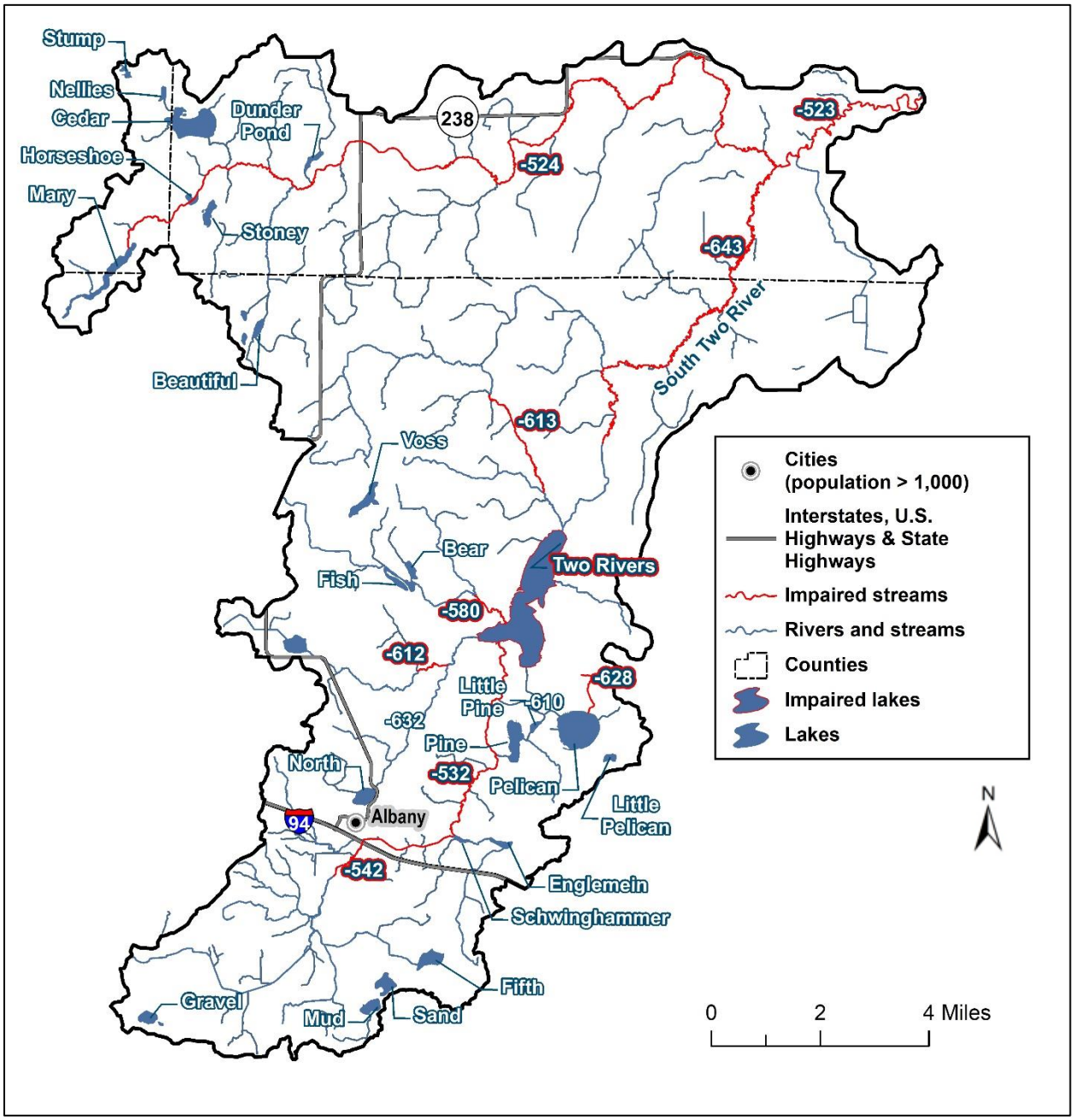


Figure 43. Two Rivers Subwatershed (0701020101). See Table 16 for corresponding restoration and protection strategies.

Table 16. Restoration and protection strategies for the Two River Subwatershed (0701020101).

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
All	Morrison, Stearns, Todd	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
				Restore historical wetlands that have been lost, focusing on those within floodplains.							See Figure 18 in the MRS Monitoring and Assessment Report
Two River (-523)	Morrison	*E. coli*	Maximum monthly geomean: 395 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 0-82%	Implement priority actions for the Two River subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
South Two River (-532)	Stearns	DO	Insufficient information		-	Develop dissolved oxygen TMDL and implement actions when complete					
South Two River (-643)	Morrison, Stearns	*E. coli*	See Figure 6-13 in MPCA 2016		Maximum monthly geomean 126 org/100mL; flow regime reductions: 18-90%	Implement priority actions for the South Two River subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					This reach is a carry forward impairment from 07010201-543.
		Habitat	fIBI 38 - 43		fIBI 47	Habitat and stream connectivity management	Increase complexity of instream habitat and coarse substrate for fish species	-	-	-	BMPs selected based on analyses provided in the MRS stressor identification report
							Further investigate cause of poor habitat to determine if it is due to anthropogenic activity	-	-	-	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
North Two River (-524) and South Two River (-542)	Morrison, Stearns, Todd	*E. coli*	Maximum monthly geomean: 1,666 org/100 mL Maximum monthly geomean: 2,561 org/100 mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction Maximum monthly geomean: 126 org/100 mL; 75% reduction	Point source control	Meet/maintain NPDES permit limit per MRSW TMDL				No reductions required in the MRS TMDL
						Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
North Two River (-524) (continued) and South Two River (-542) (continued)	Morrison, Stearns, Todd	*E. coli*	Maximum monthly geomean: 1,666 org/100 mL Maximum monthly geomean: 2,561 org/100 mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction Maximum monthly geomean: 126 org/100 mL;75% reduction	Feedlot runoff controls (continued)	Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
North Two River (-524) (continued) and South Two River (-542) (continued)	Morrison, Stearns, Todd	*E. coli*	Maximum monthly geomean: 1,666 org/100 mL Maximum monthly geomean: 2,561 org/100 mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction Maximum monthly geomean: 126 org/100 mL;75% reduction	Pasture management (continued)	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
Unnamed creek (-580) and Unnamed creek (-612) and Krain Creek (-613) and Unnamed creek (-628)	Stearns	*E. coli*	Maximum monthly geomean: 318 org/100 mL Maximum monthly geomean: 2,033 org/100 mL Maximum monthly geomean: 406 org/100 mL Maximum monthly geomean: 372 org/100 mL	TBD during 1W1P	126 org/100 mL; 60% reduction 126 org/100 mL 94% reduction 126 org/100 mL 69% reduction 126 org/100 mL 66% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Unnamed creek (-580) (continued) and Unnamed creek (-612) (continued) and Krain Creek (-613) (continued) and Unnamed creek (-628) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 318 org/100 mL Maximum monthly geomean: 2,033 org/100 mL Maximum monthly geomean: 406 org/100 mL Maximum monthly geomean: 372 org/100 mL	TBD during 1W1P	126 org/100 mL; 60% reduction 126 org/100 mL 94% reduction 126 org/100 mL 69% reduction 126 org/100 mL 66% reduction	Feedlot runoff controls (continued)	Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Unnamed creek (-580) (continued) and Unnamed creek (-612) (continued) and Krain Creek (-613) (continued) and Unnamed creek (-628) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 318 org/100 mL Maximum monthly geomean: 2,033 org/100 mL Maximum monthly geomean: 406 org/100 mL Maximum monthly geomean: 372 org/100 mL	TBD during 1W1P	126 org/100 mL; 60% reduction 126 org/100 mL 94% reduction 126 org/100 mL 69% reduction 126 org/100 mL 66% reduction	Septic system improvements (continued)	Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Two Rivers (73-0138-00)	Stearns	All	See Table 3	TBD during 1W1P		Conduct water storage opportunity study to reduce flooding and water quantity issues					See Figure 39 for area
						Implement recommendations in the Two Rivers Lake Targeted Conservation Practice Plan (RESPEC 2015)					
						Drainage ditch modifications	New in-ditch grade stabilization structures to reduce erosion in county ditches				Area has severely altered hydrology
							Inventory ditches to identify areas of high density, consider a ditch density study				
						Stream restoration and stabilization	Re-meander channelized stream reaches in select areas				
							Promote natural channel design principles for stream restorations				
							Promote critical area plantings				
							Restore floodplains and reconnect with channel				
		Phosphorus	64 µg/L	TBD during 1W1P	67%; 15,851 lb/yr reduction	Point source control	Meet/maintain NPDES permit limit per MRSW TMDL			0	No reductions required in the MRS TMDL
						Add cover crops for living cover in fall/spring	Increase late-season cover plantings with corn and soybeans to reduce sediment loss, improve nutrient uptake	7,250	acres treated	2,100 lb/yr	Reductions calculated using loading rates from BATHTUB modeling outputs and suggested reductions for HSPF-SAM
						Tillage/ residue management	Conservation tillage	12,700	acres treated	4,200 lb/yr	
						Buffers - field edge	Develop an ordinance to increase buffers	-	-	na	
							Increase acreage of field borders to complement existing conservation management systems.	11,800	acres treated	7,900 lb/yr	
							Promote upland buffer restoration				
							Encourage vegetated buffers				

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Two Rivers (73-0138-00) (continued)	Stearns	Phosphorus	64 µg/L	TBD during 1W1P	67%; 15,851 lb/yr reduction	Nutrient Management	Reduced application and incorporation	7,300	acres treated	940 lb/yr	
						Lake management	Create MIDS for future development along lakeshores	High	-	na	
							Native shoreline restoration	High	-	na	
							Develop and implement shoreline ordinance updates	High	-	na	
							Educate residents to increase awareness of BMPs and LID for future developments	High	-	na	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	Pasture contributes 1,546 lb/yr to Two Rivers Lake. Expected reductions from pasture management are not quantified in the HSPF-SAM tool but are expected to reduce phosphorus loading to Two Rivers Lake.
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Two Rivers (73-0138-00) (continued)	Stearns	Phosphorus	64 µg/L	TBD during 1W1P	67%; 15,851 lb/yr reduction	Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	112 lb/yr	Estimated reduction from Table 70 in MRS TMDL
							SSTS ordinance development and updates	High	-		
							Improve failing SSTSs	Low	-		
							Ordinance development and improved regulation of SSTS sludge land application	Low	-		
							Conduct risk assessment of septic systems	Low	-		
							Improve septic systems	Low	-		
						TOTAL Phosphorus load reduction		***Approx. 15,250 lb/yr***			
Pelican Lake (73-0118-00	Stearns	All	See Table 3	TBD during 1W1P	-	Lake management	Create MIDS for future development along lakeshores				
							Native shoreline restoration				
							Develop and implement shoreline ordinance updates				
							Educate residents to increase awareness of BMPs and LID for future development				
						Add cover crops for living cover in fall/spring	Increase late-season cover plantings with corn and soybeans to reduce sediment loss, improve nutrient uptake				
						Tillage/ residue management	Conservation tillage				
						Buffers - field edge	Develop an ordinance to increase buffers				
							Increase acreage of field borders to complement existing conservation management systems.				
							Promote upland buffer restoration				

Two River (0701020101)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Pelican Lake (73-0118-00	Stearns	All	See Table 3	TBD during 1W1P	-	Buffers - field edge (continued)	Encourage vegetated buffers				
						Nutrient Management	Reduced application and incorporation				
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing				
							Support pasture improvement and silvopasture				
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations				
							Promote practices that reduce stocking density				
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells				
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections				
							SSTS ordinance development and updates				
							Improve failing SSTSs				

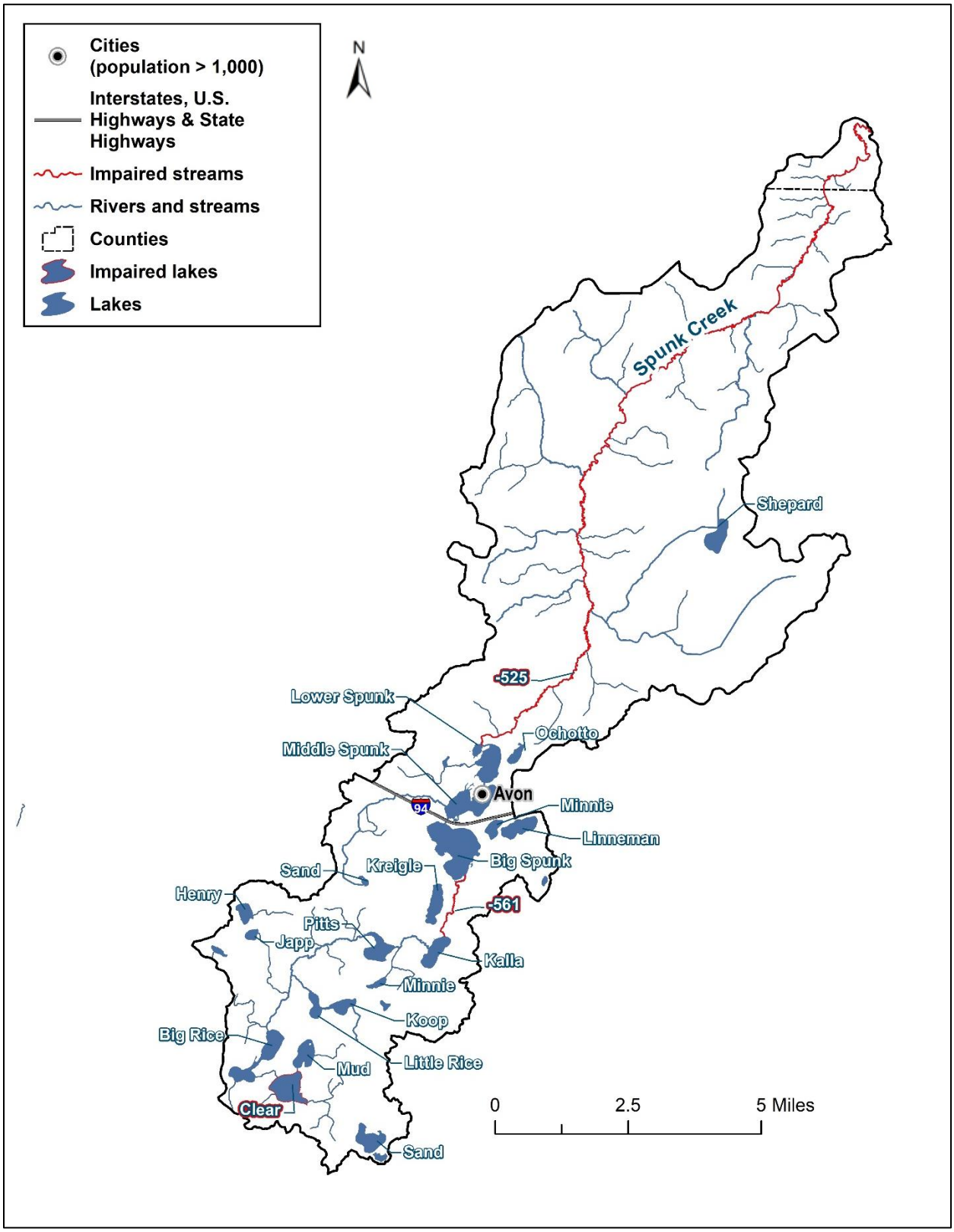


Figure 44. Spunk Creek Subwatershed (0701020102). See Table 17 for corresponding restoration and protection strategies.

Table 17. Restoration and protection strategies for the Spunk Creek Subwatershed (0701020102)

Spunk Creek (0701020102)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
All	Morrison, Stearns, Todd	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
				Lake Management			Create minimum impact design standards for future development along lakeshores				
							Develop and implement shoreline ordinance updates				
							Native shoreline restoration				
							Educate residents to increase awareness of BMPs and low impact development (LID) for future developments				
Spunk Creek (-525)	Morrison, Stearns	Fecal Coliform	Maximum monthly geomean: 1,250 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: high-0%, moist-84%, mid-range-58%, dry-75%, low-insufficient data	Implement priority actions for the Spunk Creek subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
Spunk Branch (-561)	Stearns	*E. coli*	Maximum monthly geomean: 257 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 51% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	

Spunk Creek (0701020102)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Spunk Branch (-561) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 257 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 51% reduction	Feedlot runoff controls (continued)	Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	

Spunk Creek (0701020102)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Spunk Branch (-561) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 257 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 51% reduction	Septic system management (continued)	Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	

Spunk Creek (0701020102)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Clear Lake (73-0172-00)	Stearns	Fish Bioassessment stressor: unknown	-	TBD during 1W1P	-	Lake management	Create MIDS for future development along lakeshores	Not applicable	-	unknown	
							Develop and implement shoreline ordinance updates	High	-	unknown	
							Native shoreline restoration	High	-	unknown	
							Educate residents to increase awareness of BMPs and LID for future developments	High	-	unknown	
							Encourage formation of lake association or similar homeowner and lake user organization	Not applicable	-	unknown	
						Develop a lake stressor identification report to determine cause of impairment					
Big, Middle, and Lower Spunk (73-0117-00, 73-0128-00, 73-0123-00)	Stearns	All	See Table 3	TBD during 1W1P	-	Lake Management	Create minimum impact design standards for future development along lakeshores				See Figure 39 for area of cabins converting to homes
							Native shoreline restoration				
							Develop and implement shoreline ordinance updates				
							Educate residents to increase awareness of BMPs and low impact development (LID) for future developments				

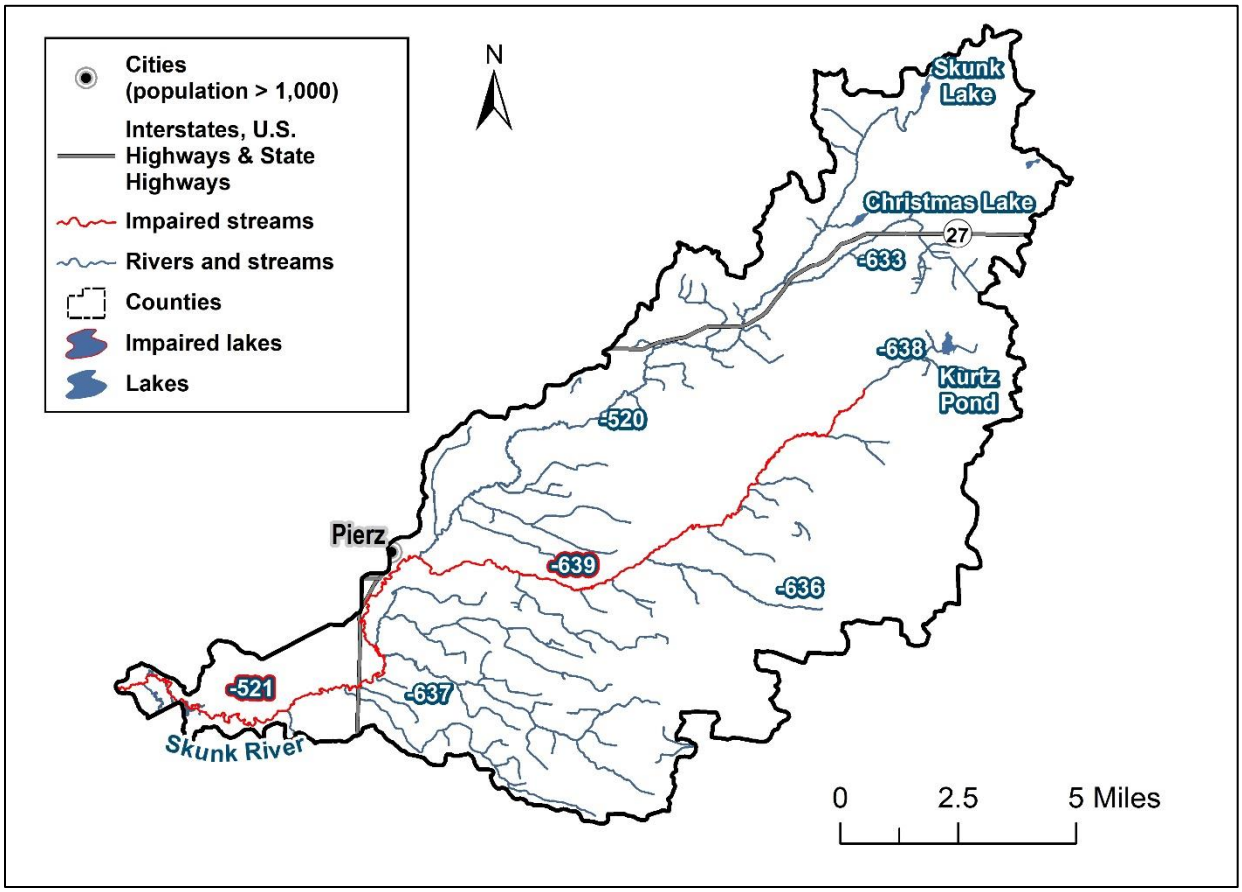


Figure 45. Skunk River Subwatershed (0701020103). See Table 18 for corresponding restoration and protection strategies.

Table 18. Restoration and protection strategies for the Skunk River Subwatershed (0701020103)

Skunk River (0701020103)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
All	Morrison, Stearns, Todd	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
Skunk River (-521)	Morrison	Fecal Coliform	Maximum monthly geomean: 4,925 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 97% reduction	Point source control	Meet/maintain NPDES permit limit per MRSW TMDL				No reductions required in the MRS TMDL
						Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	

Skunk River (0701020103)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Skunk River (-521) (continued)	Morrison	Fecal Coliform	Maximum monthly geomean: 4,925 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 97% reduction	Feedlot runoff controls (continued)	Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	

Skunk River (0701020103)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Skunk River (-521) (continued)	Morrison	Fecal Coliform	Maximum monthly geomean: 4,925 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 97% reduction	Pasture management (continued)	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
						Wildlife management	Wildlife management to discourage the congregation of wildlife in lakes and wetland	Low	-	unknown	
Hillman Creek (-639)	Morrison	*E. coli*	Maximum monthly geomean: 1,520 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	

Skunk River (0701020103)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Hillman Creek (-639) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 1,520 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction	Feedlot runoff controls (continued)	Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	

Skunk River (0701020103)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Hillman Creek (-639) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 1,520 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 92% reduction	Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	

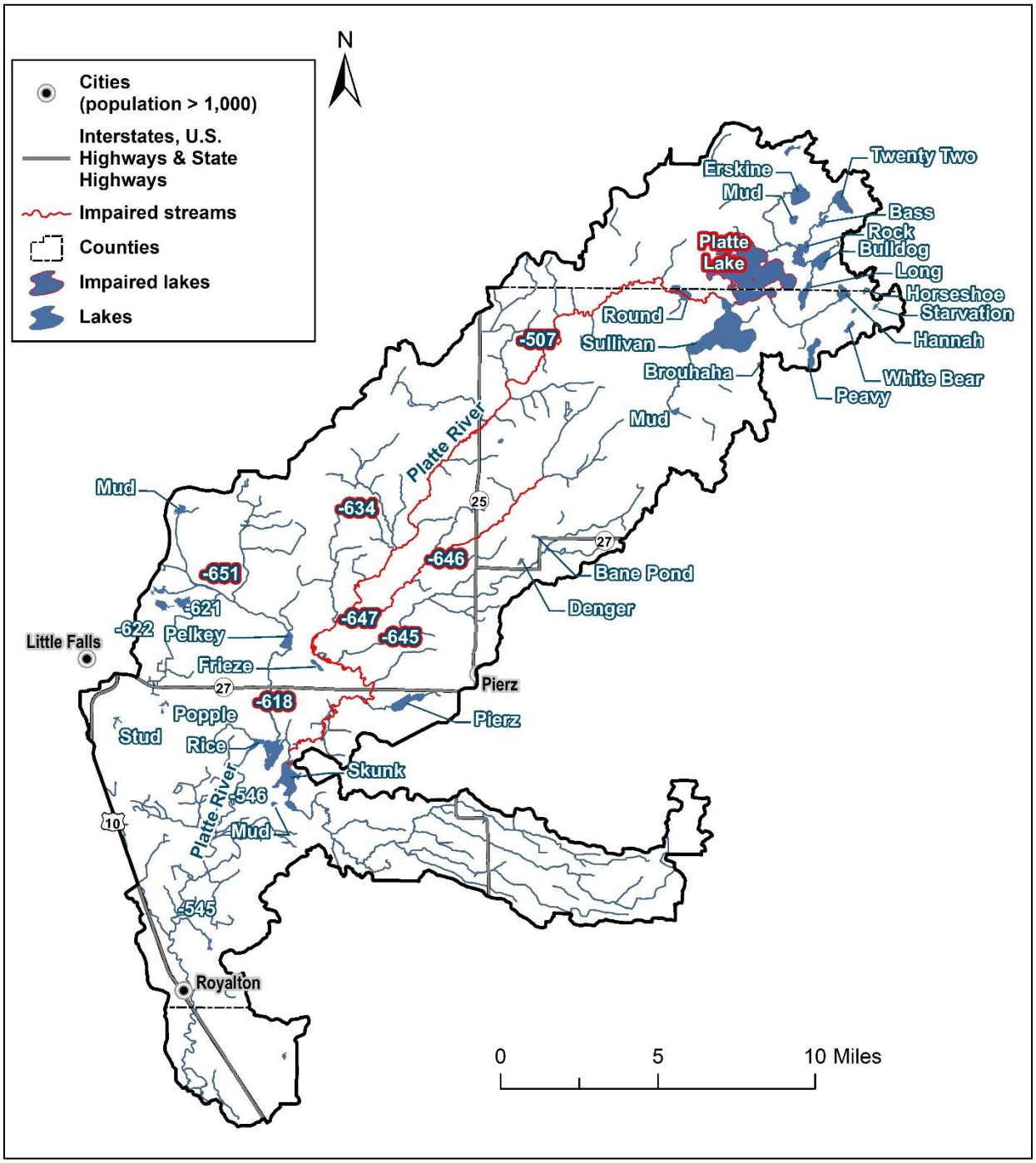


Figure 46. Platte River Subwatershed (0701020104). See Table 19 for corresponding restoration and protection strategies.

Table 19. Restoration and protection strategies for the Platte River Subwatershed (0701020104)

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE Best Management Practice (BMP) Scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ Goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
All	Benton, Crow Wing, Morrison, Todd	All	See Table 2 and Table 3	Preserve and protect wild rice areas in upper portion of the watershed as recommended in the Mississippi River–Sartell Stressor Identification Report.							
				Continue treatment of oak wilt and prevent spread of disease to additional forested areas in watershed							See Figure 39 for area of oak wilt prevention and control area
				Implement strategies and BMPs listed in the watershed wide table, as applicable.							
Platte River (-507)	Crow Wing, Morrison	Longitudinal connectivity, habitat	fIBI 31-79		fIBI 47	Habitat and stream connectivity management	Modify or replace Platte River dam for fish passage	1	dam	unknown	BMPs selected based on analyses provided in the MRS stressor identification report
							Riparian tree plantings for shade on wide and shallow sections of stream	-	-	unknown	
		E. coli	Maximum monthly geomean: 1,143 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 89% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Platte River (-507) (continued)	Crow Wing, Morrison	*E. coli*	Maximum monthly geomean: 1,143 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 89% reduction	Feedlot runoff controls (continued)	Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Platte River (-507) (continued)	Crow Wing, Morrison	*E. coli*	Maximum monthly geomean: 1,143 org/100mL	TBD during 1W1P	Maximum monthly geomean: 126 org/100 mL; 89% reduction	Septic system improvements (continued)	Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Rice Creek (-618)	Morrison	DO	mIBI 21	TBD during 1W1P	mIBI 43	Further investigate cause of low dissolved oxygen levels and determine if due to anthropogenic influence.					BMPs selected based on analyses provided in the MRS stressor identification report
Unnamed creek (-634)	Morrison	Longitudinal connectivity, DO (naturally occurring)	fIBI 25; mIBI 48	TBD during 1W1P	fIBI 42; mIBI 53	Habitat and stream connectivity management	Modify series of culverts at the 193rd St. crossing to increase available substrate and velocity breaks within the culvert to allow for smaller fish species passage per the Stressor Identification Report (MPCA 2019b)	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report
							Investigate impacts of historical beaver dams on connectivity and DO levels	-	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE Best Management Practice (BMP) Scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ Goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Unnamed creek (-634) (continued)	Morrison	Longitudinal connectivity, DO (naturally occurring)	fIBI 25; mIBI 48	TBD during 1W1P	fIBI 42; mIBI 53	Pasture management (continued)	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
Little Mink Creek (-645)	Morrison	Habitat, DO	mIBI 22-42	TBD during 1W1P	mIBI 43	Stream restoration and stabilization	Remeander channelized section upstream of biological station 16UM105 using natural design	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 22 in the stressor identification report
						Habitat and stream connectivity management	Address excessive fine bedded sediment along reach	-	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Big Mink Creek (-646)	Morrison	*E. coli*	Maximum monthly geomean: 300 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 58% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Big Mink Creek (-646) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 300 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 58% reduction	Feedlot runoff controls (continued)	Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE Best Management Practice (BMP) Scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ Goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Big Mink Creek (-646) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 300 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 58% reduction	Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
Big Mink Creek (-647)	Morrison	Habitat, DO	mIBI 33-36	TBD during 1W1P	mIBI 37	Stream restoration and stabilization	Remeander upstream channelization using natural design	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report
						Habitat and stream connectivity management	Restore productive riffle substrate habitat after areas of low flow (i.e., wetland areas)	-	-	unknown	
						Pasture management	Exclusion fencing and livestock access control along entire reach	-	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE Best Management Practice (BMP) Scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ Goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Unnamed creek (-651)	Morrison	Streamflow alteration	fIBI 17 - 29; mIBI 31 - 41	TBD during 1W1P	fIBI 42; m IBI 37	Stream restoration and stabilization	Remeander channelized section of reach using natural design	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report
						Habitat and stream connectivity management	Modify or replace culverts on 173rd street	-	-	unknown	
Platte (18-0088-00)	Crow Wing, Morrison	Phosphorus	48 ug/L	TBD during 1W1P	45%; 1,902 lb/year reduction	Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	98 lb/yr	
							SSTS ordinance development and updates	High	-		
							Improve failing SSTSs	Low	-		
							Ordinance development and improved regulation of SSTS sludge land application	Low	-		
							Conduct risk assessment of septic systems	Low	-		
							Improve septic systems	Low	-		
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	Pasture contributes approximately 329 lb/yr to Platte Lake. Expected reductions from pasture
							Support pasture improvement and silvopasture	High	-	unknown	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ Goal	Strategy type	EXAMPLE Best Management Practice (BMP) Scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Platte (18-0088-00) (continued)	Crow Wing, Morrison	Phosphorus	48 ug/L from 2008 to 2017 monitoring data	TBD during 1W1P	45%; 1,902 lb/year reduction	Pasture management (continued)	Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	… management are not quantified at this time in the HSPF-SAM tool but are expected to reduce phosphorus loading to Platte Lake
							Promote practices that reduce stocking density	High	-	unknown	
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells	High	-	unknown	
						Lake management	Create MIDS for future development along lakeshores	High	-	-	
							Develop and implement shoreline ordinance updates	High	-	-	
							Native shoreline restoration	High	-	na	
							Educate residents to increase awareness of BMPs and LID for future developments	High	-	-	
							Alum treatment to address internal loading of phosphorus	1	annual treatment	135 lb/yr	
						Add cover crops for living cover in fall/spring	Increase late-season cover plantings with corn and soybeans	670	acres treated	310 lb/yr	

Platte River (0701020104)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE Best Management Practice (BMP) Scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ Goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
Platte (18-0088-00) (continued)	Crow Wing, Morrison	Phosphorus	48 ug/L from 2008 to 2017 monitoring data	TBD during 1W1P	45%; 1,902 lb/year reduction	Tillage/ residue management	Conservation tillage	1,110	acres treated	590 lb/yr	
						Nutrient Management	Reduce application and manure incorporation	670	acres treated	140 lb/yr	
						Buffers - field edge	Update buffer law ordinances to increase compliance	high	-	na	
							Increase acreage of field borders to complement existing conservation management systems.	1,040	acres treated	1,110 lb/yr	
							Promote upland buffer restoration				
							Promote vegetated buffers				
						TOTAL Phosphorus load reduction		***Approx. 2,380 lb/yr***			

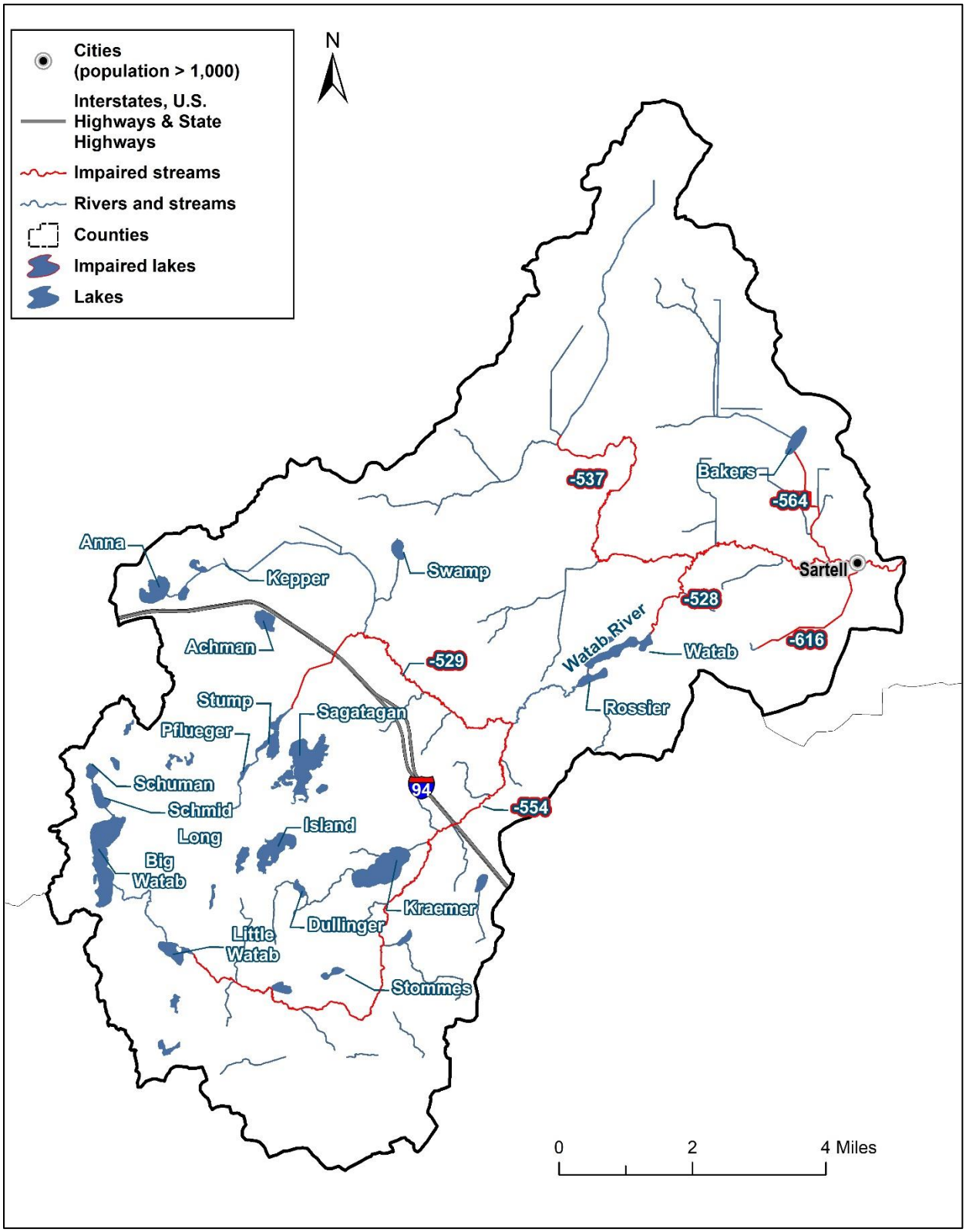


Figure 47. Watab River Subwatershed (0701020106). See Table 20 for corresponding restoration and protection strategies.

Table 20. Restoration and Protection Strategies for the Watab River Subwatershed (0701020106)

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
All	Morrison, Stearns, Todd	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
Watab River (-528)	Stearns	Streamflow alteration, habitat	fIBI 38.7	TBD during 1W1P	fIBI 47	Habitat and stream connectivity management	Modify or replace road crossing at Pine Cone Rd. crossing	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report
							Reconnect floodplain	-	-	unknown	
							Riparian buffers	-	-	unknown	
						Urban stormwater management	Decrease impervious surfaces within the watershed to reduce flashiness and support stream stability	-	-	unknown	
		E. coli	Maximum monthly geomean: 300 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 0-57%	Implement priority actions for the Watab River subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
Watab River, North Fork (-529)	Stearns	*E. coli*	Maximum monthly geomean: 3,910 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 34-74%	Implement priority actions for the Watab River, North Fork subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	**Notes**
County Ditch 12 (-537)	Stearns	*E. coli*	Maximum monthly geomean: 217 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 0-29%	Implement priority actions for the County Ditch 12 subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
Watab River, South Fork (-554)	Stearns	Longitudinal connectivity, habitat	fIBI 28-40	TBD during 1W1P	fIBI 42	Habitat and stream connectivity management	Modify or replace culverts at the CSAH75 crossing and private road crossings identified by MPCA 2019b	-	-	unknown	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 71 in the stressor identification report.
							Improve instream habitat by increasing coarse substrate, and heterogenity of stream facets	-	-	unknown	
		E. coli	Maximum monthly geomean: 407 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 44-71%	Implement priority actions for the Watab River, South Fork subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
County Ditch 13 (-564)	Stearns	DO	Insufficient information	TBD during 1W1P	-	Stream restoration and stabilization	Address channel instability (bank erosion, widening, and incision)	-	-	unknown	See Figure 71 in the MRS stressor identification report

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
							EXAMPLE BMP scenario				Notes
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**BMP**	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	
County Ditch 13 (-564) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 553 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 45-77%	Implement priority actions for the County Ditch 13 subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
County Ditch 16 (-616)	Stearns	*E. coli*	Maximum monthly geomean: 547 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 77% reduction	Point source control	Meet/maintain NPDES permit limit per MRSW TMDL				No reductions required in the MRS TMDL
						Urban stormwater runoff control	Prioritize wetland restoration, construction for treatment of urban runoff	High	-	unknown	
							Create long-term education and outreach plan for stormwater management	High	-	unknown	
							Develop BMP guidebook for residents	Not applicable	-	unknown	
							Develop reverse fee system to fund and incentivize local stormwater BMPS	Not applicable	-	unknown	
							Increase all stormwater practices to meet TMDL and permit conditions	High	-	unknown	

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
County Ditch 16 (-616) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 547 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 77% reduction	Urban stormwater runoff control (continued)	Continue to improve outreach and education plan for increasing stormwater BMP/LID, including development of demonstration projects	High	-	unknown	
							Promote bioretention, bioinfiltration basins, rain gardens, and constructed stormwater ponds	High	-	unknown	
							Regulate or limit impervious surfaces and allowable mitigation in new development	High	-	unknown	
							Stormwater Retrofit analysis	Not applicable	-	unknown	
							Develop supplemental street sweeping plan	Not applicable	-	unknown	

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Big Watab (73-0102-00)	Stearns	All	See Table 3	TBD during 1W1P	-	Lake Management	Create minimum impact design standards for future development along lakeshores				See Figure 39 for area of development pressure
							Native shoreline restoration				
							Develop and implement shoreline ordinance updates				
							Educate residents to increase awareness of BMPs and low impact development (LID) for future developments				
						Add cover crops for living cover in fall/spring	Increase late-season cover plantings with corn and soybeans to reduce sediment loss, improve nutrient uptake				
						Tillage/ residue management	Conservation tillage				
						Buffers - field edge	Develop an ordinance to increase buffers				
							Increase acreage of field borders to complement existing conservation management systems.				
							Promote upland buffer restoration				
							Encourage vegetated buffers				
						Nutrient Management	Reduced application and incorporation				
Kraemer Lake (73-0064-00)	Stearns	All	See Table 3	TBD during 1W1P	-	Pasture management	Conversion of conventional pasture to prescribed rotational grazing				
							Support pasture improvement and silvopasture				
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations				

Watab River (0701020106)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Kraemer Lake (73-0064-00) (continued)	Stearns	All	See Table 3	TBD during 1W1P	-	Pasture management	Promote practices that reduce stocking density				
							Improve coordination of smaller facilities with local ordinances related to hose pumps, dugouts, and wells				
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections				
							SSTS ordinance development and updates				
							Improve failing SSTSs				
							Ordinance development and improved regulation of SSTS sludge land application				
							Conduct risk assessment of septic systems				

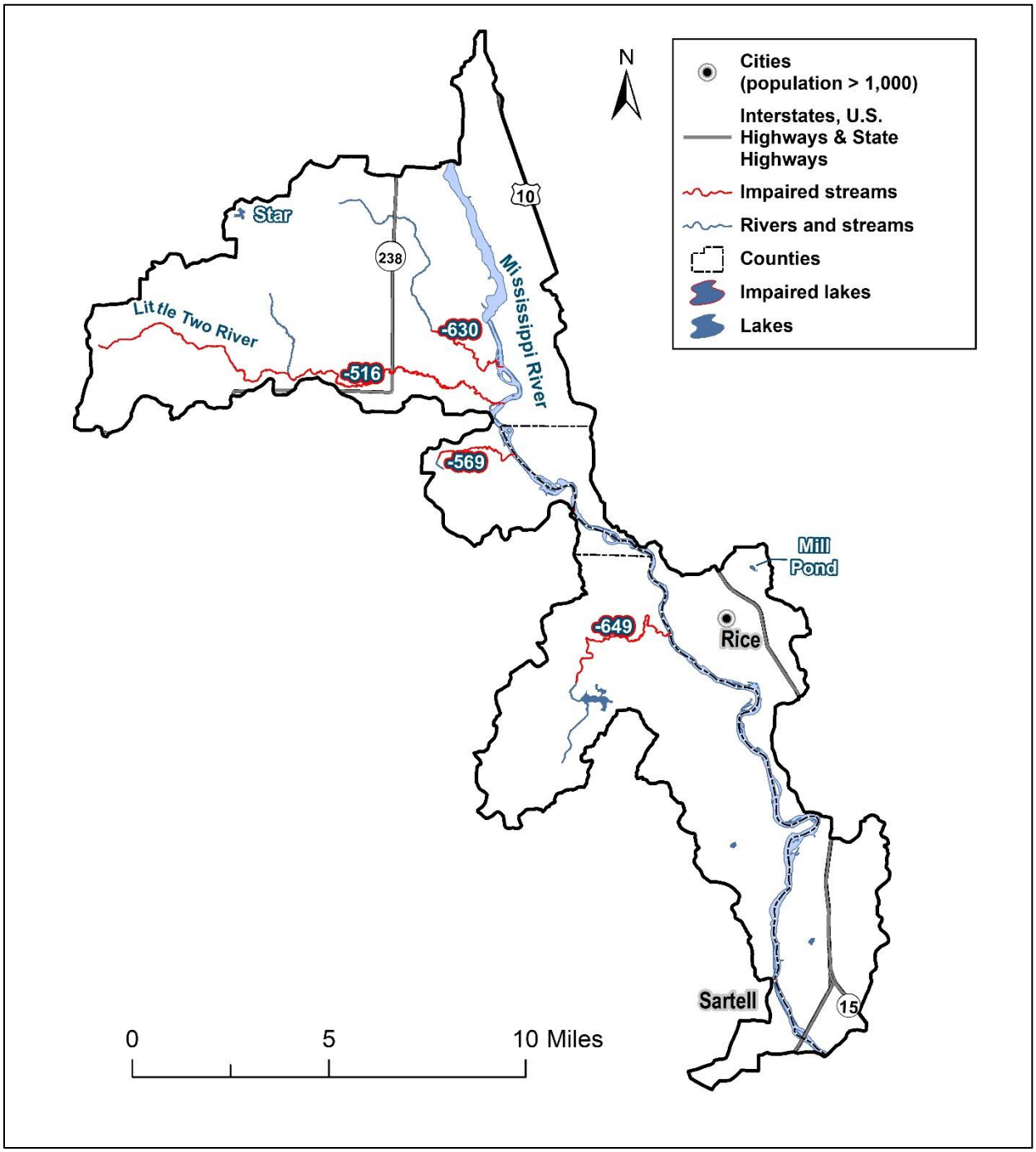


Figure 48. City of Sartell Subwatershed (0701020107). See Table 21 for corresponding restoration and protection strategies.

Table 21. Restoration and protection strategies for the City of Sartell–Mississippi River Subwatershed (0701020107)

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	**Location and upstream influence counties**	**Pollutant/ Stressor**	**Current WQ conditions**	**Milestone (optional)**	**Final WQ goal**	**Strategy type**	**EXAMPLE BMP scenario**				**Notes**
							BMP	**Amount**	**Unit**	**Estimated reduction (lb/yr)** *as applicable*	
All	Morrison, Stearns, Todd	All	See Table 2 and Table 3	Implement strategies and BMPs listed in the watershed wide table, as applicable.							
Little Two River (-516)	Morrison	*E. coli*	Maximum monthly geomean: 834 org/100mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; flow regime reductions: 0 -86%	Implement priority actions for the Little Two River subwatershed provided in the Upper Mississippi River Bacteria TMDL Implementation Plan (MPCA 2016)					
Hazel Creek (-569)	Morrison	Longitudinal connectivity	fIBI 25-35	TBD during 1W1P	fIBI 42	Stream restoration and stabilization	Remeander channelized sections using natural design	-	-	-	BMPs selected based on analyses provided in the MRS stressor identification report. See Figure 37 in the Stressor Identification Report for altered streams map
						Habitat and stream connectivity management	Modify or replace culvert along Great River Rd. for fish passage	-	-	-	
							Further investigate cause of low stream flows to determine if caused from anthropogenic activity	-	-	-	
Hay Creek (-630)	Morrison	*E. coli*	Maximum monthly geomean: 386 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 84% reduction	Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Hay Creek (-630) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 386 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 84% reduction	Feedlot runoff controls (continued)	Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	
							Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Hay Creek (-630) (continued)	Morrison	*E. coli*	Maximum monthly geomean: 386 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 84% reduction	Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	
							Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Stony Creek (-649)	Stearns	*E. coli*	Maximum monthly geomean: 633 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 80% reduction	Point source control	Meet/maintain NPDES permit limit per MRSW TMDL				No reductions required in the MRS TMDL
						Feedlot runoff controls	Feedlot runoff reduction/treatment	High	-	unknown	
							Provide funding for small operations to reduce runoff and improve treatment, especially near waters of the state	High	-	unknown	
							Feedlot manure/ runoff storage addition	High	-	unknown	
							Increase rainwater diversion practices	High	-	unknown	
							Improve inter-agency coordination of feedlot inspections and record keeping requirements	High	-	unknown	
							Feedlot relocation/ retirement	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	
							Total confinement facilities	High	-	unknown	
							Feed storage in silos/grain bins or on impervious surfaces	High	-	unknown	
							Storage of process wastewater in tank/manure pits	High	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Stony Creek (-649) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 633 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 80% reduction	Feedlot runoff controls (continued)	Improved record keeping and mapping of existing risks	High	-	unknown	
							Improve process/regulations for siting of stockpiles. Ensure that soil type and quality are considered	High	-	unknown	
						Urban stormwater runoff control	Prioritize wetland restoration, construction for treatment of urban runoff	High	-	unknown	
							Create long-term education and outreach plan for stormwater management	High	-	unknown	
							Develop BMP guidebook for residents	Not applicable	-	unknown	
							Develop reverse fee system to fund and incentivize local stormwater BMPS	Not applicable	-	unknown	
							Increase all stormwater practices to meet TMDL and permit conditions	High	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Stony Creek (-649) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 633 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 80% reduction	Urban stormwater runoff control	Continue to improve outreach and education plan for increasing stormwater BMP/LID, including development of demonstration projects	High	-	unknown	
							Promote bioretention, bioinfiltration basins, rain gardens, and constructed stormwater ponds	High	-	unknown	
							Regulate or limit impervious surfaces and allowable mitigation in new development	High	-	unknown	
							Stormwater Retrofit analysis	Not applicable	-	unknown	
							Develop supplemental street sweeping plan	Not applicable	-	unknown	
						Septic system improvements	Improve subsurface sewer treatment systems (SSTS) compliance inspections	High	-	unknown	
							SSTS ordinance development and updates	High	-	unknown	
							Improve failing SSTSs	Low	-	unknown	

City of Sartell-Mississippi River (0701020107)											
		Water quality				Strategies to achieve final water quality goal					
Waterbody (ID)	Location and upstream influence counties	Pollutant/ Stressor	Current WQ conditions	Milestone (optional)	Final WQ goal	Strategy type	EXAMPLE BMP scenario				Notes
							BMP	Amount	Unit	Estimated reduction (lb/yr) *as applicable*	
Stony Creek (-649) (continued)	Stearns	*E. coli*	Maximum monthly geomean: 633 org/100 mL	TBD during 1W1P	Maximum monthly geomean 126 org/100mL; 80% reduction	Septic system improvements	Ordinance development and improved regulation of SSTS sludge land application	Low	-	unknown	
							Conduct risk assessment of septic systems	Low	-	unknown	
							Improve septic systems	Low	-	unknown	
						Pasture management	Conversion of conventional pasture to prescribed rotational grazing	High	-	unknown	
							Support pasture improvement and silvopasture	High	-	unknown	
							Exclusion fencing and livestock access control in and near streams, lakes, and wetlands and support alternate water supply, especially on small operations	High	-	unknown	
							Promote practices that reduce stocking density	High	-	unknown	

3.4. Climate protection co-benefit of strategies

Many agricultural BMPs, which reduce the load of nutrients and sediment to receiving waters also act to decrease emissions of greenhouse gases (GHGs). Agriculture is the third largest emitting sector of GHGs in Minnesota. Important sources of GHGs from crop production include the application of manure and nitrogen fertilizer to cropland, soil organic carbon oxidation resulting from cropland tillage, and carbon dioxide emissions from fossil fuel used to power agricultural machinery or in the production of agricultural chemicals. Reduction in the application of nitrogen to cropland through optimized fertilizer application rates, timing, and placement is a source reduction strategy; while conservation cover, riparian buffers, vegetative filter strips, field borders, and cover crops reduce GHG emissions as compared to cropland with conventional tillage. Additional information about GHG emission reduction from agricultural BMPs is summarized in this MPCA report: https://www.pca.state.mn.us/air/agriculture-and-climate-change-minnesota.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) developed Comet Planner, a ranking tool for cropland BMPs that can be used by local units of government to consider ancillary GHG effects when selecting BMPs for nutrient and sediment control (http://www.comet-planner.com/). Practices with a high potential for GHG avoidance include conservation cover, forage and biomass planting, no-till and strip-till tillage, multi-story cropping, nutrient management, silvopasture establishment, other tree and shrub establishment, and shelterbelt establishment. Practices with a medium-high potential to mitigate GHG emissions include contour buffer strips, riparian forest buffers, vegetative buffers and shelterbelt renovation. A longer, more detailed assessment of cropland BMP effects on GHG emission (NRCS et al. no date) can be found at http://comet-planner.nrel.colostate.edu/COMET-Planner_Report_Final.pdf.

4. Monitoring plan

There are many monitoring efforts in place in the MRSW. Several key monitoring programs will provide, subject to resource availability and priorities, the information to track trends in water quality and evaluate compliance with TMDLs and milestones for WRAPS implementation:

- Intensive monitoring and assessment at the HUC-8 watershed scale associated with Minnesota's Watershed Approach to Restoring and Protecting Water Quality. This monitoring effort is conducted approximately every 10 years for each HUC-8. An outcome of this monitoring effort is the identification of waters that are impaired (i.e., do not meet standards and need restoration) and waters in need of protection to prevent impairment. Over time, condition monitoring can also identify trends in water quality. This helps determine whether water quality conditions are improving or declining, and it identifies how management actions are improving the state's waters overall. See Section 2.1 above.

Two young anglers enjoy an evening on Cedar Lake (Morrison County) – Photo courtesy of Gary Roerick

- The MPCA's WPLMN measures and compares data on pollutant loads from Minnesota's rivers and streams and tracks water quality trends. WPLMN data will be used to assist with assessing impaired waters, watershed modeling, determining pollutant source contributions, developing watershed and water quality reports, and measuring the effectiveness of water quality restoration efforts. Data are collected along major river main stems, at major watershed (i.e., HUC-8) outlets to major rivers, and in several subwatersheds. This long-term monitoring program began in 2007. See Section 2.2.2 above.
- Implementation monitoring is conducted by both BWSR (i.e., eLINK) and the United States Department of Agriculture. Both agencies track the locations of BMP installations. Data is displayed on the MPCA's "Healthier Watersheds" webpage.
- The Sentinel Lakes Monitoring Program is an intensive, long-term lake ecosystem monitoring program created to detect and understand the physical, chemical and biological changes occurring in Minnesota's lakes. Cedar Lake in Morrison County is included in this monitoring program.
- Discharges from permitted municipal and industrial wastewater sources are reported through discharge monitoring records; these records are used to evaluate compliance with NPDES/SDS permits. Summaries of discharge monitoring records are available through the MPCA's

Wastewater Data Browser. The MPCA's "Healthier Watersheds" webpage also displays information on wastewater discharges.

- The Citizen Surface Water Monitoring Program is a network of volunteers who make monthly lake and river transparency readings. Several dozen data collection locations exist within the MRSW. This data provides a continuous record of one water quality parameter (transparency/turbidity) throughout much of the watershed and can be found at the following webpage: https://www.pca.state.mn.us/water/volunteer-monitoring-reports-and-data

Citizen Lake Monitor Volunteers using Secchi Disks to measure lake clarity.

Additional monitoring recommendations for the MRSW are outlined below.

As recommended in the Mississippi River–Sartell TMDL:

- Expanded nutrient, chlorophyll-*a*, and DO monitoring on the upstream lakes in the Two Rivers Lake and Platte Lake watersheds including Schwinghammer, Pelican, Little Pine, and Pine Lake, and the many small lakes in the Platte Lake watershed to better understand potential internal loading to Two Rivers Lake and Platte Lake.
- Additional monitoring for segments that were deferred in the TMDL (County Ditch 13 [564] and South Two River [524]).
- Targeted and or selective microbial source tracking to determine source of *E. coli* impairments.

As recommended in the Mississippi River Stressor Identification Report:

- Further investigation of the impact of metals, specifically iron, on fish and macroinvertebrate IBI as no conclusive determinations could be made during the stressor identification process.
- Conduct assessment of state and local government implementation of BMPs on public lands to determine if an appropriate example is being set for private landowners to do the same.
- To better understand the role eutrophication, low DO, and streamflow alteration have on the aquatic life impairment on Big Mink Creek (647) and to determine if a DO TMDL is necessary on this segment, the following monitoring is recommended:

- Continuous multi-parameter sonde deployments
- Paired samples of total iron, phosphorus, and biochemical oxygen demand
- Continuous streamflow data

It is also recommended to pair as much data collection as possible on Big Mink Creek (647) with a comparable stream that sustains a thriving macroinvertebrate community, such as the Skunk River.

- Further monitoring to evaluate the application of atrazine-containing herbicides in the watershed and their potential impacts on aquatic life.
- Additional TP sampling and continuous DO monitoring to determine if eutrophication is occurring and stressing aquatic life on Bunker Hill Creek (-511).
- Monitor impacts of low DO in County Ditch 13 on downstream Watab River to ensure aquatic life protection and prevent water quality degradation.

As recommended by the Local Partner Team:

- Coordinate inventory and mapping activities to improve efficiency and encourage interagency coordination (culverts, ditches, land application of manure on cropland, etc.).
- Monitor chloride levels in WWTF discharges.
- Continued monitoring on Little Rock Lake, Little Rock Creek, Bunker Hill Creek, and Sucker Creek to better understand impacts of implemented BMPs on water quality in the Little Rock Lake subwatershed during all flow zones.
- Conduct trend analysis on other impaired waters, similar to the Little Rock Lake trend analysis in Section 2.2.3, to guide further implementation efforts.
- Conduct monitoring on Two Rivers, Clear, Big Watab, Spunk Chain, and Kraemer Lakes to provide additional data for trend analysis, and to better understand impacts of implemented BMPs on water quality in these waters.

Shoreline of Little Rock Lake after the 2019 drawdown. Photo from Benton SWCD.

5. References and further information

Benton SWCD (Soil and Water Conservation District). 2011. Little Rock Lake Nutrient TMDL. Document number wq-iw8-31e. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw8-31e.pdf

Benton SWCD (Soil and Water Conservation District). 2013. Little Rock Lake and Creek Watershed Protection and Improvement Plan. Prepared for the Minnesota Pollution Control Agency. Document number wq-iw8-31c. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw8-31c.pdf

Benton SWCD (Soil and Water Conservation District). 2015. Little Rock Creek Watershed Total Maximum Daily Load Report: Dissolved Oxygen, Nitrate, Temperature and Fish Bioassessment Impairments. Prepared by Barr Engineering. Document number wq-iw8-09e. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw8-09e.pdf

DNR (Minnesota Department of Natural Resources) 2018. Sustainable Use of Groundwater in the Little Rock Creek Area. September 2018. Document available at: https://files.dnr.state.mn.us/waters/groundwater_section/sustainability/littlerock/lrc-action-plan.pdf

MPCA (Minnesota Pollution Control Agency). 2007. Minnesota Statewide Mercury Total Maximum Daily Load. Document number wq-iw4-01b. Document available at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/special-projects/statewide-mercury-tmdl-pollutant-reduction-plan.html

MPCA (Minnesota Pollution Control Agency) 2014. Upper Mississippi River Bacteria TMDL Study and Protection Plan. Prepared by Emmons & Oliver Resources, Inc. for the Minnesota Pollution Control Agency and Minnesota Department of Health. Document number wq-iw8-08e. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw8-08e.pdf

MPCA (Minnesota Pollution Control Agency) 2016. Upper Mississippi River Bacteria TMDL Implementation Plan. Document number wq-iw8-08c. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw8-08c.pdf

MPCA (Minnesota Pollution Control Agency) 2017. Guidance Manual for Assessing the Quality of Minnesota's Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List: 2018 Assessment and Listing Cycle. Document number: wq-iw1-04j. October 2017. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-iw1-04j.pdf

MPCA (Minnesota Pollution Control Agency) 2019a. Mississippi River–Sartell Monitoring and Assessment Report. Document number wq-ws3-07010201b. May 2019. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-ws3-07010201b.pdf

MPCA (Minnesota Pollution Control Agency) 2019b. Mississippi River – Sartell Watershed Stressor Identification Report. Document number: wq-ws5-07010201). September 2019. Document available at: https://www.pca.state.mn.us/sites/default/files/wq-ws5-07010201.pdf

RESPECT. 2015. Two Rivers Lake Targeted Conservation Practice Plan. Topical Report RSI-2492. Prepared by RESPEC for Stearns County Soil and Water Conservation District. March, 2015.

Tetra Tech. 2018. Upper Mississippi River Sartell Watershed HSPF Model Recalibration Memorandum. October 31, 2018.

Tetra Tech. 2020. Draft Mississippi River-Sartell Watershed Total Maximum Daily Load. Document number wq-ws4-78a.

6. Appendices

Appendix A. Stream and Lake Priority Protection Effort

AUID or Waterbody ID (WID)	Stream Name	Reach Length (mi)	Drainage Area (mi^2)	TALU	AQL Vulnerable Designation? (Y/N)	Cold/ Warm	Community Nearly Impaired	Riparian Risk	Watershed Risk	Current Protection Level	Protection Priority Rank	Protection Priority Class
07010201-545	Platte River	13.9	447.8786	Exceptional	N	warm	neither	high	high	med/low	**10.5**	**A**
07010201-613	Krain Creek	2.56	11.2047	General	N	warm	one	high	high	low	**6**	**A**
07010201-523	Two River	5.58	154.6454	General	N	warm	one	high	high	med/low	**7**	**A**
07010201-529	Watab River, North Fork	5.79	20.40478	General	Y	warm	one	med/high	high	low	**7**	**A**
07010201-546	Platte River	3.88	398.2071	General	N	warm	one	high	high	med/low	**7**	**A**
07010201-525	Spunk Creek	23.59	81.20324	General	N	warm	one	med/high	high	med/low	**8**	**A**
07010201-524	North Two River	22.47	49.22264	General	N	warm	neither	high	high	low	**9**	**A**
07010201-537	County Ditch 12	6.16	20.03649	General	N	warm	neither	high	high	low	**9**	**A**
07010201-636	Unnamed creek	4.4	11.82484	General	Y	warm	one	med/high	medium	low	**9**	**A**
07010201-649	Stony Creek	5.57	17.01517	General	N	warm	neither	high	high	low	**9**	**A**
07010201-521	Skunk River	14.71	137.4461	General	N	warm	neither	high	med/high	low	**10.5**	**A**
07010201-630	Hay Creek	3.26	17.52739	General	N	warm	neither	high	high	med/low	**10.5**	**A**
07010201-637	Unnamed creek	2.19	14.59842	General	N	warm	neither	high	med/high	low	**10.5**	**A**
07010201-516	Little Two River	16.19	27.12575	General	N	warm	neither	med/high	high	med/low	**12**	**B**
07010201-520	Skunk River	21.43	55.77618	General	N	warm	neither	med/high	med/high	low	**12**	**B**
07010201-639	Hillman Creek	13.96	46.05039	General	Y	warm	neither	med/high	med/high	low	**12**	**B**
07010201-633	Unnamed creek	3.43	12.73625	General	N	warm	neither	medium	medium	low	**15**	**B**
07010201-632	Unnamed creek	3.92	2.88202	Modified	N	warm	one	med/high	high	low	**7**	**A**
07010201-622	Unnamed creek	4.19	9.685118	Modified	N	warm	one	med/high	high	med/low	**8**	**A**
07010201-621	Unnamed creek	0.46	15.37171	Modified	N	warm	neither	high	high	med/low	**10.5**	**A**

Lake ID	Lake_Name	Depth Class	LAKE Acres	Watershed Acres	% Disturbed Land Use	Mean TP (ug/L)	Years TP	Mean Secchi (m)	Presence of Water Clarity Trend	Predicted Pre-disturbance TP (ug/l)	Target TP (ug/L)	Predicted Load (pounds/year)	Load Target (pounds/year)	Load Goal (pounds/year)	Load Reduction Goal (pounds/year)	Sensitivity Index (S)	LPSS Priority Score	LPSS Priority Class	Lake of Biological Significance
49-0005-00	Peavy	deep	140	586	6%	10.5	4	4.40	Insufficient data	10	9	50	43	47	2	80	14	A	
73-0097-00	Kreigle	deep	102	322	16%	10.9	6	5.02	No evidence of trend	9	10	16	14	15	1	117	27	A	High
73-0122-00	Ochotto	deep	40	103	81%	12.6	2	4.15	No evidence of trend	7	12	7	6	6	0	132	60	A	Moderate
49-0140-00	Cedar	deep	236	1,636	37%	14.8	11	4.07	Improving trend	12	10	115	80	109	6	45	61	A	Outstanding
73-0104-00	Island	deep	116	362	17%	14.8	2	4.47	Insufficient data	12	13	23	21	22	1	84	24	A	High
73-0102-00	Big Watab	deep	246	2,070	13%	15.1	8	5.28	Improving trend	14	11	145	103	137	7	38	19	A	High
73-0101-00	Schmid	deep	38	281	6%	15.4	2	4.21	Insufficient data	13	14	16	15	15	1	86	3	C	
73-0099-00	Minnie	deep	27	387	38%	16.3	2	4.07	Insufficient data	9	14	23	20	22	1	76	11	B	
73-0125-00	Achman	deep	47	139	25%	17.5	2	4.88	Insufficient data	12	17	10	10	10	1	89	15	A	
49-0024-00	Pierz	deep	189	2,781	55%	18.5	3	2.71	No evidence of trend	16	17	177	167	168	9	26	40	A	
73-0126-00	Anna	deep	81	372	59%	18.7	2	3.64	Insufficient data	12	18	25	24	23	1	66	45	A	
49-0016-00	Sullivan	deep	1,103	34,153	9%	18.8	11	2.60	Improving trend	13	15	3,113	2,605	2,958	156	2	4	B	
73-0128-00	Middle Spunk	deep	236	17,364	65%	19.0	4	3.20	Improving trend	13	14	929	676	883	46	6	14	A	High
49-0015-00	Long	deep	126	723	21%	19.5	8	2.55	No evidence of trend	19	18	94	86	89	5	37	20	A	Outstanding
73-0123-00	Lower Spunk	deep	179	19,638	24%	21.4	4	2.77	Improving trend	6	17	891	693	847	45	6	4	B	High
73-0127-00	Linneman	shallow	110	790	22%	21.5	2	2.78	Insufficient data	8	20	52	48	50	3	44	10	B	
73-0118-00	Pelican	deep	291	2,006	33%	22.8	10	3.56	Improving trend	15	19	186	155	177	9	23	35	A	High
73-0117-00	Big Spunk	deep	415	14,832	25%	24.0	5	2.65	No evidence of trend	20	21	1,032	922	981	52	5	8	B	High
18-0016-00	Rock	shallow	203	4,524	6%	25.4	2	1.82	Insufficient data	24	24	540	506	513	27	8	2	C	
73-0166-00	Koop	deep	60	653	60%	26.1	2	4.10	Insufficient data	9	24	65	59	62	3	38	20	A	
18-0009-00	Erskine	shallow	182	846	4%	26.1	4	1.63	Insufficient data	25	26	140	139	133	7	23	3	C	
73-0100-00	Kalla	deep	106	12,056	13%	26.9	3	2.79	Insufficient data	15	22	790	638	751	40	6	1	C	
49-0019-00	Round	deep	130	35,682	8%	28.7	4	2.32	No evidence of trend	25	24	3,212	2,683	3,052	161	1	0	C	Outstanding

Lake ID	Lake_Name	Depth Class	LAKE Acres	Watershed Acres	% Disturbed Land Use	Mean TP (ug/L)	Years TP	Mean Secchi (m)	Presence of Water Clarity Trend	Predicted Pre-disturbance TP (ug/l)	Target TP (ug/L)	Predicted Load (pounds/year)	Load Target (pounds/year)	Load Goal (pounds/year)	Load Reduction Goal (pounds/year)	Sensitivity Index (S)	LPSS Priority Score	LPSS Priority Class	Lake of Biological Significance
73-0092-00	Sagatagan	deep	227	886	15%	31.3	4	4.27	No evidence of trend	22	26	111	92	105	6	26	13	A	High
73-0064-00	Kraemer	deep	195	1,819	12%	33.6	11	1.87	Declining trend	16	30	223	198	212	11	15	32	A	
18-0008-00	Twenty Two	shallow	164	1,409	3%	34.0	1	1.07	Insufficient data	30	28	271	226	258	14	12	6	B	Outstanding
77-0019-00	Mary	deep	129	1,250	33%	37.7	5	2.06	Insufficient data	20	32	183	154	173	9	17	11	B	Moderate
73-0136-00	Pine	deep	108	3,420	24%	39.5	4	2.29	Improving trend	23	33	448	376	426	22	8	3	C	
18-0088-00	Platte	deep	1,663	21,151	16%	40.9	16	1.56	Declining trend	32	34	4,100	3,472	3,895	205	1	44	NA	Outstanding
73-0070-00	Watab	deep	97	35,623	47%	44.7	5	2.27	No evidence of trend	37	37	3,133	2,616	2,976	157	1	1	C	
73-0098-00	Pitts	deep	114	9,228	37%	46.9	2	2.14	Insufficient data	36	45	966	917	918	48	3	4	B	
49-0033-00	Popple	shallow	25	605	29%	71.0	1	0.90	Insufficient data	47	59	115	93	109	6	12	2	C	
73-0072-00	Rossier	deep	37	33,878	29%	80.5	5	1.59	No evidence of trend	38	67	4,687	3,877	4,453	234	1	0	C	
49-0025-00	Rice	shallow	339	251,957	19%	91.5	5	0.84	Insufficient data	38	77	27,981	23,162	26,582	1,399	0	0	C	Outstanding
73-0138-00	Two Rivers	deep	583	37,791	25%	92.1	7	1.62	No evidence of trend	63	77	8,445	7,146	8,023	422	0	1	NA	
49-0030-00	Pelkey	shallow	104	18,376	26%	105.3	3	1.05	Insufficient data	96	105	3,632	3,615	3,450	182	1	0	C	
05-0012-00	Unnamed (Little Rock Channel)	shallow	153	70,033	56%	153.3	3	0.54	No evidence of trend	70	128	17,718	14,713	16,832	886	0	0	C	
49-0026-00	Skunk	shallow	370	110,379	6%	165.3	4	0.58	Insufficient data	122	162	25,959	25,331	24,661	1,298	0	0	C	Outstanding
05-0013-00	Little Rock	deep	1,311	66,123	38%	198.7	13	0.58	No evidence of trend	82	166	27,033	22,842	25,681	1,352	0	0	NA	

Appendix B. Mississippi River–Sartell Communication Plan

Mississippi River–Sartell Watershed Communication Plan

November 2017

Authors and contributors:

Phil Votruba, MPCA

Kaitlyn Taylor, Tetra Tech

Jennifer Olson, Tetra Tech

Andrea Plevan, Tetra Tech

Prepared for:

Morrison Soil and Water Conservation District

16776 Herron Road

Little Falls, MN 56345

and

Minnesota Pollution Control Agency

7678 College Road, Suite 105

Baxter, MN 56425

Prepared by:

413 Wacouta Street, Suite 435

Saint Paul, MN 55101

www.tetratech.com

Table of Contents

Mississippi River–Sartell Watershed Communication Plan 1
Element 1: Goals and Objectives 2
Element 2: Partnering Organizations and Communication Subcommittee 3
Element 3: Key Audience Characterization 3
Element 4: Tailored Messages 5
Element 5: Effective Formats 8
Element 6: Efficient Delivery Mechanisms 10
Element 7: Evaluation Measures 10
Appendix A: Communication Materials (provided electronically) A-1
Appendix B: Summary of Local Water Management Plans B-1
Appendix C: Current and Past Water Quality Improvement Projects C-1

Mississippi River–Sartell Watershed Communication Plan

Developing and implementing a successful, effective Watershed Restoration and Protection Strategy (WRAPS) for the Mississippi River–Sartell Watershed will require significant and meaningful stakeholder involvement and education. Providing consistent communication and education during all phases of the WRAPS—planning, development, and implementation—is key for developing meaningful involvement. The plan will serve as a working document that first outlines the major steps and actions needed to effectively communicate with key target audiences and among core team members during the WRAPS process. The plan is adaptive; as the WRAPS planning process develops, results from the evaluation process presented below can be used to refine and elevate the plan to include increased engagement and involvement with targeted audiences, if desired. Local partners (see Element 2) may use the plan as a guide for more specific and targeted messaging, and incorporate Elements 1 through 7 as outlined below into their existing communication activities.

The communication plan contains seven defined elements to ensure communication is targeted, effective, and efficient. The seven elements are as follows:

- **Element 1: Goals and Objectives.** These are the goals and objectives for involvement and education to support the WRAPS.
- **Element 2: Partnering Organizations and Communication Subcommittee**. This element lists the organizations with potential engagement with the WRAPS and its education, and recommends the formation of a subcommittee to lead initiatives.
- **Element 3: Key Audience Characterization.** This element identifies the priority audiences for each phase of the WRAPS process and provides details on how these audiences will receive information, other existing communication channels, and potential concerns.
- **Element 4: Tailored Messages.** Using information from Element 2, this element identifies messages to help raise awareness, encourage involvement, and promote implementation support. The objective is to create messages for the key target audiences that will resonate and achieve a result.
- **Element 5: Effective Formats.** The information about communication channels in Element 3 will also help to identify effective formats for conveying the messages developed under Element 4.
- **Element 6: Efficient Delivery Mechanisms.** Not all key target audiences get or want their information in the same manner. Some audiences might obtain their information through agency or association newsletters. Others might prefer to attend a meeting or go to a website to learn more. The communication identifies a range of possible delivery mechanisms for distributing the formats with tailored messages to key target audiences.
- **Element 7: Evaluation Measures.** Evaluating the success of the communication plan will be one way to also help measure the success of the WRAPS process. Tracking which stakeholders have played a role in the process and how their perceptions, awareness, and involvement has changed over time will help anticipate who will support implementation recommendations to improve water quality.

This communication plan includes supplementary information:

- Communication materials (Appendix A, provided electronically): These materials are intended for use by local partners and other organizations implementing the plan.
- Review of local water plans (Appendix B): Provides information on county priorities and future management activities in the watershed; to be used to inform communication and civic engagement.
- Current and past water quality improvement projects (Appendix C): Examples provided by SWCDs of projects that can be highlighted in communication efforts.

Element 1: Goals and Objectives

The primary objective of this effort is to lay a foundation on which to build inclusive conversations, strong collaborations, and engaged communities all focused on the protection and restoration of the surface waters within the Mississippi River–Sartell Watershed. This communication plan will:

- Identify a communications network
- Provide guidance and materials for watershed communications and events to local entities conducting civic engagement
- Support initial dialogues within the communities involved or interested in the watershed's protection and restoration
- Provide a general framework for local stakeholders to educate target audiences

Significant outcomes of these activities may be used to guide content and recommendations in the upcoming WRAPS report.

An Upper Mississippi–Brainerd/Sartell (MBS) Watersheds Civic Engagement Cohort ("Cohort") was sponsored by the MPCA in 2016–2017. This Cohort was provided through a partnership with the University of Minnesota Extension, which provided the training. The Cohort included partners from the Mississippi River–Brainerd watershed and complements the efforts of the Mississippi River–Sartell WRAPS project through the professional training and development of interested watershed partners in becoming civic engagement leaders within their respective watersheds. While the regular Cohort training sessions concluded in February 2017, the ongoing goal is to continue the communication among the Cohort members to help sustain the system of civic engagement support and information that was developed through the cohort sessions.

The goals of the MBS Watersheds Civic Engagement Cohort included:

- Explore and apply civic engagement research, skills, and practices in watershed restoration and protection efforts.
- Expand leadership confidence, capacity, and connections.
- Build a system of support through fellow cohort participants.
- Learn from other cohort participants.
- Reflect and collaborate to further authentic community engagement in the watersheds.

For more information on the Cohort, please contact the following MPCA staff:

- Bonnie Finnerty, MPCA Brainerd Regional Office, 218-316-3897 (Mississippi River–Brainerd watershed)
- Phil Votruba, MPCA Brainerd Regional Office, 218-316-3901 (Mississippi River–Sartell watershed)

The goal of the communication plan is *raising awareness and ensuring broad involvement of key target audiences in developing, implementing, and evaluating actions to reduce pollutant loads through restoration and protection activities.* To achieve the communication plan goal, specific objectives have been developed that will move stakeholders from awareness to education to action during all phases of the WRAPS.

Communication plan Goal:

Raising awareness and ensuring broad involvement of key target audiences in developing, implementing, and evaluating actions to reduce pollutant loads through restoration and protection activities.

Initial work will be focused on educating the public on watershed and water resource-related topics. The goal will be to create awareness of watershed and water quality issues that are relevant to the watershed landowners and stakeholders. A key outcome of this phase will be a list of landowners and stakeholders that may be interested in future activities. Future activities will focus on informing and receiving input on the total maximum daily load study and WRAPS work.

Element 2: Partnering Organizations and Communication Subcommittee

Partners and collaboration are essential to effective communication and engagement strategies. There exist several organizations within the Mississippi River–Sartell Watershed that are already conducting water quality based civic engagement activities:

- SCWDs (Benton, Crow Wing, Mille Lacs, Morrison, Stearns, Todd)
- State agencies
    - Board of Water and Soil Resources
    - Minnesota Department of Agriculture
    - Minnesota Department of Health
    - Minnesota Department of Natural Resources (DNR)
    - Minnesota Pollution Control Agency (MPCA)
- University of Minnesota Extension
- Upper Mississippi River Source Water Protection Project
- Central Minnesota Water Education Alliance (CMWA)
- Mississippi Headwaters Board
- Minnesota Erosion Control Association
- The Nature Conservancy

These organizations are well suited to continue civic engagement activities related to this WRAPS and will therefore lead implementation of this plan. Opportunities to collaborate or piggy back on existing activities will be the optimal way to expand WRAPS-related civic engagement activities.

In addition to engaging the aforementioned partners and organizations in civic engagement activities, the formation of a subcommittee is recommended. The purpose of the subcommittee is to lead and coordinate communication activities, play a role in their evaluation, and determine if adaptations are needed, as seen in Element 7. This subcommittee should include, at a minimum, representatives from:

- Soil and water conservation districts (SWCDs) in the watershed
- MPCA
- Other interested educational organizations active in the watershed

Element 3: Key Audience Characterization

Identifying the key target audiences whose support is needed to achieve the goals and interim milestones provided in a WRAPS is the foundation for a strong communication plan. Key target audiences, or stakeholders, are those who will likely have the most interest in the WRAPS because the proposed strategies have the potential to affect their resources and operations. General public awareness, education, and involvement are also critical elements of this communication plan in order to achieve stakeholder buy-in.

Key target audiences for the communication plan include:

- Urban landowners
- Shoreland landowners (including lake associations and golf courses)
- Livestock producers
- Corn, soybean, and other crop producers
- Irrigators
- Local officials and staff (city councils, township boards, county commissioners, SWCDs, Departments of Public Works, Park and Recreation Boards and departments, etc.)
- Recreational enthusiasts and tourists
- Hunting and fishing groups
- Lake Improvement Districts

Key Target Audience Characterization Questions:

1. *What is the makeup of the target audience?*
2. *What are the key behaviors associated with this audience?*
3. *Which communication channels does this audience use?*
4. *What are the environmental concerns of this audience?*

It is important to develop an understanding of the key target audiences. Detailed information about audience characteristics will influence message development, outreach format selection, involvement opportunities, and other aspects of the communication plan. Each primary audience was characterized using a series of questions; the following table contains the key target audience characterization matrix.

Key Target Audiences	Potential Water Quality Related Interests	Potential Audience Concerns	Communication Channels
Urban landowners	• Septic systems • Pet waste • Lawn maintenance • Stormwater • Household hazardous waste	• Property values • Aesthetics • Livability for future generations • Quality of fisheries • Surface water recreation (e.g., kayaking and canoeing) • Drinking water quality	• Newspapers • Social media • Homeowners/neighborhood associations • Community/civic groups • Local media • Local governments • Soil and water conservation districts
Shoreland landowners	• Property maintenance • Stormwater • Septic systems • Lake management • Pet waste • Stormwater	• Streambank erosion • Water quality issues (safety, aesthetics, quality) • Property values • Flooding • Drinking water quality • Quality of fisheries	• Newspapers • Social media • Lake associations • Community/civic groups • Local media • Local governments • Soil and water conservation districts
Livestock producers	• Manure and nutrient management • Feedlots • Property maintenance (erosion, etc.)	• Potential future regulation	• Agri-Growth Council • Commodity Groups • Minnesota Agricultural Water Resource Center • Minnesota Agricultural Water Quality Certification Program • 4-H Groups • Agricultural associations • Soil and Water Conservation Districts • Word of mouth • Radio and newspapers
Corn, soybean, and other crop producers	• Fertilizer • Fungicides, herbi-cides, pesticides • Tilling practices	• Erosion and losing valuable topsoil • Loss of cropland acreage • Potential future regulation • Flooding • Buffer law	
Irrigators	• Water withdrawal	• Potential future regulation	
Local officials and staff	• Own and operate publicly owned treatment works (POTWs), public water supplies, storm sewer systems; develop and enforce local ordinances related to development and residential practices	• Additional programmatic and regulatory requirements • Technical and financial support from state and federal partners to meet water quality goals • Compliance with existing permits • Property value and tax revenue • Zonation and planning	• Coalition of Greater Minnesota Cities • League of Minnesota Cities • Other local governments (e.g., SWCDs, counties, cities) • State agencies • Central Minnesota Water Education Alliance (CMWEA) • Minnesota Association of Watershed Districts • Association of Minnesota Counties

Key Target Audiences	Potential Water Quality Related Interests	Potential Audience Concerns	Communication Channels
Recreational enthusiasts **Tourists** **Hunting and fishing groups** **Boaters**	• Solid waste management • Wastewater management • Access waterbodies via streambanks • Transport of aquatic invasive species	• Public safety • Adequate public access points • Recreational opportunities • Aesthetics • Healthy ecosystems to support hunting, fishing, and birdwatching activities	• Websites • Local media • Public information providers • Public signage • Social media • Local Trout & Ducks Unlimited chapters • Platte River Watershed Association • Land trusts • School fishing teams • Canoe/kayak rental companies • Outdoor gear retailers

There are additional audiences that can be important to communication and engagement activities:

- Fertilizer dealerships, crop advisers, regional account managers or area representatives
- Commodity groups, Farm Bureau, and agricultural loan officers
- County Feedlot Officers
- Future Farmers of America (FFA) groups
- Agricultural equipment dealers, especially tillage equipment
- Well drillers and associations
- Irrigation dealers, including variable rate technology and moisture sensor dealers

The subcommittee can determine if further targeting is needed for the above list. If so, an evaluation of water quality related programs and behavior, communication channels, and environmental and programmatic concerns similar to the previous table can be developed.

Element 4: Tailored Messages

The objectives of the communication plan involve raising awareness, educating people on the problems and solutions, and motivating people to participate in activities to manage water quality. To achieve these objectives, the communication plan will need to communicate effectively with the wide range of audiences with varying perspectives and concerns.

Effective Tailored Messaging:

1. *Repeats frequently*
2. *Resonates with targeted audience*
3. *Connects impacts of project to audience's life and experiences*

Specific messages will be developed to make the different audiences aware of the issues, encourage behavioral changes, and to support the WRAPS project. These messages should be repeated frequently to make an impact on the audience. Each audience will respond differently to the information presented. Tailored messages that resonate with and are considerate of the needs and concerns of each audience are critical. The members of each audience must understand specifically how the information being presented affects them and relates to their daily lives.

Preliminary messages for various audiences have been developed based on available information and understanding of these audiences. Refinement to these messages may be needed as the project moves forward.

Key Target Audience: Urban Landowners

- Water quality issues in developed areas can be addressed through many good housekeeping practices. Water that flows into storm drains often travels directly to local water ways with no treatment, and with such power and velocity that it can ruin stream channels. Keep this storm

water cleaner by picking up after pets (pet waste management), keeping grass and leaf litter out of the street and gutter, only using fertilizer on lawns when needed and in appropriate amounts, implementing storm water mitigation projects such as rain barrels and rain gardens, sweeping up excess sidewalk salt and not overusing, and keeping motor oil or other greases out of driveways and roads. These simple, easy to implement activities can help improve water quality in your neighborhood and downstream.

- All of our actions can impact the health of the Mississippi River and the drinking water source for the residents of St. Cloud.

Key Target Audience: Shoreland landowners

- Each shoreland owner can help to improve water quality in their lake or stream/river by implementing good practices such as limiting fertilizer, maintaining (native) submergent and emergent aquatic plants, using sidewalk salt responsibly, implementing natural vegetation buffers that include native plantings, implementing storm water mitigation projects such as rain barrels and rain gardens, and making sure that septic systems or other onsite wastewater facilities are functioning properly.
- Shoreland owners are required to comply with shoreland regulations that are overseen by the DNR. Your local DNR representative or SWCD staff can help to provide information on good practices in shoreland areas.
- Activities in your lake or stream/river can have an effect on the overall health of the water resource. Consult the DNR for information on weed control, removal of trees and vegetation, and grading of shorelines to ensure a healthy resource in the future.

Key Target Audience: Livestock producers, crop producers, and irrigators

- Soil health and water quality are directly related.
- Conservation practices can help to protect farm fields from erosion and improve overall soil health, ultimately benefiting the producer in addition to water resources. These practices are often funded, in part, by state and federal dollars. Contact your local SWCD for more information.
- Conservation practices installed on cropland (e.g., conservation tillage, grassed waterways, filter strips, cover crops, etc.) are critical elements of a healthy farm and watershed. These voluntary practices will improve water quality both locally as well as regionally.
- Alternative water supplies and fencing to keep cattle from accessing streams can be funded in part by federal and state dollars. Contact the SWCD for more information.
- The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a voluntary opportunity for farmers and agricultural landowners to take the lead in implementing conservation practices that protect water. Those who implement and maintain approved farm management practices will be certified and in turn obtain regulatory certainty for a period of ten years.
- All wells in the state that withdrawal water for irrigation require a permit from the DNR (in addition to registering the well with the MN Department of Health). Information on irrigation wells is critical so that the DNR can make good recommendations that protect drinking water supplies and streamflow, especially in watersheds like the Mississippi between Brainerd and Sartell, where surface and groundwater are closely linked.
- The WRAPS project will work to focus implementation recommendations using practices that are going to be the most cost-effective for farmers. We need farmer input to ensure reasonable and effective outcomes.

Key Target Audience: Local officials and staff

- Protection of high quality resources is critical. Improved water quality is likely to positively affect property values, economic development, and tourism, improving the quality of life of your residents. Protecting and maintaining good water quality resources now will prevent spending time and money on future restoration.

- There are many waters in the watershed that are not meeting water quality standards and that are potentially affecting downstream drinking water sources. A watershed approach is needed to address these issues.
- Parks and outdoor recreation are an integral part of Minnesota pastime. Park management activities such as aquatic invasive species control, maintenance of adequate plant buffers between trails and water edges, and use of aquatic friendly herbicides can help improve park aesthetics, provide and protect wildlife habitat, and connect parks to broader watershed wide efforts to improve our waterways.
- Local government leadership is needed to ensure a successful WRAPS project that will translate into better water quality and quality of life for your residents and visitors.
- There are many operational changes, both small and large, that can be implemented to help support healthy, clean water ways in your area including improved leaf collection and street sweeping programs; reduced salt use and/or alternative de-icing methods (see the MN Smart Salting program); and changes to municipal properties including increased green infrastructure and natural vegetation, decreased use of fertilizer, and native plantings.

Key Target Audience: Recreational enthusiasts, tourists, hunting and fishing groups, and boaters

- Protect the water resources by eliminating waste—always use proper bathroom facilities, do not feed human food to wildlife, and leave no trash behind.
- Do not move or remove rocks from streams and rivers (e.g., to create pools, build crossings, or rock piles).
- Be careful when accessing waters; erosion of banks can cause impacts to fisheries.
- Streams and rivers may have high levels of harmful bacteria, make sure to looks for signs and other postings prior to swimming.
- Prevent the spread of harmful invasive species by following guidelines from your local DNR or county representatives.
- Follow no-wake zone rules to prevent scour and suspended sediment/pollutants.
- Properly dispose of excess fishing bait; do not dump it into the water body.

To better reach target audiences, the key messages above should be combined with other tools and resources that not only inform each key audience, but are found helpful. For example, urban land owners may be interested in learning about upcoming paint disposal days or weather updates on the best time to fertilize their lawn. Specific tools and resources for target audiences can be further identified by subcommittee and SWCDs, both of which have local stakeholder knowledge. A few examples of useful tools include:

- Soil and Water Conservation Districts Annual Tree Sales and Nitrate Testing Days
- Central Minnesota Ag Weather Network for weather and rainfall reports
- Minnesota DNR Geologic Atlas for GIS mapping data
- Crow Wing YouTube series on shoreline stabilization:
    - How to restore your shore with coir logs
    - How to restore your shore with native plants
    - How to stabilize your shore with erosion control fabric
    - How to install a soil wrap slope break
    - How to stabilize your shore with live fascines
- Positive examples in the watershed of best management practices and water quality results

Element 5: Effective Formats

Multiple formats should be used by partnering organizations to reach key target audiences and to reinforce messages over time. These formats can be phased in over time. The quantitative goal for each format is provided below in italics. Appendix A provides content for communication activities and includes the following:

- Sartell watershed fact sheet (one-page)
- Sartell watershed project poster (poster sized)
- Watershed figures
- Water quality summary and maps
- Factsheets and educational materials

Fact sheet. A watershed-specific fact sheet was developed for use by local partners and stakeholders. The one-page fact sheet (see Appendix A) includes basic information about the watershed, overall WRAPS projects, and general water quality. The fact sheet also includes contact information.

The goal for the fact sheet will be to print and distribute at least 50 fact sheets (updated as needed) during 2017, and 75 in 2018.

Poster. A poster was developed to provide an overview of the watershed, WRAPS process, and water quality (see Appendix A). The poster can be used by local partners for stakeholder gatherings and other events to showcase the project.

The goal for the poster will be to present the project poster (updated as needed) at a minimum of 6 events during 2017, and 8 in 2018.

Websites. Current websites can be updated to include the fact sheet and poster information, along with other general watershed outreach information (see Appendix A). In addition, as updated information is developed or meetings are scheduled, these websites can be updated by local partners. Suggested websites include:

- Stearns SWCD (www.stearnscountyswcd.net/)
- Benton SWCD (www.soilandwater.org)
- Morrison SWCD (www.morrisonswcd.org)
- Crow Wing SWCD (crowwingswcd.org/)
- MPCA Mississippi–Sartell Watershed website (www.pca.state.mn.us/water/watersheds/mississippi-river-sartell)

In addition to these websites, the Central Minnesota Water Education Alliance (www.h2youmn.org) also provides information on water quality and may be a useful website/Facebook site for project updates.

The goal for websites will be to include project specific information on each of these websites, updated quarterly with new watershed/water quality tips (see Appendix A) and status of project (e.g., if meetings are taking place, new reports available, etc.).

Social Media. Facebook is the most popular social media platform and was identified by stakeholders as a useful tool to communicate to landowners and stakeholders. The key to social media will be to provide posts that are relevant, timely, and link to available articles, newsletters, webpages, or blogs.

The goal for social media posts will be between 2 and 4 posts per month, spaced at no more than one post per week.

Examples of existing Facebook pages to build from and incorporate into social media activities include but are not limited to:

- H2You—A Facebook site developed by the Central Minnesota Water Education Alliance focused on water quality education in Central Minnesota, 433 people currently following
- Pine River Watershed Alliance—A Facebook site for HUC8 watershed in Upper Mississippi River Basin, maintained by a citizen-led organization, 40 people currently following

- Regional Stormwater Protection Team—A Facebook site focused on stormwater management in the Duluth area, 216 people currently following
- Respect Our Waters—A Facebook site focused on stormwater management at the residential level in the Milwaukee, WI region, 492 people currently following

A new Facebook site will be developed for this project to support existing social media sites. Content will be limited to include only the watershed. The subcommittee will be responsible for providing and/or posting content to the site.

Developing Facebook content can focus on sharing links to other relevant posts (e.g., AgriNews, MPCA, etc.), links to SWCD sites, meeting announcements, and general water quality related content taken from the materials in Appendix A. It is also beneficial to share, comment, and tag partnering organizations and their posts in order to reach larger audiences and support other water quality improvement projects.

Sponsored posts and scheduled post on Facebook are a good way to repeat messaging when time and resources are limited.

Radio Spots. Radio spots (i.e., public service announcements) are an important communication tool, particularly for producers.

The goal for radio spots will be quarterly radio spots that include watershed or water quality related education information along with meeting announcements, when timely.

Each radio spot is estimated to be 30 seconds to 5 minutes in length and includes timely, relevant information on watershed or water quality issues. Each radio spot should include a problem, solution, and a "call to action" that provides a concrete action that listeners are able to do to support the work of the WRAPS. Radio spots may take the form of a public service announcement or interviews with local experts.

"Call to Actions" may include:

- Prompts for listeners to contact their local MPCA or SWCD officials to learn more information and receive help
- Specific meeting dates or community events to attend
- Best management practices and the resources to learn more
- Specifics on federal and state grant and cost share programs


OUTDOORS

DIRT POOR? NOT HIM OR HIS DIRT

Special care keeps the Legvold farm rich and productive

Saturated buffers: How they work

The key radio stations that should be used include:

- Falls Radio (Little Falls)
- WJJY Brainerd
- 1150 am KASM

Current examples include:

- Weekly Stearns County "Dirt Tapes" with 1150 am KASM
- Morrison County SWCD weekly radio addresses

Newspapers. Articles can be placed in local newspapers to create awareness for watershed issues and provide education and outreach related to water quality. For example, the Star Tribune in Minneapolis has often included detailed articles on water quality and watershed issues:

- Mississippi River Faces Mounting Environmental Threats
- How the Upper Mississippi Goes from Pristine to Polluted
- MPCA plans Mississippi River watershed work

Potential local newspapers include:

- St. Cloud Times

- Morrison County Record
- Brainerd Dispatch
- Sartell–St. Stephen Newsleader

The goal for newspapers will be quarterly newspaper articles that include watershed or water quality related education information as provided in Appendix A and notices of public meetings.

Element 6: Efficient Delivery Mechanisms

The materials identified above can be distributed through a variety of mechanisms. One of the most effective means of distributing information and asking stakeholders to get involved is to *piggy-back* messages and involvement onto existing materials and stakeholder involvement activities that the target audience already receives or participates in. This approach helps to leverage resources, and materials are more likely to be seen by the audience because they are already familiar with the format.

Activities during 2017–2018 when civic engagement activities could be included:

- County fairs
- River clean-up events
- Lake association meetings and newsletters
- Sportsmen's and Rod or Gun club events (e.g., St. Joe Rod and Gun Club, Rice Area Sportsmen's Club, St. Stephen Sportsmen Club, and Sauk Rapids Sportsmen's Club)
- Neighborhood association meetings and newsletters
- Library events, 4-H clubs, and other civic meetings
- Agricultural demonstrations (e.g., Benton County Tour of Practices)
- Producer events (e.g., corn and soybean growers, cattleman)
- Irrigator association meetings and newsletters (e.g., Irrigators Association of Minnesota)
- City Council and other local government meetings

The following activities and newsletters are planned for 2018:

- Benton County Water Resources Advisory Committee (WRAC) meetings (January 23, March 27, and May 22, 2018)
- Sartell Watershed Monitoring and Assessment Plan Professional Judgement Group meeting (Spring, 2018)
- 2018 Annual Tree Sales (all SWCDs)
- Others

Element 7: Evaluation Measures

Evaluation provides a feedback mechanism for continuous improvement of the communication plan. Evaluation tools must be built into the program at the beginning to ensure that accurate feedback is generated. The indicators selected must include several parameters that integrate both outputs (number of fact sheets or web page hits) with outcomes (increases in participation, support for the WRAPS). To successfully determine if the objectives were met, a pre- and post- survey is useful. Surveys can be conducted by mail, email, by telephone, or in- person at events. The kind of information a survey should capture includes the following:

- Demographic information on the audience (i.e., ask participant to select which group they identify best with from the list of Key Target Audiences)
- How they heard about a meeting or event
- Interest level in the WRAPS
- Change in awareness or participation based on information received

Feedback on the previous metrics should influence future outreach strategies and modes of communication to more effectively reach and engage the key target audiences and create a working dialogue. The subcommittee should lead this effort in order to ensure consistency across the watershed.

The most important objectives are raising awareness and generating *participation* by key target audiences. The following table provides detailed information on the specific activities to be conducted for the proposed tasks and potential tracking indicators to evaluate the success of the task in addition to any pre- and post- surveying.

Summary of Activities and Tracking Indicators

CE Activities	Tracking Indicators
Fact Sheet ▪ Develop additional fact sheets as needed, using the template provided ▪ Print fact sheet ▪ Distribute fact sheets ▪ Pick one captivating fact from the sheet to spray and repeat everywhere (e.g. on posters, websites, radio spots, articles etc.)	▪ How many fact sheets were distributed? ▪ How were the fact sheets distributed? ▪ Was the information useful to the target audience? ▪ Did awareness increase as a result of the fact sheets?
Poster Presentations ▪ Schedule poster presentations throughout the watershed by identifying key workshops and meetings where target audience will be present ▪ Ensure presenters have sufficient information to present poster information	▪ How many presentations were made and how were those presentations requested? ▪ How many requests for follow-up were received because of information presented? ▪ How much feedback was received from event attendees? ▪ How long, on average, did each passerby spend at the poster? ▪ How many comments were received by attendees?
Websites ▪ Update websites with WRAPS project information ▪ Update websites with water quality and watershed information	▪ How many updates or new posts were made to websites? ▪ How many requests for follow-up were received? ▪ How many people clicked on the water quality links?
Social Media ▪ Identify types of information to be included on social media (calendar of events, events, key contacts, related links, project information, other partnering Facebook content, etc.). ▪ Prepare materials to be posted. ▪ Post 3–4 times per month.	▪ What percentage of people follow Facebook sites? ▪ How many new followers each month? ▪ Average user views and interactions (likes, comments, shares, etc.) per post ▪ How many RSVPs for each event posted?
Radio Spots ▪ Quarterly radio spots	▪ How many radio spots were played? ▪ How many requests for follow-up were received because of information presented?
Newspaper Articles ▪ Quarterly articles for inclusion in local newspapers	▪ How many articles were published? ▪ How many requests for follow-up were received because of information presented?

Appendix A: Communication Materials (provided electronically)

1. **Mississippi River–Sartell watershed fact sheet (one-page)**

2. **Mississippi River–Sartell watershed project poster (poster sized)**

3. **Watershed figures**
   - Location
   - Base map
   - Land cover
   - Land cover and feedlots

4. **Water quality summary and maps**

   - Lake clarity
   - Stream sediment
   - Stream phosphorus
   - *E. coli*

5. **Existing fact sheets and educational materials**

Minnesota Department of Agriculture fact sheets
- Summer Lawn and Landscape Tips
- Watering Your Lawn
- Watersheds, Lawn Care & Water Quality
- Responsible Use of Fertilizers

U.S. Environmental Protection Agency
- Septic Smart (for more graphics see: https://www.epa.gov/septic/septic-systems-outreach-toolkit)

University of Minnesota
- Taking Care of Your Septic System

Minnesota Department of Natural Resources fact sheets
- Understanding Our Streams and Rivers
- Healthy Shorelines
- Why Shoreland Vegetation Is Important
- Managing Runoff in Shoreland Areas

Additional educational fact sheets
- Simple strategies to improve Minnesota's waters: fall leaves

Appendix B: Summary of Local Water Management Plans in the Mississippi River–Sartell Watershed

Contents

Benton County Overview 3

1. General 3
2. Comprehensive Water Management Plan 3
3. Other Outreach/Education 3

Crow Wing County Overview 3

1. General 3
2. Comprehensive Water Management Plan (2013–2023) 3
3. Other Outreach/Education 4

Morrison County Overview 4

1. General 4
2. Local Water Plan 4
3. Other Outreach/Education 5

Sterns County Overview 5

1. General 5
2. Local Water Management Plan (2008–2017) 5
3. Other Outreach/Education 5

Broad Reaching Civic Engagement/Outreach 6

1. Central Minnesota Water Education Alliance (CMWA 6
2. Annual Tree Sales 6
3. Central MN Ag Weather Network 6
4. Take the Day Off 6
5. Minnesota Smart Salting Program 7
6. Stewardship Week 7

Summary Table of Local Water Plan Priorities and Actions 8

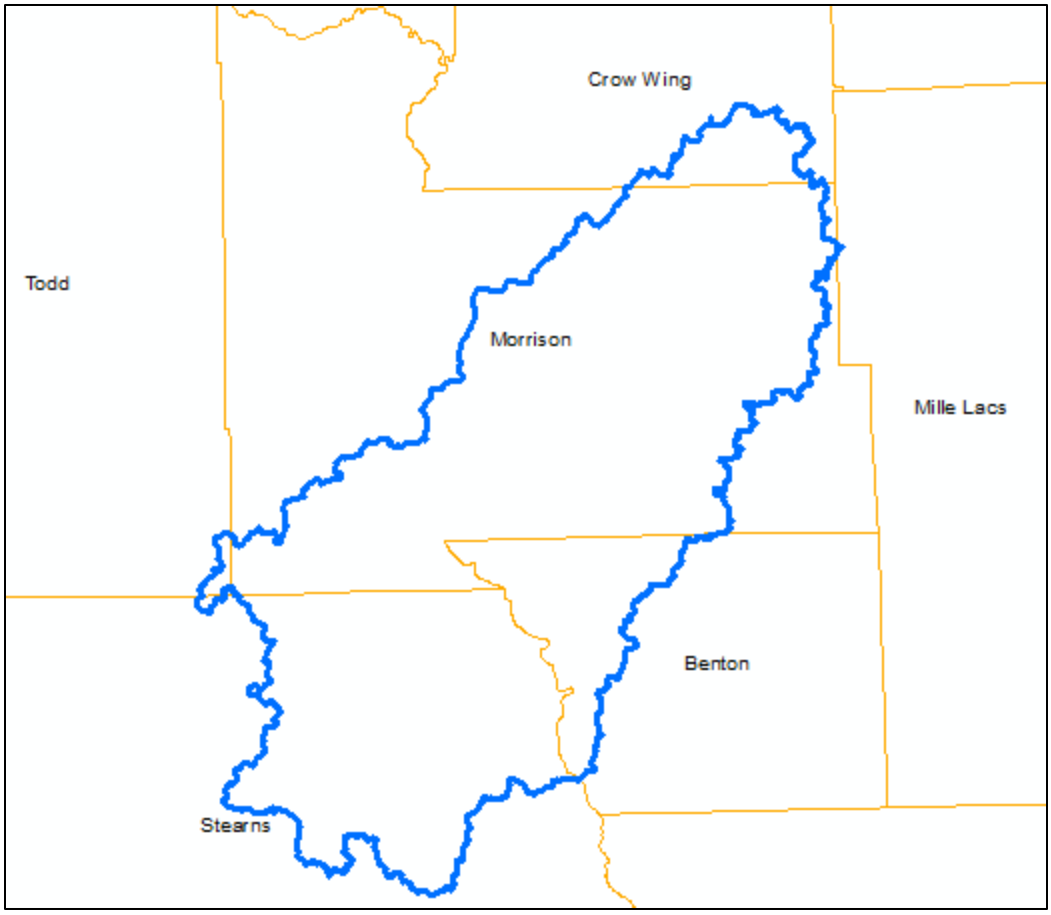


Figure 1. Counties that are in the Mississippi River–Sartell Watershed

Benton County Overview

1. General

Soil and Water Conservation District website: http://www.soilandwater.org/

2. Comprehensive Water Management Plan

County in process of updating plan 2018–2028
Current Plan (2008–2018), amended for 2011–2018 to adjust costs and implementation

- Priority Concerns
    1. Feedlot/nutrient management—agricultural land use is dominant
    2. Development—anticipated population increase of 23 percent by 2015
    3. Groundwater quantity and quality—over pumping and contamination concern (nitrates)
    4. Little Rock Lake: Impaired due to excessive nutrients. Has active lake association and is major concern for both old and new plans.
- Water Resource Advisory Committee (WRAC)
    - The WRAC is the entity responsible for plan development
    - Lead by SWCD Water Plan Technician (Amanda Guertin for upcoming, Annie Felix for development of 2008–2018 plan)
    - Mission: to provide coordination between units of government, citizens, and others involved in the protection, management, and improvement of the water resources in Benton County
- Outreach/Education
    - No specific section on outreach and education in CWMP but education and outreach consistently included in activities listed to address priority concerns.
    - Examples include farm demonstrations, distribution of materials for residential, construction contractors, farmers, and municipal officials, newsletters, creation of a county wide "water week" to celebrate water resources, and partnering to create a water resources website.

3. Other Outreach/Education

- Free Nitrate Testing Days for private wells through the Central Sands Private Well Network (CSPWN). In 2017 the event was paired with the annual tree sale of native tress.
- Enewsletter sign up on website.

Crow Wing County Overview

1. General

- Soil and Water Conservation District Website: http://crowwingswcd.org/
- Facebook: https://www.facebook.com/cwswcd/?hc_ref=SEARCH&fref=nf (link not functioning on SWCD site)

2. Comprehensive Water Management Plan (2013–2023)

- Priority Concerns and objectives
    1. Surface water
    2. Ground water
    3. Aquatic invasive species

- New to this plan
    - Focus on aquatic invasive species for the first time in plan history
    - Targets specific surface and ground water resources to focus implementation efforts
    - Implementation plan for the Mississippi River
    - Use of a watershed-based, land protection model
    - Analysis and maps of all 125 minor watersheds in the county

3. Other Outreach/Education

- YouTube video series on shoreline stabilization

    - How to restore your shore with coir logs
    - How to restore your shore with native plants
    - How to stabilize your shore with erosion control fabric
    - How to install a soil wrap slope break
    - How to stabilize your shore with live fascines

- Water Quality Monitoring
    - Citizen monitoring program funded through Surface Water Assessment Grants (SWAG)
    - 36 lakes and 14 river locations since 2007
    - Integrated sampler for surface water and Secchi disk for depth. 3 reps.
- Planned activities
    - We Are Water informational gathering on August 8, 2017
      We Are Water is a touring exhibit and community engagement project. The goals are to build common awareness of local water issues and reconnect people to their relationship with water by using personal narratives, historical materials, and scientific information. The Minnesota Humanities Center, in partnership with state agencies and others, works with local host organizations to build networks of people to share knowledge and co-plan events and activities to take place during a 6-week programming window. Part of the activities include the display of a 1,000 square-foot exhibit brought free of charge.

Morrison County Overview

1. General

Morrison County Soil and Water Conservation District: http://morrisonswcd.org/

2. Local Water Plan

Five year focus plan (2017–2021)
Final Draft Stage with last Public Input Hearing April 17, 2017

- Priorities
    1. Protect the quality and manage the quantity of groundwater resources
    2. Protect the quality and manage the quantity of surface water resources
    3. Promote and implement sound land use practices that reduce the impacts on all water resources
- Achievements 2010–2016
    - Aquatic Invasive Species Planning (AIS)

- Lake Improvement Districts
- Feedlot Program
- Feedlot Registration Update
- Sub-Surface Treatment System Inventory
- Surface Water Assessment Grant Monitoring
- County Comprehensive Land Use Plan
- Impaired Waters List
- Army Compatibly Buffer
- Camp Ripley Wellhead Protection Program
- Ground Water Nutrient Monitoring
- Water Festival

3. Other Outreach/Education

- Elected Officials and Partners Conservation County Tour in 2016
  Morrison County Soil and Water Conservation Staff toured the county to host educational and demonstrative talks on various conservation best management practices.

Sterns County Overview

1. General

Stearns County Soil and Water Conservation District:
https://co.stearns.mn.us/Environment/WaterResources

Facebook: https://www.facebook.com/Stearns-County-Soil-and-Water-Conservation-District-309249202425135/

2. Local Water Management Plan (2008–2017)

- Priority concerns developed from written and online surveys and two public meetings
  1. Source Water Protection
  2. Development Impacts
  3. Impaired Waters

- MDNR developed a Sensitivity of Ground-Water Systems to Pollution Map for the County
- MHD developed a Nitrate-Nitrogen Probability Map for the county

3. Other Outreach/Education

- Shoreland Homeowner Guides
- Video on Manure Management near sensitive areas. Education on reviewing land applications during inspection. Created by the County Feedlot Officer.
  - Topics covered: Perennial and Intermittent Streams, Lakes and protected wetlands, drainage ditches, open tile intakes, steeply sloping land, road ditches.

- The Dirt Tapes—weekly conservation update from Stearns County Soil and Water Conservation District Staff.

Broad Reaching Civic Engagement/Outreach

1. Central Minnesota Water Education Alliance (CMWA)

- Coalition of Central Minnesota entities and organizations that provides educational outreach to promote water quality stewardship with *residential homeowners.*
- Encourage residential homeowners in Central Minnesota to protect water resources through education and simple behavior changes.
- Provides best management practices for your home, yard, car, and pets.
- Funded by membership dues to meet their storm water I/E requirements.

MS4 Members		
Stearns County	City of St. Cloud	City of Sartell
City of St. Joseph	City of Waite Park	City of Sauk Rapids
St. Joseph Township	Le Sauk Township	St. Cloud University
MN Department of Transportation	**Benton County**	Minden Township
Sauk Rapids Township	Watab Township	Haven Township
St. Cloud Technical and Community College		
Source Water Protection Members		
City of Sauk Centre	City of Melrose	City of Rockville
City of Paynesville	City of Richmond	City of Cold Spring
Upper Mississippi River Source Water Protection Program		
Advisory Members		
Sauk River Watershed District	**Stearns County SWCD**	Minnesota Rural Water Association

2. Annual Tree Sales

All SWCDs

3. Central MN Ag Weather Network

- Covers areas of **Benton, Morrison, Todd**, Hubbard, Becker, Otter Tail, Douglas, Pope, **Stearns**, Sherburne, **Crow Wing**, and Wadena Counties
- Weather Data, Crop Water Use Information, and growing degree day
- Data collected using network of 12 weather stations

4. Take the Day Off

Minnesota River Renaissance (MRR), **Benton and Stearns SWCD** and County Parks with MDNR. The event offers participants hands-on instruction in a variety of outdoor activities, education on land use impacts to our natural resources, and an increased awareness of the Mississippi River within central Minnesota.

5. Minnesota Smart Salting Program

Video: https://www.youtube.com/watch?v=qc8Y-_Nmfmo

Trainings: https://stormwater.pca.state.mn.us/index.php/Smart_Salting_(S2)_training_information

6. Stewardship Week

Promotes the personal and social responsibility to learn about and improve natural resources as we use them wisely. Last week in April, annual.

Summary Table of Local Water Plan Priorities and Actions

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Benton	1. Feedlot/Nutrient Management	Reduce or minimize negative impact of animal manure and fertilizer on surface and groundwater	Increase adoption of feedlot site BMP and manure and fertilizer application BMPs	completed by 2018	• Host field days, meetings, publish written material, etc. • Recruit participants through non-traditional methods, i.e., on farm visits • Support compliance with MN Rule 7020 • Promote low cost feedlot solutions and pasture/grazing management planning • Demonstrate economic, environmental, and other benefits of BMP adoption • Identify and work with non-compliant farms to install BMPs • Provide basic manure management tools and services, i.e. spreader calibration, manure and soil testing, spreading equipment, etc. • Promote adoption of manure management BMP's, targeting efforts on dairy and poultry manure and/or land areas of highest concern • Conduct demonstration trial plots and other on farm educational work with producers in cooperation with private/public entities
			Increase the adoption of improved manure handling, pasture management, and other BMPs related to water quality with small non- traditional hobby/enterprise farms		• Partner with other entities who provide programs and services to this audience to adopt BMP's • Investigate and promote improved manure handling and application systems, i.e.: community composting, small rental equipment
			Resolve feedlot regulation/delegation issue	2010	• Consider need for LGU review of new projects on feedlots under 300 animal units • Host exploratory meeting(s) regarding the county feedlot delegation topic, invite other counties/interested parties to speak on the topic
	2. Development	Balance Open space and development to maintain and/or improve the region's water quality	Develop a natural resources inventory that identifies rare/critical /vulnerable resources related to water quality	2010–2018	• Assist in the development of the County Geologic Atlas • Identify & compile list of existing inventories of rare/ critical/ vulnerable water resources • Survey Local Government Units and public to identify water resource concern areas and priorities • Create sensitive areas management plan using the resource concern areas and priorities developed & list compiled • Develop tools such as conservation subdivision for use in designated areas • Host Alternative Shoreline Ordinance standard discussion between Local Government Units • Development of Geologic Atlas • Identification/compilation of rare/critical/vulnerable water resource areas • Sensitive areas management plan (2018)

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Benton			Prepare and provide materials to developers on requirements for water quality and quantity through a unified local government delivery system	2012–2018	• Develop a single source of contact for developers to receive information about rules/regulations for all county and township development projects • Create a quick reference guide on development regulations • Bring together Local Government Units to discuss development issues and the needs associated with those issues. • Educate townships about municipal separate storm sewer systems (MS4) plans if they do not have them • Develop/utilize and distribute materials about best management practices to new landowners at time of purchase • MS4 plans • Materials on BMPs to new landowners at time of purchase • Reference guide on development regulations
		Encourage LGUs to adopt development related ordinances and policies to maintain and enhance water resources	Review and amend MS4 plans in TMDL watersheds (Little Rock Creek, Little Rock Lake)		• Assist MS4s with Total Maximum Daily Load (TMDL) implementation
			Utilize plat process/policy to implement urban BMPs		• Create & promote incentives to establish and maintain low impact development • Explore updating standards for high rainfall events • Identify standard and optional Best Management Practices for development • Incentives for LIDs
			Mandate installation of perennial vegetation filters for public ditches	2018	• Include the installation of perennial vegetation filters as part of any ditch cleaning/maintenance project, i.e. grass filters • Review public ditch inventory, created electronic map (Hwy department)
		Provide information and education opportunities through a coordinated local government effort.	Develop a unified outreach effort	2018	• Develop a crisis delivery system to address emergency or hot topic issues as they arise • Water quality issues into county wide newsletter • Establish a county wide educational water resource program that incorporates all audiences and ages • Explore water resources website for county
		Plan for future growth in order to protect water resources and minimize land use conflicts	Plan for a full build out around rapidly developing areas	2009–2010	• Model impact of full build out on water resources (DOD 2010)
	3. Groundwater	Protect and maintain groundwater quality resources in Benton County	Maintain/promote existing cooperative partnerships that monitor groundwater	2012–2018	• DoA Central Sands Monitoring Network • Groundwater quality database (2012)
			Wellhead protection plans (WHPA) for all public/community water supplies	2012–2018	• Establish priority protection area overlays on land use and zoning maps • Create a process to identify performance standards for sensitive areas, recharge areas, wellhead protection areas that are impacted by developments
			Continue to regulate SSTS	2010–2018	• Develop plan to ID priority areas (2010) and to inspect and/or upgrade SSTS in priority areas (2012)
			Develop plan to eliminate unused wells	2010–2018	• Develop plan

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Crow Wing (2013–2023)	1. Aquatic Invasive Species	To provide leadership in the fight against Aquatic Invasive Species by developing proactive solutions aimed at educating and empowering local citizens.	Lake Association Coordination	Length of plan	• Distribute a relevant news, grant opportunities and info on upcoming events to Lake associations • Host open houses or educational events
			Water Craft Inspections	Length of plan	• Coordinate a water craft inspection program with DNR and local lake associations
			Lake Improvement District Management	Length of plan	• Maintain LID reports and contact information online
			Education and Outreach	Length of plan	• Develop AIS displays, presentations, and promotional material for area schools, County Fair, and other forums.
	2. Surface Water	To empower landowners to steward surface water resources for use and enjoyment by current and future generations	Stormwater management, erosion and sediment control, and shoreline buffers	Length of plan	• Provide technical assistance and onsite guidance • Expand the availability of educational materials, workshops, and network of resources • • Develop public and private drainage solutions that incorporate effective stormwater management and erosion & sediment control. • Support scientific research and methods that promote minimal impact stormwater techniques that use natural drainage-ways and vegetated soil surfaces to convey, store, filter, and retain storm water onsite while mimicking the natural hydrology of a site.
			Wetland Protection	Length of plan	• Lead administrative leadership of WCA • Provide educational opportunities to contractors and professionals
			Land use and Development	Length of plan	• Outcome based ordinances • Measures impervious cover • Measure phosphorus inputs from land use activities. Promote no net increase in phosphorus from developed activities • Common sense mitigation measures (e.g., shoreline buffers) • Conservation easements • Identify sensitive shorelines • Promote private forest management
			Measure water quality data and assess trends	Length of plan	• Assess water quality trends and impairments • Promote citizen water quality monitoring • Determine future monitoring needs
			Ag BMPs	Length of plan	• Nutrient management plans • Pasture management/rotational grazing plans • Cover crops, conservation drainage, other agricultural BMPs etc.
	3. Groundwater	To maintain safe, clean drinking water for future generations.	Septic System Maintenance and Inspection	Length of plan	• Inspections every three years • Identify potential centralized treatment options in small communities • Identify current and potential sites for land application of septage
			Nitrates and other contamination testing	Length of plan	• Regular nitrate testing opportunities • Make groundwater/nitrate data readily available to public

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Crow Wing (2013–2023)	Groundwater (cont.)		Wellhead and Drinking water source protection	Length of plan	• Participate on local Wellhead Protection (WP) planning teams. • Integrate WP Priorities into water plan implementation strategies. • Provide educational opportunities to non-community water sources and well owners about the importance of WP. • Promote agricultural BMPs that reduce the potential for groundwater contamination such as irrigation, fertilizer, and herbicide management. • Integrate the County Geologic Atlas into WP and water planning efforts
			Sealing of Unused /Abandoned Wells	Length of plan	• Identify unused/abandoned wells • Offer incentives to seal unused/abandoned
			Solid & Hazardous Waste Disposal	Length of plan	• Provide information on recycling and solid waste management. • Promote proper disposal of household hazardous waste, electronic waste, and petroleum products. • Promote product stewardship for properly disposal of various types of solid and hazardous wastes as well as materials management which focuses on the economic value in waste recovery and recycling in addition to environmental protection.
Morrison County	1. Quality and quantity of groundwater resources	Protect high quality groundwater resources	Increase the available background information of the County's groundwater resources	Duration of plan	• Twice annual nitrate testing in May and October • Development of Geological and Hydrological Atlas • Identify sensitive groundwater areas, distribute • Geological Atlas workshops • Compile usable groundwater monitoring information, distribute
			Develop and implement public information programs aimed at public awareness in the protection of public water supply in the well head protection communities (Little Falls, Camp Ripley, Bowlus, Randall, Rich Prairie (Pierz), Royalton)	Duration of plan	• Annual presentations • 5 prescribed grazing plans per year • 5 nutrient management plans per year • 5 conversion to no-till/strip till plan per year • 10 cover crop plan every other year • 4 agricultural waste facility improvement everyone year
			Prevent groundwater contamination from both current and abandoned wells.	Duration of plan	• Seal 30 unused wells • Distribute abandoned well information to all county residents • Survey all DWSMA cities for Class V wells • Distribute Class V well information to all high risk landowners
			Work to establish a coordinated spill response plan for the Transportation Corridor through joint training and spill notification	Duration of plan	• Annual meetings to adopt and/or update the emergency spill response plan.
			Support continued solid waste programs and educational efforts on the proper disposal of hazardous waste and recycling programs for the preservation of the Drinking water aquifer. (Little Falls WHPP)	Duration of plan	• Hold 2 waste pesticide collections annually • Follow-up and surveys on 2 permitted waste sites annually • 3 WP work group meetings held
			Work to establish a coordinated spill response plan for the Transportation Corridor through joint training and spill notification	Duration of plan	• Annual meetings to adopt and/or update the emergency spill response plan.

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Morrison County	Quality and quantity of groundwater resources (cont.)		Continue to regulate subsurface sewage treatment systems (SSTS) and above ground tanks in the county.	Duration of plan	• Create high priority SSTS database. • Compliance inspections • Low interest SSTS loan information distributed to all landowners in high priority areas. • Upgrade ten failing systems for low-income residents • Track septic installs, upgrades, and maintenance as part of all land use permits. • Conduct or host one septic-related workshop every other year. • Online factsheets, ordinances, and other septic information • Education program for above ground tanks • Clean up 5 old sites reviewed for contaminated soils • Inventory above and below ground tanks
			Support Source Water/Wellhead Protection planning and implementation	Duration of plan	• Develop 4 WHP plans, annual PWS/WHP meetings • Update 4 WHP plans • Identify groundwater thresholds for 5 aquifer areas • Restore/preserve 3 recharge area wetlands • 150 water samples collected annually from WHPs
			Maintain and promote existing cooperative partnerships that monitor groundwater	Duration of plan	• Monitor all monitoring wells • Annual nitrate clinic • Annual news releases on groundwater issues • 3 meetings held with Little Rock Watershed Partnership
		Preserve and ensure adequate quantity of groundwater	Improve groundwater understanding, awareness, and protection relating to irrigation practices.	Duration of plan	• 2 surface/groundwater studies launched • Participate in Little Rock Creek Sustainable Groundwater Use Planning Project • 3 water conservation initiatives established • Water conservation plans for all new irrigators • Update 20 existing irrigation plans • Complete windbreak removal study • Pursue a soil loss ordinance in Morrison County
	2. Quality and quantity of surface water resources	Protect, enhance and maintain the quality of all surface waters	Reduce impacts of agricultural run-off from feedlots and farming practices by completing the MN Buffer law or all protected waters and public ditches.	Duration of plan	• Buffer law implemented within prescribed time limits • Landowners affected by the buffer law monitored and appropriate enforcement actions taken. • All riparian feedlots in compliance • A farm management strategy developed for the Little Rock Watershed and implemented on 5 farms • Nutrient management practices implemented on 10 farms
			Study and comprehend the hydrology and storm water management through evaluating watershed changes in surface water elevations in Morrison County	Duration of plan	• Culvert inventory completed and hydrologic model developed. • Ordinance drafted and adopted by the County Board
			Ensure that land use decisions for shore land development take environmental impacts into consideration.	Duration of plan	• All developers have approved NPDES permits • One storm-water training session held • Draft riparian vegetation protection language presented to the County Board • A septic system inspection process similar to that completed around Fish Trap Lake developed for Agram Township. Corrective action incorporated.

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Morrison County	Quality and quantity of surface water resources (cont.)		To provide coordination in the fight against aquatic invasive species by developing proactive solutions aimed at educating and empowering local citizens	Duration of plan	• AIS risk assessment completed and AIS prevention priorities developed. • Utilize MHB social media campaign and Wildlife Forever's "Clean, Drain, and Dry" materials and signs Enlist and enroll volunteers from 5 high priority lake associations in the Extension "AIS Detector Program".
			Protect and enhance the County's wetlands.	Duration of plan	• WCA administered efficiently and effectively. • 5 wetland restorations completed. • 1 wetland identification training sessions held annually. • 20 WCA radio spots aired, 5 general WCA presentations delivered to schools and civic groups. • Rules established requiring wetland delineations on new development. • Biannual realtor wetland training sessions held over duration of plan
			Assist Lake Associations and Lake Improvement Districts in developing and maintaining good lake protection plans.	Duration of plan	• LID's submit complete annual reports to the County Board. • 5 LID annual meetings held. • Water quality monitoring program established on all high priority lakes. • Aquatic vegetation monitored on10 high priority lakes, 5 enhancement projects completed. • 4 wild rice lake enhancement projects completed. • Low interest loan program information sent to lakeshore owners on 10 high priority lakes. 4 septic systems upgraded using low interest loan funds. • CWF grant application submitted. • Continued nutrient monitoring of high priority lakes
			To improve, maintain, and ensure clean and healthy rivers in Morrison County.	Duration of plan	• Little Falls Storm-water Management Plan (2016) • Annual participation in Little Rock Lake and Little Rock Creek WRAP projects. • 8 native buffer projects completed on critical erosion sites. • 5annual River Days held • 20 cost shared projects in critical impaired and protected waters areas.
			To increase protection of lakes and rivers from floodwaters by promoting storage of floodwaters on the landscape.	Duration of plan	• Flood funding targeted to critical flood areas. • Local input provided to FEMA for review • New floodplain maps adopted by the County
			Complete and implement the developing Morrison County Comprehensive Drainage Management Plan and maintain the culvert inventory being conducted.	Duration of plan	• Local partner input received for consideration by the Water Plan Committee • Minor watersheds prioritized • Priority minor watershed protection projects identified and an implementation list developed • Project funding acquired from Federal, State and local grants • 10 priority projects completed
Morrison County	3. Land use practices that reduce the impacts on all water resources	To ensure that land use decisions are compatible with natural resource protection	To assure all riparian feedlot producers are in full compliance	Duration of plan	• Cost-share feedlot pollution control practices on 20 feedlots. • Technical staff compliment maintained. • Continued representation on PC and BOA. • Environmental reviews on all feedlot changes • Manure stockpile rules enforced

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
					• State and federal programs used to promote pasture management, nutrient management, and residue management.
			Reduce the pressure and impact of shore-land, rural residential and marginal land development.	Duration of plan	• Enact over-development standards. • PCA requires conditions to address impacts on developments. • Continue support of ACUB program. • Identify boundaries and assist landowners in the Sentinel Landscape area. • State funding secured for conservation easements, 3 easements completed. • Land use changes monitored, report developed. • Dock and boathouse ordinance provisions enacted.
			Reduce the loss of natural habitat.	Duration of plan	• Soil loss ordinance drafted and presented to County Board. • 2 training sessions held on DNR ecological classification system. • Actively support ordinance amendments that better protect natural resources, preserve green space in developments, and require storm water management. • High priority forestlands in the County identified and mapped. A forest protection and restoration funding proposal drafted in cooperation with MFRC. • Information on forest stewardship plans distributed to all private forest landowners in the County. 15 forest stewardship plans completed • A grassland protection and restoration strategy drafted and presented to agencies and County Board
Stearns County 2013–2017 amended 2008–2017	1. Source Water Protection	Protect, enhance and improve, as needed, the quality of drinking water supplied by the public water suppliers in Stearns County	Civic engagement directed at issues affecting source water protection: public water suppliers with Source Water Protection Plans, public water suppliers that will have SWPPs	Duration of plan	• Long term maintenance of SSTS, hazardous chemical, stormwater runoff, LID, unsealed wells, agricultural nutrient application, etc. • Expand well testing with MDA • County wide database of arsenic and nitrate
			Focus inspection and compliance activities within the Drinking Water Supply Management Areas.	Duration of plan	• City of St. Cloud will continue to inspect work done under NPDES Phase II Construction • Permits throughout its City limits.
			Administer initiatives that advance source water protection	Duration of plan	• Assist with development of Source water protection plans • Nitrate “clinics” with MDA • Explore development of additional required protective measures for aggregate mining in • wellhead protection areas overlying geologically sensitive aquifers

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Stearns County 2013–2017 amended 2008–2017	Source water protection (cont.)		Employ land and water treatment initiatives for the protection of source water. Focus will be in DWSMA's.	Duration of plan	• Maintain annual average of sealing 6 unused wells • Inventory SSTS located within the vulnerable areas of DWSMA • BMOS associated with irrigation on coarse textured soils in DWSMA • Support research for the purpose of developing the use of native/alternative plants as a cellulosic source for biofuels • Support trading programs that reduce nutrient loading in vulnerable SWP areas. Explore opportunities available through Conservation Marketplace Midwest. • Develop an initiative for the installation of a 50' permanently vegetated buffer along public water lakes, wetlands and streams within St. Cloud DWSMA A. Use of programs such as CCRP, CRP, RIM and EQIP will be explored
			Conduct mapping and inventory initiatives for the purpose of source water protection.	Duration of plan	• Develop an interactive map outlining the DWSMA's and the vulnerabilities associated with each DWSMA.
			Assist and support the implementation of approved Source Water Protection Plans.	Duration of plan	• Holdingford • Paynesville • Cold Spring and Melrose • Rockville • New Munich
	2. Development Impacts	Minimize the impact from existing, new development and redevelopment on surface and ground water resources	Encourage low impact development and better site design on all new and redevelopment projects throughout County.	Duration of plan	• Demonstration projects (rain gardens, green roofs, pervious pavement, etc.) and virtual tour of them • Promote low impact development strategies by seeking to include in the zoning ordinance • incentives for projects that use low impact development strategies • Recognize that some areas are corridors that serve as connections between natural areas and guide development away from those areas of connection. • Implement portions of the Alternative Shoreland Standards as developed by the Governor's Initiative • Complete county wide natural resource inventory to ID sensitive natural areas
			Promote land and water best management practices in shoreland and riparian areas, urban areas	Duration of plan	• Assist riparian landowners with BMPs • Disconnect impervious • Stormwater/erosion control retrofits • Issuance of construction permits in shoreland will include running the Stearns County Pollutant Loading Model • Retaining walls as a last solution only if other • Promote use of SWCD's Shoreland Preservation Agreement • Assist financially with SSTS upgrades • Develop a program to allow for small scale projects in developed areas when NRCS Field Office Technical Guide design standards cannot be met.

County	Priority Concern	Goal	Objective	Schedule	Relative Projects/Results
Stearns County 2013–2017 amended 2008–2017	Development Impacts (cont.)		Reduce impacts of stormwater runoff and manage flow and volume	Duration of plan	• Provide information, technical and/or financial assistance to County landowners implementing • development retrofit-related BMP's • Work with contractors • Evaluate permanent stormwater practices for installation, maintenance and effectiveness. • Revisit erosion control and stormwater provisions of Land use and zoning ordinance after MPCA stormwater manual is updated • Continue to participate in CMWEA
			Better coordination of the County's stormwater efforts with the MS4 communities within the County	Duration of plan	• Stormwater Hotline for citizens to report illegal dumping • County will provide the opportunity for education of County staff on construction site run-off controls and other activities that may impact stormwater quality, including road salt and sand application and illicit discharge. • County staff to be trained to identify instances of illicit discharge while doing field work and will take corrective action.
	3. Impaired Waters	To address the issue of impaired waters and will require the following steps: 1. determine the status of the County's water resources in relation to whether they can meet their designated uses 2. improve those rivers, lakes, wetlands and streams that do not meet their designated uses 3. protect those lakes, rivers, wetlands and streams that support their designated uses	Assess the ability of the County's lakes, rivers and streams to meet its designated uses.	Duration of plan	• Coordinate and track water monitoring for the entire County • Develop and annually review a priority list of lake, river and stream monitoring for each year's monitoring. • Promote volunteer monitoring • Annual submission to EQuIS
			Improve those water resources that are impaired and protect those that are not impaired.	Duration of plan	• Provide information, technical and/or financial assistance to County landowners implementing • BMP's on rural property • Work with urban and rural landowners on proper land application of nutrients and pesticides • Continue to inspect all feedlots, with an emphasis on feedlots in shoreland or with a direct connection to a water resource. • Adoption and implementation of comprehensive nutrient management practices. • Support and cooperate with Watershed Districts, the MPCA and BWSR on ongoing TMDL projects. • Seek ways to engage all citizenry in the County in the value of natural resources • Work with and provide information to feedlot owners and operators on natural resource management techniques, including manure storage and application. • Promote and market federal/state/local conservation programs to targeted landowners and help prepare them for eligibility in programs such as CSP, CRP, EQIP • Establish vegetative buffers on public and private ditches, streams, lakes, wetlands and tile inlets • Conservation Marketplace Midwest • Promote conservation drainage best management practices • Assist landowners with pasture management and alternative water sources for livestock • TMDL implementation

Appendix C: Current and Past Water Quality Improvement Projects in the Mississippi River–Sartell Watershed

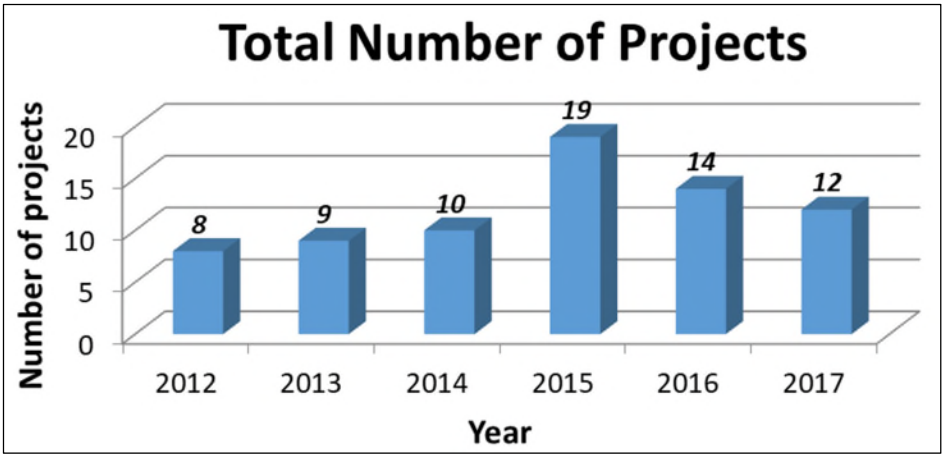
1. **Benton County SWCD project overview**
   - Little Rock Lake projects

2. **Morrison County SWCD project overview**
   - Swan River
   - Platte River
   - Current RCPP

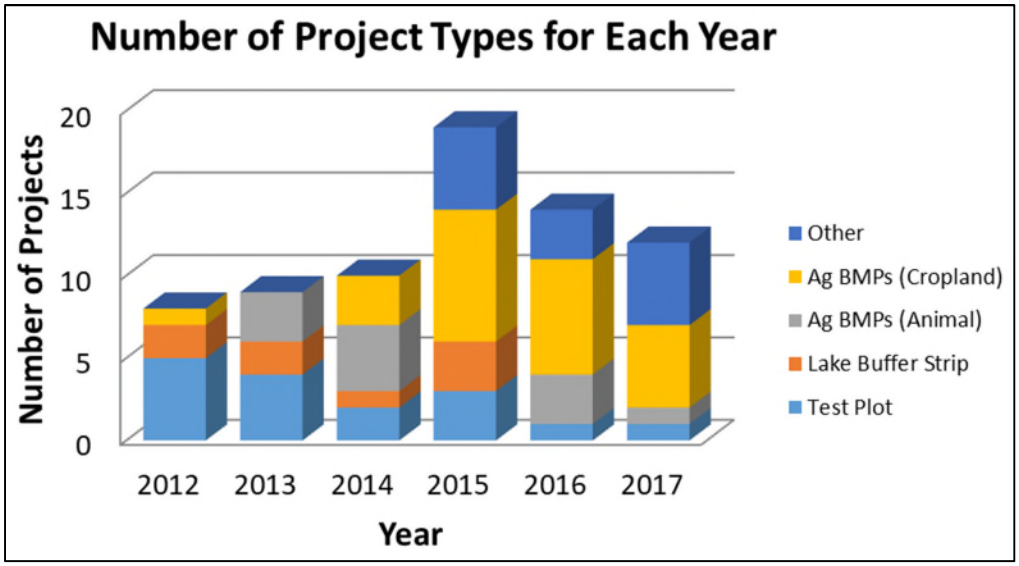
3. **Stearns County SWCD project fact sheets**
   - Annalise Edeburn shoreline project (2013)
   - Galen Wilczek agricultural waste project (2016)
   - Galen Wilczek erosion project (2016)
   - Gemma Lim shoreline project (2014)
   - SJU Stump and Sagatagan stormwater treatment (2016)

Little Rock Lake Watershed Projects

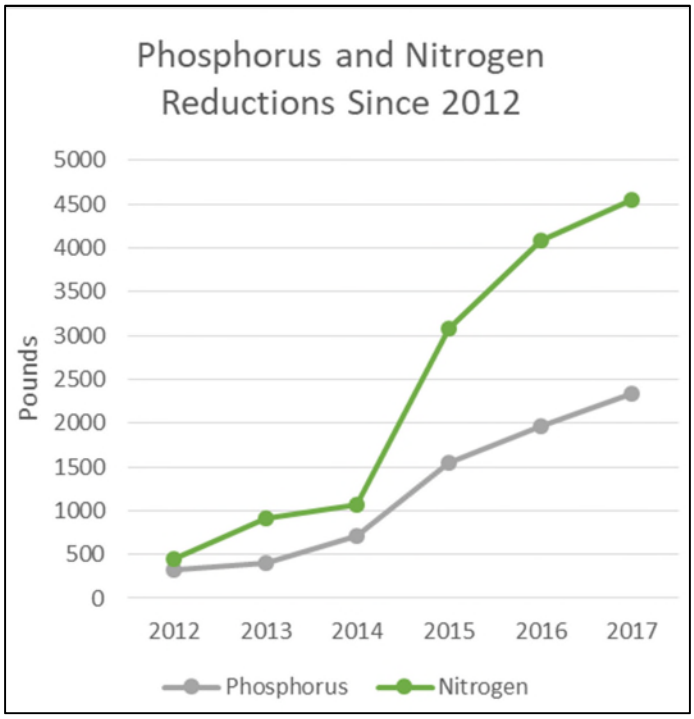
Year	# of Projects
2012	8
2013	9
2014	10
2015	19
2016	14
2017	12
Total	72

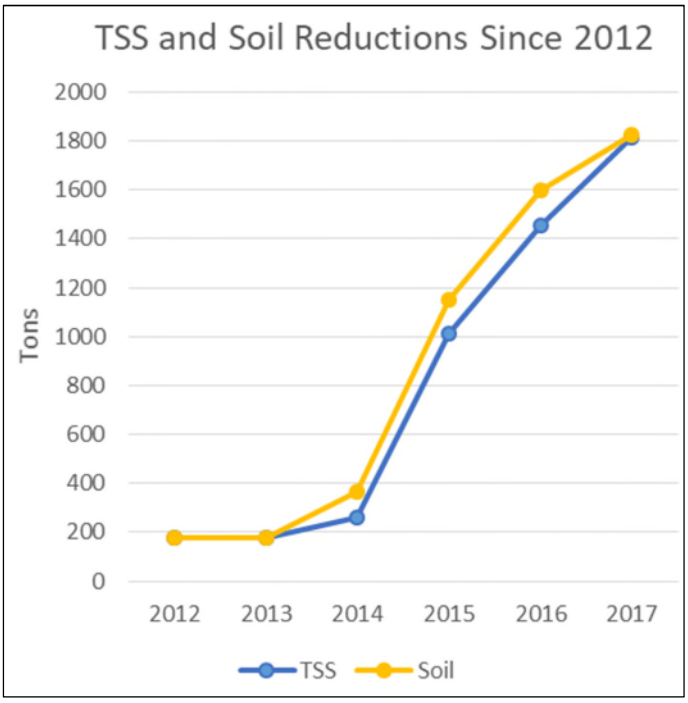


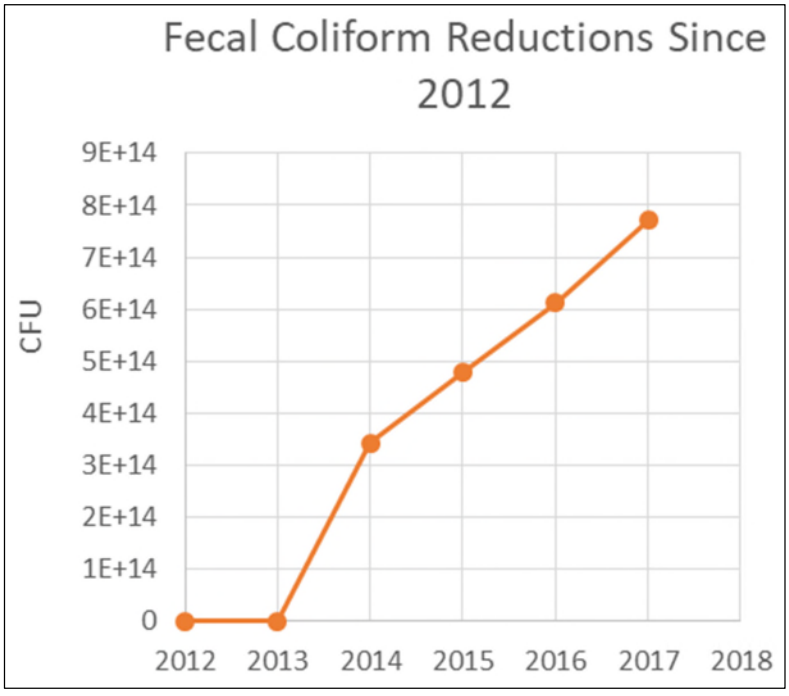
Type of Project	2012	2013	2014	2015	2016	2017	Totals
Test Plot	5	4	2	3	1	1	16
Lake Buffer Strip	2	2	1	3	0	0	8
Ag BMPs (Animal)	0	3	4	0	3	1	11
Ag BMPs (Cropland)	1	0	3	8	7	5	24
Other	0	0	0	5	3	5	13
Total	8	9	10	19	14	12	72



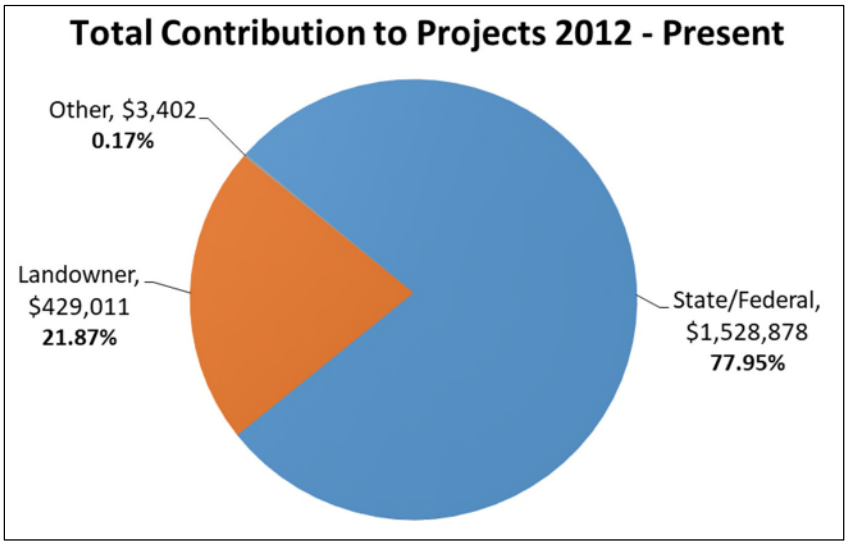
Reductions					
Year	**TSS**	**Soil**	**Phosphorus**	**Nitrogen**	**CFU**
2012	175	175	329	455	0
2013	0.4	3	70	461	0
2014	84	187	309	146	3.419E+14
2015	750	786	839	2019	1.3674E+14
2016	447	447	423	998	1.341E+14
2017	358	229	370	474	1.57672E+14

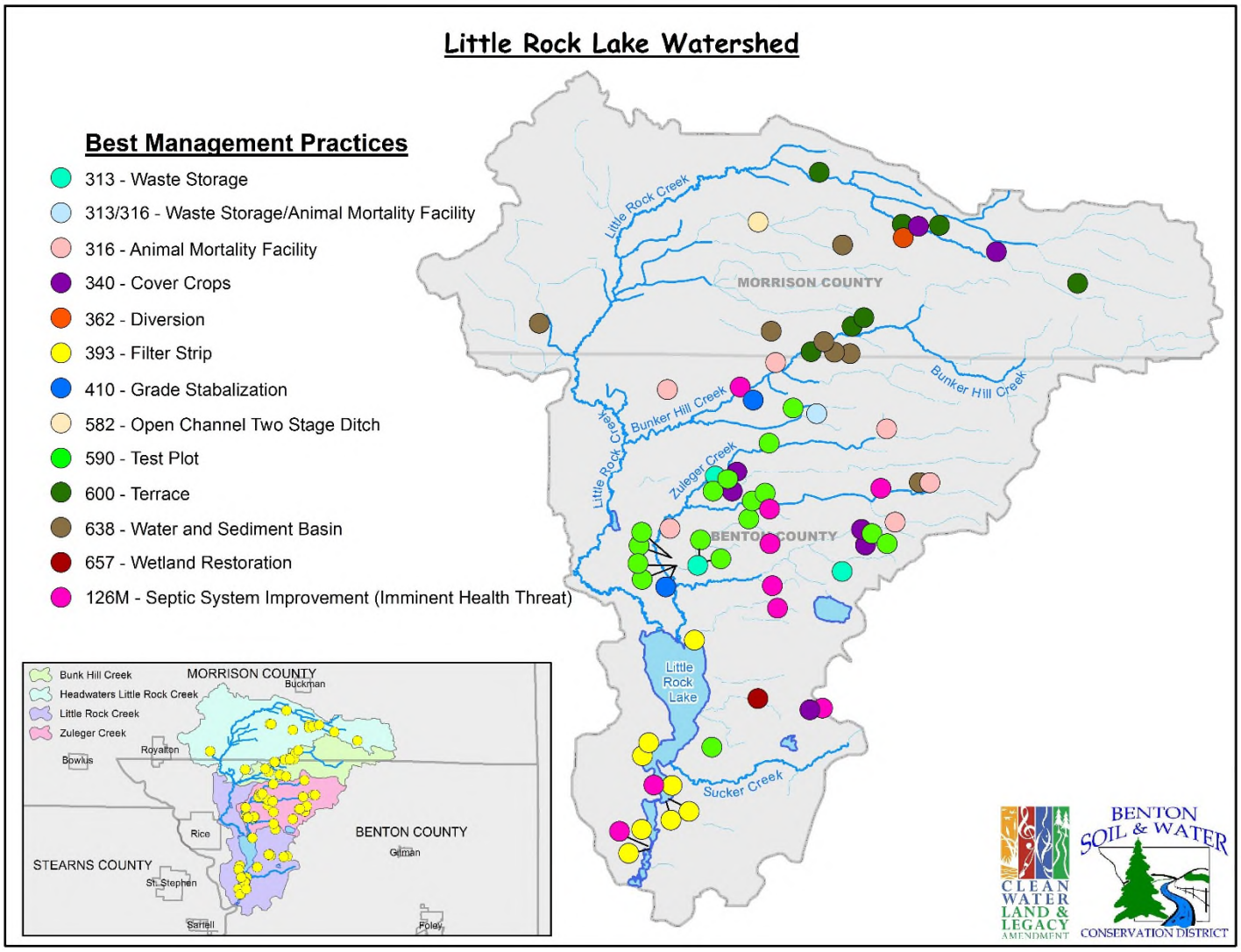






Funds For Projects	
State/Federal	$1,528,878
Landowner	$429,011
Other	$3,402
Total	**$1,961,291**





Morrison County Soil and Water Conservation District Project Overview

Swan River 319 project (completed in 2010). A 319 grant was used by Morrison and Todd SWCD to work with poultry and hog producers for nutrient management to reduce phosphorus loading to the Swan River. The grant totaled $140,000 in projects which included a $70,000 match by Morrison and Todd SWCD. Figure 1 provides a summary of projects completed during the project from the Morrison County Water Plan 2010-2020.

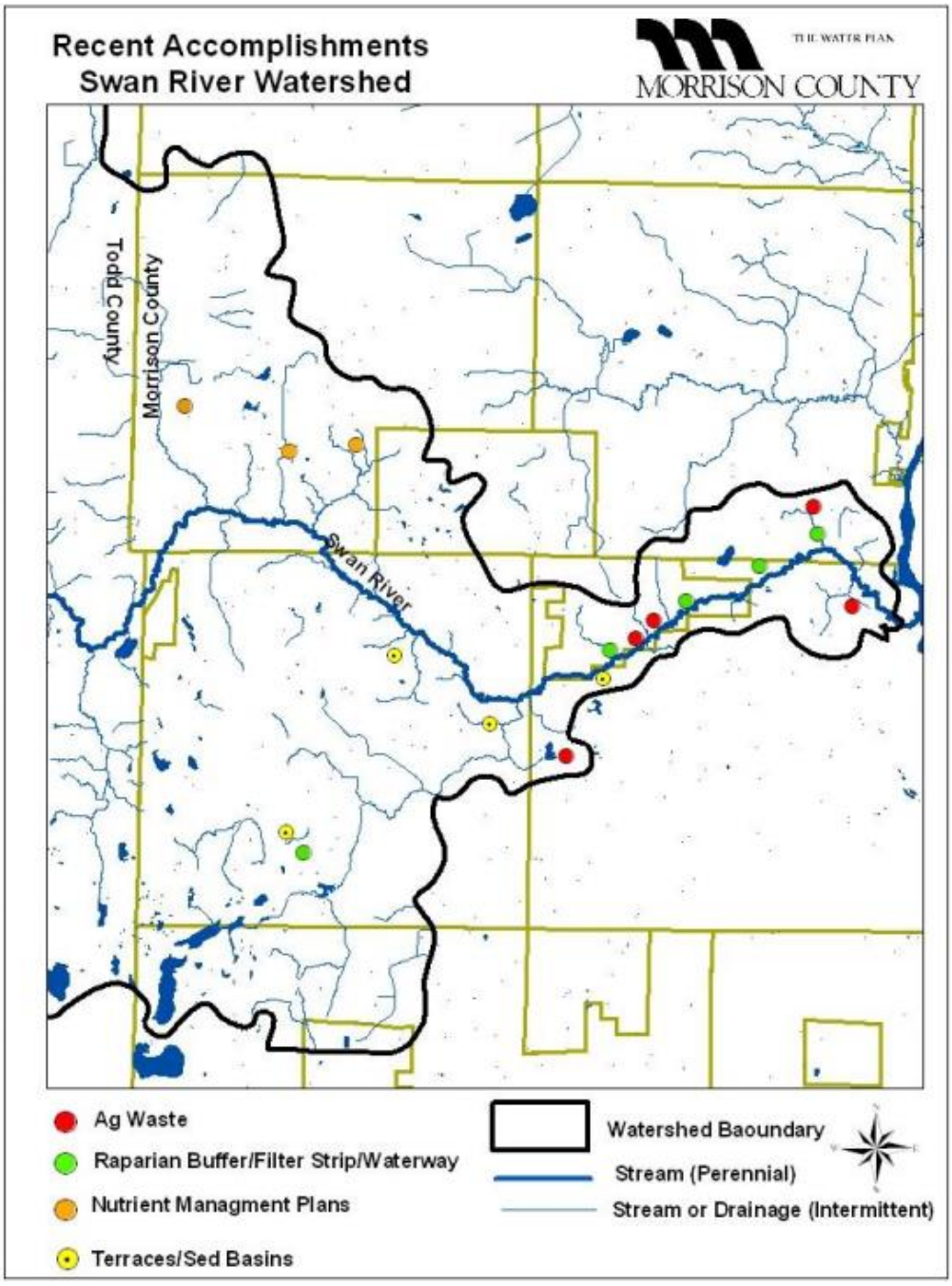


Figure 1. Recently completed projects in the Swan River Watershed (Morrison County, 2010).

Platte River bioengineering and armoring project (2015). The project had several partners including partners from the county, private landowners, and the city. It included a combination of rip-rap, a series of two rock stream barbs, and cedar tree revetments to reduce erosion and provide fish habitat on private property on the Platte River. Funding was provided by the Clean Water Partnership and supplemented with funds from the city, Morrison SWCD cost share, and the private landowner. Pre-construction (Figure 2) and post-construction (Figure 3) photos are provided below.

Figure 2. Pre-construction site photo.

Figure 3. Post-construction site photo.

RCPP award (current). Morrison SWCD has a current $2.8 million dollar RCPP grant. The funds will be used primarily for Platte River watershed restoration and brings in addition CSP and EQIP funding for the area. The award also supports a Healthy Forest easement project.

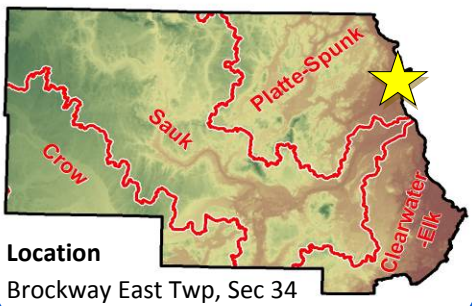
Annalise Edeburn

Shoreline Restoration

Project Description: This property on Mississippi River had a failing retaining wall and deck system and extensive erosion occurring on the bank. The shoreline was stabilized with riprap. The retaining walls and deck were removed and erosion control blanket installed along the entire shoreline on the property to protect the sloped until the planted native vegetation can become established. The landowner did install an integrated stone stairway which was installed to the dock (this was at their own expense).

Pollution Reduction Estimates:

Phosphorus	47.60	Lbs/Yr
Sediment (TSS)	55.97	Tons/Yr



Location
Brockway East Twp, Sec 34

Practice:

Shoreline Restoration

Target Waters:

Mississippi River

Year Constructed:

2013

Components:

- Native Grass Planting
- Wildflower Planting
- Shrub Planting
- Sediment Logs
- Erosion Control Blanket
- Weed Free Straw Mulch

Benefits:

- Sediment Reduction
- Nutrient Reduction
- Natural Aesthetics
- Wildlife Habitat

Partners:

- Landowner
- Stearns County SWCD
- West Central TSA
- Board of Water & Soil Resources

Watershed:

Mississippi River – Platte-Spunk

Stearns County Soil and Water Conservation District
110 2nd Street South, Waite Park, MN 56387
Ph: 320-251-7800 x3
www.stearnscountyswcd.net

Annalise Edeburn

Shoreline Restoration

Failing Retaining Wall System

Shoreline Stabilization

After Shoreline Restoration

"Annalise was concerned about the stability of the shoreline, they felt naturalization would do the best job at protecting the bank as well as the Mississippi River."

– Greg Berg, SWCD Lakeshed Specialist

Before Shoreline Restoration – Erosion Issues

Erosion Blanket & Plant Installation

Funding:

State Funds*	$	12,375
Landowner Investment	$	4,125

* **Administered by Stearns SWCD**
State Cost Share

Galen Wilczek

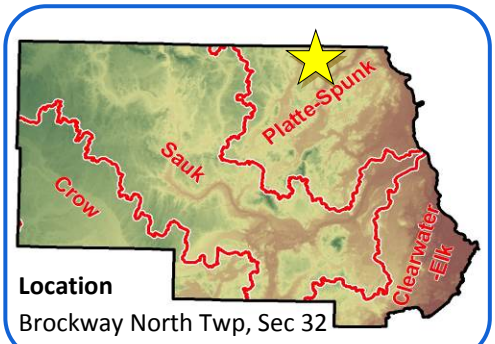
Animal Manure Storage System

Project Description: This project consisted of a concrete stacking slab and earthen diversions. Diversion are berms that direct clean water away from feedlots and the manure on them so it does not become contaminated. The landowner stores manure from their feedlots on the stacking slab. It is designed and constructed to hold and store the manure and any runoff or polluted water. The landowner can then apply the manure to their fields at the proper rates and during times of the year that the manure will be most beneficial as a nutrient source. This also allows for application/incorporation at times of the year that reduce the chances of it being washed off the fields and becoming a pollution concern.

Pollution Reduction Estimates:

Phosphorus	10	Lbs/Yr
COD	533	Lbs/Yr
BOD5	114	Lbs/Yr
Nitrogen	30	Lbs/Yr

* COD - Chemical Oxygen Demand
* BOD 5 – Biological Oxygen Demand



Location
Brockway North Twp, Sec 32

Practice:
Animal Manure Storage System

Target Waters:
Spunk Creek

Year Constructed:
2016

Components:
- Water Diversion
- Concrete Stacking slab

Benefits:
- Pollution Reduction
- Improve Water Quality
- Environmentally Sound and Efficient Application of Manure
- Sustain the Agriculture Industry

Partners:
- Landowner
- Stearns County SWCD
- MN Dept of Ag
- USDA/NRCS
- West Central TSA
- Stearns County ESD

Watershed:
Platte-Spunk

Stearns County Soil and Water Conservation District
110 2nd Street South, Waite Park, MN 56387
Ph: 320-251-7800 x3
www.stearnscountyswcd.net

Galen Wilczek

Animal Manure Storage System

Diversion Routes Clean Water Around Feedlot

Concrete Stacking Slab Construction

Completed Manure Stacking Slab

"The stacking slab and related components of this project will result in greatly improvement manure management for the landowner. This will results in a more efficient operation for Galen while reducing pollution from his feedlot."

– Kevin Carlson, Stearns SWCD Engineering Technician

Forming of Concrete Stacking Slab Walls

Completed Manure Stacking Slab

Funding:

State Funds*	$	3,120
Landowner Investment	$	12,904
Federal Funds also utilized		

* **Administered by Stearns SWCD**
MN Ag Water Quality Certification Program

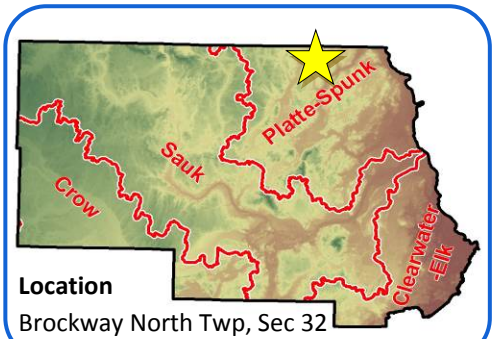
Galen Wilczek

Erosion Control

Project Description: This project consisted a number of erosion control practices including a grassed waterway, Earthen Diversion, Water and Sediment Control Basins and Terracing. All these practices work together to slow the water down to stop the erosion that was occurring in this landowner's field. The landowner will maintain and manage these practices assuring not only that nutrients and sediment are kept out of our waters but they are able to maintain the productivity of their fields.

Pollution Reduction Estimates:

Phosphorus	766	Lbs/Yr
Sediment (TSS)	901	Tons/Yr



Location
Brockway North Twp, Sec 32

Practice:
Erosion Control

Target Waters:
Spunk Creek

Year Constructed:
2016

Components:
- Water and Sediment Control Basins
- Clean Water Pipe
- Earthen Diversion
- Grassed Waterway
- Terrace

Benefits:
- Pollution Reduction
- Improve Water Quality
- Maintain Cropland Topsoil

Partners:
- Landowner
- Stearns County SWCD
- MN Dept of Ag
- USDA/NRCS
- West Central TSA

Watershed:
Platte-Spunk

Stearns County Soil and Water Conservation District
110 2nd Street South, Waite Park, MN 56387
Ph: 320-251-7800 x3
www.stearnscountyswcd.net

Galen Wilczek

Erosion Control

Field Erosion Before Construction

Grassed Waterway Shaped, Seeded and Erosion Blanket

Establish Basin and Grassed Waterway

"Galen was dealing with some pretty serious field erosion prior to this project. This was bad for his farming operation and was leading to some pollution concerns. The practices he installed ended up solving both those issues."

– Lee Zabinski, NRCS Technician

- NRCS/SWCD Construction Staking

Water and Sediment Basin with Control Inlet

Funding:

State Funds*	$ 15,025
Landowner Investment	$ 7,611
Federal Funds also utilized	

* **Administered by Stearns SWCD**
MN Ag Water Quality Certification Program

Gemma Lim

Shoreline Restoration

Practice:
Shoreline Restoration

Target Waters:
Mississippi River

Year Constructed:
2014

Components:
- Native Grass Planting
- Wildflower Planting
- Shrub Planting
- Erosion Control Blanket

Benefits:
- Sediment Reduction
- Nutrient Reduction
- Natural Aesthetics
- Wildlife Habitat

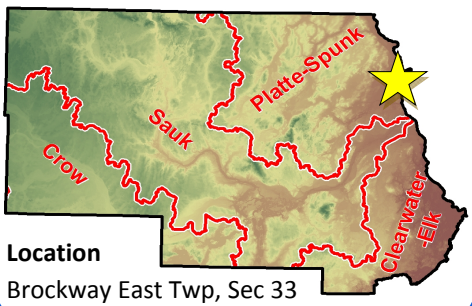
Partners:
- Landowner
- Stearns County SWCD
- West Central TSA
- MN DNR
- Stearns County ESD

Watershed:
Platte-Spunk
(Mississippi River)

Project Description: This property on Mississippi River was very low land and was experience erosion occurring on the bank. Existing riprap was left in place. Much of the area was mowed very close to the river. The lawn grass was terminated. The project area was planted with native vegetation and erosion control blanket was installed to protect the planting until the planted native vegetation can become established. Out of almost 800 feet of Mississippi River Shoreline only 25 was left to lawn for the landowner to access their dock, the rest was naturalized!

Pollution Reduction Estimates:

Phosphorus	0.53	Lbs/Yr
Sediment (TSS)	0.50	Tons/Yr



Location
Brockway East Twp, Sec 33

Stearns County Soil and Water Conservation District
110 2nd Street South, Waite Park, MN 56387
Ph: 320-251-7800 x3
www.stearnscountyswcd.net

Gemma Lim

Shoreline Restoration

Failing Retaining Wall System

Planting Preparation

After Shoreline Restoration (same view as above!)

"Gemma felt this project would have many benefits. It would help protect their property while providing a great wildlife and esthetic value."

– Greg Berg, SWCD Lakeshed Specialist

Before Shoreline Restoration – Erosion Issues

Erosion Blanket & Planting

Funding:

State Funds*	$	10,783
Landowner Investment	$	3,594

* **Administered by Stearns SWCD**
DNR Aquatic Habitat Restoration Grant

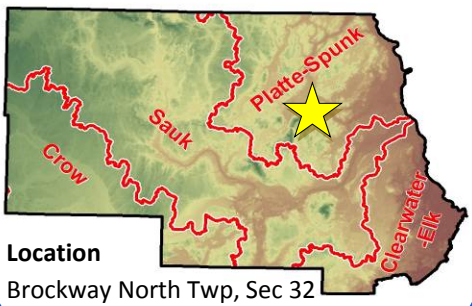
St Johns University Stump and Sagatagan

Storm Water Treatment

Project Description: As part of an infrastructure updates the College of St. Johns University wanted to incorporate some practices that would provide additional treatment of storm water runoff on campus coming from buildings, parking areas and other developed areas prior to the water entering Stump Lake and Lake Sagatagan. The Stearns County SWCD applied for a Clean Water Fund grant to help get this project completed. Storm water was directed into vegetated Infiltration basins to allow for treatment and infiltration of the storm water coming off the campus. This greatly reduces the amount of pollution entering these local lakes.

Pollution Reduction Estimates:

Phosphorus	3.77	Lbs/Yr
Sediment (TSS)	1,225	Tons/Yr



Location
Brockway North Twp, Sec 32

Practice:
Storm Water Treatment

Target Waters:
Stump Lake & Lake Sagatagan

Year Constructed:
2016

Components:
- Infiltration Basins
- Clean Water Pipes
- Earthen Diversions

Benefits:
- Pollution Reduction
- Improve Water Quality

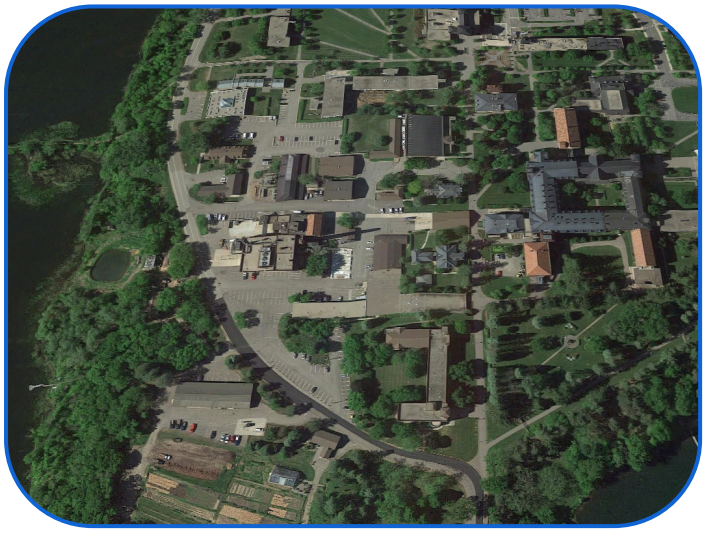
Partners:
- St. John's University
- Anderson-Johnson Associates, Inc.
- Board of Water and Soil Resources
- Stearns County SWCD
- West Central Technical Service Area

Watershed:
Platte-Spunk

Stearns County Soil and Water Conservation District
110 2nd Street South, Waite Park, MN 56387
Ph: 320-251-7800 x3
www.stearnscountyswcd.net

Galen Wilczek

Erosion Control



Existing Highly Impervious Landscape

Volleyball Court Amended to a Infiltration Basin

Volleyball Court Infiltrates Stormwater (See Above)

"It was great working with St John's University. They were being proactive in addressing water quality concerns and were willing to work with some pretty creative solutions to ensure Stump Lake and Lake Sagatagan can maintain a great level of water quality for years to come."

– Greg Berg, SWCD Watershed Specialist

- Infiltration Trench Along a Parking Lot

Water Diversions/Infiltration Basins

Funding:

State Funds*	$	167,475
SJU	$	139,055

Federal Funds also utilized

* **Administered by Stearns SWCD**
MN Clean Water Fund

Appendix C. Public Input and Information from the Mississippi River Sartell Public Meetings

Figure 49. Station #1: Where in the watershed? Northeastern portion of the watershed. Attendees were asked to place a star on the map marking their home. Note, yellow arrows were added later to better show location of stars.

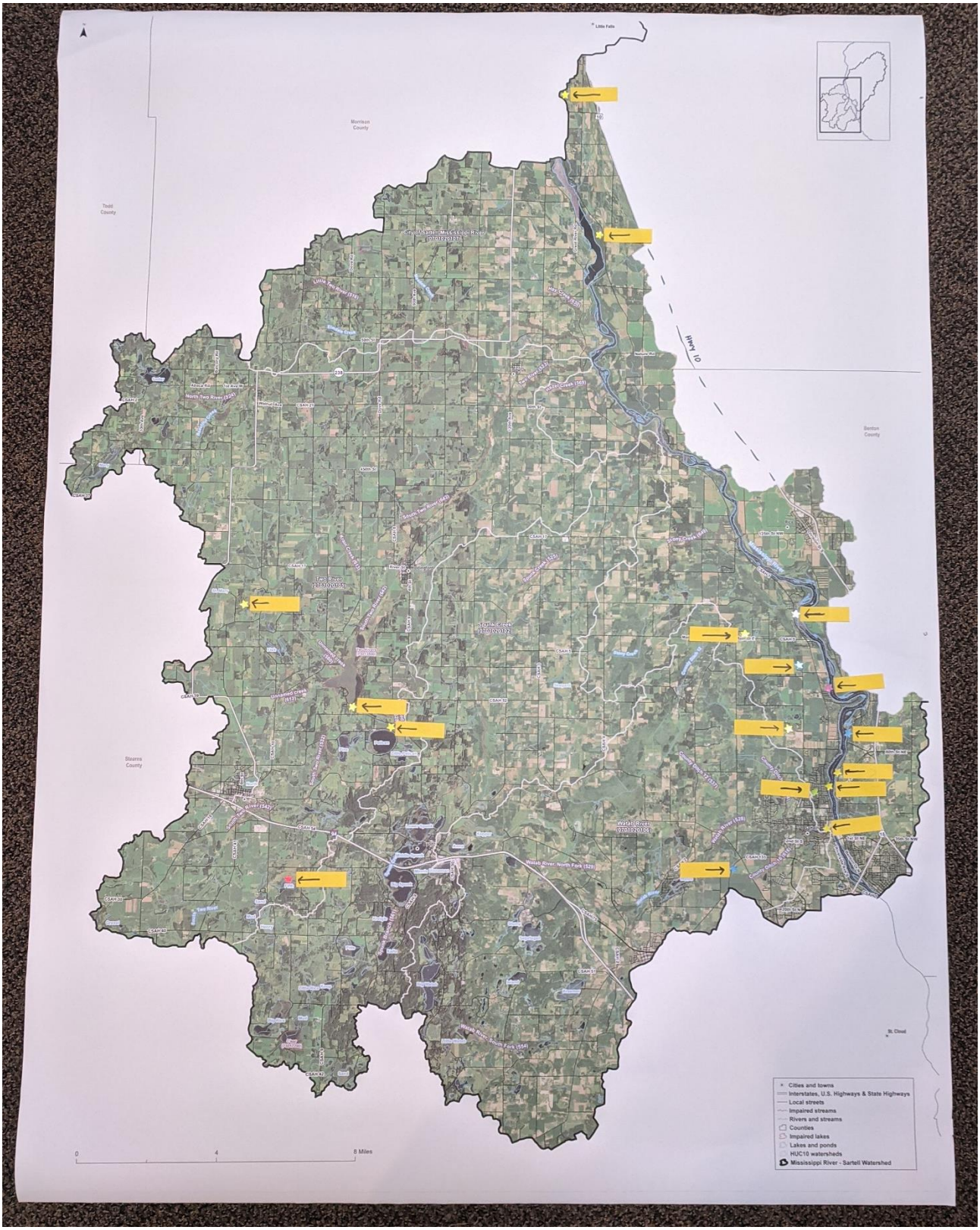


Figure 50. Station #1: Where in the watershed? Southwestern portion of the watershed. Attendees were asked to place a star on the map marking their home. Note, yellow arrows were added later to better show location of stars.

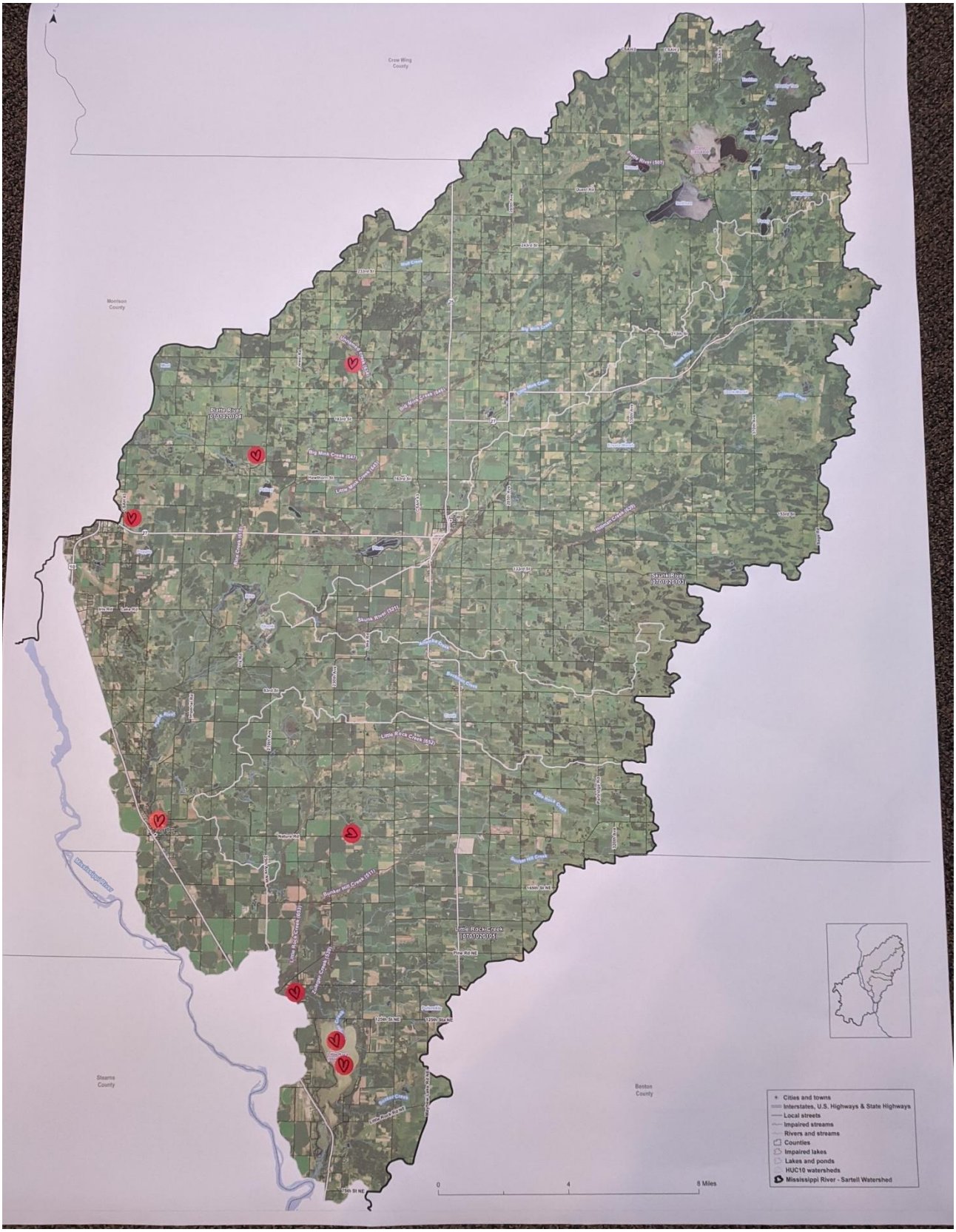


Figure 51. Results from Station #2: Love your watershed—northwestern portion of the watershed. Attendees were asked to mark a heart sticker on natural areas within the watershed that they care about.

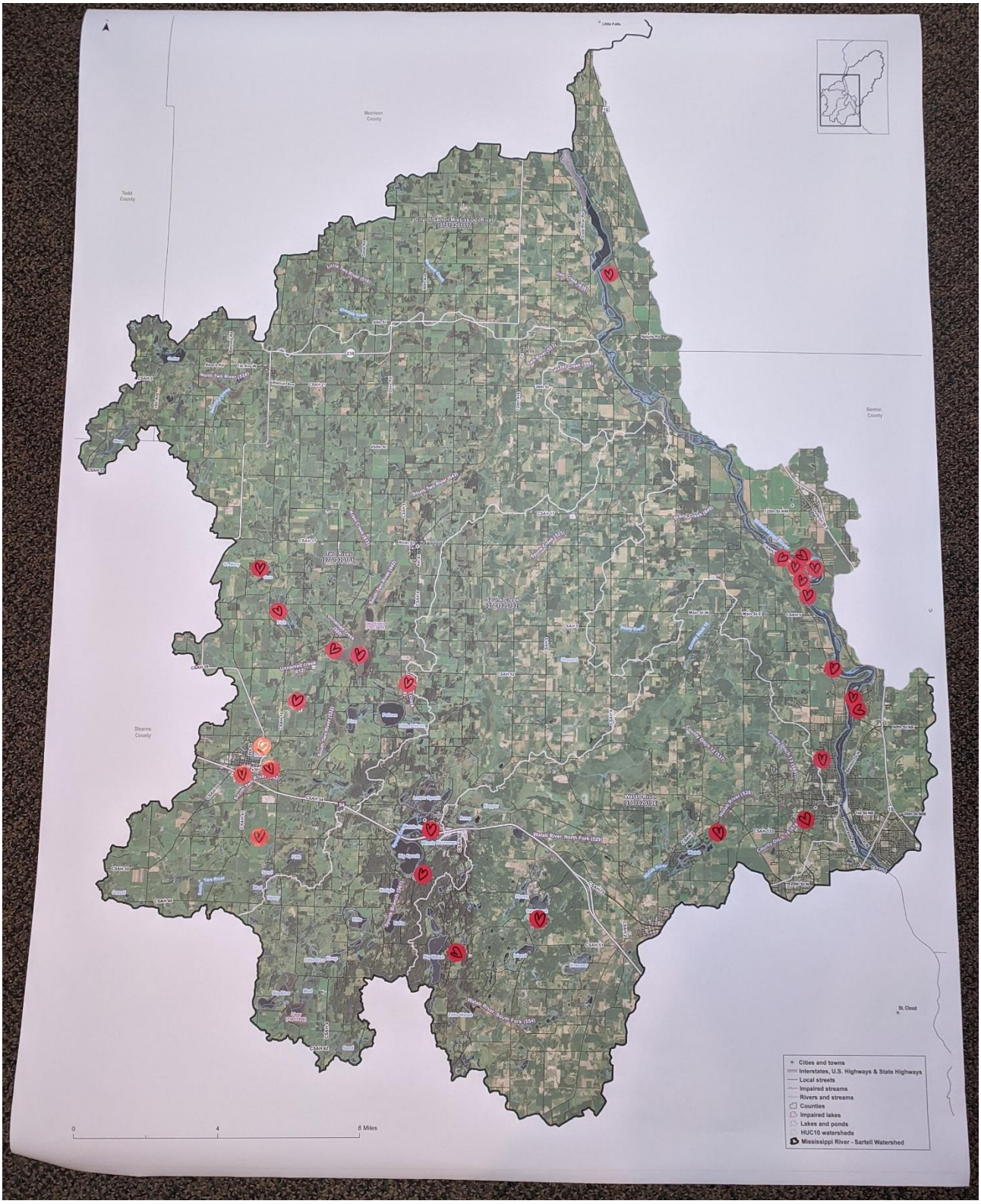


Figure 52. Results from Station #2: Love your watershed—southwestern portion of the watershed. Attendees were asked to mark a heart sticker on natural areas within the watershed that they care about.

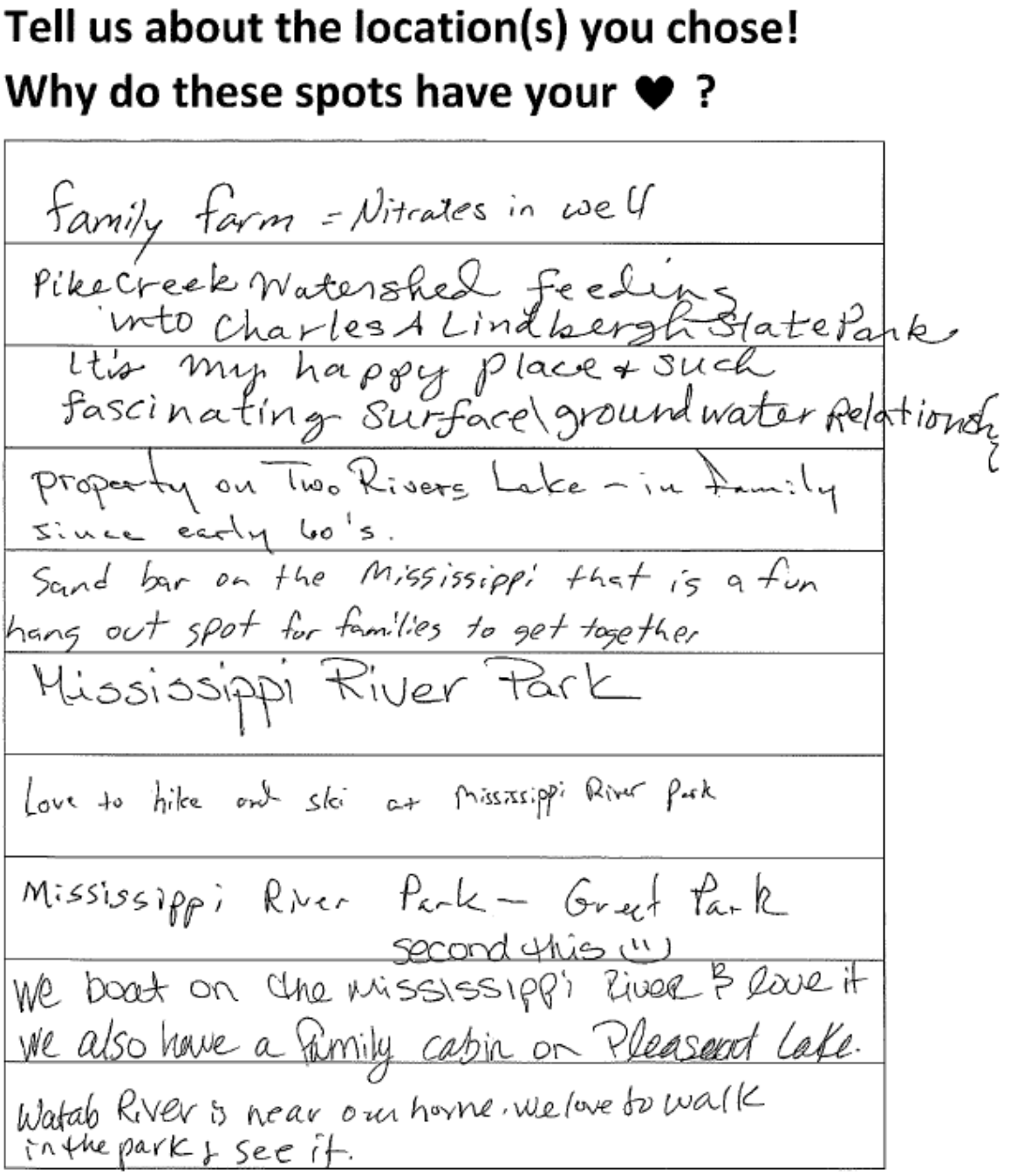


Figure 53. Written results from Station #2: Love your watershed sheet 1. Attendees were given the option to write down why the location they chose was important to them.

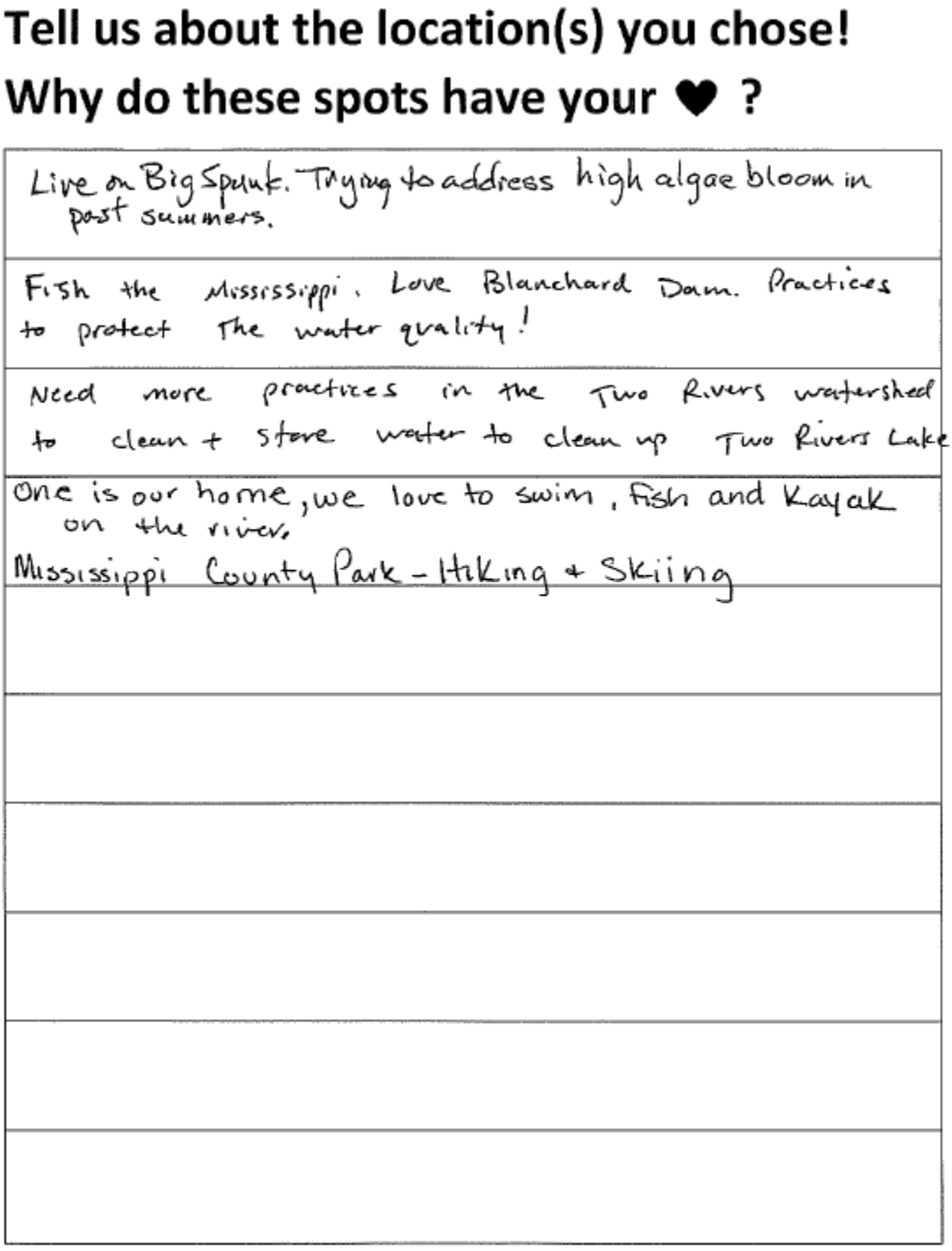


Figure 54. Written results from Station #2: Love your watershed sheet 2. Attendees were given the option to write down why the location they chose was important to them.

Table 22. Issue and Concerns Survey results from February 2020 Public meeting and local partner team members. Surveyed were asked to select their top three issues and/or concerns in the Mississippi River–Sartell Watershed.

Issue or concern	Public Meeting votes	Local Partner Team votes
Row crop agriculture	8	16
Feedlots	9	10
Irrigation and groundwater levels	7	3
Lake management	6	0
Urban stormwater runoff	6	2
Septic systems/wastewater	6	1
Climate change	4	3
Source water protection	4	6
Streambank erosion and channelization	3	3
Altered hydrology	3	6
Pastured areas	2	5
Other (write in option)	"Stormwater" "Habitat loss for birds and animals" "Nitrates" "Please monitor the pollution being fed into the Mississippi at the Harris channel" "Dam removal on Little Rock Creek at Sartell WMA" "Invasive species"	"Urban development"