Mississippi River – St. Cloud
Watershed Restoration and Protection Strategy Report

A summary of watershed conditions and restoration and protection strategies for the Mississippi River – St. Cloud Watershed

January 2015

Watershed Partners

Minnesota Pollution Control Agency

CLEAN WATER LAND & LEGACY AMENDMENT

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*The science, analysis and strategy development described in this report began before accountability provisions were added to the Clean Water Legacy Act in 2013 (MS114D); thus, this report does not address all of those provisions. When this watershed is revisited (according to the 10-year cycle), information will be updated according to the statutorily required elements of the Watershed Restoration and Protection Strategy Report.

Key Terms

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

Aquatic life impairment (AL): 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 (AR): 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, chlorophyll-a, or Secchi disc depth standards are not met.

Civic Engagement (CE): refers to citizens taking an active role in a decision making processes. Defined by the University of MN Extension as: "Making resourceFULL decisions and taking collective action on public issues through processes that involve public discussion, reflection, and collaboration" (University of MN Extension, 2013.

Hydrologic Unit Code (HUC): A Hydrologic Unit Code (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 – St. Cloud Watershed is assigned a HUC-8 of 07010203.

Impairment: Water bodies 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).

Nonpoint Source: pollutants that come from diffuse sources; most of these sources are not regulated. Non-point source include: agricultural field runoff, agricultural drain tile discharge, stormwater from smaller cities and roads, bank, bluff and ravine failures, atmospheric deposition, internal nutrient recycling in lakes, failing septic systems, animals and other sources.

Point Source Pollution: Point source pollutants are pollutants that can be directly attributed to one location; generally, these sources are regulated by permit. Point sources include: wastewater treatment plants, industrial dischargers, stormwater discharge from larger cities (MS4 permit), and storm water runoff from construction activity (construction storm water permit).

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.

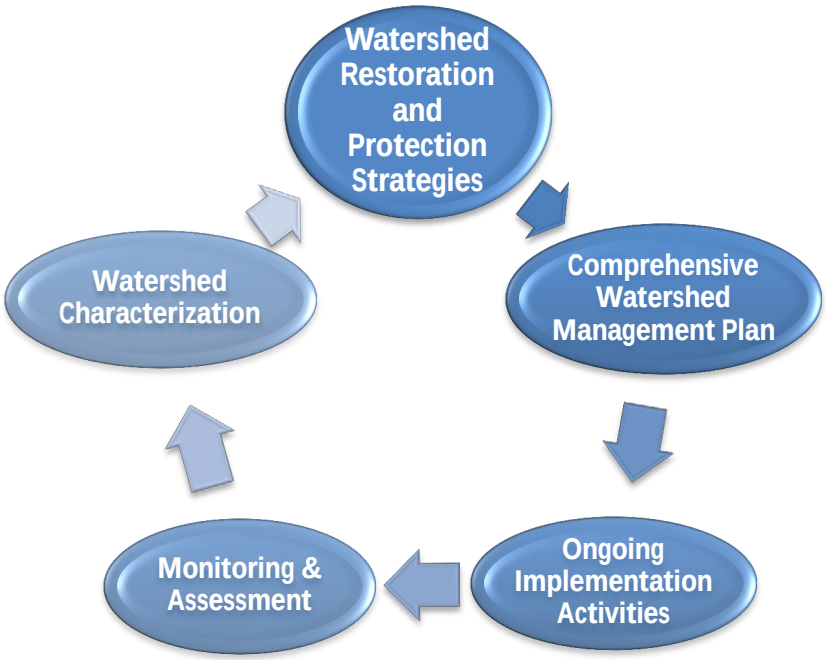
Source (or Pollutant Source): This term is distinguished from 'stressor' to mean only those actions, places or entities that deliver/discharge pollutants (e.g., sediment, phosphorus, nitrogen, pathogens).

Stressor (or Biological Stressor): This is a broad term that includes both pollutant sources and non-pollutant 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.

What is the WRAPS Report?

The State of Minnesota has adopted a "watershed approach" to address the state's 81 "major" watersheds (denoted by 8-digit hydrologic unit code or HUC). This watershed approach incorporates **water quality assessment, watershed analysis, civic engagement, planning**, **implementation**, and **measurement of results** into a 10-year repeating cycle that addresses both restoration and protection.



As part of the watershed approach, waters not meeting state standards are listed as impaired and Total Maximum Daily Load (TMDL) studies are performed, as has been done in the past, but in addition the watershed approach facilitates a more cost-effective and comprehensive characterization of multiple water bodies and overall watershed health. A key aspect of this effort is to develop and utilize watershed-scale models and other tools to help state agencies, local governments and other watershed stakeholders determine how to best proceed with restoring and protecting lakes and streams. This report summarizes past assessment and diagnostic work and outlines ways to prioritize actions and strategies for continued implementation.

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:
  - *Mississsippi River - St. Cloud Watershed Monitoring and Assessment*
  - *Mississippi River - St. Cloud Watershed Stressor Identification*
  - *Mississippi River - St. Cloud Watershed Total Maximum Daily Load (TMDL)*
  - *Water Quality Assessments of Select Lakes within the Mississippi River - St. Cloud Watershed*
  - *Other studies and plans relavant to the watershed (including other TMDLs)*

Scope

- Achieving water quality goals to meet aquatic recreation and aquatic life uses in streams
- Achieving water quality goals to meet aquatic recreation use standards in lakes

Audience

- Local working groups (local governments, SWCDs, watershed management groups, etc.)
- State agencies (MPCA, DNR, BWSR, etc.)
- Watershed Citizens (water planning committees, Community Leaders, interested parties/groups)

1. Watershed Background & Description

Physical setting

The Mississippi River (St. Cloud) (MR-SC) Watershed covers 717,479 acres (1,121 sq. mi) in central Minnesota within the Upper Mississippi River Basin. The Watershed originates at the confluence of the Sauk and Mississippi Rivers (upstream of CSAH 3, near St. Cloud, Minnesota). This portion of the Mississippi River flows approximately 50 miles southeast, where it joins with the North Fork of the Crow River. The Mississippi River (St. Cloud) watershed contains a total of 907 river miles, draining approximately 717,374 acres (1,121 sq. mi.). The watershed includes all or parts of seven counties in central Minnesota: Benton, Meeker, Mille Lacs, Morrison, Sherburne, Stearns, and Wright. The watershed is entirely contained within the North Central Hardwood Forests (NCHF) Ecoregion (Omernik, 1988) (Figure 1). Ecoregions are areas of relative homogeneity based on land use, soils, land and surface forms and potential natural vegetation. Researchers have observed distinct surface water characteristics based on ecoregion location; thus, water quality standards for this watershed are based on those set for the NCHF ecoregion. More detailed information on ecoregions and water quality can be found at: www.waterontheweb.org/under/lakeecology/18_ecoregions.html.

This portion of the Mississippi River has been designated as a wild and scenic river due to the abundance of wildlife, a high quality smallmouth bass fishery, and a series of unique bluffs and islands (MPCA 2012, DNR 2011).

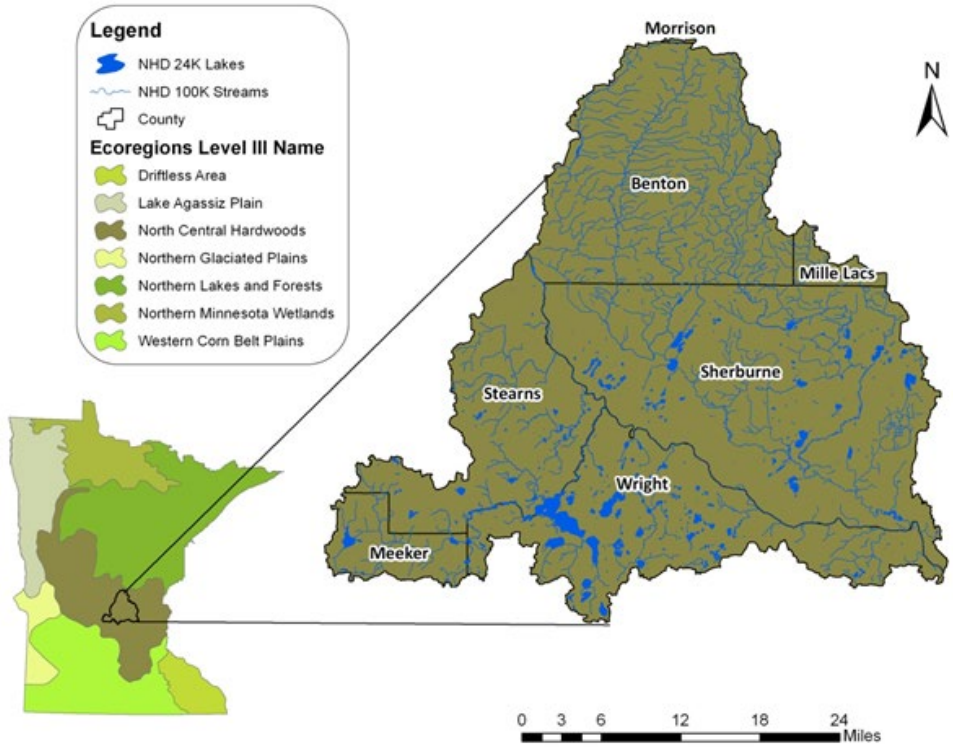


Figure 1.1: The Mississippi River (St. Cloud) Watershed within the North Central Hardwoods Ecoregion of central Minnesota

Land Use Summary

A myriad of land use types make up the watershed (Figure 1.2). Cropland, the dominant land use, is predominately planted in corn, soybeans and forage for livestock (USDA 2007 a, b, c, d, e, f). Cropland within the watershed is often irrigated through center pivot irrigation systems. Other dominant land use types are rangeland and forest/shrub lands. The central to east central portion of the watershed has several areas where forest is dominant, while the northern portion is made up of large areas of pasture and rangeland.

161,917 people reside in the MR-SC Watershed, equating to 144 people per square mile (Minnesota State Demographic Center 2010). The majority of the population live along I-94 (St. Cloud, Monticello and Albertville) and Highway 10 (Sauk Rapids, Becker, Big Lake, Elk River and Otsego), which roughly splits the watershed in half. The remaining cities to the north include Gilman, Foley, and Zimmerman, with Annandale, Kimball, South Haven, and Watkins in the southwestern portion of the watershed.

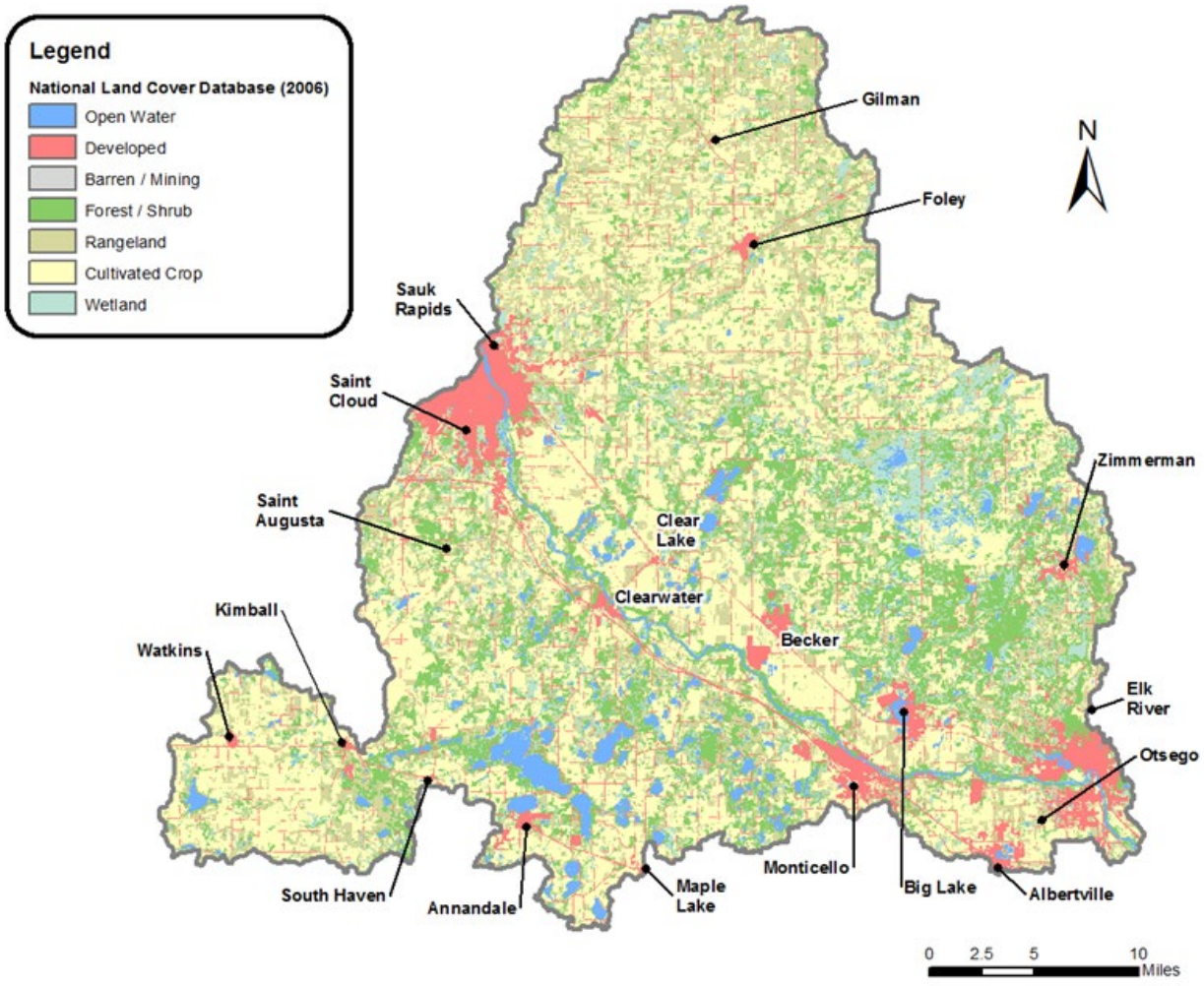


Figure 1.2: Land use in the Mississippi River (St. Cloud) Watershed

Surface Water Hydrology

The MR-SC Watershed is a flow-through watershed that receives flow in the City of Sauk Rapids from the Mississippi River-Sartell watershed and the Sauk River Watershed. This segment of the Mississippi River flows southwest past the City of St. Cloud, in Sherburne County, then past Monticello, eventually reaching the Mississippi River-Twin Cities watershed in the City of Elk River. From Sauk Rapids to the mouth, the river drops 80 feet within an overall mean gradient of nearly 4 feet per mile. Major lakes in the watershed include: Clearwater, Lake Maria, Maple, Sugar, Briggs Chain, Little Elk and Orono Lake. Major rivers and streams include: Mayhew Creek, Rice Creek, Elk River, St. Francis River and Clearwater River.

This portion of the Mississippi River has been designated as a wild and scenic river due to the abundance of wildlife, a high quality smallmouth bass fishery, a series of unique bluffs, and beaver islands (MPCA 2012, DNR 2011).

Additional Mississippi River – St. Cloud Watershed Resources (For comprehensive list, see appendix A)

USDA Natural Resources Conservation Service (NRCS) Rapid Watershed Assessment for the Mississippi River – St. Cloud Watershed: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mn/technical/?cid=nrcs142p2_023592

Minnesota Department of Natural Resources (DNR) Watershed Assessment Map book for the Mississippi River – St. Cloud Watershed: http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/wsmb17.pdf

Minnesota Department of Natural Resources (DNR) Watershed Health Assessment Framework for the Mississippi River – St. Cloud Watershed: http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#

Mississippi River – St. Cloud Watershed Reports: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html

2. Watershed Conditions

In the recent past, during the height of the economy, significant residential development occurred within the watershed. In general, areas of concern include the many areas where the riparian zones have been removed or reduced to allow for said development or land use changes. Additionally, many of the lakes within the watershed tend to have intensively developed shorelines.

On the other hand, several areas within the watershed have wide and extensive forested riparian corridors (i.e. Lake Maria State Park, Mississippi River SNA and the Sherburne National Wildlife Area), which may ameliorate the negative influence of land use disturbances. Based on the results of the 2011 water quality assessment cycle, these areas should be conserved and management practices should be focused on areas near sensitive waterbodies.

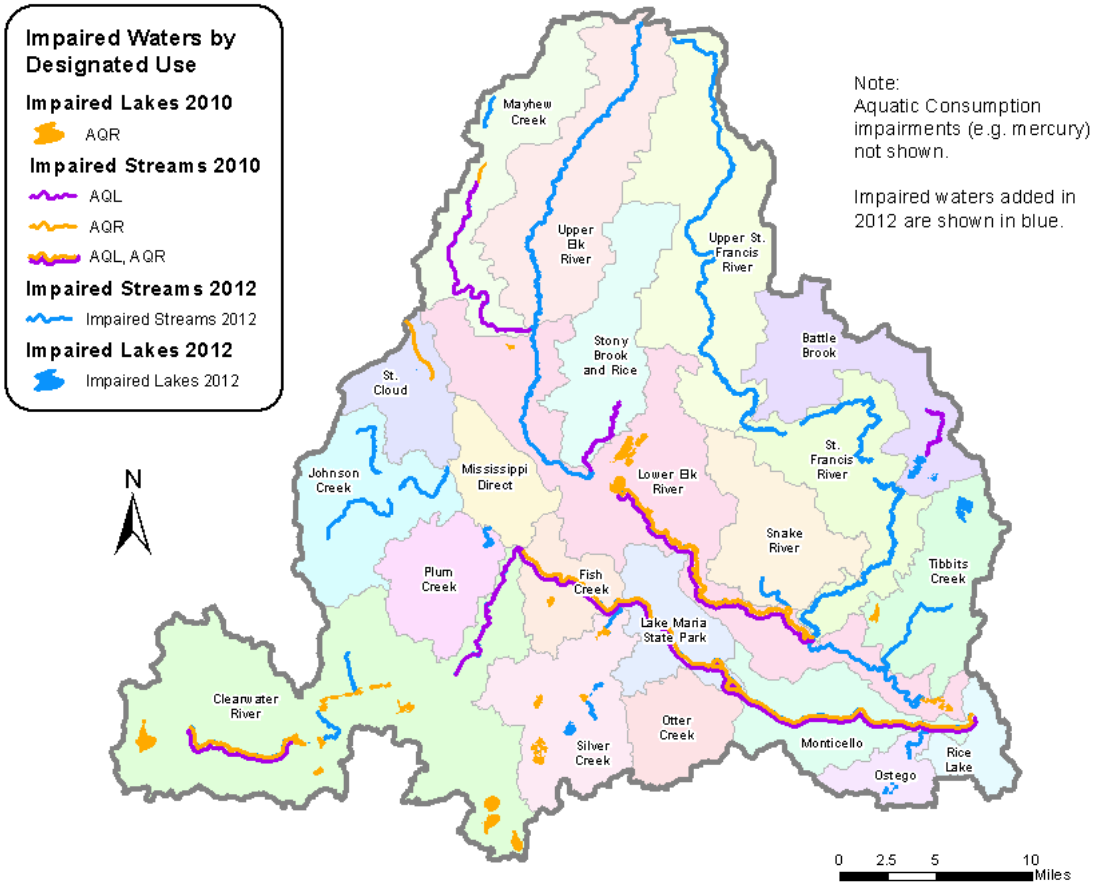


Figure 2.1: Impaired waters by designated use in the Mississippi River (St. Cloud) Watershed

2.1 Condition Status

As part of the Watershed Approach many streams and lakes throughout the watershed were monitored and assessed to determine if the waters are clean (supporting) or polluted (impaired). The information in the following sections documents and summarizes those results.

Not all water bodies were monitored or assessed during this effort due to one or more of the following: water was classified as limited use resource, stream reach is >50% channelized, insufficient data available, time or budget constraints, or because they were within the Mississippi River main stem Assessment Unit Identifiers (AUIDs). Through continuing work and future iterations of the watershed approach, additional water bodies may be monitored and assessed.

The results of the monitoring and assessment are summarized in the following sections. Please refer to Mississippi River (St. Cloud) Watershed Monitoring and Assessment Report (MPCA, 2012a) and the Water Quality Assessments of Select Lakes within the Mississippi River (St. Cloud) Watershed (MPCA, 2012b) and the Mississippi River (St. Cloud) Stressor Identification Report (MPCA, 2012c) for full details.

It is important to note that this report addresses impairments to aquatic recreation and aquatic life in stream reaches and lakes but does not address impairments to aquatic consumption (mercury or other toxic pollutants) or impaired wetlands. Impairments to aquatic consumption are addressed in the *Minnesota Statewide Mercury TMDL*. Impaired wetlands are not addressed due to an evolving understanding of wetland processes relative to impairment status.

Streams

Stream conditions were assessed using a range of parameters including fish and macroinvertebrate IBI, DO, suspended solids, and bacteria. Water quality measurements from streams were compared to the normal ecoregion range as well as state water quality standards. The aquatic life standards are based on the IBI scores as well as DO and suspended solids, while aquatic recreation is based on bacteria.

Table 1 summarizes the results of 32 stream reaches that were monitored and assessed via this effort. 23 or the stream reaches were classified as impaired for impacts to aquatic recreation and/or impacts to aquatic live, five were classified as supporting of aquatic life, and four had insufficient data to make a determination. The assessed stream reaches are organized in the table by HUC-11, subwatersheds.

While the impact to aquatic recreation (Aq Rec) considers only bacteria concentrations, the impact to aquatic life considers: the fish Index of Biotic Integrity (IBI), the macroinvertebrate IBI, total suspended solids (TSS), dissolved oxygen, and additional parameters not included in the table. If one parameter does not meet the standard, the stream reach is considered impaired for impacts to aquatic life. The Mississippi River (St. Cloud) Watershed Monitoring and Assessment Report (MPCA, 2012b) contain a thorough discussion of stream impairments.

Table 1: Assessment status of stream reaches in the Mississippi River – St. Cloud Watershed, presented (mostly) from north to south

HUC-11 Subwatershed	AUID (Last 3 digits)	Stream	Reach Description	Aquatic Life				Aq Rec
				Fish Index of Biotic Integrity	Macroinvertebrate Index of Biotic Integrity	Dissolved Oxygen	Turbidity/TSS	Bacteria
Upper Elk River (07010203010)	508	Elk River	Headwaters to Mayhew Creek	Imp	Imp	IF	Sup	Imp
Mayhew Creek (07010203020)	675	Mayhew Creek	Unnamed Creek to CD 7	Imp	Imp	NA	NA	NA
	509	Mayhew Creek	Mayhew Lake to Elk River	NA	NA	Imp	Sup	Imp
Upper St. Francis River (07010203060)	700	St. Francis River	Headwaters to Unnamed Lake	Imp	Imp	IF	Sup	Imp
Stony Brook and Rice Creek (07010203030)	546	Stony Brook	T36 R29W S17	Sup	Sup	NA	Sup	NA
	512	Rice Creek	Rice Lake to Elk River	Sup	Sup	Imp	Imp	Imp
Battle Brook (07010203070)	535	Battle Brook	CD 18 to Elk Lake	Imp	Imp	IF	Sup	Imp
Lower Elk River (07010203040)	507	Elk River	Mayhew Creek to Rice Creek	Sup	Sup	IF	Sup	Imp
	538	Briggs Creek	North line to Briggs Lake	Sup	Sup	NA	IF	NA
	579	Elk River	Elk Lake to St. Francis River	Imp	Sup	IF	Imp	IF
	548	Elk River	St. Francis River to Orono Lake	Sup	Sup	Sup	Sup	Imp
St. Francis River (07010203080)	704	St. Francis River	Unnamed Lake to Rice Lake	Imp	Sup	NA	IF	NA
	702	St. Francis River	Rice Lake to Elk River	Imp	Sup	IF	Sup	Sup
Mississippi River Direct (07010203690)	--	--	--	--	--	--	--	--
Johnson Creek (07010203710)	724	Unnamed Creek	CD 14 to CSAH 136	NA	NA	IF	Sup	Imp
	633	Johnson Creek	Unnamed Creek to Unnamed Creek	Sup	Sup	NA	IF	NA
	561	Unnamed Creek	T123 R28W S30, South line to Johnson Creek	Sup	Sup	IF	IF	Imp
Snake River (07010203050)	529	Snake River	Unnamed Creek to Eagle Lake Outlet	NA	NA	IF	Sup	Imp
Tibbits Creek (07010203090)	522	Tibbits Brook	Rice Lake to Elk River	NA	NA	IF	Sup	Imp
Plum Creek (07010203720)	572	Plum Creek	Warner Lake to Mississippi River	NA	NA	IF	IF	Imp
Clearwater River (07010203730)	533	County Ditch 20	Unnamed Creek to Unnamed	NA	NA	NA	NA	NA
	550	County Ditch 44	Clear Lake to Clearwater River	NA	NA	NA	NA	NA
	549	Clearwater River	CD 44 to Lake Betsy	NA	NA	NA	NA	NA

HUC-11 Subwatershed	AUID (Last 3 digits)	Stream	Reach Description	Aquatic Life				Aq Rec
				Fish Index of Biotic Integrity	Macroinvertebrate Index of Biotic Integrity	Dissolved Oxygen	Turbidity/TSS	Bacteria
	717	Clearwater River	Scott Lake to Lake Louisa	Imp	Imp	NA	Sup	NA
	565	Fairhaven Creek	Headwaters to Lake Louisa	NA	NA	IF	IF	Imp
	545	Threemile Creek	Unnamed stream outlet of Lake Lur to T122 R28W S36	Imp	Sup	NA	NA	NA
	544	Threemile Creek	T122 R28W S35, east line to Otter Lake	NA	NA	IF	Sup	IF
	611	Unnamed Creek	Nixon Lake to Clearwater River	NA	NA	NA	NA	NA
	511	Clearwater River	Clearwater Lake to Mississippi River	Imp	Sup	Imp	Sup	Sup
Fish Creek (07010203740)	--	--	--	--	--	--	--	--
Silver Creek (07010203750)	662	Silver Creek	Unnamed Creek to Silver Lake	Imp	Imp	NA	NA	NA
	555	Silver Creek	Little Mary Lake to Locke Lake	NA	NA	NA	Sup	NA
	557	Silver Creek	Locke Lake to Mississippi River	Imp	Imp	Imp	Sup	Imp
Otter Creek (07010203770)	--	--	--	--	--	--	--	--
Lake Maria State Park (07010203760)	--	--	--	--	--	--	--	--
Monticello Watershed (07010203780)	--	--	--	--	--	--	--	--
Otsego (07010203790)	528	Unnamed Creek	T121 R23W S19, south line Mississippi River	Imp	Imp	NA	NA	IF
Rice Lake (07010203800)	--	--	--	--	--	--	--	--

Sup = found to meet the water quality standard, Imp = does not meet the water quality standard and therefore, is impaired, IF = the data collected was insufficient to make a finding, NA = not assessed

Blank columns have no assessed waters because they were within the Mississippi River main stem AUIDs. Monitoring plans for these AUIDs are described in Section 4.

Lakes

Lakes were assessed against Class 2B standards for deep and shallow lakes. Findings show that nearly half of the assessed lakes exceed the eutrophication standards for the ecoregion and are impaired for aquatic recreation use.

Table 2 below presents the 79 lakes that were monitored and the assessment status of each of the lakes. Of the 79 lakes that were monitored 36 lakes were classified as impaired for aquatic recreation, 34 lakes were classified as supporting, and 9 lakes had insufficient data to make a determination. At this time, unlike streams, lakes are not monitored and assessed for impacts to aquatic life.

The lakes are organized by 11-digits Hydrologic Unit Codes (HUC-11) and are mostly presented from north to south. Lakes are impaired for impacts to aquatic recreation if one or more water quality standards are exceeded. The water quality standard parameters for lakes are: total phosphorus, chlorophyll-a, and Secchi depth. The water quality standard parameter concentrations are specified for lakes depending on the lake's maximum depth, eco-region location, and other factors. The Water Quality Assessments of Select Lakes within the Mississippi River (St. Cloud) Watershed contains a thorough discussion of lake assessments.

Table 2: The impaired and supporting lakes of the Mississippi River – St. Cloud Watershed, presented (mostly) from north to south

HUC-11 Subwatershed	Lake ID	Lake	Aquatic Recreation
Upper Elk River (07010203010)	--	--	--
Mayhew Creek (07010203020)	05-0007-00	Mayhew	Imp
Upper St. Francis River (07010203060)	--	--	--
Stony Brook and Rice Creek (07010203030)	--	--	--
Battle Brook (07010203070)	71-0055-00	Elk	Imp
	71-0041-00	Cantlin	Sup
	71-0046-00	Diann	Imp
Lower Elk River (07010203040)	05-0004-02	Donovan	Imp
	71-0145-00	Julia	Imp
	71-0146-00	Briggs	Imp
	71-0147-00	Rush	Imp
	71-0141-00	Elk	Imp
	71-0123-00	Camp	Sup
	71-0096-00	Thompson	Sup
	71-0081-00	Mitchell	Sup
	71-0082-00	Big	Sup
	71-0013-01	Upper Orono	Imp
	71-0013-02	Lower Orono	Imp
City of St. Cloud (07010203700)	73-0611-00	George	Imp
	73-0701-00	Melrose Deep Quarry	IF
Mississippi Direct (07010203690)	71-0167-00	Round	Sup
	71-0159-00	Long	Sup
	71-0158-00	Pickerel	Sup

HUC-11 Subwatershed	Lake ID	Lake	Aquatic Recreation
Johnson Creek (07010203710)	73-0023-00	Beaver	Sup
Snake River (07010203050)	71-0069-00	Ann	Sup
	71-0067-00	Eagle	Imp
Tibbits Creek (07010203090)	71-0016-00	Fremont	Imp
	71-0057-00	Birch	Imp
Fish Creek (07010203740)	86-0183-00	Fish	Imp
Plum Creek (07010203720)	73-0010-00	Bunt	Sup
	73-0011-00	Warner	Sup
	73-0001-00	Dallas	Sup
	73-0002-00	Feldges	Sup
	73-0003-00	Maria	Sup
	73-0004-00	Long	Sup
	73-0006-00	Crooked	Sup
	73-0007-00	Quinn	Sup
Clearwater River (07010203730)	73-0042-00	Island	Sup
	86-0238-00	Nixon	IF
	86-0242-00	Wiegand	IF
	73-0020-00	Laura	Sup
	86-0281-00	Caroline	Imp
	73-0014-00	Marie	Imp
	86-0282-00	Louisa	Imp
	73-0015-00	Otter	Sup
	86-0243-00	Grass	IF
	86-0252-02	Clearwater (West)	IF
	86-0252-01	Clearwater (East)	Sup
	86-0234-00	Bass	Sup
	86-0284-00	Augusta	Imp
	47-0095-00	Clear	Imp
	47-0096-00	Little Mud	IF
	47-0042-00	Betty	Imp
	86-0297-00	Scott	Imp
	86-0227-00	Cedar	Sup
	86-0251-00	Pleasant	Sup
	86-0298-00	Union	Imp
	86-0208-00	Swartout	Imp
	86-0212-00	Albion	Imp
	86-0213-00	Henshaw	Imp
Silver Creek (07010203750)	86-0168-00	Locke	Imp
	86-0163-00	Limestone	Sup
	86-0171-00	Ember	Sup
	86-0139-02	Little Mary (North Bay)	Imp
	86-0139-01	Little Mary (South Bay)	Imp
	86-0233-00	Sugar	Sup
	86-0223-00	Indian	Imp
	86-0140-00	Silver	Imp

HUC-11 Subwatershed	Lake ID	Lake	Aquatic Recreation
	86-0152-00	Millstone	Imp
	86-0229-00	Mink	Imp
	86-0230-00	Somers	Imp
	86-0156-00	Mary	Sup
Otter Creek (07010203770)	86-0146-00	Ida	Sup
	86-0067-00	First	IF
	86-0068-00	Mud	IF
	86-0066-00	Birch	Sup
	86-0069-00	Long	IF
	86-0070-00	Bertram	Sup
	86-0148-00	Eagle	Sup
	86-0073-00	Cedar	Sup
Lake Maria State Park (07010203760)	--	--	--
Monticello Watershed (07010203780)	--	--	--
Otsego (07010203790)	86-0026-00	Hunters (Mud)	Imp
	86-0025-00	School	Imp
Rice Lake (07010203800)	--	--	--

Imp = impaired for impacts to aquatic recreation, Sup = fully supporting aquatic recreation, IF = insufficient data to make an assessment, Blank=no lakes assessed

2.2 Water Quality Trends

Table 3 Water quality monitoring trends of the Mississippi River from three MPCA Milestone Monitoring Stations (Sauk Rapids – Monticello). Green Decrease indicates an improving trend in water quality for that parameter while red Increase indicates a degrading trend in water quality for that parameter.

		Parameter					
Monitoring Station	Monitoring History	Phosphorus	Nitrogen	Ammonia	Biological Oxygen Demand	Total Suspended Solids	Bacteria
UM-930 (S000-026); Mississippi River upstream of MN-15 bridge at Sauk Rapids	1953-2010	Decrease	Increase	Decrease	Decrease	Decrease	No Trend
UM-914 (S000-148); Mississippi River at bridge on MN-24 at Clearwater	1967-2010	No Trend	Increase	No Trend	Decrease	No Trend	Decrease
UM-895 (S000-221); Mississippi River at bridge on MN-25 at Monticello	1976-2010	Decrease	Increase	Decrease	No Trend	No Trend	No Trend

See link for more information on MPCA's Milestone Program - Minnesota Milestone River Monitoring Program

Year-to-year weather variations affect water quality observation data; for this reason, interpreting long term data trends minimizes year-to-year variation and provides insight into changes occurring in a water body over time. Table 3 above illustrates the general water quality trends from three Minnesota Pollution Control Agency (MPCA) Milestone Monitoring Stations located within the MR-SC Watershed. The Minnesota Milestone Program was designed to collect water quality data at designated river sites over a long period of time. This data is then used to get an understanding of the overall health trends of Minnesota's rivers. The trend analysis shown in Table 3 was performed using the Seasonal Kendall Test for Trends. This nonparametric analysis has the advantage of being robust to outliers, missing values, and values less than detection limits, can account for seasonal differences, and is now commonly used to analyze water quality trends. See link to the June 2014 report Water Quality Trends for Minnesota Rivers and Streams at Milestone Sites for additional Milestone Site trend information.

The Minnesota Milestone Program was eliminated in September 2010, and replaced with the current intensive watershed approach of assessing the rivers in Minnesota. While early historic data is limited, a general water quality trend determination was made based on the available Milestone data. In general, water quality trend data for the Mississippi River at the three Milestone Monitoring Stations suggests that a decreasing or no trend is apparent for the monitored parameters except for nitrogen, where trend increases are being observed. For more information on nitrogen trends in Minnesota see the June 2013 MPCA report Nitrogen in Minnesota Surface Waters.

With the surface waters within this watershed draining to this reach of the Mississippi River, the Mississippi River serves as a good overall indicator of the health of the watershed. It is important to note that trend information should be considered in relation to other more recent monitoring and assessment data. However, trend data can be particularly useful for understanding the condition of the watershed in relation to changes in the landscape made over the same period of record.

Additional Mississippi River Monitoring Efforts and Reports

MPCA Large River Monitoring – Upper Mississippi River Pilot 2013

Currently, large rivers (i.e. the main stem rivers flowing in Minnesota's major river basins such as the Mississippi River and the Red River) are not explicitly addressed in the major watershed approach. The MPCA has been working to develop a large river monitoring strategy with a 10-year schedule that provides sufficient data to assess the aquatic life, aquatic recreation, and aquatic consumption designated uses of large rivers. The strategy is being developed to complement and dovetail with the major watershed approach such that little to no additional staffing is needed for implementation.

A pilot effort of this large river monitoring strategy was conducted starting in May of 2013 on the Upper Mississippi River (headwaters to Upper St. Anthony Falls Dam). Biological, water chemistry, and fish contaminants data will be collected over the course of two sampling seasons. The monitoring strategy is similar to the systematic design of the major watershed approach in that sampling sites will be located near the pour point of HUC 8, 10, 12 watershed delineations.

State of the River Report

In 2012, a "State of the River" report was developed in partnership with Friends of the Mississippi River and the National Park Service's (NPS) Mississippi National River and Recreation Area. This report provides an excellent assessment on the health of the Mississippi River just downstream of the MR-SC Watershed. This report is available at the following link: http://stateoftheriver.com/state-of-the-river-report/.

Water Quality trends - Lakes

Data available on lakes to make determinations on the long term water quality trends varies within the watershed. For specific trending information on select lakes see the Water Quality Assessments of Select Lakes within the Mississippi River (St. Cloud) Watershed (2012 Lakes Assessment Report).

Within the Clearwater River subwatershed, the Clearwater River Watershed District (CRWD) conducts an annual water quality monitoring program. For more information, including yearly reports and discussions on water quality trends within this subwatershed, visit http://www.crwd.org/.

2.3 Stressors and Sources

In order to develop appropriate strategies for restoring or protecting waterbodies, the stressors and sources impacting or threatening them must be identified and evaluated. Biological stressor identification (ID) is done for streams with either fish or macroinvertebrate biota impairments and encompasses both evaluation of pollutants and non-pollutant-related factors as potential stressors (e.g. altered hydrology, fish passage, habitat). Pollutant source assessments are done where a biological stressor ID process identifies a pollutant as a stressor as well as for the typical pollutant impairment listings. Section 3 provides further detail on stressors and pollutant sources.

Stressors of Biologically-Impaired Stream Reaches

Thirteen (13) stream reaches in the MR-SC Watershed were identified as impaired due to low fish and/or macroinvertebrate IBI scores. For these "biologically-impaired" reaches, the cause of the impairment (referred to as stressor) was identified using a stressor ID process. Results of this process are reported in the 2013 Mississippi River-St. Cloud Stressor Identification Report.

In the stressor ID process, several candidate stressors were considered and from those, primary stressors were identified. A full review of candidate and primary stressors and the effect stressors have on aquatic life is presented in the *Stressor ID* report. The primary stressors for each biologically-impaired stream reach were identified through an intensive analysis of data, including application of the U.S. Environmental Protection Agency's (EPA's) Causal Analysis/Diagnosis Decision Information System (EPA, 2012a), as well as professional judgment, stakeholder and local insight. The most common stressors identified were: lack of habitat availability, excess bedded sediment, and low dissolved oxygen concentrations. Other identified stressors were nutrients (high phosphorus), high turbidity, lack of connectivity for fish passage due to impoundments (dams), and altered hydrology (table 4 below).

Table 4: Primary stressors to aquatic life in biologically-impaired reaches in the Mississippi River – St. Cloud Watershed

HUC-11 Subwatershed	AUID (Last 3 digits)	Stream	Reach Description	Biological Impairment	Primary Stressor						
					Dissolved Oxygen	Bedded Sediment	Phosphorus	Turbidity	Fish Passage (dams)	Altered Hydrology	Habitat
Upper Elk River (07010203010)	508	Elk River	Headwaters to Mayhew Creek	Fish & Macroinvert.		●	●			●	●
Mayhew Creek (07010203020)	675	Mayhew Creek	Unnamed Creek to CD 7	Fish & Macroinvert.	●	●				●	●
Lower Elk River (07070203040)	579	Elk River	Elk Lake to St. Francis River	Fish			●	●			
Upper St. Francis River (07010203060)	700	St. Francis River	Headwaters to Unnamed Lake	Fish & Macroinvert.	●	●	●		●	●	●
Battle Brook (07010203070)	535	Battle Brook	CD 18 to Elk Lake	Fish & Macroinvert.	●	●			●		●

HUC-11 Subwatershed	AUID (Last 3 digits)	Stream	Reach Description	Biological Impairment	Primary Stressor						
					Dissolved Oxygen	Bedded Sediment	Phosphorus	Turbidity	Fish Passage (dams)	Altered Hydrology	Habitat
St. Francis River (07010203080)	702	St. Francis River	Rice Lake to Elk River	Fish	●	●	●		●	●	●
	704	St. Francis River	Unnamed Lake to Rice Lake	Fish	●	●	●		●	●	●
Clearwater River (07010203730)	511	Clearwater River	Clearwater River to Miss. River	Fish	●	●			●		●
	545	Threemile Creek	Unnamed Stream to Lake Lur to T122 R28W S36	Fish	●	●			●		●
	717	Clearwater River	Scott Lake to Lake Louisa	Fish & Macroinvert.	●	●			●		●
Silver Creek (07010203750)	557	Silver Creek	Locke Lake to Miss. River	Fish & Macroinvert.	●	●	●		●	●	●
	662	Silver Creek	Unnamed Creek to Silver Lake	Fish & Macroinvert.	●	●	●		●	●	●
Otsego (07010203790)	528	Unnamed Creek	T121 R23W S19, south line Miss. River	Fish & Macroinvert.	●	●	●	●	●	●	●

Pollutant sources

Understanding the sources of pollution to surface waters is a key element in the development of restoration and protection strategies. This section provides an inventory of both point (Table 5) and nonpoint (Table 6) sources of pollution to impaired water bodies in the MR-SC Watershed categorized by HUC-11 subwatersheds. Point source pollution refers to pollution that comes from discrete conveyances which are permitted to discharge. Permitted sources can range from industrial effluent to municipal wastewater treatment plants. Nonpoint source pollution (NPS), on the other hand, comes from many diffuse sources. NPS is caused by rainfall or snowmelt moving over and through the ground. NPS can include sources such as: excess fertilizers from agricultural lands, bacteria and nutrients from leaking septic systems, pet waste and livestock and sediment from eroding streambanks. According to the EPA, States report that NPS is the leading cause of water quality problems (EPA, 2012b).

For point sources, a list permit holders was obtained from the MPCA Stormwater Division. The TMDL references are indicated for permitted discharges with existing TMDL allocations. Detailed permit information can be found on the MPCA website at: http://www.pca.state.mn.us/enzq915.

Relative magnitudes of NPS were estimated using a combination of documentation from completed TMDLs and local knowledge which were then reviewed and agreed upon by a technical committee made up of staff from various governments and agencies (state and local). The committee agreed upon the high, moderate or low ranking scheme based on available documentation. For impaired waters with no completed TMDL, the technical committee agreed there was not sufficient information to base relative magnitudes; thus, it is simply noted whether or not the non-point pollution source was likely to be contributing to the impairment (http://water.epa.gov/polwaste/nps/whatis.cfm).

Table 5: Point Sources in the Mississippi River – St. Cloud Watershed

HUC 11 Subwatershed	Point Source			Pollution Allocation (No/Yes/Categorical)	TMDL Reference
	Name	Permit #	Type		
Upper Elk River (07010203010)	Gilman WWTP	MNG580021	Municipal	Yes	Elk River Watershed TMDLs 2012
	MTD Excavating LLC Gravel Pits	MNG490217	Industrial	N/A	
	Rock Solid Land Co LLC	MNG490244	Industrial	Yes-Categorical	
	Minden Township	MS400147	Municipal	Yes-Categorical	
	Bluestreak Dairy	009-76189	CAFO	Yes	MR-SC TMDLs 2014
Mayhew Creek (07010203020)	Sauk Rapids City	MS4400118	Municipal	Yes-Categorical	Elk River Watershed TMDLs 2012
	Sauk Rapids Township	MS4400153	Municipal	Yes-Categorical	
	MNDOT Outstate District	MS4400180	Municipal	Yes-Categorical	
	Minden Township	MS400147	Municipal	Yes-Categorical	
	Watab township MS4	MS400161	Municipal	Yes-Categorical	
Upper St. Francis River (07010203060)	Duane Winkelman Farm	009-50013	CAFO	Yes	MR-SC TMDLs 2014
	Saldana Excavating & Aggregates/Granite	MNG490166	Industrial	No	--

HUC 11 Subwatershed	Point Source			Pollution Allocation (No/Yes/Categorical)	TMDL Reference
	Name	Permit #	Type		
Stony Brook and Rice Creek (107010203030)	Eagle View Commons WWTP	MN0063983	Municipal	No	Elk River Watershed TMDLs 2012
	Foley WWTP	MN0023451	Municipal	Yes	
	Haven Township	MS4400136	Municipal	Yes-Categorical	
	Minden Township	MS400147	Municipal	Yes-Categorical	
Battle Brook (07010203070)	Nordwall Estates c/o Bank of Elk River	MN0066583	Municipal	No	N/A
Lower Elk River (07010203040)	Becker WWTP	MN0025666	Municipal	Yes	Elk River Watershed TMDLs 2012, MR-SC TMDLs 2014
	Elk River Municipal Utilities	MNG250016	Industrial	No	N/A
	Elk River Municipal Utilities WTP	MNG820027	Municipal	No	N/A
	Knife River Central Minnesota	MNG490003	Industrial	Categorical	Elk River Watershed TMDLs 2012
	Tescom Corp-Industrial Controls	MNG120027	Industrial	No	N/A
	Eiler Bros Farm	141-62651	CAFO	Yes	Elk River Watershed TMDLs 2012
	Goenner Poultry LLC	141-50006	CAFO	Yes	
	Sherburne County	MS4400155	Municipal	Yes-Categorical	Elk River Watershed TMDLs 2012, MR-SC TMDLs 2014
	Big Lake Township	MS4400234	Municipal	Yes-Categorical	Elk River Watershed TMDLs 2012
	City of Big Lake	MS4400234	Municipal	Yes-Categorical	
	Benton County MS4	MS4400067	Municipal	Yes-Categorical	
	Sauk Rapids City	MS4400118	Municipal	Yes-Categorical	
	Sauk Rapids Township	MS4400153	Municipal	Yes-Categorical	
	St. Cloud City	MS4400052	Municipal	Yes-Categorical	Elk River Watershed TMDLs 2012, MR-SC TMDLs 2014
	MNDOT Outstate District	MS4400180	Municipal	Yes-Categorical	Elk River Watershed TMDLs 2012
	Haven Township	MS4400136	Municipal	Yes-Categorical	
	Minden Township	MS400147	Municipal	Yes-Categorical	
	Minnesota Correctional-St. Cloud MS4	MS400179	Municipal	Yes-Categorical	
	Elk River City	MN0020567	Municipal	Yes-Categorical	MR-SC TMDLs 2014
	Benton County MS4	MS4400067	Municipal	No	--
	Sauk Rapids City	MS4400118	Municipal	No	--
	Sauk Rapids Township	MS4400153	Municipal	No	--

HUC 11 Subwatershed	Point Source			Pollution Allocation (No/Yes/Categorical)	TMDL Reference
	Name	Permit #	Type		
City of St. Cloud (07010203700)	St. Cloud City	MS4400052	Municipal	No	Upper Mississippi River Bacteria TMDL
	MNDOT Outstate District	MS4400180	Municipal	No	
	Haven Township	MS4400136	Municipal	No	--
	St Cloud State University MS4	MS400197	Municipal	No	--
	Le Sauk Township	MS400153	Municipal	No	--
	Sartell City	MS400048	Municipal	No	--
	St. Cloud Technical & Community College	MS400204	Municipal	No	--
	Stearns County	MS400159	Municipal	Yes-Categorical	Upper Mississippi River Bacteria TMDL
	Sherburne County	MS4400155	Municipal	No	--
	Waite Park City	MS400127	Municipal	Yes-Categorical	Upper Mississippi River Bacteria TMDL
	Saint Cloud WWTP	MN0040878	Municipal	No	--
	Starrett Tru-Stone Division	MN0069001	Industrial	No	--
	Sysco Western Minnesota	MN0052728	Industrial	No	--
St. Francis River (07010203080)	Rivercrest Farms WWTP	MN0065960	Municipal	No	--
	Savannah Meadows WWTP	MN0065706	Municipal	No	--
Mississippi Direct (07010203690)	Haven Township	MS4400136	Municipal	No	--
	Sherburne County	MS4400155	Municipal	No	--
	St. Cloud City	MS4400052	Municipal	No	--
	Clear Lake/Clearwater WWTP	MN0047490	Municipal	No	--
Johnson Creek (07010203710)	St. Cloud City	MS4400052	Municipal	Yes-Categorical	Upper Mississippi River Bacteria TMDL
	Stearns County	MS400159	Municipal	No	--
	Waite Park City	MS400127	Municipal	No	--
Snake River (07010203050)	Hidden Haven WWTP	MN0065986	Municipal	No	--
	Shores of Eagle Lake Homeowners Association	MN0067369	Municipal	No	--
	Woods at Eagle Lake WWTP	MN0066354	Municipal	No	--
Tibbits Creek (07010203090)	Aspen Hills WWTP	MN0066028	Municipal	Yes	MR-SC TMDLs 2014
	Elk River City	MN0020567	Municipal	Yes-Categorical	
	Ridges of Rice Lake Homeowner's Association	MN0065935	Municipal	No	--
	Windsor Park 3rd Addition Home Owners	MN0066346	Municipal	No	--

HUC 11 Subwatershed	Point Source			Pollution Allocation (No/Yes/Categorical)	TMDL Reference
	Name	Permit #	Type		
	Country Meadows WWTP	MN0065978	Municipal	No	--
	J & B Mining	MNG490191	Industrial		--
	Meadow Woods Village WWTP	MN0065781	Municipal	No	--
	Windsor Meadows	MN0067768	Municipal	No	-
	Windsor Park Homeowner's Association	MN0065412	Municipal	No	--
	Zimmerman WWTP	MN0042331	Municipal	Yes	MR-SC TMDLs 2014
Fish Creek (07010203740)	--	--	--	--	--
Plum Creek (07010203720)	Lakes of Fairhaven WWTP	MN0066664	Municipal	No	--
	St. Cloud City (UMB)	MS4400052	Municipal	Yes-Categorical	Upper Mississippi River Bacteria TMDL
Lake Maria State Park (07010203760)	Monticello City	MS400242	Municipal	No	--
	Veit Co-Rogers	MNG490183	Industrial	No	--
	Xcel-Monticello Nuclear Generating Pit	MN0000868	Industrial	No	--
	Xcel-Sherburne Generating Plant	MN00186	Industrial	No	--
Clearwater River (07010203730)	Clearwater Forest LLC	MN0069582	Municipal	No	--
	Clearwater Harbor Sewage Treatment	MN0065226	Municipal	No	-
	Kimball WWTP	MN0052647	Municipal	Yes	Clearwater River 5 Lakes TMDLs 2010; CD #44 to Lk Betsy DO TMDL 2010; CD #44 to Lk Betsy and Lakes Nutrients TMDL 2010
	South Haven WWTP	MN006461	Municipal	Yes	
	Watkins WWTP	MN0051365	Municipal	Yes	
	Rest-a-While Shores	09-17550	Cluster System*	Yes	
	Wandering Ponds	09-20199	Cluster System*	Yes	
	Lake Louisa Hills	Pending*	Cluster System*	Yes	
	Kolles Sand & Gravel Inc.	MNG490241	Industrial		
	Annandale Rock Products Inc.	MNG490022	Industrial		
	Schiefelbein Farm Sec. 33	093-114543	CAFO	No	--
Silver Creek (07010203750)	--	--	--	--	--
Monticello (07010203780)	Big Lake WWTP	MN0041076	Municipal	No	--
	Monticello City	MS400242	Municipal	No	--

HUC 11 Subwatershed	Point Source			Pollution Allocation (No/Yes/Categorical)	TMDL Reference
	Name	Permit #	Type		
	Monticello WWTP	MN0020567	Municipal	No	--
	City of Big Lake	MS4400234	Municipal	No	--
	Big Lake Township	MS4400234	Municipal	No	--
	Elk River City	MS400089	Municipal	No	--
	Otsego City	MS400243	Municipal	No	--
Rice Lake (07010203800)	Elk River City	MS400089	Municipal	No	--
	Elk River WWTP	MN0020788	Municipal	No	--
	Great River Energy: Elk River Station	MN0001988	Industrial	No	--
	Otsego City	MS400243	Municipal	No	--
	Riverbend Mobile Home Park WWTP	MN0042251	Municipal	No	--
	Windsor Oaks of Elk River Home Owners Association	MN0066613	Municipal	No	--
Otter Creek (07010203770)	Monticello City	MS400242	Municipal	No	--
Otsego (07010203790)	Albertville WWTP	MN0050954	Municipal	Yes	Upper Mississippi River Bacteria
	Otsego WWTP West	MN0066257	Municipal	Yes	
	Otsego City	MS400243	Municipal	Yes-Categorical	
	St. Michael City	MS400246	Municipal	Yes-Categorical	

For more detail on allocation and TMDL watershed boundaries, refer to approved TMDL reports on the MPCA website.

Table 6: Nonpoint Sources in the Mississippi River – St. Cloud Watershed. Relative magnitudes of contributing sources are indicated for impaired waters with TMDLs only.

HUC-11 Subwatershed	Stream/Reach (AUID) or Lake (ID)	Pollutant	Pollutant Sources											
			Fertilizer & manure run-off	Livestock/feedlots in riparian areas	Failing septic systems	Wildlife[1]	Poor riparian vegetation cover	Bank erosion[4]	Channelization/ditching	Dams/Culverts	Upstream influences[2]	Internal sources[3]	Rural Residential Runoff
Upper Elk River (07010203010)	Elk River (508)	F-IBI & M-IBI	Ê	Ê			Ê		Ê				
		Bacteria	Ê	Ê	Ê	Ê	Ê						
Mayhew Creek (07010203020)	Mayhew Creek (675)	F-IBI & M-IBI	Ê	Ê					Ê				
	Mayhew Creek (509)	Dissolved Oxygen	Ê	Ê			Ê		Ê		Ê		
		Bacteria	Ê	Ê	Ê	Ê							
	Mayhew Lake (05-0007-00)	TP	~	~								TM	
Upper St. Francis River (07010203060)	St. Francis River (700)	F-IBI & M-IBI							~	~			
		Bacteria	Ê	Ê	Ê	Ê							Ê
Stony Brook and Rice Creek (07010203030)	Rice Creek (512)	Dissolved Oxygen	TM	›					~	~			
		Turbidity	TM	›							›		
		Bacteria	Ê	Ê	Ê	Ê							
Battle Brook (07010203070)	Battle Brook (535)	F-IBI	›						~	~			
		Bacteria	Ê	Ê	Ê	Ê							
	Elk Lake (71-0055-00)	TP	Ê	Ê	Ê	Ê				Ê	Ê	Ê	Ê
	Diann Lake (71-0046-00)	TP	Ê	Ê	Ê							Ê	Ê
Lower Elk River (07010203040)	Elk River (507)	Bacteria	Ê	Ê	Ê	Ê							
	Elk River (579)	F-IBI							Ê		Ê		
		Bacteria	TM	~	›	TM							
		Turbidity	~	~	TM			TM			~		
	Elk River (548)	Bacteria	Ê	Ê	Ê	Ê							
	Donovan Lake (05-0004-02)	TP	›									›	›
	Julia Lake (71-0145-00)	TP			TM							~	~
	Briggs Lake (71-0146-00)	TP	›	›	TM						~	~	›
	Rush Lake (71-0147-00)	TP	›		TM						~	~	›
	Elk Lake (71-0141-00)	TP	~	~	TM						~	›	~
	Upper Orono Lake (71-0013-01)	TP	~	~	TM							TM	
	Lower Orono Lake (71-0013-02)	TP	~	~								TM	
City of St. Cloud (07010203700)	Lake George (73-0611-00)	TP											

HUC-11 Subwatershed	Stream/Reach (AUID) or Lake (ID)	Pollutant	Pollutant Sources											
			Fertilizer & manure run-off	Livestock/feedlots in riparian areas	Failing septic systems	Wildlife[1]	Poor riparian vegetation cover	Bank erosion[4]	Channelization/ditching	Dams/Culverts	Upstream influences[2]	Internal sources[3]	Rural Residential Runoff
St. Francis River (07010203080)	St. Francis River (704)	F-IBI	~	~					›				
	St. Francis River (702)	F-IBI	™	™					›	~	™		
Mississippi River Direct (07010203690)	Not assessed	--											
Johnson Creek (07010203710)	Unnamed Creek (724)	Bacteria	Ê	Ê	Ê	Ê							
	Unnamed Creek (561)	Bacteria	Ê	Ê	Ê	Ê							
	Johnson Creek (635)	Bacteria	Ê	Ê	Ê	Ê							
	Johnson Creek (639)	Bacteria	Ê	Ê	Ê	Ê							
Snake River (07010203050)	Snake River (529)	Bacteria	Ê	Ê	Ê	Ê			Ê				
	Eagle Lake (71-0067-00)	TP			Ê							Ê	Ê
Tibbits Creek (07010203090)	Tibbits Brook (522)	Bacteria	Ê	Ê	Ê	Ê							Ê
	Fremont Lake (71-0016-00)	TP	Ê		Ê							Ê	Ê
	Birch Lake (71-0057-00)	TP			™							™	›
Fish Creek (07010203740)	Fish Lake (86-0183-00)	TP	~	~	™						›	›	›
Plum Creek (07010203720)	Plum Creek (572)	Bacteria	Ê	Ê	Ê	Ê							
Clearwater River (07010203730)	Clearwater River (717)	F-IBI & M-IBI	Ê	Ê			Ê		Ê		Ê		
	Fairhaven Creek (565)	Bacteria	Ê	Ê		Ê							Ê
	Threemile Creek (545)[2]	F-IBI	Ê	Ê			Ê		Ê				
	Clearwater River (511)[1]	F-IBI, DO	~	™	™					›	™		™
	Caroline Lake (86-0281-00)	TP	›	›	™						~	›	™
	Marie Lake (73-0014-00)	TP	~	™	™						~	›	™
	Louisa Lake (86-0282-00)	TP	~		™						~	›	™
	Augusta Lake (86-0284-00)	TP	~	›	™						~	›	™
	Clear Lake (47-0095-00)	TP	~	›							›	~	™
	Betty Lake (47-0042-00)	TP	~	›	™						~	›	™
	Scott Lake (86-0297-00)	TP	~	›							~		
	Union Lake (86-0298-00)	TP	~	›	™							™	™
	Swartout Lake (86-0208-00)	TP	~	›	™		~				›	~	™
	Albion Lake (86-0212-00)	TP	~	›			›					~	™

HUC-11 Subwatershed	Stream/Reach (AUID) or Lake (ID)	Pollutant	Pollutant Sources											
			Fertilizer & manure run-off	Livestock/feedlots in riparian areas	Failing septic systems	Wildlife[1]	Poor riparian vegetation cover	Bank erosion[4]	Channelization/ditching	Dams/Culverts	Upstream influences[2]	Internal sources[3]	Rural Residential Runoff
	Henshaw Lake (86-0213-00)	TP	~	›			™					~	™
Silver Creek (07010203750)	Silver Creek (662)	F-IBI & M-IBI	~	~						~			›
	Silver Creek (557)	F-IBI & M-IBI	~	~						~	~		›
		DO	~	~						~	~		›
		Bacteria	Ê	Ê	Ê	Ê					Ê		Ê
	Locke Lake (86-0168-00)	TP	~	~	™								›
	Indian Lake (86-0223-00)	TP	~	~	™							™	™
	Little Mary, North (86-0139-02)	TP										Ê	Ê
	Little Mary, South (86-0139-01)	TP	Ê									Ê	Ê
	Silver Lake (86-0140-00)	TP	~	~	™						~	™	›
	Millstone Lake (86-0152-00)	TP	Ê									Ê	Ê
	Mink Lake (86-0229-00)	TP	~	~								~	›
	Somers Lake (86-0230-00)	TP									~	~	›
Otsego (07010203790)	Unnamed Creek (528)	F-IBI & M-IBI							~				
	Hunters (Mud) Lake (86-0026-00)	TP	Ê										
	School Lake (86-0025-00)	TP	Ê										
Lake Maria State Park (07010203760)	Not assessed	--											
Monticello Watershed (07010203780)	Not assessed	--											
Rice Lake (07010203800)	Not assessed	--											

Key: Lake and Stream Impairments with completed TMDLS and/or Stressor ID reports: ~ = High › = Moderate ™ = Low
Lake and stream impairments with NO TMDL or Stressor ID completed: Ê = potential source

Notes: 1. From MR-SC Monitoring & Assessment Report. / **2.** From MR-SC Stressor ID Report. / **3.** From CRWD TMDLs Reports./ 4. Reference Elk River Watershed Multiple TMDLS

2.4 TMDL Summary

This section summarizes TMDLs completed in conjunction with the Watershed Restoration and Protection Strategy (WRAPS) process. Readers should refer to the complete MR-SC TMDL report for specific detail, located at: http://www.pca.state.mn.us/hqzqdd6.

In addition to the TMDLs completed during the WRAPS process (summarized here), a number of TMDL projects aimed at restoring water quality for impaired waters or protection high-quality waters within the watershed have been completed or are in progress. For a list of these TMDL plans and their specific targets within the watershed, visit the MR-SC website at: (http://www.pca.state.mn.us/hqzqdd6).

TMDLs completed during the 2009, 10-year watershed cycle were prepared by Sherburne Soil and Water Conservation District (SWCD) staff cooperatively with partner agencies within the MR-SC Watershed with assistance from Wenck Associates, Inc. The TMDLs summarized here include three low dissolved oxygen impairments, one turbidity impairment, and 13 lake eutrophication impairments. The impaired waters addressed in the MR-SC TMDLs were listed on or before the 2010 Impaired Waters List. Surface waters listed after 2010 will be addressed during the 2019 cycle.

The TMDLs described here were completed using a variety of platforms to evaluate current loading, contributions by various pollutant sources and the allowable pollutant loading capacity of the impaired water bodies. Platforms included lake response models (excess nutrients), QUAL2K (DO), and load duration curves (turbidity). Current pollution loading and allocations for each of the impaired waters can be found in Appendix B. Detailed descriptions of models including model outputs, priority areas and restoration strategies can be found in the MR-SC TMDLs report at: http://www.pca.state.mn.us/hqzqdd6.

Table 7 Mississippi River (St. Cloud) Lake and Stream TMDLs completed during the 2009 WRAPS cycle and % reduction needed to meet water quality standards. See Appendix B for current loading and allocations.

HUC-11 Subwatershed	Lake/Stream	Impairment	Critical Condition	Load Reduction
Lower Elk River (07010203040)	Donovan Lake (05-0004-02)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	63%
	Julia Lake (71-0145-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	0%[3] (no increase)
	Briggs Lake (71-0146-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	56%
	Rush Lake (71-0147-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	48%
	Upper Orono Lake (71-0013-01)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	48%
	Lower Orono Lake (71-0013-02)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	48%
Tibbits Creek (07010203090)	Birch Lake (71-0057-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	0%[3] (no increase)
Silver Creek (07010203750)	Locke Lake (86-0168-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	44%
	Indian Lake (86-0223-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	27%
	Silver Lake (86-0140-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	56%
	Mink Lake (86-0229-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	69%
	Somers Lake (86-0230-00)	Excessive Nutrients (total phosphorus)	Summer Growing Season (June-September)	42%
Battle Brook (07010203070)	Battle Brook (535)	Aquatic macroinvertabrate bioassessments (Low DO) (NBOD, SOD)	Low Flow	80%[1]
Stony Brook and Rice Creek (07010203030)	Rice Creek (512)	Dissolved Oxygen (NBOD, SOD)	Low Flow	80%[2]
		Turbidity	Mid and Low Flow	24/75/275%[4]
Clearwater River (07010203730)	Clearwater River (511)	Dissolved Oxygen (NBOD, SOD)	High Flow	80%[1]

[1] In addition to these allowable loads, changes in headwater conditions are necessary

[2] In addition to these allowable loads, changes in channel morphology are necessary.

[3] In-lake water quality data suggests that these lakes are very close to the existing water quality standards. Lake water quality standards are within a standard deviation of the most recent 10-year mean TP concentrations. Load reductions for these lakes will represent only a MOS necessary to guarantee they achieve the standard.

[4] Based on % reductions needed for High, Mid and low flow conditions.

The focus of the implementation strategies is broad because, in most cases, the load reduction goals are significant in order to meet state standards. Areas for implementation will focus first on impaired lakes, focusing on the most achievable goals first. Addressing the impaired lakes will provide some improvement for area streams. Once impaired lakes are addressed in full, the additional work to target impaired streams will be re-assessed.

Point sources requiring load reductions in conjunction with the MR-SC TMDLs are listed in Table 5 of this report, and priority areas and restoration strategies are summarized in Table 9.

HSPF Model

Hydrologic Simulation Program FORTRAN (HSPF) modeling is being implemented across all of Minnesota's 81 major watersheds concurrently with the WRAPS cycle. HSPF models simulate hydrology and water quality parameters on a watershed basis and can be used for source allocation of sediment and nutrients, TMDL table generation, estimation of needed pollutant reductions and impacts to water quality from point sources and evaluation of potential implementation strategies. More details on the capabilities of HSPF can be found in Section 3.1 of this report.

The TMDLs completed during the 2009 WRAPS cycle were finalized prior to the completion of HSPF modeling for the MR-SC Watershed due to its location along the Mississippi River. HSPF models are projected to be complete by mid-2015. The TMDLs and implementation recommended implementation strategies should be revisited upon HSPF model completion.

2.5 Protection Considerations

The MR-SC Watershed is home to several outstanding resources including but not limited to the Sherburne National Wildlife Refuge, Stand Dunes State Forest, Lake Maria State Park, Sand Dunes State Forest, and the Knukle Wildlife Management Area. These natural areas provide recreational opportunities and support a diverse population of mammals, plants and birds including several which are classified as endangered, threatened or species of special concern (DNR Rare Species Guide). These special areas within the watershed play an important role in protecting our water quality and way of life; care should be taken to preserve these areas. More information regarding areas of biodiversity significance can be found at: http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html.

The reach of the Mississippi River within the watershed is designated as a wild and scenic river. The rolling forested bluffs, numerous accesses and rest areas, along with abundant wildlife make this segment of the Mississippi River a popular route for day-long canoe trips. This portion of the river also provides excellent recreational fishing opportunities and is recognized for its high quality smallmouth bass fishing. The characteristics mentioned above make this watershed unique and should be protected.

During the WRAPS process many high-quality water bodies were identified. All waters currently supporting aquatic life and recreation in the watershed are considered waters to protect. Over time, if these waters are not protected, it is possible they will join the ranks of impaired waters. To date, the majority of management efforts in the watershed have focused on restoring impaired water bodies. As part of this project, several of the water management entities identified high priority protection lakes (Section 3.1). Criteria used in selection of priority protection waters differ from entity-to-entity and are described in Section 3.

There are several designated trout streams in the watershed; many of which have not been monitored for water quality. The watershed partners feel it is important to gather data on these streams to ensure the water quality is not degraded. Designated trout streams include: Briggs Creek and Snake River in Sherburne County; and Willow Creek, Spring Brook, Thiel Creek, Fairhaven Creek, Hansen Brook, Johnson Creek, Robinson Hill Creek and Luxemburg Creek in Stearns County.

Protecting drinking water supplies is also a high priority. The city of St. Cloud is the first city along the Mississippi River to obtain its drinking water from this resource. Apart from the city of St. Cloud, the remaining municipalities in the watershed rely on groundwater for their drinking water supply. The susceptibility of groundwater to contamination from a variety of sources varies throughout the watershed.

Working to protect the surface waters through the implementation of best management practices is critical to the overall environment and economic health of the area.

The major threats to the watershed include:

- Introduction of large amounts of phosphorus, sediment, and bacteria to surface waters from various sources, including hydrological changes.

- Relatively high percentage of agricultural land use, including row crops, feedlots and riparian pasturelands, as well as concentrated urban/residential land uses within or directly connected to riparian zones.
- Increased nutrient, contaminant, and sedimentation loading from stormwater runoff from agriculture, urban/residential development and other non-point sources.
- Loss of riparian buffers and habitat due to agricultural land use and urban/residential development.
- Loss of biodiversity due to competition from invasive species (ex. exotic aquatic organisms such as common carp and curly leaf pondweed in shallow lake ecosystems), changes in hydrology (ex. draining of seasonal basins and channelization of streams) and climatic changes (ex. changes in frequency and amount of precipitation events.
- The combination of long, moderately steep slopes and easily erodible sandy loam soil that is inherently high in phosphorus.
- Some wetlands contributing soluble phosphorus to downstream waters due to nutrient loading over time.

3. Prioritizing and Implementing Restoration and Protection

The Clean Water Legacy Act (CWLA) requires that Watershed Restoration and Protection Study (WRAPS) reports summarize priority areas for targeting actions to improve water quality, identify point sources and identify nonpoint sources of pollution with sufficient specificity to prioritize and geographically locate watershed restoration and protection actions. In addition, the CWLA requires including an implementation table of strategies and actions that are capable of cumulatively achieving needed pollution load reductions for point and nonpoint sources (see Table 9).

This section of the report provides the results of such prioritization and strategy development. Because much 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 best management practices. Thus, effective ongoing civic engagement is fully a part of the overall plan for moving forward.

The successful implementation of restoration and protection strategies requires a combined effort from multiple entities within the MR-SC Watershed. By bringing these groups together in the decision making process, it will increase the transparency and eventual success of implementation. Collaboration and compromise will also ensure that identified priorities and strategies are incorporated into local plans, future budgeting, and grant development.

At a minimum, water management units will amend the WRAPS plans into existing Local Water Plans or Comprehensive Watershed Plans. In an effort to more efficiently manage the water resources of the watershed, the watershed partners are also investigating the best way to continue the partnerships developed during the WRAPS process. An example of a continued partnership is pooling resources to continue Civic Engagement related activates.

3.1 Targeting of Geographic Areas

There are multiple opportunities for protection or restoration in any watershed. Narrowing down what practices to implement and where on the landscape to implement them can help more effectively target conservation and protection efforts. It can also result in a more efficient use of limited resources. A number of tools are or will be available in the near future to assist in accomplishing targeting goals. There are multiple ways these tools may be used for targeting efforts; for instance some of the tools can be used to identify potential disproportionately high pollutant loading areas within the landscape. Ultimately, these tools, along with local working group and stakeholder feedback, field reconnaissance, knowledge of Best Management Practice (BMP) suitability, and landowners support, are intended to identify projects that can be implemented to restore and protect Minnesota's waters.

Tools developed (or under development) under this WRAPS are summarized in Table 8. These tools can be paired with existing plans to help refine target areas. In addition to the GIS tools presented in said table, local working staff may find and apply tools that are more geared towards their expertise and local priorities. Additional tools include but are not limited to: other GIS mapping applications, simple or elaborate computer models, or empirical calculation models.

Target areas for both restoration and protection activities were selected as part of this project using a combination of the following criteria:

Restoration Criteria:

- Area identified as high priority in existing TMDLs
- TMDL or other significant water quality study completed in area
- Presence of willing participants and multiple partners
- Restoration funds have already been targeted to area
- Water is close to meeting state standards
- Location in headwater or small watershed size

Protection Criteria:

- Presence of willing participants and multiple partners
- Water has high public visibility and/or public access
- Location in headwater or small watershed size
- Water quality is trending towards exceeding state standards
- Significant time and money has already been spent in the area.
- The need to protect existing best management practices from expiration has been identified

Hydrology Inventory Criteria:

- Channel restoration has been identified in TMDL plans or WRAPS-related work as the primary method of improvement.
- Inventory needed of culverts and crossings in these areas.

Geographic targets can be seen in Figure 3.1 below. Local water managers may choose to pair these areas with other tools, such as those described in table 8, to assist with target area specific planning. For instance, a priority area could be paired with Zonation maps to identify areas where work may be most beneficial or locally accepted. It is very important to note that the target areas identified here may change after completion of the HSPF model for this watershed; this is expected to take place in mid-2015. Local partners have already expressed interest in seeking funds to incorporate HSPF based decisions into this plan.

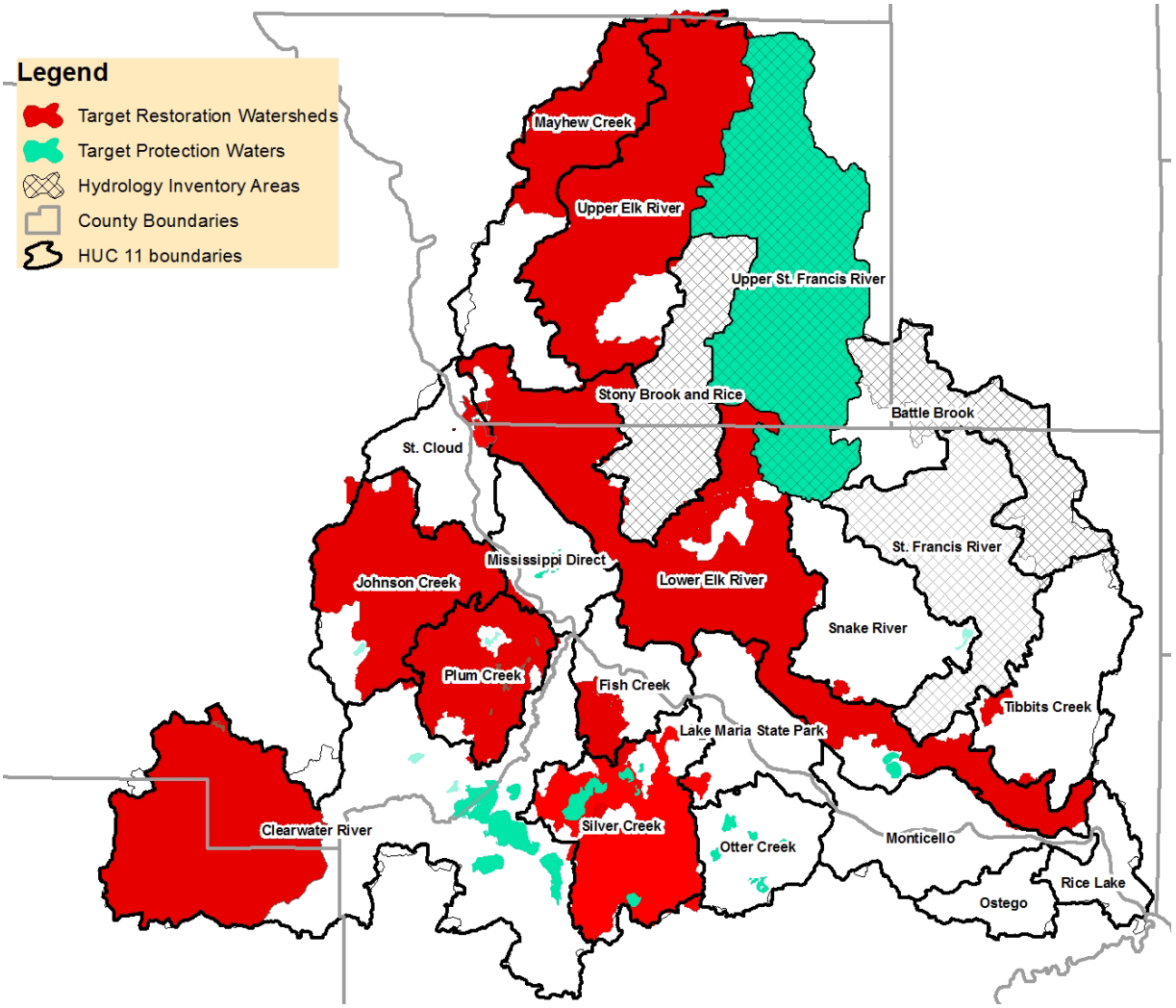


Figure 3.1: MR-SC Targeted Protection, Restoration and Hydrology Inventory Areas. Targets shown are priority level 1 only.

Zonation

Watershed partners worked with the Minnesota Department of Natural Resources (DNR) to develop a Zonation model for the MR-SC Watershed which can be used to help with priority area targeting. In short, Zonation is a value based model which uses a compilation of individual criteria of valuable landscape features and aggregated criteria with an objective function to prioritize places within the landscape for conservation. These models are typically run using information from the HSPF model, but the HSPF model is slated to be complete for this watershed by mid-2015. As such, the zonation maps and priority areas for this watershed do not have HSPF model information included. The maps and priority areas may change drastically after the zonation model is updated with the HSPF model information.

The current version of this model can be used by local water management planners to assist with planning processes if they choose to do so. The files are available by request to the Sherburne SWCD. A detailed description of the process used to build the MR-SC model can be found in Appendix D.

Two priority maps were created with the Zonation value model. The first map was a protection priority map where lands were ranked as to their importance for land management activities that would provide greater protection of ecosystem functions, especially water quality (Figure 3.2). The second map was a restoration priority map where lands were ranked as to their importance for application of various land best management practices (Figure 3.3).

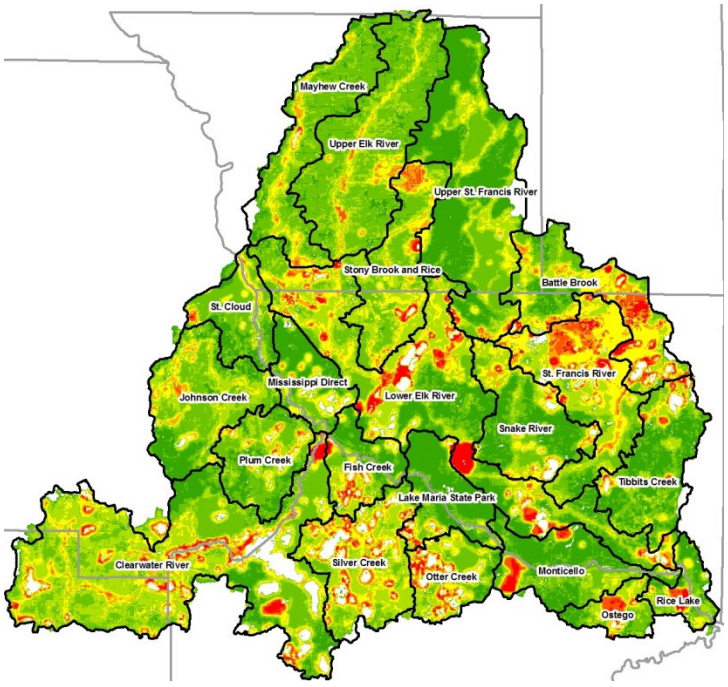


Figure 3.2: Zonation Restoration priority map: multiple benefits - water quality highest priority

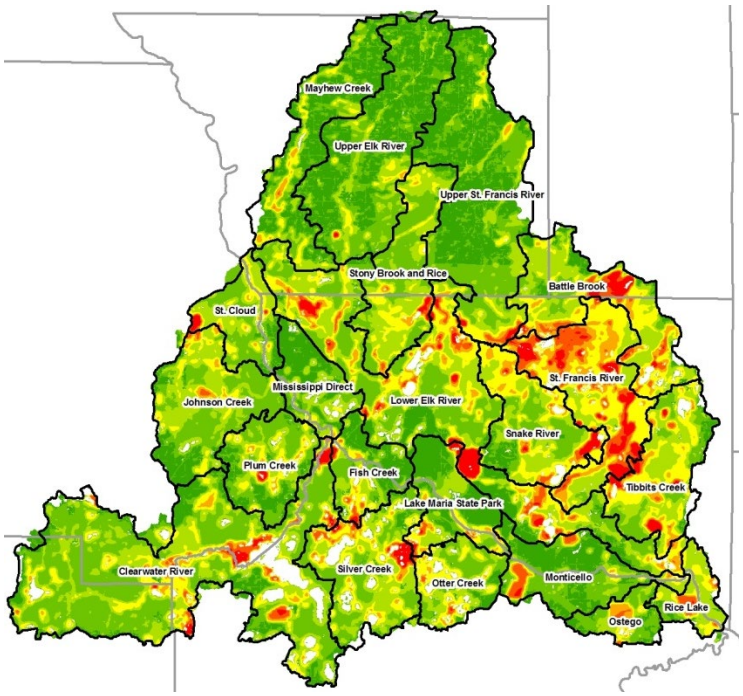


Figure 3.3: Zonation Protection Priority Map: multiple benefits - water quality, habitat, erosion, economic value

The protection priority map identified several general priority areas. First, high rankings were given to lands south of the Sherburne National Wildlife Refuge, including the riparian corridor to Eagle Lake and south to Big Lake. High priority rankings were also given to lands west of the city of Princeton, as well as to areas in the southwest part of the watershed, from the city of Kimball to Clearwater Lake. Finally, high rankings were calculated for lands within the numerous city drinking water wellhead protection areas.

The restoration priority map from the Zonation analysis identified at least four general areas for consideration. First, high rankings were evident in the areas in and around the Sherburne National Wildlife Refuge. Second, riparian corridors east of the city of St. Cloud were calculated to have high rankings, as did shore lands in the southern part of the watershed. Finally, as with the protection priority map, high rankings were calculated for lands in the numerous wellhead protection areas.

Table 8 GIS tools for targeting restoration and protection practices in the Mississippi River (St. Cloud) Watershed.

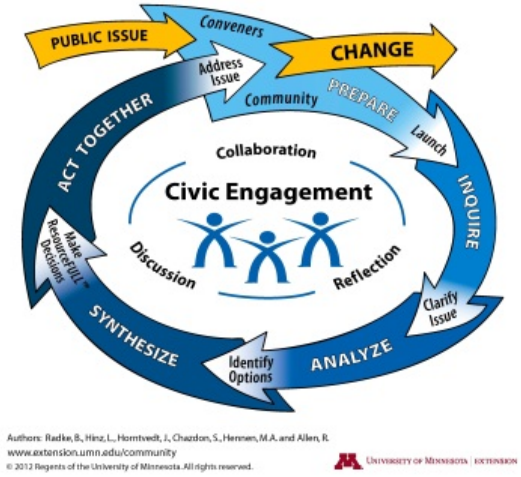
Tool	Description	How can the tool be used?	Notes	Link to Information and data
Ecological Ranking Tool (Environmental Benefit Index - EBI)	Three GIS layers containing: soil erosion risk, water quality risk, and habitat quality. Locations on each layer are assigned a score from 0-100. The sum of all three layer scores (max of 300) is the EBI score. This higher the score, the higher the value in applying restoration or protection.	Any one of the three layers can be used separately or the sum of the layers (EBI) can be used to identify areas that are in line with local priorities. Raster calculator allows a user to make their own sum of the layers to better reflect local values.	MPCA ran analysis in 2013 for Watershed. Raw GIS layers are available on the BWSR website; MPCA has shapefiles.	*BWSR*
Zonation	A framework and software for large-scale spatial conservation prioritization; it is a decision support tool for conservation planning. This values-based model can be used to identify areas important for protection and restoration.	Zonation produces a hierarchical prioritization of the landscape based on the occurrence levels of features in sites (grid cells). It iteratively removes the least valuable remaining cell, accounting for connectivity and generalized complementarity in the process. The output of Zonation can be imported into GIS software for further analysis. Zonation can be run on very large data sets (with up to ~50 million grid cells).	Analysis ran late 2013 sans HSPF model; should be updated with HSPF results when complete. Mississippi River Zonation displayed in Appendix D.	*CBIG*
Human Disturbance Gradient Score	Calculates the amount of human disturbance impacting a site.	Used in conjunction with the IBI. Can help identify subwatersheds which have the greatest impact of human disturbance.	MPCA completed with IBI 2013. Separate fine resolution variables within the HDS index were used in Zonation model; Sherburne SWCD has shapefiles.	*MPCA*
DNR Watershed Health Assessment Framework	The NHD is a vector GIS layer that contains features such as lakes, ponds, streams, rivers, canals, dams and stream gages, including flow paths. The WBD is a companion vector GIS layer that contains watershed delineations.	Provides a comprehensive overview of the ecological health of Minnesota's watersheds. The approach expands our understanding of processes and interactions that create healthy and unhealthy responses in watersheds. Health scores are used to provide a baseline for exploring patterns and relationships in emerging health trends.	Interactive tool available on the DNR website.	*MN DNR*

Light Detection and Ranging (LiDAR)	Elevation data in a digital elevation model (DEM) GIS layer. Created from remote sensing technology that uses laser light to detect and measure surface features on the earth.	General mapping and analysis of elevation/terrain. These data have been used for: erosion analysis, water storage and flow analysis, siting and design of BMPs, wetland mapping, and flood control mapping. A specific application of the data set is to delineate small catchments.	Available for all counties in watershed. The layers are available on the MN Geospatial Information website for most counties.	*MGIO*
Hydrological Simulation Program – FORTRAN (HSPF) Model	Simulation of watershed hydrology and water quality for both conventional and toxic organic pollutants from pervious and impervious land. Typically used in large watersheds (greater than 100 square miles).	Incorporates watershed-scale and non-point source models into a basin-scale analysis framework. Addresses runoff and constituent loading from pervious land surfaces, runoff and constituent loading from impervious land surfaces, and flow of water and transport/ transformation of chemical constituents in stream reaches.	Local or other partners can work with MPCA HSPF modelers to evaluate at the watershed scale: 1) the efficacy of different kinds or adoption rates of BMPs, and 2) effects of proposed or hypothetical land use changes. –Scheduled completion date: Early to Mid-2015	*USGS*

Once a specific location is targeted for restoration or protection, a BMP or conservation practice can be selected for the location. Generally, local working group staff has an extensive working knowledge of available BMPs and the suitability of specific BMPs in their region. Some available BMP resources (with links) are listed below:

- Agricultural BMP Handbook for Minnesota (MDA, 2012)
- Minnesota Natural Resources Conservation service Field Office Technical Guide (FOTG) (USDA, 2013)
- Stormwater BMP Manual (MPCA, 2000)
- Industrial Stormwater BMP Guidebook (MPCA, 2012d)
- Shoreland BMP factsheets (UM, 2002)
- Forestry Best Management Practice for Wetlands (USDA, 1997)

3.2 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. 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." A resourceFULL decision is one based on diverse sources of information and supported with buy-in, resources (including human), and competence. The civic engagement process is visualized as circular in nature, allowing for reevaluations, revised decisions, and renewed actions. This circular nature meshes well with the "watershed approach" undertaken as part of this project. Further information on civic engagement is available at: http://www1.extension.umn.edu/community/civic-engagement/.

Working off of this basic definition, civic engagement (as part of this project) began in 2011 with the establishment of a civic engagement committee made up of representatives from several stakeholder groups. While the makeup of the committee has changed over time, the current membership is:

1. Tiffany Determan, Local Project Coordinator, Sherburne SWCD
2. Phil Votruba, Project Manager, MPCA
3. Mark Hauck, DNR
4. Joe Jacobs, Wright SWCD
5. Cole Loewen, CRWD
6. Lark Weller, NPS

By creating and following a customized civic engagement model (see Appendix C), the committee serves as the guiding force behind all engagement activities undertaken as part of this project. These activities take on various forms, but the purpose remains the same – to increase local capacity among current and emerging watershed leaders in order for watershed work to be dynamic, inclusive and sustainable and for the watershed to become (and remain) healthy and vibrant. Special thanks to consultant Denise Stromme for her guidance and expertise during the establishment of the committee.

Other already-existing groups within the watershed have various forms of civic engagement already underway. Each of the counties in the watershed has water planning committees, which assist the respective board of commissioners draft plans for water-related activities in the respective county. The CRWD has various education programs running, ranging from attendance at lake association meetings to

its own citizen advisory committee. The Central Minnesota Water Education Alliance is an educational partnership between several municipalities, townships, governmental groups, civic groups, and others focused on providing educational outreach to promote water quality stewardship. Through stakeholder involvement during the development of the Elk River Watershed Association's (ERWA) Multiple TMDLs, the ERWA collected citizen input on preferred education initiatives. This information is used in planning and available at Sherburne or Benton SWCDs. A formal public notice period for this MR-SC WRAPS was held from October 13, 2014, through November 12, 2014. Finally, all SWCDs in the watershed also engage in a variety of annual educational and engagement actives.

Accomplishments

Measuring accomplishments of civic engagement is not a simple task. Using the working definition of civic engagement given above as our measurable outcome, the summary paragraphs below list several accomplishments achieved as part of this project:

Creation of civic engagement model

The civic engagement committee invested many hours of staff time in the creation of a model which serves multiple purposes. These include: a common framework for all civic engagement activities, a listing of needed resources and to-be-completed tasks in order to meet defined outcomes, and an evaluation tool for both completed and future civic engagement activities. The model is not considered a static document; it is to be reviewed and modified as necessary. This model is located in Appendix C.

Staff training in civic engagement principles

Several conferences and training events geared toward principles of civic engagement work have been attended by several members of the committee. The ideas and resources gained at these events have been brought back to improve civic engagement activities in the watershed. Several of these principles have had a direct effect of activities that are a part of this project, including the watershed community leaders group and the open-house style events.

Open-house style events

Several open house events were held throughout the project. These events served as a means for citizens to interact with project staff to learn more about the project, as well as a means to develop relationships, encourage involvement, and fulfill specific, legal requirements for public meetings. These events were well attended by various groups, from local and regional watershed-related professionals, to decision makers, members of various civic

2nd Watershed-wide Open House, Clearwater Township Hall. March 7th 2013

groups, and the general citizenry. These events served to foster new ideas for further involvement in restoration and protection of the natural resources of the watershed.

Assisting with stream/lake monitoring

By offering training and direction to monitoring volunteers, the watershed receives two benefits: one, more data is collected that allows for long-term trend analysis on the health of the watershed's stream/rivers and lakes, and two, these volunteers will oftentimes use what they have learned to inform and influence others in their respective communities. By doing so, more citizens become aware and involved with the project's purposes and goals. For this reason, this is considered to be an effective part of civic engagement.

Presenting at existing civic groups about the project

Public Meeting on proposed TMDLs for several waterbodies in the Mississippi River (St. Cloud) Watershed

Several members of the civic engagement committee attended various civic group meetings to share about the project and to seek involvement from among each membership. Groups attended include (but are not limited to): numerous lake associations, Minnesota Corn Growers Association, and Irrigators Association of Minnesota. Information disseminated varied from basic project information to ways to get involved in the project to in-depth discussions on TMDLs and completed project reports. From these presentations, several members of the watershed community leaders group came forward.

Establishment of Watershed Community Leaders Group

First official Community Leaders Tour: St. Cloud Drinking Water Treatment Plant.

As a means to promote perpetuating involvement and collaboration from diverse members of various communities within the watershed, a Watershed Community Leaders group was formed. Members were invites to participate in the group based on various parameters, such as previous interactions at other events, representation of a distinct community within the watershed, and interest in protection and restoration efforts.

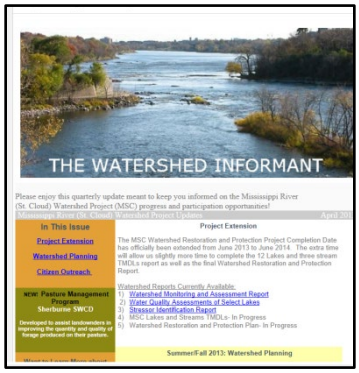
This group serves as a type of "two-way street." Project staffs offer education and expertise to the group through special events and correspondence, and group members take what has been learned back to their respective communities. Members bring to the group their communities' views of various aspects of the watershed, and project staffs use this information in the creation and implementation of long-term watershed protection and restoration plans.

Current Community Leader Members:

1) Agricultural Representative : Jon Hansmeir, Minnesota Corn Growers Association, Present
2) Agricultural Representative : Dorothy Smith-Jacobs' s Minnesota Corn Growers Association, Regional Representative
3) Recreational/Small Business Representative: Dan Meer, Clearwater Outfitters, Owner
4) Point Source& Community Service Representative: Kevin Beadles, Elk River Wastewater treatment Plant, Wastewater Operator and Elk River Lions Club Vice President
5) Realtors Representative: Lynne Crandall, St. Cloud Area Association of Realtors
6) Sportsmen's Club/Native Land Management Representative: Brad Vierkant, Sauk Rapids Sportsman's Club, Prairie Restorations Site Manager
7) Lake Association and Elected Officials Representative: Charlotte Quiggle, Wright County COLA, Corinna Township official and board of adjustment
8) Agricultural Irrigation Representative: Tem Prom, East Central Irrigators Association

Creation of communication network

A communication network was designed and implemented in order to facilitate the quick transfer of project-related information out to project partners, current and emerging leaders, and the interested public. This network included: defined webpages on the MPCA's website, an active Facebook page, a recurring electronic newsletter, regular press releases to traditional news outlets, attendance at various civic group meetings to present of the project, and other means as opportunities arose. Information disseminated included: project updates, completed reports, events (both project related and watershed-related events being held by other groups), interesting stories and articles related to the watershed, ways to get involved, etc.



Zonation Questionnaires

In order to assist with the prioritization of watershed restoration and protection efforts as part of this project, DNR staff was brought in to offer their expertise with the Zonation process. The Zonation process allows for the input of various groups through the use of a questionnaire. From this, data is collected on various parameters, which in turn lead to the creation of prioritization maps to be used by implementation groups (LGUs, non-profits, etc.). Groups that took the survey include: the governing boards of CRWD, Wright County SWCD, Sherburne SWCD, and the ERWA; the CRWD's Advisory Committee, and the Watershed Community Leaders group. Results of the Zonation process can be found in Appendix D.

Future Plans

Currently, the various project partners are holding discussion on the future of the civic engagement committee, and the activities established as part of this project. Ideas include:

1. Creation of a formal agreement between the partners to work together on civic engagement activities within the MR-SC Watershed (build upon existing civic engagement, both through this project, and other existing activities).
2. Continue the committee in an informal capacity (maintain status quo).
3. Dissolving the committee, and discontinuing all activities.

If options one or two are chosen, this will require investment from the partners in the form of funds and staff time.

3.3 Restoration & Protection Strategies

Water quality restoration and protection strategies within the MR-SC Watershed were identified through collaboration with state and local partners. Local watershed partners (Sherburne, Benton, Stearns, and Wright SWCDs and CRWD) made a noteworthy effort to review and summarize restoration and protection strategies called out in reports completed in conjunction with the Monitoring and Assessment process as well as existing Water Plan related documents (a list of these plans can be found in Appendix A). The summarized work was presented to a panel of watershed technical experts for review; the resulting strategies are presented in Table 9.

Table 9 lists the strategies for restoration and protection by identifying BMPs that are appropriate for the subwatershed and/or impairment. Some site-specific considerations and new technologies are not covered; therefore, the strategies are not entirely prescriptive. To achieve optimal pollutant reductions, the strategies should be spatially-targeted to locations that will provide the most benefit using some of the tools and criteria identified in Section 3.1.

It should be pointed out that Table 9 is designed to help identify general recommended strategies for restoration and protection. These recommendations should be further refined and applied by local working groups. For example, water management organizations may have site-specific strategies that are considered a high priority based on characteristics such as land use, soil type, and slope. Thus, detailed planning will need to be completed to select site-specific BMPs, programs and funding activities. Additionally, because a strategy is not identified as a priority in a particular watershed does not necessarily mean that strategy is not appropriate for that location.

The prioritization of watersheds and strategies should be re-evaluated upon completion of HSPF models for this watershed in mid-2015. Eventually, the refined restoration and protection strategies may be reflected in local water plans, comprehensive watershed plans, and applications for federal and state clean water funds.

Table 9 is organized base on 11-digit HUC subwatershed, and the map below shows the location of each of these subwatersheds. Please refer to the map to assist with review of Table 9.

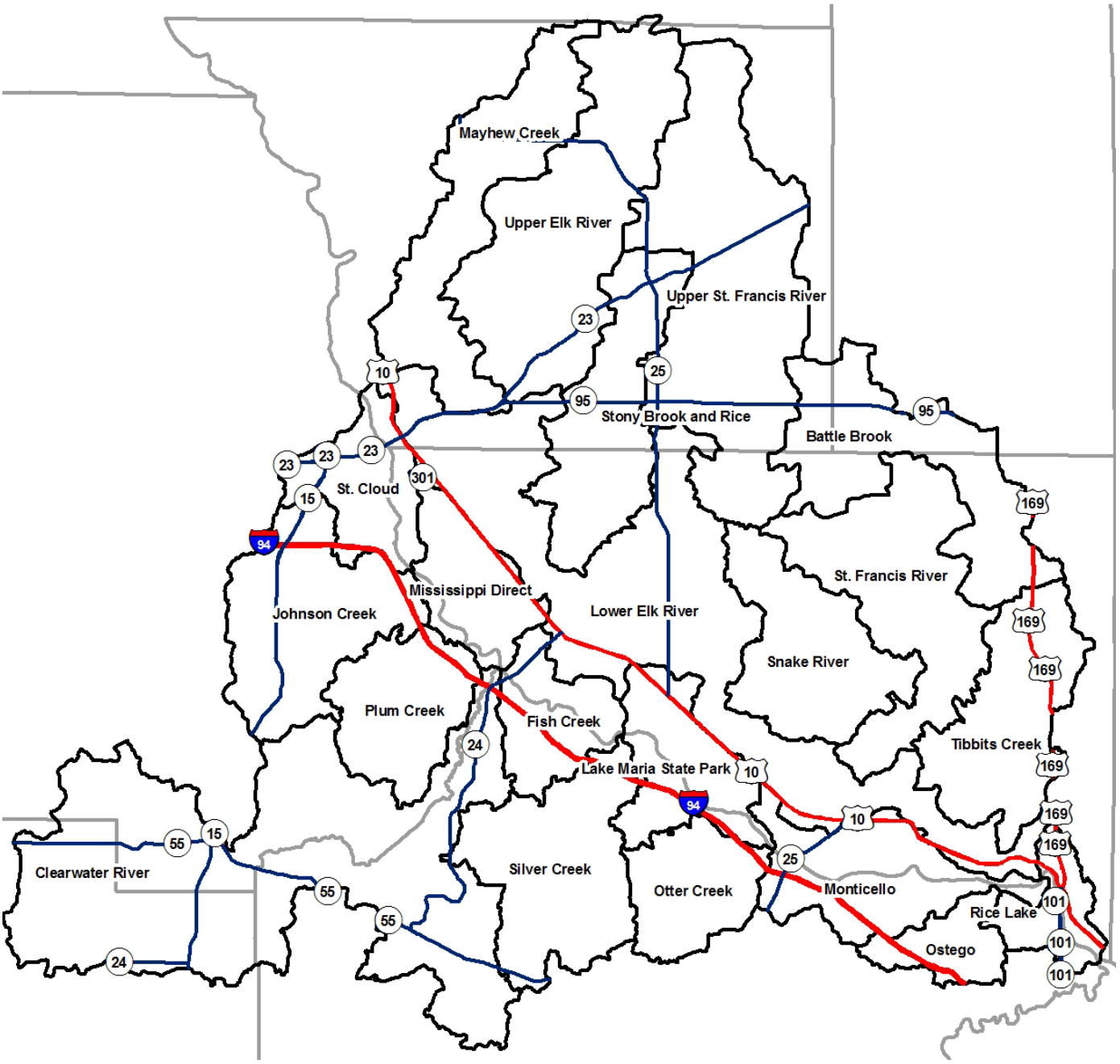


Figure 3.4 HUC 11 reference map for Table 9

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Table 9: Strategies and actions proposed for the Mississippi River St. Cloud Watershed.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
Upper Elk River 07010203010 IWM EQuIS ID S005-539 (HUC outlet monitoring location)	Highest levels of bedded sediments and lowest DO in farthest upstream reaches of this AUID. Low DO potentially caused by Increased nutrient concentrations which are causing elevated growth of aquatic plants. Cattle pastures are common in the upstream reaches and free animal access to the stream banks is accelerating bank erosion and increasing nutrient concentrations. Corridor is high priority in ERWA TMDLs-to address nutrient/turbidity impairment.	Elk River (07010203-508) *Headwaters to Mayhew Cr.*	**Benton,** Morrison	Deposited & Bedded Sediments (Habitat)[1]	55-75% embedded sediment[1]	Decrease in bedded sediments and stabilized channel	**Pasture Management**	Focus on riparian areas in Upper Watershed. Registered and unregistered operations.		•	•	•				•	0-5+ years	1	All feedlots along riparian corridor will be assessed for runoff. A project list will be compiled. Implementation to occur after list compiled. Feed management implemented.
				Bacteria[2]	Mean[3] = 419 Orgs/100mL[2]	126/1260Orgs/100mL[5]	**Feedlot Runoff Reduction**	Focus on riparian areas in Upper Watershed		•	•	•				•			
							Cropland Runoff Reduction	Focus on riparian areas in Upper Watershed.		•	•					•	0-5+ years	1	ERWA/CCRP buffer contracts protected; feed management implemented. Overall improved soil quality management
				Dissolved Oxygen (Habitat)[1]	5 mg/L daily minimum[1]	>5mg/L daily minimum[5]	**Hydrology Restoration**	Low DO seems to be at worst during low flows. Focus on activities that restore hydrology. Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage.		•	•		•			•	10+ years	3	Wetland restoration and soil quality initiative initiated. Other hydrologic opportunities investigated, including stream connectivity survey.
Mayhew Creek 07010203020 IWM EQuIS ID S002-946 (HUC outlet monitoring location)	Mayhew Creek has been channelized to allow water to flow more quickly off landscape, may have been done due to poor drainage capabilities of soils. Bank and field erosion are likely	Mayhew Creek (07010203-675) *Unnamed Creek to CD 7*	**Benton**	Loss of Habitat[1,15]	--	--	**Assess with Tiered Aquatic Life Use (TALU)**	DNR (EWR-CWL Regional Team) provides technical assistance for assessments-investigate opportunity. Determine feasibility of morphology restoration post-TALU Assessment. 2 stage ditch is compromise.				•	•	•			10+ years	3	Follow up on DNR technical assistance for assessment. Reassess at IWM with TALU[17] (Habitat/biology).
							Channel Morphology and Hydrology Restoration												
		Mayhew Creek	**Benton**	Bacteria[2]	Mean[3] = 1126 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Feedlot runoff Reduction**	Focus on Riparian Corridors. Registered and		•	•					•	0-5+ years	1	All feedlots along riparian corridor will be assessed for

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	contributing to fine sediment accumulation. Due to channelization, Aquatic Life recommendations will be differed until TALU. Low DO is likely in part caused by Mayhew Lake high nutrient concentrations. Mayhew Lake TMDL (ERWAMultiple TMDLs) was approved in 2012. Local staff indicates the TMDL target for this lake should be set to the shallow lake standard of 60 µg/L due to modification of the lake outlet.	(07010203-509) *Mayhew Lake to Elk River*					**Pasture Management**	unregistered operations											runoff. A project list will be compiled. Implementation to occur after list compiled. Feed management implemented.
				Dissolved Oxygen[2]	0.48 mg/L daily minimum[2]	>5 mg/L daily minimum[5]	Follow strategies to reduce nutrients for Mayhew Lake	Nutrient Reduction during spring flows.	--	--	--	--	--	--	--	--	5-10+ Years	2	Saturation of practices in Tier 1 & 2 areas per Mayhew Lake TMDL (ERW Multiple TMDLs)
		Mayhew Lake (07-0007)	**Benton**	Total Phosphorus[7]	171 µg/L[7]	40 µg/L [5] (78% reduction[6]	**For complete strategy list see Elk River Watershed (ERW)Multiple TMDLs 2012**	Nutrient Reduction during spring flows. Focus on riparian areas. General strategies listed below;	--	--	--	--	--	--	--	--	0-5+ years	1	Practices implemented in Tier & 2 areas as identified in ERWA TMDLs; reduced growing season total phosphorus
							Cropland Runoff Reduction	Focus on reducing spring nutrient loads.		•	•					•	0-5+ years	1	ERWA/CCRP buffer contracts protected; feed management implemented; harvestable filter strip program initiated. Overall improved soil quality management
							Pasture Management	Focus on riparian areas. Registered and unregistered operations.											
							Manage Internal Phosphorus	TBD-last in sequence		•		•	•			•	10+ years To be implemented after external sources are addressed.	3	Monitor water quality, if watershed sources have been addressed and water quality still exceeds standards then consider.
Upper St. Francis River 07010203060 IWM EQuIS ID S005-582 (HUC outlet monitoring location)	This reach is above the USFWS NWR where the USFWS maintains 3 dam structures to control wetland water elevation. The riparian corridor is noted to have been cleared for pasture and is heavily grazed. This has resulted in	St. Francis River (07010203-700) *Headwaters to Unnamed Lk (71-0371)*	**Benton,** Sherburne	Connectivity [1]	3 dams downstream[1]	--	**Channel Morphology and Hydrology Restoration**	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage. Dam Removal: Low priority stressor relative to others.		•		•	•				10+ years	3	Stream connectivity inventory completed.
				Bacteria[2]	Mean[3] = 249.47 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Pasture Management**	Focus on riparian areas.		•	•					•	0-5+ years	1	**ERWA/CCRP buffer contracts protected (highest priority);** harvestable filter strip program initiated; feed

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	a riparian zone that lacks deeply rooted vegetation necessary to protect stream banks and provide shading. Additionally, areas of bank erosion were observed along edges of cultivated cropland and even woodland riparian corridors (this suggests multiple pollution sources). Four of five AUIDs are channelized, thus aquatic life recommendations have been deferred for TALU.			Deposited & Bedded Sediments[1]	>70% embedded, D50 size 4.28[1]	--													management implemented; stream crossings for animals used in programs; Overall improved soil quality management
				Dissolved Oxygen/TP[1]	5.49 mg/L daily minimum;70µg/L [2]	>5 mg/L;<100 µg/L[5]	**Feedlot runoff reduction**	Particularly reduce sources of TP movement during early spring		•	•	•				•	0-5+years	1	
							Cropland Runoff Reduction			•	•					•	5-10+ years	2	
Stony Brook and Rice Creek 07010203030 IWM EQuIS ID S001-523	Stony Brook originates north of Foley and flows into Rice Lake where it is called Rice Creek at the outflow. Many of the tributaries flowing into Stony Brook have been channelized and	Stony Brook (07010203-546) *T36 R29W S17*	**Benton,** Sherburne	Aquatic Life (AL)[2]	Meets all criteria set for AL[5]	--	**Cropland Runoff Reduction** **Feedlot runoff reduction** **Pasture & Manure Management:**	Non-point source BMPs across the watershed-focus on riparian areas. If considering morphology restoration, focus on tributaries.	•	•	•	•				•	10+ years	3	Overall improved soil quality management Monitor during 2019 IWM process.
							Channel Morphology and Hydrology Restoration			•			•			•			

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location: Waterbody (ID)	Waterbody and Location: **Location** and Upstream Influence Counties	Parameter (incl. non-pollutant stressors)	Water Quality: Current Conditions	Water Quality: Goals / Targets	Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility: County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA	Timeline	Local Priority Level[14]	Interim 10-yr Milestones
	drain agricultural lands. In general, riparian habitat was good across all sites; however the stream bed was covered with fine sediment and had a lack of cover for fish. One AUID in in Rice Creek has been deferred for aquatic life recommendations due to Channelization. Rice Creek DO and Turbidity impairment is addressed in MR-SC TMDLs. In general, DO declines in the lower reaches where it widens and flows through a wetland with several backwater areas. The MR-SC TMDL indicates that reducing watershed loads of	Rice Creek (07010203-512) *Rice Lake to Elk River*	Sherburne, Benton	Dissolved Oxygen[2]	4.2 mg/L daily minimum[2,4]	>5 mg/L daily minimum[5]	**A complete description of strategies is described in MR-SC TMDLs 2014 Strategies listed below will address all three impairments**	General strategies listed below:	--	--	--	--	--	--	--	--	5-10+ years	2	IWM will occur prior to implementation. Condition will be assessed in 2019. If new data suggests Rice Creek is major contributor to Briggs Lake Chain this becomes Level 1.
							Manage Internal Load (Rice Lake, Curly leaf pondweed)	Gather additional in-lake data		•		•	•			•	5-10+	2	Collection of Total phosphorus, chl-*a*, Secchi depth plus field parameters Aquatic plant management plan for Rice Lake.
							Channel Morphology and Hydrology Restoration	Evaluate feasibility of replacing culvert on private drive, downstream CR 16		•		•	•			•			If funds become available and landowner expresses interest to replace culvert on private drive this will be completed.
				Turbidity[2]	12.18 mg/L TSS[2,4, 23]	30 mg/L TSS[22]	**Cropland Runoff Reduction**	Reduce nutrient loading focused on Riparian areas. Pasture and manure management should include registered and unregistered operations.	•	•	•					•	5-10+ years	2	If new data suggests rice Creek is a major contributor to Briggs Lake Chain, this becomes level 1. Initiate cover crop program.
							Feedlot Runoff Reduction		•	•	•	•				•			
							Pasture & Manure Management		•	•	•					•			

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	TP and nitrogen may be the most beneficial. Turbidity was noted to be caused by significant amounts of suspended detrital material. Per TMDL reporting, nutrient reduction to improve DO would be beneficial.			Bacteria[2]	Mean[3] = 667.33 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Repair leaking septic systems**	Riparian Focus	•			•					10+ years Lakes with TMDLs completed will be first	3	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways
Battle Brook 07010203070 IWM EQuIS ID S004-004	A dam located at the outlet of Elk Lake was identified to cause water to be backed up 0.6 miles above Elk Lake giving it the characteristic of a wetland. The backed up water in the lake allows for the settling of fine organic material on the stream bed upstream, decomposition lowers DO and materials smother habitat. The dam also impedes fish movement and causes a change in slope change resulting in saturated riparian wetlands. One AUID (county Ditch 6) has been deferred for aquatic life recommendations	Battle Brook (07010203-535) *CD 18 to Elk Lk*	**Sherburne**, Benton	Deposited and Bedded Sediments.[2]	100% silt and muck[2]	--	**Channel Morphology and Hydrology Restoration**	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage. Lower priority: Evaluate feasibility of increasing slope of stream upstream of Little Elk Lake		•		•	•				5-10+ years	2	Complete inventory process. Investigate partnerships to restore hydrology Current connectivity issues (Dam downstream Little Elk Lake) may restrict the impairments from meeting goals. May reconsider goals.
				Connectivity -Loss of fish passage[2]	Dam at outlet of Little Elk Lk[2]														
				Dissolved Oxygen[1]	3.48 mg/L daily minimum[2,4]	>5 mg/L daily minimum[5]	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	10+ years	3	Evaluate during 2019 WRAPS process. Overall improved soil quality management
							Cropland Runoff Reduction	Reduce nutrient loading focused on Riparian areas. Pasture and manure management should include registered and unregistered operations. Very few registered feedlots identified.	•	•	•					•			
							Feedlot Runoff Reduction		•	•	•					•			
							Pasture & Manure Management		•	•	•					•			
				Bacteria[2]	Mean[3] = 314.87 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Pasture & Manure Management**	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations.	•	•	•					•			
							Repair leaking septic systems		•			•							

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location: Waterbody (ID)	Waterbody and Location: **Location** and Upstream Influence Counties	Parameter (incl. non-pollutant stressors)	Water Quality: Current Conditions	Water Quality: Goals / Targets	Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility: County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA	Timeline	Local Priority Level[14]	Interim 10-yr Milestones
	due to Channelization. While the reduction of TP may have little effect on DO, there are registered feedlots and unregistered pasturing operations as well as cropland that may be contributing to high nutrients. Most lakes are shallow and located in the south east near the pour point. Diann and Cantlin Lakes have relatively small direct watersheds; Elk Lake receives the majority of water from this watershed.	Elk Lake (71-0046)	**Sherburne** Mille Lacs, Benton	Total Phosphorus[7]	73 µg/L[7]	60 µg/L[5]	**Follow Battle Brook Strategies**	Reduce nutrients at inflow (Battle Brook) and direct watershed.	--	--	--	--	--	--	--	--	5-10+ years	2	Approved TMDL during 2019 10-year cycle. Increase participation in cost share programs. ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	●	●						●			
							Repair leaking septic systems	Riparian Focus	●			●					10+ years	3	
		Diann Lake (71-0046)	**Sherburne**	Total Phosphorus[7]	66 µg/L[7]	60 µg/L[5]	**Manage/Protect Forest Cover**	Maintain/manage ≥25% forest cover in watershed		●							10+ years	3	Approved TMDL during 2019 10-year cycle. ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
							Pasture & Manure Management	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations.	●	●	●					●			
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	●	●			●			●			
							Repair leaking septic systems	Riparian Focus	●			●							
							Manage Internal Phosphorus	Last in sequence		●		●	●						
		Cantlin Lake (71-0041)	**Sherburne**	Total Phosphorus[7]	26 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Manage/ Protect Forest Cover**	Focus on South side of watershed where the bulk of forest cover remains – maintain minimum 25% forest cover		●			●			●	10+ years	3	Forest cover and diversity inventoried. Residential consultations offered.
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	●	●			●						No increase in total phosphorus identified during 2019 10-year cycle
							Repair leaking septic systems	Riparian Focus	●			●				●			ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
Lower Elk River 07010203040 IWM EQuIS ID	Water chemistry in Elk River from Mayhew Creek to Rice Cr is influenced by the	Elk River (07010203-507) *Mayhew Cr to Rice Cr*	**Benton,** Sherburne	Bacteria[2]	Mean[3] = 208.35 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	See strategies listed in Upper Elk & Mayhew Creek 11 HUC	Riparian Focus	●	●	●					●	0-5+ years	1	Will benefit Big Elk Lake

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
S000-278	Upper Elk 11 HUC. Elk River 07010203-579 bacteria impairment was addressed in the ERWA Multiple TMDLs (2012). All months had exceedances of the standard which indicates that bacteria cannot be attributed to a specific use or subwatershed and the impairment is most likely a land use issue throughout the entire watershed, most specifically in the riparian areas. The turbidity impairment on Elk River 07010203-579 is noted to be due to the Big Elk Lake nutrient impairment. Low dissolved oxygen is most likely tied to Big Elk Lake impairment as well. Briggs Creek was determined to be a warm water stream following discussions with DNR and was	Elk River (07010203-579) *Elk Lk to St. Francis R*	**Sherburne**, Benton	Bacteria[2]	Mean[3] = 208.35 Orgs/100mL[2,4]	126/1260 Orgs/100mL[5] (72.5% reduction[6])	**For complete strategy list see ERW Multiple TMDLs 2012**	Focus on sources contributing during mid to low flow[4]. High priority parcels identified in TMDLs.	--	--	--	--	--	--	--	--	--	--	--
							Pasture & Manure Management	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations.	●	●	●					●	0-5+ years	1	High priority parcels targeted with BMPs, Goal is 20 pasture and manure management plans completed
							Cropland Runoff Reduction												Inventory of potential buffer locations. Increased participation by landowners in federal programs
							Repair leaking septic systems	Riparian Focus	●			●					10+ years	3 (lakes first)	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
				Turbidity/TSS[2]	11.79 TSS[2]	100 TSS[4,5]	**For complete strategy list see ERW Multiple TMDLs 2012**	Focus on strategies outlined for Big Elk Lake Nutrient TMDL	--	--	--	--	--	--	--	--	0-5 years See Big Elk Lake (07-141)	1	Increased clarity in the Elk River, reduction in algal blooms in Big Elk Lake.
				DO/elevated TP[1,2]	<6.35mg/L[1], 90 µg/L[2]	>5 mg/L daily minimum[5]			--	--	--	--	--	--	--	--			Reassess during 2019 IWM, water quality identified as high priority.
				Bedded sediment causing lack of habitat[1]	75% embeddedness, D50 0.35, very fine sand[1]	--	**Pasture Management**	See Bacteria strategies above.	--	--	--	--	--	--	--	--	--	--	See Bacteria Strategies above. Reassess during 2019 IWM, water quality identified as higher priority.
		Elk River (07010203-548) *St. Francis R to Orono Lk* (Bacteria only)	**Sherburne**	Bacteria[2]	Mean[3] = 208.35 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Pasture & Manure Management**	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations.	●	●	●					●	0-5+ years	1	Sherburne SWCD targeting concurrently with 07010203-579; 20 pasture and manure management plans completed.
							Repair leaking septic systems	Riparian Focus	●			●					10+	3 (Lakes first)	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
		Briggs Creek (07010203-538)	Benton Sherburne	AL[2, 21]	Meets all criteria set for AL[5]	--	**Cropland Runoff Reduction** **Feedlot Runoff Reduction**	Focus on riparian areas. Pasture and manure management should include registered and	●	●	●	●				●	0-5+ years	1	Assess aquatic life with use class change for this AUID during 2019 cycle Inventory of potential BMP locations.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	assessed with Class 2B standards. One AUID in has been deferred for aquatic life recommendations due to Channelization. Elk Lake (71-0141) impairment was addressed in the ERWA Multiple TMDLs (2012). Donovan, Upper & Lower Orono, Briggs, Julia and Rush Lakes impairments are addressed in MR-SC TMDLs (2014).	*North line to Briggs Lk*					**Pasture & Manure Management**	unregistered operations.											Increased participation by landowners in federal programs; Overall improved soil quality management
		Donovan Lake (05-0004)	Benton	Total Phosphorus[7]	137 µg/L[7]	60 µg/L[5] (63% Reduction[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	10+	3	Cleanup strategy's initiated.
							NPDES point source compliance	Follow MPCA permit - minimal control measures				●					On-going	1	Strategies to address TMDL listed in next permit cycle. Permit in compliance.
							Cropland Runoff Reduction	Riparian Focus/directly connected to lake drainage system.	●	●	●					●	10+	3	Identify existing cropland with potential to influence lake system. Overall improved soil quality management
							Manage Internal Phosphorus	Last in sequence		●		●	●			●	10+	3	Healthy shallow lake system, improved habitat for wildlife.
		Upper Orono (71-0013-01)	Sherburne, Benton	Total Phosphorus[7]	132 µg/L[7]	60 µg/L[5] (48% Reduction4,[6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	10+	3	--
		Lower Orono (71-0013-02)	Sherburne, Benton		122 µg/L[7]		**NPDES point source compliance**	Follow MS4 permitted - minimal control measures				●					On-going	1	Strategies to address TMDL listed in next permit cycle. Permit in compliance.
							All Strategies listed for waters upstream.	Non-point source reduction across the Elk River Watershed. Focus is nutrient reduction in Elk River watershed, see strategies listed for Elk River 579-548	--	--	--	--	--	--	--	--	--	--	Records of upstream strategies implemented and supporting effectiveness information.
		Mitchell Lake (71-0082)	Sherburne	Total Phosphorus[7]	19 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Residential Runoff Reduction**	Focus on riparian and directly connected surfaces		●			●			●	0-5+ years	1	No increase in total phosphorus identified during 2019 assessment cycle. Continued coordination with Big and Mitchell Area Lakes Association and City of Big Lake to protect water quality.
		Big Lake (71-0081)	Sherburne		18 µg/L[7]		**NPDES point source compliance**	Follow MPCA permit - minimal control measures				●				●	On-going	1	
							Manage Internal Phosphorus	Investigate management of recycled nutrients.		●		●	●			●	5-10+	2	
		Thompson Lake (71-0096)	Sherburne	Total Phosphorus[7]	20 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Protect/manage forest Cover**	Maintain/manage minimum 25% forest cover		●							10+	3	Forest cover and diversity inventoried. Residential consultations offered.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	●	●			●			●			No increase in total phosphorus identified during 2019 assessment cycle; Overall improved soil quality management
							Repair improperly functioning septic systems	Riparian Focus	●			●				●			
		Camp Lake (71-0123)	Sherburne	Total Phosphorus[7]	17 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Cropland Runoff Reduction**	Riparian Focus	●	●	●					●			
							Shoreline Protection	Maintain natural/undisturbed shorelines	●	●			●			●			
							Repair leaking septic systems	Riparian Focus	●	●		●							
		Elk Lake (71-0141)	Sherburne	Total Phosphorus[7]	155 µg/L[7]	60 µg/L[5] (62% Reduction[4,6])	**For complete strategy list see ERW Multiple TMDLs 2012**	Follow strategies outlined in Elk river 579 turbidity impairment & Julia, Briggs, Rush Strategies below. Ditch 13 W side lake protection.	--	--	--	--	--	--	--	--	0-5+ years	1	Continued coordination with Briggs Lake Chain Association. 20 stormwater reduction practices implemented (2014-2016)
		Julia Lake (71-0145)[8]	Sherburne	Total Phosphorus[7]	65 µg/L[7]	60 µg/L[5] (no increase)	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed for Julia, Briggs and Rush Lakes listed below:	--	--	--	--	--	--	--	--			
							Manage/Protect Forest Cover	Maintain/manage minimum 25% forest cover in Julia Lake Watershed		●			●						Forest cover and diversity inventoried. Residential consultations offered.
		Briggs Lake (71-0146)[8]	Sherburne	Total Phosphorus[7]	97 µg/L[7]	40 µg/L[5] (56% reduction[4,6])	**Hydrology Manipulation**	Complete feasibility monitoring/analysis on Bayou for hydrological manipulation (flow/nutrients/elevation)		●		●	●			●	10+ years	3	Feasibility assessed if Lake Improvement District formation is successful.
							Gather additional data	Locations identified in Briggs Lake Chain Flyover (reports located at Sherburne SWCD)		●							0-5+ years	1	3 locations monitored for total phosphorus, ortho-phosphorus, and total suspended solids

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Riparian Focus	•	•	•						0-5+ years	1	Sherburne SWCD & NRCS currently targeting Inventory of potential buffer locations. Increased participation by landowners in federal programs. Increase in participation in Federal Programs; overall improved soil quality management
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	•	•			•				0-5+ years	1	20 stormwater reduction practices implemented. Continued partnership with Lake Association
							Repair leaking septic systems	Riparian Focus	•			•					5-10+ years	2	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
		Rush Lake (0147)[8]	Sherburne	Total Phosphorus[7]	104 µg/L[7]	60 µg/L (48% reduction[4,6])	**Manage Internal Phosphorus**	Last in sequence									10+ years	3	N/A
City of St. Cloud 07010203700	Other than short segment of the Mississippi River, the watershed has no sampleable tributary streams. High levels of impervious surface impact Lake George.	Lake George (73-0611)	Stearns	Total Phosphorus[7]	45 µg/L[7]	40 µg/L[7]	**NPDES point source compliance**	Follow MPCA permit - minimal control measures	City of St. Cloud								On-going	1	MS4 Permit compliance approved TMDL during 2019 10-year cycle. Internal phosphorus reduction strategies employed by the City of St. Cloud; Continued progress on Mississippi River Corridor Action items. Continued focus on stormwater reduction to the Miss River in NE and SE Cloud
							Manage Internal Phosphorus	Integrated strategy outlined by Chem2Hill.									5-10+ years	2	
St. Francis River 07010203080 IWM EQuIS ID S005-582	Water quality is influenced by Upper St. Francis HUC 11. Recommended to focus on early summer and better management of TP during the planting season for row	St. Francis River (07010203-704) *Unnamed Lk (71-0731) to Rice Lk* St. Francis	Sherburne, Benton	Deposited & Bedded Sediments[1]	>70%, D50 1.8mm medium fine sand[1]	--	**Pasture Management**	Focus on riparian areas. Pasture management should include registered and unregistered operations.	•	•	•						10+ years	3	Reassess during 2019 IWM, water quality identified as higher priority.
				Dissolved Oxygen[1]	0.2 mg/L daily minimum[1]	>5 mg/L daily minimum[5]	Gather Data in Wetlands	Monitor SOD in wetlands to determine effect on river				•		•			10+ years	3	USFWS is continuing to monitor for DO, trends will be monitored. Overall improved soil quality management
							Feedlot Runoff Reduction	Focus on **Upper St. Francis River HUC** 07010203060	•	•	•					•			

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	crops. Impoundments located in the NWR may have high SOD. River slope is affected by the impoundments which deposition of san din lower gradient section. Only 2 registered feedlots, smaller unregistered large animal operations may contribute to nutrient and bank failure due to animal access and trampling.	River (07010203-702) *Rice Lk to Elk R*					**Cropland Runoff Reduction** **Pasture and Manure Management**	strategies to reduce nutrients.											
				Connectivity -Loss of fish passage[1]	3 dams[1]	--	**Channel Morphology and Hydrology Restoration**	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage. Investigate stream restoration opportunities as identified.				•	•	•			10+ years	3	USFWS replaced the facing on radial gates in 2013; life expectancy is 20 years. Assess feasibility at that time. Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage
Mississippi River Direct 07010203690	Other than a short segment of the Mississippi River, the watershed has no sampleable tributary streams. Lakes identified as fully supporting are land-locked. Protection strategies for all three lakes are listed together.	Pickerel Lake (71-0158)[8]	Sherburne	Total Phosphorus[7]	26 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**NPDES point source compliance**	Follow MPCA permit - minimal control measures				•					On-going	1	MS4 Permit compliance
		Long Lake (71-0159)[8]			30 µg/L[7]		**Cropland Runoff Reduction**	Riparian Focus	•	•	•						0-5+ years		No increase in total phosphorus identified in 2019 assessment cycle. One Runoff reduction project on west side of Lake completed; overall improved soil quality management
		Round Lake (71-0167)[8]			29µg/L[7]		**Residential Runoff Reduction**	Focus on riparian and directly connected surfaces	•	•			•						Increased participation by lakeshore owners in stormwater reduction.
							Repair leaking septic systems	Riparian Focus	•			•					10+	3 (impaired priority 1 first)	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
	The headwaters of Johnson Creek drain agricultural landscapes and	Unnamed Creek-Robinson Hill Creek	Stearns	Bacteria[2]	Mean[3] = 3,222 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Feedlot Runoff Reduction**	Focus on riparian areas. Pasture and manure management should	•	•	•	•					0-5+ years	1	All feedlots compliance with Feedlot Rules. Increase in participation in Federal programs.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location: Waterbody (ID)	Waterbody and Location: **Location** and Upstream Influence Counties	Parameter (incl. non-pollutant stressors)	Water Quality: Current Conditions	Water Quality: Goals / Targets	Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility: County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA	Timeline	Local Priority Level[14]	Interim 10-yr Milestones
Johnson Creek 07010203710 (IWM EQuIS ID S003-370)	have been channelized to allow for increased drainage. There are 58 registered feedlots within this watershed. Notes indicate there are several feedlots with direct access to the stream in the watershed. The riparian corridor along AUID 07010203-639 is forested although a housing development is encroaching on the northern portion. There is diverse channel morphology and unembedded gravel and cobble in Johnson Creek 633 and Unnamed Creek 561 One AUID (724) in has been deferred for aquatic life recommendations due to Channelization.	(07010203-724) *CD 14 to CSAH 136* Unnamed Creek-*Luxemburg Ck* (07010203-561*)* Johnson Creek-Meyer (07010203-635) Creek *Unnamed Cr to Unnamed Cr* Johnson Creek-Meyer Creek (07010203-639) *T123 R28W, West line to Mississippi R*					**Pasture and Manure Management**	include registered and unregistered operations.		•	•	•					0-5+ years	1	Site visits made to feedlots to assess for installation of Agriculture Waste Management Systems and supporting practices.
							Urban and Rural Runoff Reduction	Focus on riparian and directly connected surfaces- addressed as identified with above practices.	•	•							5-10+ years	2	Identified pastures adjacent to creek. Begin working with landowners to develop pasture and manure management plans, livestock exclusions, and riparian buffers where needed. Increased participation by rural landowners in bacteria reduction practices
							Repair leaking septic systems	Riparian Focus	•			•					0-5+ years	2	ID and upgrade all ITPHS threat systems ID and upgrade all non-conforming systems near streams/waterways.
		Johnson Creek-Meyer Creek (07010203-639) *T123 R28W S14, West line to Mississippi R*	Stearns	AL but no stressor completed[2]	--	--	Hydrology and Channel Morphology	Hydrology Restoration: Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage.	•	•		•	•				5-10+ years	2	Complete inventory process Reassess during 2019 IWM, water quality identified as higher priority.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		Johnson Creek-Meyer Creek (07010203-633) *Unnamed Cr to Unnamed Cr* Unnamed Creek-Luxemburg Ck (07010203-561) *T123 R28W S30, South line to Johnson cr*	Stearns	AL[2]	Meets all criteria set for AL[5]	--	**Hydrology and Channel Morphology.**	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage. Focus on directly connected surfaces and riparian corridor.	•	•		•	•				5-10+ years	2	Complete inventory process. Opportunities for partnership to protect habitat investigated. Trout habitat is maintained. Water quality monitoring initiated. Long term flow gauging station installed.
		Beaver Lake (73-0023)	Stearns	Total Phosphorus[7]	17.33 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Cropland Runoff Reduction**	Riparian Focus		•	•						0-5 years	1	Contact with producers regarding tillage practices as well as nutrient and pest management techniques and other structure conservation practices as needed. Increased use of crop residue to reduce wind erosion.
							Feedlot Runoff Reduction		•	•	•								Site visits to feedlots to assess for installation of Agriculture Waste Management Systems and supporting practices.
Snake River 07010203050 (IWM EQuIS ID S003-006)	Snake River is a designated trout stream and was actively managed for brown trout from 1972-1979. Portions of the Snake River have been channelized, as such	Snake River (07010203-529) *Unnamed Cr to Eagle Lk Outlet*	Sherburne	Bacteria[2]	Mean[3] = 407.58 Orgs/100mL[2]	126-1260 Orgs/100mL[5]	**Pasture & Manure Management**	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations. Tributary to Elk River-	•	•	•					•	5-10+ years	2	Increased participation in local and federal programs, pasture and manure management program initiated. IWM will occur prior to implementation. Condition will be assessed in 2019.
							Repair leaking septic systems	Riparian Focus	•			•					10+ years	3	
		Eagle Lake (71-0067)	Sherburne	Total Phosphorus[7]	51 µg/L[7]	40 µg/L[5]	**Manage/Protect Forest Cover**	Maintain/manage minimum 25% forest cover		•			•			•			

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	assessments for aquatic life are deferred for TALU. However, two locations visited indicated favorable biological communities. Habitat, substrate and channel morphology were marginal. Cool/cold water temperatures and a stable flow regime likely maintain biological community. **Restoration and conservation easements should be obtained to maintain Resource.**						**Residential Runoff Reduction**	Focus on riparian and directly connected surfaces	•	•			•			•			
							Manage Internal Phosphorus	Last in sequence				•	•			•			
		Ann Lake (71-0069)	Sherburne	Total Phosphorus[7]	21 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Manage/Protect Forest Cover**	Maintain/manage minimum 25% forest cover		•			•				0-5+ years	1	Offer residential forest health consultations. Increased participation by lakeshore owners in stormwater reduction practices. No increase in total phosphorus identified in 2019 assessment cycle.
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces	•	•			•						
Tibbits Creek 07010203090 (IWM EQuIS ID S005-538)	The City of Zimmerman is located at the headwaters of Tibbits Brook and covers less than 8% of watershed area. Additionally, a small portion of the SNWR is in the watershed. Most streams have been channelized or are existing ditch systems. Two AUIDs (7010203-522 & 7010203-523) were been deferred for	Tibbits Brook (07010203-522) *Rice Lk to Elk R*	Sherburne	Bacteria[2]	Mean[3] = 203.13 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	Gather Additional Data	DO measurements recommended: Location: 07010203-522[2]		•						•	0-5+ years	1	Annual DO data gathered at 07010203-522 (before 9 AM)
							Pasture and Manure Management	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations.	•	•	•					•	10+ years	3	IWM will occur prior to implementation. Condition will be assessed and TMDL completed in 2019. Activities will be prioritized upon completion of TMDL
							Repair leaking septic systems	Riparian Focus	•			•							
		Fremont Lake (71-0016)	Sherburne	Total Phosphorus[7]	166.29 µg/L[7]	60 µg/L[5]	**Residential Runoff Reduction**	Focus on riparian and directly connected surfaces	•	•		•				•	10+ years	3	TMDL will be completed in during 2019 WRAPS process. Activities will be prioritized upon completion of TMDL
							Repair leaking septic systems	Riparian Focus	•			•							
							Manage Internal Phosphorus	Last in sequence		•	•		•			•			
		Birch Lake (71-0057)	Sherburne	Total Phosphorus[7]	48.17 µg/L[7]	40 µg/L[5]	**Manage/protect Forest Cover**	Maintain/manage minimum 20% forest cover		•			•				0-5+ Years	1	Forest cover and diversity inventoried. Residential tree health consultations offered.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	aquatic life recommendations due to Channelization. Birch Lake impairment is addressed in MR-SC TMDLs (2014).						**Follow activates outlined in MR-SC TMDL 2014 & Birch Lake Subwatershed Assessment (SWA) 2013**[16]	Adoption of practices and data collection identified in Birch SWA	--	--	--	--	--	--	--	--	0-5+ Years	1	Stormwater site assessments completed and SWA Practices Implemented, reduction or no increase in TP
							Manage Internal Phosphorus	Last in sequence		●		●	●			●	10+ Years	3	Investigate management of recycled nutrients. Hypolimnetic sampling if applicable
Plum Creek 07010203720	Many headwaters are channelized and have poor habitat. No outlet chemistry was collected in watershed due to its small size. Both Dallas and Feldges Lakes are classified as wetlands by DNR but have characteristics of a lake and were assessed as such. Fully supporting lakes BMPs are similar for all lakes and are listed as such.**	Plum Creek (07010203-572) *Warner Lk to Mississippi R*	Stearns	Bacteria[2]	N/A	126/1260 Orgs/100mL[5]	**Feedlot Runoff Reduction**	Riparian Focus (Lynden Township is lead party)	●	●	●	●					0-5+ years	1	Locally led improvement program leading to reduced bacteria concentrations. Initiation of cleanup strategies as identified via program.
							Pasture and Manure Management	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations. (Lynden Township is lead party)	●	●	●								
							Repair leaking septic systems	Riparian Focus(Lynden Township is lead party)	●			●					5-10+ years	2	Records of up-to-date compliant SSTS
		Dallas Lake (73-0001)	Stearns	Total Phosphorus[7]	25 µg/L[7]	No Increase State Standard: 60 µg/L[5]	**Manage/Protect Forest Cover** (strategy applies to all protection lakes here)	Maintain/manage minimum 20% forest cover					●				5-10+ years	2	Offer residential forest health consultations and inventory existing forest stands.
		Feldges Lake (73-0002)	Stearns		30 µg/L[7]	No Increase State Standard: 60 µg/L[5]													
		Maria Lake (73-0003)	Stearns		32 µg/L[7]	No Increase State Standard: 60 µg/L[5]	**Cropland Runoff Reduction** (strategy applies to all protection lakes here)	Riparian Focus	●	●	●	●					0-5+ years	2	Contact with producers regarding tillage practices as well as nutrient and pest management techniques and other structure conservation practices as needed. Increased use of crop residue to reduce wind erosion. Overall improved soil quality management
		Burnt Lake (73-0010)	Stearns		52 µg/L[7]	No Increase State Standard: 40 µg/L[5]													
		Warner Lake (73-0011)	Stearns		21 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Feedlot Runoff Reduction** (strategy applies										0-5+ years	2	Increased livestock exclusions and riparian buffers. Site visits to feedlots to assess

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		Long Lake (73-0004)	Stearns		52 µg/L[7]	No Increase State Standard: 40 µg/L[5]	to all protection lakes here)												for installation of Agriculture Waste Management Systems and supporting practices.
		Crooked Lake (73-0006)	Stearns		21 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Residential Runoff Reduction** (strategy applies to all protection lakes here)	Focus on existing and new residential development & target stormwater BMPs and shoreline buffers on individual lots.	•	•			•				5+ years	2	Increased participation by lakeshore owners in stormwater reduction practices.
		Quinn Lake (73-0007)	Stearns		24 µg/L[7]	No Increase State Standard: 40 µg/L[5]											5-10+ years	3	
Clearwater River 07010203730 (IWM EQuIS ID S004-508)	TMDLs completed prior to the WRAP process are summarized in CRWD TMDL Implementation Plan (2010). Because watersheds of both impaired and protection waters overlap in many cases, the District can address multiple issues at once. For example, BMPs used to address impairment in Lake Betsy and Clear Lake will improve water quality in downstream lakes. For this reason, the portion of the watershed above Lake Betsy is considered the highest priority by the CRWD. Three stream reaches were not assessed as part of	Clearwater River (07010203-511) *Clearwater Lake to Mississippi R* **Note:** Listed for AL[2, 10], but Full Support for AR[2], see below.	**Wright, Stearns,** Meeker	Deposited and Bedded Sediments[1]	>70% embeddedness, D50 3mm coarse sand[1]		**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling along stream & ditch banks. Pasture management should include registered & unregistered operations. Other riparian management may include streambank stabilization. Other various BMPs, both in immediate watershed and upstream, will also have a benefit. Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction		•	•	•				•		10+ years	3	HEL land plans are implemented
				Connectivity -Loss of Fish Passage[1]	2 dams[1]	--	Dam Removal Feasibility	Restricted to locations of dams. Low priority.	•				•		•		10+ years	3	Low priority, no 10-yr milestone established
				Dissolved Oxygen[1]	< 5mg/L Minimum	>5 mg/L daily minimum	**Force mixing of Clearwater River**	Weigland Lake-High Flow Note: A complete description of strategies is described in MR-SC TMDLs (2014)					•		•		10+ years	3	Low priority, no 10-yr milestone established
							Dam Modification	Grass Lake Dam					•		•		10+ years	3	Low priority, no 10-yr milestone established

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location: Waterbody (ID)	Waterbody and Location: **Location** and Upstream Influence Counties	Parameter (incl. non-pollutant stressors)	Water Quality: Current Conditions	Water Quality: Goals / Targets	Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility: County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA	Timeline	Local Priority Level[14]	Interim 10-yr Milestones
	the MR-SC Watershed Project due to channelization; aquatic life recommendations have been deferred for TALU. (County ditch 20 (07010203-533) County ditch 44 (07010203-550), Clearwater river (07010203-549). There are 46 lakes, 25 were assessed for use support as part of MR-SC Watershed Project. The following lakes were not assessed due to insufficient data: Nixon Lake (86-0238), Wiegand Lake (86-0242), Grass Lake (86-0243) and Clearwater Lake West (86-0252) Free access of cattle and horses to water is common. In some areas the riparian corridor has been cleared for pasture and heavily grazed; the resulting						**Channel Morphology Restoration**	Upstream Weigland Lake					•		•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction	Targeted Fertilizer Implementation, cover crops, other ag BMPs; riparian management, such as bank stabilization; pasture and feedlot management should include registered & unregistered operations. Review HEL land and ensure erosion control plans are being implemented	•	•	•		•		•		10+ years	3	Watkins Stormwater Treatment Project implemented, Kimball Stormwater Treatment Project completed
							Cropland Runoff Reduction		•	•	•				•		5-10 years	2	Work focused in upper watershed of Clearwater River, see items for Lakes Albion, Betsy, Clear, Henshaw and Swartout.
							Pasture, Feedlot & Manure Management / Reduction		•	•	•				•		10+ years	3	HEL land plans are implemented
		Clearwater River (07010203-511) *Clearwater Lk to Mississippi R*	**Wright, Stearns,** Meeker	FS-AR (Bacteria)	69.46 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Manage/Protect Forest cover**	Riparian Corridor protection; streambank stabilization	•	•	•	•	•		•		10+ years	3	Existing forest cover is maintained
							Pasture, Feedlot & Manure Management / Reduction **Feedlot Runoff Reduction**	Reduce animal trampling along stream & ditch banks. Pasture management should include registered & unregistered operations. Wright Co. has identified one priority feedlot with elevated pollution concerns.	•	•	•				•		10+ years	3	Priority feedlot is upgraded
		Threemile Creek (07010203-545) *Unnamed stream outlet of Lk Lur to T122 R28W S36*	**Stearns**	AL[2, 10]	Exceeds criteria for aquatic life for fish species	--	**Additional stressor assessment work needed;** likely stressor are due to land use in watershed	Since large portions of watershed are agricultural use, BMPs focused of improving ag practices will likely benefit this waterbody; riparian BMPs will also likely have a benefit	•	•	•	•			•		10+ years	3	Conduct additional stressor assessment work as part of IWM in 2019

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	corridor lacks deep rooted vegetation which is needed to protect streambanks and provide shading. The lower section of the Clearwater river is disconnected from the Mississippi River by a dam located at CR75 just northwest of Clearwater. The dam directs flow at high velocity. There is also a dam at Lake Marie outlet near Stearns CR 7. Both dams impede fish migration and repopulation. The CRWD conducts an ongoing water quality monitoring program. Reports generated from this program can be reviewed at: http://crwd.org/water_quality_monitoring_reports.html	Clearwater River (07010203-717) *Scott Lk to Lk Louisa* **Note:** Listed for AL[2, 10], but Full Support for AC[2].	**Stearns, Wright,** Meeker	Deposited and Bedded Sediments[1]	>70% embeddedness, D50 3mm coarse sand[1]		**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling along stream & ditch banks. Pasture management includes registered & unregistered operations.	•	•	•				•		10+ years	3	Low priority, no 10-yr milestone established
							Manage/Protect Forest cover	Riparian Corridor protection; streambank stabilization	•	•	•	•	•		•		10+ years	3	Existing forest cover is maintained
							Cropland Runoff Reduction	Other various BMPs, both in immediate watershed and upstream will also have a benefit.	•	•	•				•		5-10 years	2	Work focused in upper watershed of Clearwater River, see items for Lakes Albion, Betsy, Clear, Henshaw and Swartout
							Residential, Rural & Urban Runoff Reduction	Riparian management may include streambank stabilization and shoreline restorations. Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		10+ years	3	Watkins Stormwater Treatment system implemented; HEL land plans are implemented
				Connectivity -Loss of Fish Passage[1]	2 dams[1]	--	Dam Removal Feasibility	Restricted to locations of dams. Low priority.	•				•		•		10+ years	3	Low priority, no 10-yr milestone established
		Clearwater River (07010203-549) County ditch 44 to Lk Betsy Note: A complete description of strategies is described in CRWD DO & Bacteria	Meeker	Dissolved Oxygen[11]	< 5mg/L daily minimum	>5 mg/L daily minimum	**Mitigate Wetland Impacts** **Channel Morphology and Hydrology Restoration**	Kingston Wetland Restoration (Clearwater River, low flow channel)	•	•	•		•		•		0-5 years	1	The Kingston Wetland Restoration Project has been completed, annual monitoring will continue to establish effectiveness of project
							Residential, Rural & Urban Runoff Reduction **Cropland Runoff Reduction**	Streambank stabilization, Targeted Fertilizer implementation, cover crops, field erosion controls, tile intake / outlet improvements, other ag BMPs; Watkins Stormwater Treatment	•	•	•				•		0-10 years	1,2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs, Watkins Stormwater Treatment will be implemented

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		TMDL (2010)		Bacteria[11]	Mean[3] = >1,000 Orgs/100mL[4-wait]	126/1260 Orgs/100mL[5] (35-92% reduction[4,6])	**Pasture, Feedlot & Manure Management / Reduction**	Riparian Focus, registered and unregistered operations; manure management BMPs	•	•	•				•		0-10 years	1,2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
		Unnamed Creek (Fairhaven Creek) (07010203-565) *Headwaters to Lk Louisa*	**Stearns**	Bacteria (E-Coli)		126/1260 Orgs/100mL[5]	**Additional stressor assessment work needed; Pasture & Feedlot Management**	Riparian Focus, registered and unregistered operations.	•	•	•	•			•		10+ years	3	Conduct additional stressor assessment work as part of IWM in 2019
		Clear Lake (47-0095)	**Meeker**	Total phosphorus[7]	185 µg/L[7]	60 µg/L[5] (90% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management Note: Fuller descriptions of strategies for following water bodies is described in CRWD Watershed Protection and Improvement Plan (2009)	•				•		•		10+ years	3	Low priority, no 10-yr milestone established
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore); Notch Weirs, sand/iron and/or limestone filter systems, sediment basins, other erosion controls	•	•	•				•		5-10 years	2	Installation of filtration system at north inlet to Clear Lake, improved shoreline management around lake, retention of existing forest cover

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
		Betsy Lake (47-0042)	**Meeker**	Total phosphorus[7]	172 µg/L[7]	40 µg/L[5] (87% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Aeration; Hypolimnetic Withdrawal; Rough Fish Management	•				•		•		0-5 years	1	Completion of feasibility study and installation of internal phosphorus management project in Lake Betsy
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore); Kimball Stormwater Phases I & II; Watkins Stormwater Treatment	•	•	•				•		0-5 years	1	Installation of Watkins Stormwater Treatment system, improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
		Marie Lake (73-0014) Note: Upper Watershed is prioritized due to riverine system	**Stearns, Wright,** Meeker	Total phosphorus[7]	108.17 µg/L[7]	60 µg/L[5] (43% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Management of rough fish continues, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		0-5 years	1	Stearns County Environmental Services: Inventory of ISTSs in riparian areas, funding allocated to assist low-income households in upgrading ISTSs

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Installation of Watkins Stormwater Treatment system, completion of Kimball Stormwater Treatment Project improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Louisa Lake (86-0282) Note: Upper Watershed is prioritized due to riverine system	**Stearns, Wright**, Meeker	Total phosphorus[7]	66 µg/L[7]	40 µg/L[5] (57% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Management of rough fish continues, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		0-5 years	1	Stearns County Environmental Services: Inventory of ISTSs in riparian areas, funding allocated to assist low-income households in upgrading ISTSs
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Installation of Watkins Stormwater Treatment system, completion of Kimball Stormwater Treatment Project improved shoreline management around lake, retention of existing forest cover

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Union Lake (86-0298)	**Meeker, Wright**	Total phosphorus[7]	73 µg/L[7]	40 µg/L[5] (26% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Feasibility study of rough fish management conducted, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Riparian Focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Scott Lake (86-0297) Note: Upper	**Meeker, Wright**	Total phosphorus[7]	185 µg/L[7]	40 µg/L[5] (85% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Feasibility study of rough fish management conducted, feasibility study of internal phosphorus management completed

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		Watershed is prioritized due to riverine system					**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Installation of Watkins Stormwater Treatment system, completion of Kimball Stormwater Treatment Project improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Caroline Lake (86-0281) Note: Upper Watershed is prioritized due to riverine system	**Stearns, Wright,** Meeker	Total phosphorus[7]	82 µg/L[7]	40 µg/L[5]	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Feasibility study of rough fish management conducted, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		0-5 years	1	Stearns County Environmental Services: Inventory of ISTSs in riparian areas, funding allocated to assist low-income households in upgrading ISTSs

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Installation of Watkins Stormwater Treatment system, completion of Kimball Stormwater Treatment Project improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Augusta Lake (86-0284) Note: Upper Watershed is prioritized due to riverine system	**Stearns, Wright**, Meeker	Total phosphorus[7]	68 µg/L[7]	40 µg/L[5] (27% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		5-10 years	2	Feasibility study of rough fish management conducted, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		0-5 years	1	Stearns County Environmental Services: Inventory of ISTSs in riparian areas, funding allocated to assist low-income households in upgrading ISTSs
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Installation of Watkins Stormwater Treatment system, completion of Kimball Stormwater Treatment Project improved shoreline management around lake, retention of existing forest cover

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Swartout Lake (86-0208)	**Wright**	Total phosphorus[7]	422 µg/L[7]	60 µg/L[5] (90% reduction[46])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		0-5 years	1	Continue rough fish management, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction	Protect & restore natural vegetation in riparian areas (including lakeshore); Notch Weirs, sand/iron and/or limestone filter systems, sediment basins, other erosion controls	•	•	•				•		0-5 years	1	Completion of Cedar Lake Watershed Protection & Improvement Project
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Completion of Cedar Lake Watershed Protection & Improvement Project, Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Albion Lake (86-0212)	**Wright**	Total phosphorus[7]	199 µg/L[7]	60 µg/L (91% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		0-5 years	1	Continue rough fish management, feasibility study of internal phosphorus management completed

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Residential, Rural & Urban Runoff Reduction	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		10+ years	3	Low priority, no 10-yr milestone established
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Henshaw Lake (86-0213)	**Wright**	Total phosphorus[7]	208 µg/L[7]	40 µg/L (93% reduction[4,6])	**Manage Internal Phosphorus**	Ex. Internal Load Management; Rough Fish Management	•				•		•		0-5 years	1	Continue rough fish management, feasibility study of internal phosphorus management completed
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		5-10 years	2	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Residential, Rural & Urban Runoff Reduction	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		10+ years	3	Low priority, no 10-yr milestone established
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Cedar Lake (86-0227)	**Wright**	Total Phosphorus[7]	31 µg/L[7]	20 µg/L (per CRWD goals)	**Upper Watershed Management**	See Albion, Henshaw, and Swartout Lakes							•		0-5 years	1	Work focused in upper watershed of Cedar Lake, see items for Lakes Albion, Henshaw and Swartout

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Septic System Management	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/Protect Forest cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•	•					5-10 years	2	Improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•	•			•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Little Mud Lake (47-0096)	Meeker	Total Phosphorus[7]	49 µg/L[7]	40 µg/L[7]	**Cropland Runoff Reduction**	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
							Manage/protect existing forested areas (>20%)	Minimize development (LID strategies employed), riparian management enforced	•	•	•				•		10+	3	Retention of existing forest cover
		Otter Lake (73-0015)	Stearns	Total Phosphorus[7]	22 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		10+ years	3	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
							Manage/protect existing forested areas (>20%)	Minimize development (LID strategies employed), riparian management enforced	•						•		10+	3	Retention of existing forest cover

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		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		Laura Lake (73-0020)	Stearns	Total Phosphorus[7]	20 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		10+ years	3	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
		Island Lake (73-0042)	Stearns	Total Phosphorus[7]	29 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Cropland Runoff Reduction**	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs	•	•	•				•		0-5 years	1	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs
							Manage/protect Forest Cover (37%)	Minimize development (LID strategies employed), riparian management enforced	•						•		10+	3	Retention of existing forest cover
		Bass Lake (86-0234)	Wright	Total Phosphorus[7]	18 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		10+ years	3	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/protect Forest Cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		5-10 years	2	Improved shoreline management around lake, retention of existing forest cover
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
		Pleasant Lake (86-0251)	Wright	Total Phosphorus[7]	29 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Pasture, Feedlot & Manure Management / Reduction**	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		10+ years	3	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction	Protect & restore natural vegetation in riparian areas (including lakeshore); City of Annandale stormwater conveyance systems in place (work w/ city to add treatment)	•	•	•				•		5-10 years	2	Improved shoreline management around lake, retention of existing forest cover, implement improvements to City of Annandale Stormwater
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
		Clearwater (East) (86-0252)	Wright	Total Phosphorus[7]	33 µg/L[7]	No Increase State Standard: 40 µg/L[7]	**Upper Watershed Management**	See Cedar Lake Sub-watershed as well as Upper Clearwater Sub-watershed									0-5 years	1	Refer to other lakes above Clearwater Lake
							Pasture, Feedlot & Manure Management / Reduction	Reduce animal trampling in riparian areas, riparian focus, registered and unregistered operations; manure management BMPs	•	•	•				•		10+ years	3	Prioritization of feedlots in need of upgrades, pastures in need of better management, and improvements to manure application methods occurs
							Repair Leaking Septic Systems	Riparian Focused, faulty system are brought into compliance	•						•		10+ years	3	Low priority, no 10-yr milestone established
							Residential, Rural & Urban Runoff Reduction **Manage/protect Forest Cover**	Protect & restore natural vegetation in riparian areas (including lakeshore)	•	•	•				•		0-5 years	1	Implement Kimball Stormwater and Watkins Stormwater Treatment Projects, improved shoreline management around lake, retention of existing forest cover

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Cover Crops, Targeted Fertilizer, Tile Intake / Outlet Improvements, other ag BMPs Review HEL land and ensure erosion control plans are being implemented	•	•	•				•		5-10 years	2	Targeted Fertilizer Application will be implemented across the watershed to this reach; increased implementation of other ag. BMPs; HEL land plans are implemented
Fish Creek 07010203740	A pour point water chemistry station was not established within the Fish Creek watershed due to the small size of the watershed. Turbidity data was collected from Fish Creek (between Sheldon Lake and Fish lake) and there were no exceedances. The Fish Lake impairment is addressed in MR-SC TMDLs (2014). The Mississippi River is noted to backflow into the lake under high water conditions.	Fish Lake (86-0183)	Wright	Total Phosphorus[7]	48 µg/L[7]	40 µg/L[5] (22% reduction[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	0-5+ years	1	Cleanup strategy's initiated.
							Gather Additional Data	Find suitable location between lake and Mississippi River to monitor elevation, flow and nutrients to determine impact of Miss River on lake.		•									Data gathered and analyzed
							Mitigate Wetland Impacts	Limited to impacted wetland areas, monitoring may be necessary		•									Scale of wetland impact assessed.
							Cropland Runoff Reduction	Riparian focus in Fish Creek Watershed	•	•	•								HEL lands reviewed and erosion control plans are being implemented.
Silver Creek 07010203750 IWM EQuIS ID S005-540	There is a dam located in the AUID between the Silver Creek 662 and 556, located approximately .4 miles downstream from Curtis Road,	Silver Creek (07010203-662) *Unnamed Cr to Silver Lk* &	Wright	Deposited & Bedded sediments[1]	37% sand & 53% small gravel, D50 4.57mm[1] (upstream dam) 10.31mm[1](downstream dam)	--	**Channel Morphology and Hydrology Restoration**	Investigate feasibility of dam removal-Restricted to Curtis avenue dam.		•		•	•				10+ years	3	Reassess during 2019 IWM, water quality identified as higher priority.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	which acts as a fish barrier. The site above the dam scored very low for fish IBI. Downstream of the dam is also unsuitable for habitat due to scour. Bedded sediments are caused by the dam which backs up water and impacts the slope which and allows for settling of small particles on the stream bed. Low DO is likely caused by high nutrients (algae) in Locke Lake. Feedlots and unregistered pasturing operation may contribute to bank failure due to animal trampling. Mink, Somers, Indian, Silver and Locke Lake impairments are addressed in MR-SC TMDLs (2014).	(07010203-557) *Locke Lk to Mississippi R*		Connectivity -Loss of Fish Passage[1]	1 dam[1]	--	**Cropland Runoff Reduction**	Riparian corridor and directly connected lands focus.	●	●	●						0-5+ years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
				Dissolved Oxygen1,[2]	1.5 mg/L daily minimum2	>5 mg/L daily minimum[5]	Investigate effects of Locke Lake Nutrient reduction on DO.	Locke Lake Focus		●		●					10+ years	3	See Locke Lake Milestones
		Silver Creek (07010203-557)	Wright	Bacteria[2]	Mean[3] = 137 Orgs/100mL[2]	126/1260 Orgs/100mL[5]	**Pasture and Manure Management**	Focus on riparian areas. Pasture and manure management should include registered and unregistered operations. (practices support Silver Lake and Locke Lake)	●	●	●						0-5+ years	1	Increase in participation in Federal Programs and County Feedlot Rules compliance.
							Feedlot Runoff Reduction		●	●	●	●							
		Indian Lake (86-0223)	Wright	Total Phosphorus[7]	47 µg/L[7]	40 µg/L[5] (21% reduction[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	0-5+ years	1	Cleanup strategy's initiated.
							Cropland Runoff Reduction	Riparian corridor and directly connected lands focus.	●	●	●							1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces-Residential properties											Increased participation in stormwater reduction practices.
							Manage Internal Phosphorus	Last in sequence				●	●				10+ years	3	N/A
		Little Mary South (86-0139) & Little Mary North (86-0139)	Wright	Total Phosphorus[7]	106 µg/L[7], 163 µg/L[7]	40 µg/L[5]	**Cropland Runoff Reduction**	Riparian corridor and directly connected lands focus.	●	●	●						10+ Years	3	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Mitigate Wetland Impacts	Limited to impacted wetland areas, monitoring may be necessary		●	●						10+ Years	3	Scale of wetland impact assessed.
		Silver Lake (86-0140)	Wright	Total Phosphorus[7]	105 µg/L[7]	40 µg/L[5] (57% reduction[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	5-10+ years	1	Cleanup strategy's initiated.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Cropland Runoff Reduction	Riparian focus (and directly connected areas) along Silver Creek	•	•	•								HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Mitigate Wetland Impacts	Identify phosphorus exporting wetlands for lake watershed		•							0-5+ years	1	Identify phosphorus exporting wetlands and locate phosphorus sequestering areas
							Protect quality of Sandy Creek[9]	Restoration/protection practices focused at Sugar and Limestone Lakes	--	--	--	--	--	--	--	--	0-5+ years	1	No degradation of water quality in creek. Strategies to protect Sugar and Limestone Lakes Implemented.
		Millstone Lake (86-0152)	Wright	Total Phosphorus[7]	357 µg/L[7]	60 µg/L[5]	**Cropland Runoff Reduction**	Riparian focus (and directly connected areas), appears to be a lack of buffers	•	•	•						10+ years	3	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
		Locke Lake (86-0168)	Wright	Total Phosphorus[7]	66 µg/L[7]	60 µg/L[5] (44% reduction[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	0-5+ years	1	Cleanup strategy's initiated.
							Mitigate Wetland Impacts	Identify phosphorus exporting wetlands for lake watershed		•									Identify phosphorus exporting wetlands and locate phosphorus sequestering areas
							Upstream Nutrient Strategies	Upstream focus: follow strategies outline for Silver Lake (86-0140)	--	--	--	--	--	--	--	--			Upstream strategies implementation initiated
		Mink Lake (86-0229) & Somers Lake (86-0230)	Wright	Total Phosphorus[7]	134 µg/L[7]	60 µg/L[5] (70% & 41% reduction respectively[4,6])	**A complete description of strategies is described in MR-SC TMDLs 2014**	General strategies listed below:	--	--	--	--	--	--	--	--	0-5+ years	1	Cleanup strategy's initiated.
							Cropland Runoff Reduction	Riparian Focus(and directly connected areas), in Mink Lake Watershed	•	•	•						0-5+ years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Feedlot/Manure Management	Wright Co. has identified one priority feedlot with elevated pollution concerns	•	•	•								Increase in participation in Federal Programs and County Feedlot Rules compliance.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
					84 µg/L[7]		**Mitigate Wetland Impacts**	Limited to impacted wetland areas, monitoring may be necessary; Identify phosphorus exporting wetlands for lake watershed		•	•							Scale of wetland impact assessed; Identify phosphorus exporting wetlands and locate phosphorus sequestering areas
							Residential Runoff Reduction	Focus on riparian and directly connected surfaces-residential properties	•	•			•				5+ years	2	Increased participation in stormwater reduction practices.
		Limestone Lake (86-0163)	Wright	Total Phosphorus[7]	24 µg/L[7]	No Increase State Standard: 40 µg/L	**Cropland Runoff Reduction**	Riparian Focus (and directly connected areas)	•	•	•						0-5 years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Manage/protect existing forested land (22%)	Maintain/manage minimum 20% forest cover		•			•				5-10+ years	2	No reduction in forested lands. Residential forest health consultations offered and inventories of existing communities completed.
		Sugar Lake (86-0233)	Wright	Total Phosphorus[7]	20 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Cropland Runoff Reduction**	Riparian Focus(and directly connected areas)	•	•	•						0-5+ years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
							Feedlot/Manure Management	Riparian Focus Wright Co has identified one priority feedlot with elevated pollution concerns	•	•	•	•							Increase in participation in Federal Programs and County Feedlot Rules compliance.
							Mitigate Wetland Impacts	Identify phosphorus exporting wetlands for lake watershed		•									Identify phosphorus exporting wetlands and locate phosphorus sequestering areas
							Residential Runoff Reduction	Focus on minimizing runoff from existing and new residential developments	•	•			•						Increased participation in stormwater reduction practices.
		Mary Lake (86-0156)	Wright	Total Phosphorus[7]	35 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Cropland Runoff Reduction**	Riparian Focus(and directly connected areas)	•	•	•						0-5+ years	2	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
							Feedlot/Manure Management	Wright Co. has identified one priority feedlot with elevated pollution concerns	•	•	•								Identified feedlot pollution mitigated.
							Mitigate/Protect Wetland Impacts	Limited to impacted wetland areas, monitoring may be necessary; Identify phosphorus exporting wetlands for lake watershed		•	•							Increase in participation in Federal Programs and County Feedlot Rules compliance; Identify phosphorus exporting wetlands and locate phosphorus sequestering areas
		Ember Lake (86-0171)	Wright	Total Phosphorus[7]	24 µg/L[7]	No Increase State Standard: 40 µg/L[5]	**Cropland Runoff Reduction**	Riparian Focus(and directly connected areas)	•	•	•						0-5 years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
Otter Creek 07010203770	There are 13 lakes in this small watershed, only 5 were assessed for aquatic recreation use. Three additional lakes were assessed; however, the existing data was determined to be insufficient (Mud, Long, Bertram). Lake restoration strategies are listed together.	Birch Lake (86-0066)	Wright	Total Phosphorus[7]	18.57 µg/L	No Increase State Standard: 40 µg/L[5]	**Protect forested land ≥30%**	Maintain/manage minimum 25% forest cover		•			•				0-5 years	1	No reduction in forested lands. Residential forest health consultations offered and inventories of existing communities completed.
		Cedar Lake (86-0073)			17 µg/L														
		Ida Lake (86-0146)			14 µg/L		**Cropland Runoff Reduction**	Riparian Focus(and directly connected areas)	•	•	•						0-5 years	1	HEL lands reviewed and erosion control plans are being implemented; overall soil quality management improved
		Eagle Lake (86-0148)			32 µg/L		**Residential Runoff Reduction**	Focus on minimizing runoff from existing and new residential developments	•	•			•				0-5 years	1	Increased participation in stormwater reduction practices.

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
Lake Maria State Park 07010203760	No waters in this unit were assessed; this watershed contains a short segment of the Mississippi River. Lakes within this watershed were not large enough for monitoring. A separate monitoring strategy will be competed for this HUC (Miss River monitoring)	No waters assessed	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Assess condition of surface water upon Mississippi River Monitoring implementation	--	State Park Land preservation.
Monticello Watershed 07010203780	No waters in this unit were assessed; the watershed is split between Sherburne and Wright counties. A separate monitoring strategy will be competed for this HUC (Miss River monitoring)	No waters assessed	Sherburne, Wright	--	--	--	--	--	--	--	--	--	--	--	--	--	Assess condition of surface water upon Mississippi River Monitoring implementation	--	--
Otsego 07010203790	The riparian corridor along unnamed creek is forested and channel morphology was noted to be good; however, channelization of >40% of the stream has diminished habitat. Habitat is degraded	Unnamed Creek (07010203-528) *T121 R23W S19, south line Mississippi R*	Wright	Loss of Habitat due to Channelization/ ditching[1]	--	--	**NPDES point source compliance**	Follow MPCA permit - minimal control measures				•					On-going	1	Strategies to address TMDL listed in next permit cycle. Permit in compliance.
							Channel Morphology and Hydrology Restoration.	Evaluate feasibility of reshaping channelized reaches. 2 Stage ditch is a compromise		•		•	•				10+ years	3	Reassess during 2019 IWM, water quality identified as higher priority.
				Deposited & Bedded Sediments[1]	20% silt, 67% sand 13% gravel; D50 0.35mm[1]	--	**Streambank Restoration**	Restoration of deep rooted vegetation-Focus on non-vegetated streambanks		•			•						
							Increase/replace woody debris to create scour pools.	Identify critical locations to place debris		•		•	•						

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
	due to Fine sediments which are accumulating due to channel incision from altered hydrology due to upstream channelization and increased Stormwater (development and agriculture) runoff and bank failure. There are 7 road crossings downstream of unnamed lake 86-0351 that have culverts. 3 have culverts with large scour holes on the DS side indication that the culvert is undersized or improperly installed.			Dissolved Oxygen[1]	<5 mg/L daily minimum[1]	>5mg/L daily minimum[5]	**Channel Morphology and Hydrology Restoration**	Create Riffles: Critical location: low gradient reaches				•	•					
				Connectivity -loss of fish passage[1]	3 culverts[1]	--	**Channel Morphology and Hydrology Restoration**	Investigate feasibility of replacing 3 culverts: Restricted to identified private culverts				•	•					
		School Lake (86-0025)	Wright	Total Phosphorus[7]	261 µg/L[7]	60 µg/L[5]	**NPDES point source compliance**	Follow MPCA permit - minimal control measures				•				On-going	1	Approved TMDL during 2019 10-year cycle. Permit in compliance.
		Hunters Lake (86-0026)			521 µg/L[7]		**Residential Runoff Reduction**	Focus on minimizing runoff from existing and new residential developments	•	•						10+ Years	3	Approved TMDL during 2019 10-year cycle. Increased participation in stormwater reduction practices.
Rice Lake	No waters in this unit were assessed. A separate monitoring strategy will be created for this HUC.	Not assessed	--	--	--	--	--	--								Assess condition of surface water upon Mississippi River Monitoring implementation		

HUC-11 Subwatershed	Subwatershed Source Description	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Strategies[12, 18, 20] (see Table 10 below)	Estimated Scale of Adoption Needed[13]	Governmental Units with Primary Responsibility								Timeline	Local Priority Level[14]	Interim 10-yr Milestones
		Waterbody (ID)	**Location** and Upstream Influence Counties		Current Conditions	Goals / Targets			County	SWCD	NRCS	MPCA	DNR	USFWS	CRWD	ERWA			
Key: Red rows = impaired waters requiring restoration; Green rows = unimpaired waters requiring protection																			

1: Identified stressor in MR-SC Stressor ID Report 2012 / **2:** Identified in MR-SC Monitoring and Assessment Report 2012 / **3:** Geometric mean of all samples is provided for E. coli / **4:** Refer to TMDL for more detailed information / **5:** Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List, MPCA 2014 Assessment Cycle. / **6:** Percent reduction identified in TMDL / **7:** Water Quality Assessments of Select Lakes within the MR-SC Watershed 2012 / **8:** Chain of Lakes, TMDLs and strategies are listed together / **9:** Protection activities include minimizing residential, cropland and feedlot runoff / **10:** No stressor ID completed / **11:** Impairment not listed in MR-SC Monitoring and Assessment Report, separate TMDL completed. / **12:** Civic Engagement and outreach, while not listed specifically, is considered a critical component to all strategies identified in this table. / **13:** Currently this column provides supplemental detail regarding strategy focus areas. Scale of reduction will be refined upon completion of HSPF models (2014) / **14:** Local priority level definitions: 1= High Priority (0-5 years); 2= medium priority (5-10 years); 3= (10+/not a priority). Priorities are based off local input and priority management zoning tools. Reasons water body may be listed as higher priority: 1) completed TMDL, 2) the area/water was identified as high priority via DNR Zonation modeling, 3) high priority local water. / **15:** This reach was identified as impaired for Aquatic Life during the MR-SC assessment process and some preliminary stressor ID work was completed. It is important to note that technical committee determined that a full Stressor ID should be completed upon adoption of Tiered Aquatic Life Use (TALU) standards. / **16:** Subwatershed Analysis completed in cooperation with Metro Conservation District. Report is located at Sherburne SWCD. / **17:** TALU based assessments are projected to begin in 2015 / **18:** The BMP reduction strategies are intended to provide a roadmap as to the type of implementation activities that could be used to achieve goals for protection or restoration. Recommended BMP strategies are based off majority land use and local information where available. It is recognized that additional planning activities are necessary to optimize ongoing efforts, collect additional water quality data, and promote change. / **19:** Timeline levels: 0-5 years; 5-10 years; 10+ years. Extended timelines are due to a combination of factors such as lack of staff, low priority impairment (i.e. aquatic life vs water quality), low priority activity, no funding available. / **20:** Periodic reviews for the effectiveness of existing ordinances meant to protect water quality are considered standard with each set of BMP strategies. / **21:** Reach was assessed based on use class included in table and existing use class as defined in Minn. Rule 7050 is different. MPCA is currently in the process of changing the existing use class for this AUID in rule based on an analysis of the biological community and temperature data. **22**: See Wenck Technical Memorandum (Wenck, 2013). The Central River Nutrient (CNR) Region threshold of 30 mg/L was used to calculate the reductions to be conservative and due to the lack of a substantial dataset in calculating the TSS-surrogate./ **23**: Only 16% of samples collected from 2000-2012 violated the CNR standard. Current condition shown is average.

Table 10: Key for Strategies Column

Primary Strategy Category	Description (NRCS code if applicable)	Reference
Pasture Management (registered and unregistered operations)	Livestock Exclusion/Fencing (382 and 472)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 45
	Prescribed Grazing (528)	NRCS Field office Technical Guide
	Riparian and Channel Vegetation (322/390)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 99
	Riparian Forest Buffer (391)	NRCS Field office Technical Guide
	Stream Crossing (578)	NRCS Field office Technical Guide
	Harvestable Filter Strip	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 55, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
	Feed Management	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 53, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
	Agricultural Land Preservation/Reservation Programs (CRP, CCRP, etc.)	USDA Programs: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=landing
Manure Management (registered and unregistered operations)	Compost Facilities	Manure and Pasture Management for Recreational Horse Owners, UMN Extension pg. 6
	Planned Manure Spreading	Manure and Pasture Management for Recreational Horse Owners, UMN Extension pg. 4
	Manure Hauling Services	Manure management: ERWATMDLs Implementation Plan; service example: http://www.horsefarmservices.com
	Waste Storage Facility (313)	NRCS Field office Technical Guide
	Nutrient Management (590)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 48
Feedlot Runoff Reduction (registered and unregistered operations)	Roof Runoff Management (558)	NRCS Field office Technical Guide
	Feedlot/Wastewater Filter Strips (635)	NRCS Field office Technical Guide
	Clean Runoff Water Diversion (362)	NRCS Field office Technical Guide
	Constructed (treatment) Wetlands	Ag-BMP Handbook pg. 146
	Waste Storage Facility (313)	NRCS Field office Technical Guide
	Grade Stabilization at Side Inlets (410)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 137
	Sediment Basin (350)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 134
	Riparian Forest Buffer (391)	NRCS Field office Technical Guide
	Harvestable Filter Strip	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 55, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
	Feed Management	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 53, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
Cropland Runoff Reduction	Riparian and Channel Vegetation (322/390)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 99
	Conservation Cover (327)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 22
	Crop Residue Management (329, 345, 346)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 94
	Conservation Crop Rotation (328)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 26
	Contour Buffer Strips (332)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 28
	Contour Farming (330)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 28
	Cover Crops (340)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 37
	Grade Stabilization	Ag-BMP Handbook pg. 40
	Nutrient Management (590), including test plots	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 48
	Constructed (treatment) Wetlands (656)	NRCS Field office Technical Guide; EPA Constructed wetlands handbook
	Grassed Waterways	Ag-BMP Handbook pg. 84
	Filter Strips (393)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 125
	Field Borders (386)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 125
	Sediment Basin (350)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 134
	Alternative Tile Intakes	Ag-BMP Handbook pg. 67
	Contour Strip cropping (585)	NRCS Field office Technical Guide
	Terrace (600)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 113
	Controlled Drainage (554)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 75
	Riparian Forest Buffer (391)	NRCS Field office Technical Guide
	Soil Quality Management (several practices)	NRCS Field office Technical Guide
	Harvestable Filter Strip	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 55, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
	Feed Management	Little Rock Lake and Creek Watershed Protection and Improvement Plan, pg. 55, http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf
	Highly Erodible Land (HEL) Determination	NRCS Field office Technical Guide
	Agricultural Land Preservation/Reservation Programs (CRP, CCRP, etc.)	USDA Programs: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=landing
Residential Runoff Reduction (directly connected to surface waters-low to medium density)	Wise Site Planning	MPCA Lakes Guide to Protection & Management pg. 10
	Minimize Waterfront Alterations	MPCA Lakes Guide to Protection & Management pg. 11
	Modify Yard Care	MPCA Lakes Guide to Protection & Management pg. 11
	Reduce Runoff from Yard (and strategies listed under Urban and Rural Runoff Reduction)	MPCA Lakes Guide to Protection & Management pg. 11
	Modified boating, swimming and fishing practices	MPCA Lakes Guide to Protection & Management pg. 13
	Streambank and Shoreline Protection (580)	NRCS Field office Technical Guide
	Filter Strips (393)	NRCS Field office Technical Guide
	Riparian and Channel Vegetation (322/390)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 99
Urban & Rural Runoff Reduction	Sediment Basin (350)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 134
	Constructed (treatment) Wetlands	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 146
	Infiltration basin and filtration trench	MPCA Stormwater Manual
	Filtration	MPCA Stormwater Manual
	Bioretention	MPCA Stormwater Manual
	Stormwater Re-Use and Rainwater Harvesting	MPCA Stormwater Manual
	Permeable Pavement	MPCA Stormwater Manual
	Iron Enhanced Sand Filter	MPCA Stormwater Manual
	Tree BMPs	MPCA Stormwater Manual
	Urban Forestry	MPCA Stormwater Manual
	Hydrodynamic Devices	MPCA Stormwater Manual
	Filtration Devices	MPCA Stormwater Manual
	Turf	MPCA Stormwater Manual

Primary Strategy Category	Description (NRCS code if applicable)	Reference
	Chemical Treatment	MPCA Stormwater Manual
Manage/Protect Forest Cover	Forest Stand Improvement (666)	NRCS Field office Technical Guide
	Riparian Forest Buffer (391)	NRCS Field office Technical Guide
	Urban Forestry	MPCA Stormwater Manual
	Forest Stand Preservation/Management	My Minnesota Woods, Sherburne SWCD
Mitigate Wetland Impacts	Wetland Restoration (651)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 151
	Wetland Phosphorus Reduction / Inactivation	MPCA Lakes Guide to Protection & Management pg. 20, St. Anthony Falls Laboratory
NPDES Point Source Compliance	MS4 Permit- Minimal Control Measures	Stormwater Program for Municipal Separate Storm Sewer Systems (MS4)
	Construction General Permit	Stormwater Program for Construction Activity
	Industrial Stormwater Multi-Sector	Industrial Stormwater Program
	Minimal Impact Design Standards	MPCA Stormwater Manual
Manage Internal Phosphorus	Sediment Phosphorus Inactivation	MPCA Lakes Guide to Protection & Management pg. 20
	Hypolimnetic Withdrawal	MPCA Lakes Guide to Protection & Management pg. 20
	Curly-leaf Pondweed Management	Contact DNR representative
	Biomanipulation	MPCA Lakes Guide to Protection & Management pg. 20
	Rough Fish Management	Contact DNR representative
	Aeration	MPCA Lakes Guide to Protection & Management pg. 20
	Dredging	MPCA Lakes Guide to Protection & Management pg. 20
Repair Leaking Septic Systems	SSTS Upgrade	MPCA SSTS Program
	Community Sewer Systems	MPCA SSTS Program
Channel Morphology and Hydrology Restoration	Natural Channel Restoration	Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage
	Two Stage Ditch	Ag-BMP Handbook pg. 115
	Dam Removal	Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage
	Wetland Restorations (651)	NRCS Field office Technical Guide, Ag-BMP Handbook pg. 151
	Culvert Modification	Reducing localized impacts to river systems though proper geomorphic sizing of in-channel and floodplain openings at road/river intersections, DNR 2013.
	Manage for Soil Quality	Ag-BMP Handbook pg. 115

4. Monitoring Plan

Data from three monitoring programs will continue to be collected and analyzed for the MR-SC Watershed as part of *Minnesota's Water Quality Monitoring Strategy* (PCA, 2011). These monitoring programs are summarized below:

1. The Intensive Watershed Monitoring (MPCA, 2012) collects water quality and biological data throughout each major watershed once every ten years. This work is scheduled for its second iteration in the MR-SC Watershed in 2019. This data provides a periodic but intensive "snapshot" of water quality throughout the watershed. In addition to the monitoring conducted in association with this process, each local unit of government associated with water management may have their own monitoring plan. All data collected locally should be submitted regularly to the MPCA for entry into the EQuIS database system.
2. The Watershed Pollutant Load Monitoring Network (MPCA, 2014) intensively collects pollutant samples and flow data to calculate daily sediment and nutrient loads on either an annual or seasonal (no-ice) basis. In the MR-SC Watershed, there are three proposed seasonal subwatershed pollutant load monitoring sites.
3. The Citizen Surface Water Monitoring Program (MPCA, 2014) is a network of volunteers who make monthly lake and river transparency readings. Several dozen data collection locations exist in the MR-SC Watershed. This data provides a continuous record of one water quality parameter throughout much of the watershed.

In addition to the monitoring conducted in association with the WRAPS process, each local unit of government associated with water management may have their own monitoring plan. Furthermore, there are many citizen monitors throughout the watershed collecting both stream and lake data. All data collected locally should be submitted regularly to the MPCA for entry into the EQuIS database system.

5. References and Further Information

Benton County Soil and Water Conservation District. 2013. "Little Rock Lake and Creek Watershed Protection and Improvement Plan (TMDL Implementation Plan)." Located at: http://www.soilandwater.org/images/SWCD/pdf/Little%20Rock%20Implementation%20Plan%20FINAL.pdf.

Central Minnesota Water Education Alliance. 2014. Located at: http://www.mnwaterconnection.com/.

Conservation Biology Informatics Group. 2014. "Zonation: Conservation Planning Software." Located at: http://cbig.it.helsinki.fi/software/zonation/.

Minnesota Board of Water and Soil Resources. 2014. "Ecological Ranking Tool." Located at: http://www.bwsr.state.mn.us/ecological_ranking/.

Minnesota Department of Agriculture. 2012. "The Agricultural BMP Handbook for Minnesota." Located at: http://www.mda.state.mn.us/protecting/cleanwaterfund/research/agbmphandbook.aspx.

Minnesota Department of Natural Resources. 2010. "Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage." Located at: http://files.dnr.state.mn.us/eco/streamhab/reconnecting_rivers_intro.pdf.

Minnesota Department of Natural Resources. 2011. "More about the Mississippi River: St. Cloud to Anoka." Located at: http://www.dnr.state.mn.us/watertrails/mississippiriver/seven_more.html.

Minnesota Geospatial Information Office. 2013. "LiDAR Information." Located at: http://www.mngeo.state.mn.us/chouse/elevation/lidar.html.

Minnesota Department of Natural Resources. 2013. "Reducing Localized Impacts to River Systems Through Proper Geomorphic Sizing of On-Channel and Floodplain Openings at Road/River Intersections." Located at: http://files.dnr.state.mn.us/eco/streamhab/geomorphology/reducing-rior.pdf.

Minnesota Department of Natural Resources. 2013. "Watershed Health Assessment Framework." Located at: http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/.

Minnesota Pollution Control Agency. 2004. "Guide to Lake protection & Management." Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/lakes/lake-protection-and-management.html.

Minnesota Pollution Control Agency. 2011. "Minnesota's Water Quality Monitoring Strategy 2011 to 2021." Located at: http://www.pca.state.mn.us/dm0r8f7

Minnesota Pollution Control Agency. 2011. "MPCAs Milestone program." Located at: http://www.pca.state.mn.us/0agxf5e.

Minnesota Pollution Control Agency. 2012. "Watershed sampling design: Intensive watershed monitoring." Located at: http://www.pca.state.mn.us/index.php?option=com_k2&view=item&id=1197

Minnesota Pollution Control Agency. 2012a. "Mississippi River (St. Cloud) Watershed." Located at: http://www.pca.state.mn.us/hqzqdd6.

Minnesota Pollution Control Agency. 2012b. "Mississippi River (St. Cloud) Watershed Monitoring and Assessment Report." Located at: http://pca.state.mn.us/hqzqdd6.

Minnesota Pollution Control Agency. 2012c. "Industrial Stormwater BMP Guidebook." Located at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

Minnesota Pollution Control Agency. 2012d. "Water Quality Assessments of Select Lakes within the Mississippi River (St. Cloud) Watershed." Located at: http://www.pca.state.mn.us/hqzqdd6.

Minnesota Pollution Control Agency. 2013. "Nutrient Reduction Strategy." Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/nutrient-reduction/nutrient-reduction-strategy.html.

Minnesota Pollution Control Agency. 2013a. "Construction Stormwater" Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/construction-stormwater/index.html.

Minnesota Pollution Control Agency. 2013b. "Municipal Separate Storm Sewer Systems (MS4)." Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/municipal-stormwater/municipal-separate-storm-sewer-systems-ms4.html.

Minnesota Pollution Control Agency. 2013c. "Nitrogen in Minnesota Surface Water." Located at: http://www.pca.state.mn.us/6fwc9hw.

Minnesota Pollution Control Agency. 2013d. "Mississippi River-St. Cloud Stressor Identification Report." Located at: http://www.pca.state.mn.us/hqzqdd6.

Minnesota Pollution Control Agency. 2013e. "Statewide Mercury TMDL Pollutant Reduction Plan." Located 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

Minnesota Pollution Control Agency. 2014. "Citizen Water Monitoring." Located at: http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/volunteer-water-monitoring/volunteer-surface-water-monitoring.html.

Minnesota Pollution Control Agency. 2014. "Impaired Waters List." Located at: http://www.pca.state.mn.us/lupg1125.

Minnesota Pollution Control Agency. 2014. "Mississippi River St. Cloud Watershed Total Maximum Daily Loads Report." Located at: http://www.pca.state.mn.us/hqzqdd6.

Minnesota Pollution Control Agency. 2014. "Stormwater BMP Manual." Located at: http://www.pca.state.mn.us/pyria84.

Minnesota Pollution Control Agency. 2014. "Subsurface Sewage Treatment Systems Program." Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/subsurface-sewage-treatment-system-ssts/index.html.

Minnesota Pollution Control Agency. 2014. "Water Permits." Located at: http://www.pca.state.mn.us/enzq915.

Minnesota Pollution Control Agency. 2014. "Watershed Pollutant Load Monitoring Network." Located at: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/watershed-pollutant-load-monitoring-network.html.

Minnesota State Demographic Center. 2012. "2010 Census Results." Located at: http://www.demography.state.mn.us/Census2010/.

National Park Service & Friends of the Mississippi River. 2013. "State of the River Report." Located at: http://stateoftheriver.com/state-of-the-river-report/

Omernik, J. M. and A. L. Gallant. 1988. "Ecoregions of the Upper Midwest States." Environmental Protection Agency publication PL-12J.

Radke, B., Hinz, L., Horntvedt, J., Chazdon, S., Hennen, M.A., and Allen, R. 2011. "Civic Engagement at a Glance." University of Minnesota Extension. Located at: http://www.extension.umn.edu/community/civic-engagement/engage-citizens-decisions/#section-one.

United States Department of Agriculture. 1997. "Forestry Best Management Practice for Wetlands." Located at: http://www.srs.fs.usda.gov/pubs/680.

United States Department of Agriculture. 2007a. "Census of Agriculture: Benton County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture. 2007b. "Census of Agriculture: Sherburne County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture. 2007c. "Census of Agriculture: Stearns County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture. 2007d. "Census of Agriculture: Meeker County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture. 2007e. "Census of Agriculture: Mille Lacs County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture. 2007f. "Census of Agriculture: Wright County, Minnesota." National Agricultural Statistics Service. Located at: http://www.agcensus.usda.gov/index.php.

United States Department of Agriculture, Farm Service Agency. 2014. "Conservation Programs." Located at: http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=landing.

United States Department of Agriculture, Natural Resources Conservation Service. 2013. "Field Office Technical Guide." Located at: http://efotg.sc.egov.usda.gov/efotg_locator.aspx.

U.S. Environmental Protection Agency (EPA). 2012a. "Causal Analysis/Diagnosis Decision Information System." Located at: http://www.epa.gov/caddis/.

U.S. Environmental Protection Agency (EPA). 2012b. "What is Non-Point Pollution?" Located at: http://water.epa.gov/polwaste/nps/whatis.cfm.

United States Environmental Protection Agency (EPA). 2013. "Constructed Wetlands." Located at: http://water.epa.gov/type/wetlands/restore/cwetlands.cfm.

United States Geological Survey. 2014. "Hydrological Simulation Program--Fortran." Located at: http://water.usgs.gov/software/HSPF/.

University of Minnesota. 2002. "Shoreland BMP factsheets." Located at: http://www.shorelandmanagement.org/depth/bmp.pdf.

University of Minnesota. 2009. "MyMinnesotaWoods." Located at: http://www.myminnesotawoods.umn.edu/.

University of Minnesota, Extension. 2013. Civic Engagement. Located at: http://www.extension.umn.edu/community/civic-engagement/.

University of Minnesota, Extension. 2013. "Manure and pasture management for recreational horse owners." Located at: http://www.extension.umn.edu/agriculture/horse/care/manure-and-pasture-management-for-recreational-horse-owners/.

University of Minnesota, St. Anthony Falls Laboratory. 2012. Located at: http://www.safl.umn.edu/.

Water on the Web. 2004. "Ecoregions" Located at: http://www.waterontheweb.org/under/lakeecology/18_ecoregions.html.

Mississippi River – St. Cloud Reports

All Mississippi River – St. Cloud reports referenced in this watershed report are available at the Mississippi River – St. Cloud Watershed webpage: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html

Appendix A: Directory of Plans & Surface Water Resource-related Studies within the Mississippi River (St. Cloud) Watershed

Table 11: Directory of Plans & Surface Water Resource-Related Studies within the Mississippi River (St. Cloud) Watershed

Plan/Report	Lead Agency	Plan focus	Location
State of the River Report, 2013	NPS & Friends of the Mississippi River	Mississippi River	http://stateoftheriver.com/state-of-the-river-report/
Sherburne County Local Water Management Plan, 2007-2017	Sherburne SWCD	Sherburne County	http://www.sherburneswcd.org/Programs/LWP
Benton County Local Water Management Plan, 2008-2018	Benton SWCD	Benton County	http://www.soilandwater.org/water-plan
Stearns County Comprehensive Water Management Plan, 2008-2017	Stearns County	Stearns County	http://www.co.stearns.mn.us/Environment/WaterResources/ComprehensiveWaterPlanning
Wright County Local Water Management Plan, 2006-2015	Wright SWCD	Wright County	http://www.wrightswcd.org/docs/WaterPlan.pdf
Wright County Local Water Management Plan Amendment, 2011	Wright SWCD	Wright County	http://www.wrightswcd.org/docs/Wright2011Amendment.pdf
Clearwater River Watershed District Watershed Management Plan, 2010	Clearwater River Watershed District	CWRD	http://crwd.org/about_us.html
Mille Lacs County Local Water Management Plan, 2006-2017	Mille Lacs SWCD	Mille Lacs	http://www.millelacsswcd.org/water-management-plan/
Meeker County Comprehensive Local Water Plan, 2013-2023	Meeker County	Meeker County	http://www.co.meeker.mn.us/index.asp?Type=B_BASIC&SEC={FF938334-855B-4037-9FC3-ABDE81974281}
Morrison County Water Plan, 2010-2020	Morrison SWCD	Morrison County	http://morrisonswcd.org/programs-services/water-plan/
Mercury Pollutant Reduction Plan	MPCA	State-Wide	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection
Clearwater River & Lake Louisa TMDL	CRWD	CRWD	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection
Upper Mississippi River Bacteria TMDL	MPCA	Upper Miss	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection
Clearwater River (Upper Miss) 5 Lks Nutrient TMDL	CRWD	CRWD	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection
ERWA TMDL	ERWA	Elk River Watershed	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection
Clearwater River (Upper Miss) Low Oxygen TMDL	CRWD	CRWD	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html#restoration-and-protection

Plan/Report	Lead Agency	Plan focus	Location
2012 Northeast Drainage Analysis, St. Cloud Minnesota	St. Cloud/Benton SWCD	City of St. Cloud	http://mn-stcloud.civicplus.com/documentcenter/view/2152
Hydrological Effects of Impoundments in Sherburne NWR, 1984	USGS	Sherburne NWR	Sherburne National Wildlife Refuge
St. Francis River Fish Passage Feasibility Study	USFWS & Inter-Fluve Inc.	Sherburne NWP-St. Francis River	Sherburne National Wildlife Refuge
Big & Mitchell Lake LMP, 2009	Big Lake Area Lakes Association	Big and Mitchell Lakes - Sherburne County	http://www.lakesassociation.org/
Briggs Lake Chain LMP, 2007-2010	Briggs Lake Chain Association	Julia, Briggs, Rush, Big Elk Lakes	https://www.briggslakechainassociation.com/
Lake Fremont LMP, 2002	Lake Fremont Improvement Association	Lake Fremont	Sherburne SWCD
Little Elk Lake LMP, 2004	Little Elk Lake Improvement Association	Little Elk Lake	http://littleelklake.com/index.php/lake-information
Lake Orono LMP, 2003	Lake Orono Improvement Association	Lake Orono	http://www.lakeorono.org/
Briggs Lake Chain Phosphorus Mass Balance	Sherburne SWCD	Julia, Briggs, Rush, Big Elk Lakes	http://www.sherburneswcd.org/ERWSA/ERWS.htm
Briggs Lake Chain Infra-Red Flyover	AW Research Laboratories	Julia, Briggs, Rush, Big Elk Lakes	Briggs Lake Chain Association
Upper Mississippi River Source Water Protection Plan	MN Department of Health	Watershed Wide	http://www.umrswpp.com/project.htm
Sherburne County Lake Assessment Report, 1998	MPCA	Birch, Julia, Briggs, Rush, Big Elk Lake	MPCA, Sherburne SWCD
Fish Lake Assessment Report, 1992	MPCA	Fish Lake, Wright County	MPCA, Sherburne SWCD
Mink and Somers Lakes Assessment Report, 1993	MPCA	Mink and Somers Lakes, Wright County	MPCA, Sherburne SWCD
Indian Lake Assessment Report, 1988	MPCA	Indian Lake, Wright County	MPCA, Sherburne SWCD
CRWD District Watershed Protection and Improvement Plan	CRWD	CRWD	http://www.crwd.org/tmdl_reports.html
Rapid Watershed Assessment for the Mississippi River-St. Cloud Watershed	USDA NRCS	Watershed Wide	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mn/technical/?cid=nrcs142p2_023592

Plan/Report	Lead Agency	Plan focus	Location
Watershed Assessment Map book for the Mississippi River – St. Cloud Watershed	DNR	Watershed Wide	http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/wsmb17.pdf
Watershed Health Assessment Framework for the Mississippi River – St. Cloud Watershed	DNR	Watershed Wide	http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#
Mississippi River - St. Cloud Watershed Monitoring and Assessment	MPCA	Watershed Wide	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html
Mississippi River - St. Cloud Watershed Stressor ID	MPCA	Watershed Wide	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html
Mississippi River - St. Cloud Watershed Total Maximum Daily Load	MPCA	Watershed Wide	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html
Water Quality Assessments of Select Lakes within the Mississippi River - St. Cloud Watershed	MPCA	Watershed Wide	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/mississippi-river-st.-cloud.html
Upper Mississippi River Basin Planning, 2003	MPCA	Upper Mississippi River Basin	http://www.pca.state.mn.us/pyriaba
MPCA State-Wide Nutrient Reduction Strategy		StateWide	http://www.pca.state.mn.us/86h6wwa

Appendix B: MR-SC Lakes and Streams TMDLs Summary

Table 12: MR-SC Lakes TMDLs existing phosphorus loading

Lake	Phosphorus Source	Phosphorus Load (lbs. / year)
Donovan Lake (05-0004-02)	Watershed	241
	Atmospheric	12
	Groundwater	12
	Internal	87
	Total	**352**
Julia Lake (71-0145-00)	Watershed	97
	Atmospheric	34
	Inflow from Upstream Lakes	--
	Groundwater	34
	Internal	212
	Total	**376**
Briggs Lake (71-0146-00)	Watershed	1,135
	Atmospheric	90
	Inflow from Upstream Lakes	83
	Groundwater	36
	Internal	1,688
	Total	**3,032**
Rush Lake (71-0147-00)	Watershed	134
	Atmospheric	36
	Inflow from Upstream Lakes	1,263
	Groundwater	43
	Internal	1,290
	Total	**2,765**
Birch Lake (71-0057-00)	Watershed	175
	Atmospheric	34
	Groundwater	31
	Internal	27
	Total	**267**
Upper & Lower Orono Lake (71-0013-01 & -02)	Watershed	48,250
	WWTP	2,012
	Atmospheric	72
	Groundwater	80
	Internal	3,842
	Total	**98,605**
Fish Lake (86-0183-00)	Watershed	679
	Atmospheric	21
	Groundwater	--
	Internal	17
	Total	**717**
Mink Lake (86-0229-00)	Watershed	719
	Atmospheric	71
	Inflow Mink Lake	--

Lake	Phosphorus Source	Phosphorus Load (lbs. / year)
	Groundwater	0
	Internal	1,335
	Total	**2,125**
Somers Lake (86-0230-00)	Watershed	64
	Atmospheric	35.2
	Inflow Mink Lake	400
	Groundwater	--
	Internal	525
	Total	**1,025**
Silver Lake (86-0220-00)	Watershed	2,686
	Mink-Somers Lakes	367
	Atmospheric	18
	Groundwater	--
	Internal	62
	Total	**3,134**
Locke Lake (86-0168-00)	Watershed	100
	Atmospheric	30
	Groundwater	--
	Internal	185
	Total	**315**

Table 13: Donovan Lake (05-0004-02) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**0.392**	**143.28**
Margin of Safety	0.039	14.33
Wasteload Allocation*		
Construction Stormwater	0.002	0.76
"Straight Pipe" Septic Systems	0.000	0.00
MS4 Communities Benton County St. Cloud Minden Twp. MN DOT, non-trad.	0.033	12.16
Load Allocation		
Watershed	0.173	63.08
Internal	0.079	28.91
Atmospheric + Groundwater	0.066	24.04

Table 14: Julia Lake (71-0145-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**1.03**	**376.46**
Margin of Safety	0.103	37.65
Wasteload Allocation*		
Construction Stormwater	0.002	0.59
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.161	58.73
Internal	0.580	211.82
Atmospheric + Groundwater	0.185	67.67

Table 15: Briggs Lake (71-0147-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**3.693**	**1,348.85**
Margin of Safety	0.369	134.90
Wasteload Allocation*		
Construction Stormwater	0.020	7.39
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	2.004	732.03
Upstream Lake (Julia Lake)	0.227	82.82
Internal	0.728	265.91
Atmospheric + Groundwater	0.344	125.80

Table 16: Rush Lake (71-0147-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**3.931**	**1,435.86**
Margin of Safety	0.393	14359
Wasteload Allocation*		
Construction Stormwater	0.001	0.43
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.116	42.41
Upstream Lake (Briggs Lake)	1.636	597.54
Internal	1.570	573.49
Atmospheric + Groundwater	0.215	78.41

Table 17: Birch Lake (71-0057-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**0.731**	**266.96**
Margin of Safety	0.073	26.70
Wasteload Allocation*		
Construction Stormwater	0.004	1.48
MS4 Communities Big Lake Township	0.007	2.39
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.394	143.91
Internal	0.075	27.41
Atmospheric + Groundwater	0.178	65.08

Table 18: Upper & Lower Orono Lake (71-0013-01 & -02) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**139.123**	**50,814.83**
Margin of Safety	13.912	5,081.50
Wasteload Allocation*		
Zimmerman WWTP[1]	2.529	923.74
Becker WWTP[1]	5.450	1990.77
Aspen Hills WWTP[1]	0.163	59.52
Construction Stormwater	0.641	234.05
"Straight Pipe" Septic Systems	0.000	0.00
MS4 Communities City of Elk River City of Big Lake Town of Big Lake	1.282	468.11
CAFOs	0.000	0.00
Load Allocation		
Watershed	62.158	22,703.26
Upstream Lakes (Big Elk Lake)	51.310	18,740.85
Internal	1.262	460.99
Atmospheric + Groundwater	0.416	152.03

Table 19: Fish Lake (86-0183-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**1.536**	**560.86**
Margin of Safety	0.154	56.09
Wasteload Allocation*		
Construction Stormwater	0.013	4.68
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	1.270	463.73
Internal	0.041	15.03
Atmospheric + Groundwater	0.058	21.33

Table 20: Mink Lake (86-0229-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**1.777**	**649.07**
Margin of Safety	0.178	64.91
Wasteload Allocation*		
Construction Stormwater	0.005	1.93
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.522	190.68
Internal	0.877	320.34
Atmospheric + Groundwater	0.195	71.22

Table 21: Somers Lake (86-0230-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**1.635**	**597.36**
Margin of Safety	0.164	59.74
Wasteload Allocation*		
Construction Stormwater	0.001	0.23
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.063	22.86
Upstream Lakes (Mink Lake)	0.547	199.83
Internal	0.765	279.51
Atmospheric + Groundwater	0.096	35.20

Table 22: Silver Lake (86-0220-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**3.727**	**1,361.35**
Margin of Safety	0.373	136.14
Wasteload Allocation*		
Construction Stormwater	0.024	8.76
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	2.375	867.59
Upstream Lakes (Mink & Somers Lakes)	0.820	299.44
Internal	0.085	31.05
Atmospheric + Groundwater	0.050	18.37

Table 23: Indian Lake (86-0223-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**0.633**	**231.07**
Margin of Safety	0.063	23.11
Wasteload Allocation*		
Construction Stormwater	0.002	0.57
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	0.154	56.32
Internal	0.332	121.17
Atmospheric + Groundwater	0.082	29.91

Table 24: Locke Lake (86-0168-00) TMDL allocations

Total Phosphorus	TMDL Lbs. per day	TMDL Lbs. per year
Loading Capacity	**6.485**	**2,368.50**
Margin of Safety	0.648	236.85
Wasteload Allocation*		
Construction Stormwater	0.017	6.26
"Straight Pipe" Septic Systems	0.000	0.00
Load Allocation		
Watershed	1.698	620.22
Upstream Lakes (Silver Lake)	3.476	1,269.61
Internal	0.564	206.01
Atmospheric + Groundwater	0.081	29.55

Table 25: MR-SC Existing Daily Dissolved Oxygen (DO) demand

Stream	Loads	CBOD (lbs/day)	NBOD (lbs/day)	SOD (lbs/day)
Battle Brook	Headwater Watershed	4	20	--
	Diffuse & Tributary	9	115	--
	SOD	--	--	105
	Total	**13**	**135**	**105**
Rice Creek	Headwater Watershed	626	1,290	--
	Diffuse & Tributary	79	419	--
	SOD	--	--	847
	Total	**705**	**1,709**	**847**
Clearwater River	Headwater Watershed	37,571	13,557	--
	Diffuse & Tributary	87	0	--
	SOD	--	--	721
	Total	**37,658**	**13,557**	**721**

Table 26: TMDL allowable loads for modeled Dissolved Oxygen impaired streams

Stream	Allocation	Load	CBOD (lbs./day)	NBOD (lbs./day)	SOD (lbs./day)
Battle Brook	**Wasteload Allocation (WLA)**	NPDES Construction[1]	0.1	1	--
		Other	--	--	--
		WLA Total	*0.1*	*1*	*0*
	Load Allocation (LA)	Headwater Watershed	0.7	4	--
		Tributary Watershed	1.8	35.9	--
		SOD	--	--	21.1
		LA Total	*2.5*	*39.9*	*21.1*
	MOS		**Implicit**		
	TMDL		**2.6**	**40.9**	**21.1**
Rice Creek	**Wasteload Allocation (WLA)**	NPDES Construction	2	5	
		Other	--	--	--
		WLA Total	2	5	0
	Load Allocation (LA)	Headwater Watershed	124	255	--
		Tributary Watershed	15	82	--
		SOD	--	--	169
		LA Total	139	337	169
	MOS		**Implicit**		
	TMDL		**141**	**342**	**169**
Clearwater River	**Wasteload Allocation (WLA)**	NPDES Construction	113	41	--
		Other	--	--	--
		WLA Total	113	41	--
	Load Allocation (LA)	Headwater Watershed	7,404	2,670	--
		Tributary Watershed	14	0	--
		SOD	--	--	649
		LA Total	7,418	2,670	649
	MOS		**Implicit**		
	TMDL		**7,531**	**2,711**	**649**

[1] NPDES Construction Waste Loads are assigned 1.5% of the total Waste Load allocation.

Figure C.1: Impaired waters by designated use in the Mississippi River (St. Cloud) Watershed

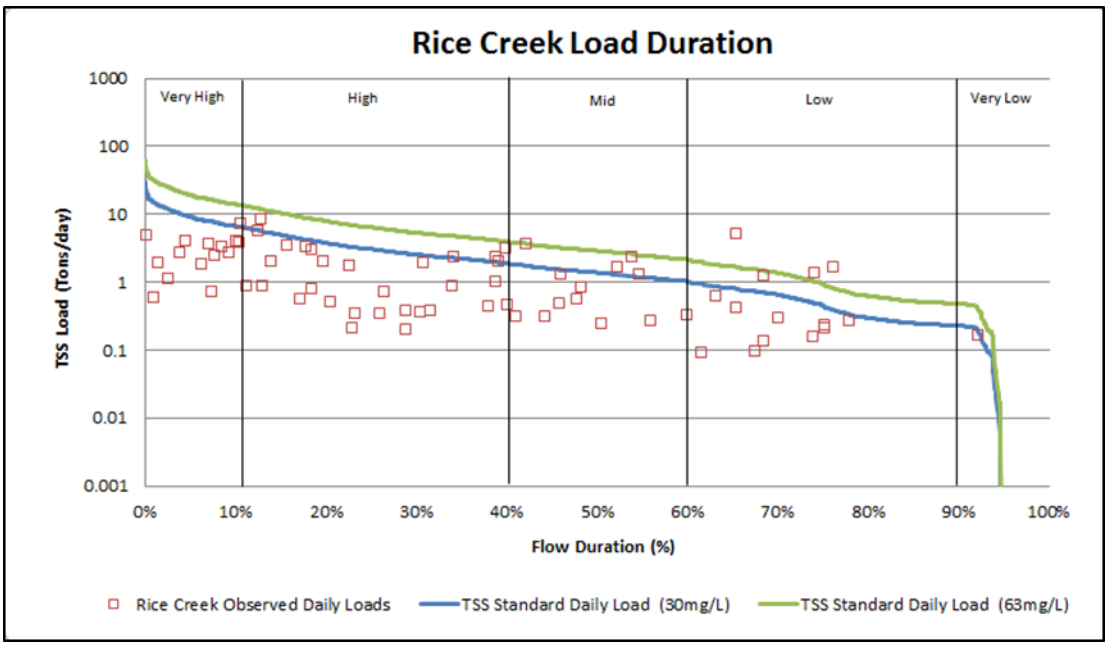

Table 27: Rice Creek (AUID 07010203-512) TSS total loading capacities and allocations

Rice Creek (AUID 07010203-512)		Flow Zones				
		Very High	High	Mid-Range	Low	Dry
		TSS Load (tons/day)				
Wasteload Allocation	Construction Stormwater	0.14	0.05	0.02	0.01	0.00
Load Allocation	Nonpoint source and in-stream	8.97	3.00	1.34	0.43	0.17
MOS		**Implicit**				
Total Daily Loading Capacity		**9.11**	**3.05**	**1.36**	**0.44**	**0.17**
Value expressed as percentage of total daily loading capacity						
Total Daily Loading Capacity		100%	100%	100%	100%	100%
Wasteload Allocation	Construction Stormwater	1.5%	1.5%	1.5%	1.5%	1.5%
Load Allocation	Nonpoint source and channel	98.5%	98.5%	98.5%	98.5%	98.5%

Appendix C: Mississippi River (St. Cloud) Watershed Logic Model

Program: Mississippi St. Cloud Watershed Logic Model

Situation: Currently, government entities and a small group of stakeholders and interested citizens are the driving forces behind the watershed restoration and protection efforts in the Mississippi-St. Cloud watershed. Additional local (watershed-wide) people, especially a variety of emerging leaders, are needed in the restoration and protection planning, decisions, policies and practices for the watershed work to be dynamic, inclusive and sustainable. Many of these people have not had the opportunity to increase their capacity, whether it is awareness, motivation, desire, knowledge, attitude, skills, support or resources, to be engaged to the extent that is necessary for the watershed to become, and remain, healthy and vibrant.

Inputs *What we invest*	**Outputs** ***Activities*** *What we do*	**Outputs** ***Participation*** *Who we reach*	**Outcomes -- Impact** **Short** (results) *Learning*	**Outcomes -- Impact** **Medium** (results) *Action*	**Outcomes -- Impact** **Long** (impact) *Condition*
Time: staff, peripheral partners, volunteers Money: grants, education budgets In Kind Resources: computer networks, office space and supplies County Data or existing data that agencies may have Expertise Existing relationships Positive Attitude	1. Build and utilize a Communication Network that allows for the dissemination of information and the gathering of feedback in order to further the protection and restoration efforts of the watershed. Pieces may include an email listserv, a website and/or social media such as Facebook and Twitter. 2. Identify and foster emerging and current leaders in the watershed. 3. Organize and hold a Watershed Launch. 4. Identify and disseminate targeted key messages throughout the watershed protection and restoration process. 5. Gather people, or go to gatherings, at key points of the watershed process to dialogue, share, learn and offer direction in the protection and restoration efforts of the watershed.	1. General interest public (GIP), local government units (LGU), agencies, civic groups, citizen monitors, businesses, decision makers, water planners, youth groups, sportsmen groups, internal core group, landowners, producers, professional service providers, connectors, residents and peripheral partners. 2. Chambers of commerce, non-profits, civic groups, faith groups, peripheral partners, agriculture and other interest groups, citizen monitors, youth, higher education institutions, moms and lake associations. 3. General interest public, core partners, peripheral partners, citizen monitors, and water planners. 4. Residents, chambers, civic groups, agriculture, LGUs, PP, higher education, faith communities, women groups 5. Civic groups, agriculture, LGUs, GIP, landowners, comp plan people, PMZ workers, shoreline owners, citizen monitors, businesses (chamber), water users (source water protection), and realtors.	1. People in the watershed and key players are aware of communication and feedback channels of the watershed process. 2. Key leaders are aware of, interested in, and motivated to participate in the watershed work. 3. People with an interest in the watershed are aware of the Launch and its purpose. 4. Audiences hear, read and/or see key messages that resonate with them and that increase their awareness, knowledge or attitude. 5. People of the watershed are aware of the opportunities to gather and dialogue on the watershed issues.	1. Key players in the watershed use the communication network for information, feedback and connectivity. 2. Leaders are engaged in the watershed activities and opportunities. 3. People who attend the Launch share the information attained with other groups and individuals in the watershed to increase their knowledge and involvement in the watershed process. 4. Audiences share and act on the messages they encounter at key points of the watershed process. 5. People of the watershed attend and participate in community conversations.	1. Decisions affecting the watershed take into account the information and feedback provided by the network. 2. Leaders and supporters are directing the watershed protection/restoration efforts. 3. The Launch and similar watershed events are considered integral to the watershed protection and restoration efforts and are therefore well attended and serve as impetus for further watershed involvement. 4. Key messages concerning the watershed's protection and restoration are a constant in regional groups' and individuals' informational pieces and educational efforts. 5. People of the watershed consistently address and discuss watershed issues in a safe, inclusive and open manner that leads to effective protection and restoration efforts.

Appendix D: Zonation

Prioritization Overview

As threats to Minnesota's watersheds continue to mount, it is becoming increasingly important to identify and conserve high-priority areas. There are multiple opportunities for protection or restoration in any watershed. Identifying which practices to implement and where in the landscape to implement them can help more effectively target efforts and more efficiently utilize limited resources. A number of information technology tools are available for prioritizing and targeting land for restoration and protection efforts within a watershed.

A systematic approach aimed at optimizing environmental benefits while reducing interference between competing land uses is critical. Two of the most common approaches for conservation prioritization are system-based models and value-based models. One of the major strengths of system-based models is that they require us to think deeply about a system by thoroughly defining how we believe the system functions. For many watersheds this has been done using the HSPF hydrologic system model, which simulates watershed hydrology and water quality at the catchment scale. However, we often do not have system models that can accurately identify where in the watershed specific good management practices should be applied or that have the ability to simulate alternative land management actions and predict consequences at specific locations in the watershed.

In addition, our conservation problems are social problems that are first and foremost about challenges in changing human behavior. Rittel and Webber (1973) declared that these kinds of problems are inherently "wicked" problems to solve, and they caution scientists, engineers, and planners to be wary of relying extensively on forecasts and simulations. They assert that use of such methods may fail, as these tools were not developed to deal with public policy problems. Collaborative approaches to address conservation may be the most effective way to begin working toward changing human behavior and perceptions, and value-based models provide a structure for collaborative efforts.

Value-based models use a compilation of individual criteria of valuable landscape features (heterogeneous content) and aggregated criteria (context and connections) with an objective function to prioritize places within the landscape for conservation. Although there are some shortcomings of using value models (value models only allow exploration of tradeoffs and optimization, and they do not provide guidance on what practices should be implemented where), the use of value models is an efficient method for prioritizing places for protection or restoration.

The values-based model prioritization approach we used is based on fundamental conservation principles, including content, context, heterogeneity, and connectivity. We used the DNR's five-component healthy watershed conceptual model to facilitate an organized process to review and think of watershed problems and solutions. The five components are: biology, hydrology, water quality, geomorphology, and connectivity. This approach recognizes that attempts to solve our clean water

needs are not separate from our other conservation needs; each conservation activity should provide multiple benefits. Value models help achieve this multiple benefits goal by identifying areas that optimize benefits by accounting for what the community values. The use of an additive benefits objective function in the value models allows the retention of high quality occurrences of as many conservation features as possible while reducing interference between competing land uses (e.g., row crop areas). Value models also can be used in a public participation process, whereby participants can decide on what features are valued and the ranking of those valued features. In addition, value models and the five-component conceptual model used to structure the content in the value models are simple concepts that are easy to explain and apply at the local government scale.

Methods

The value models were developed using Zonation software (Moilanen et al. 2009). Zonation produces a nested hierarchy of conservation priorities. It begins with the full landscape and iteratively removes parcels (cells) that contribute least to conservation; therefore, the removal order is the reverse order of the priority ranking for conservation. Zonation assumes that the full watershed is available for conservation. In our models, the lakes were masked out prior to analysis. This focused the prioritization on the terrestrial parcels, in accordance with the conservation and restoration goals of our partners. Zonation's algorithms seek maximal retention of weighted normalized conservation features.

Weights are used to influence which features are valued more. Within the five-component healthy watershed framework, for example, water quality conservation features could be weighted higher than biological features. The feature-specific weights used in our value models reflect social valuation, and they were set using the analytic hierarchy process (AHP; Saaty and Peniwati 2007). A survey comprised of pairwise comparisons was used to solicit the preferences of professional technical staff and engaged individuals (48 people submitted responses to the survey). Weights were set on two levels. A broad-scale comparison was based on the DNR's five-component healthy watershed approach, with the addition of an economic value component. A fine-scale comparison was used to set weights on 17 features within the broad-scale components. These fine-scale features included water quality, biology, hydrology/geomorphology, agricultural, and urban data layers, as well as the Sherburne NWR. The pairwise survey was structured to gather value preferences for both a protection and a restoration scenario. Each individual used his or her judgment about the relative importance of all elements at each level of the hierarchy. The relative importance values included equal, prefer, and strongly prefer. The use of abbreviated pairwise importance values helped reduce the cognitive burdens associated with a large number of pairwise comparisons. Individual responses were aggregated with a geometric mean, and the pairwise comparison matrix was constructed to compute the feature-specific weights consistent with the AHP.

There are three commonly definable objective functions possible in Zonation: core area, target-based planning, and additive benefit functions. The core area objective function aims to retain high-quality occurrences of each feature. This function is most appropriate when there is a definite set of

conservation features and all of them are to be conserved. The target-based planning objective function is a prescriptive approach where requirements are specified *a priori* for each feature. This function produces a minimum set coverage solution, and is most appropriate when a defined proportion of the watershed is assigned for conservation.

We used the additive benefit function variant of Zonation, which aggregates values by summation across features:

$$V(P) = \Sigma w_j N_j(P)^z_j - \Sigma w_k N_k(P)^z_k$$

where the value of a parcel *V(P)* is equal to the summation of weighted *w* normalized conservation features of the parcel $N_j(P)$, squashed to the power of *z*, minus the summation of the weighted normalized alternative land use features of the parcel $N_k(P)$, squashed by *z*.

We used $z_j = 0.25$ for conservation features and $z_k = 4$ for alternative land uses. The additive benefit function is appropriate when tradeoffs between conservation features are allowed and it is necessary to account for alternative land use features. In our analyses, we developed prioritizations that would minimize interference with important agricultural areas. Additionally, Zonation allows ranking to be influenced by neighboring parcels, so that highly valued areas can be aggregated. This minimizes fragmentation of conservation within the landscape. We utilized the distribution-smoothing algorithm in Zonation, which uses an aggregation kernel a parameter. Using this algorithm assumes that fragmentation (low connectivity) generally should be avoided for all conservation features. Initial analyses indicate that an aggregation kernel a of 0.01, which corresponds to a connectivity distance of 200m, may be appropriate for conservation efforts targeted at the watershed scale. We found that very small connectivity distances made no difference in parcel prioritization, since the connectivity effect did not extend very far into neighboring parcels, and very large connectivity distances aggregated parcels across unrealistically large areas. We also found that across a modest range of connectivity distances the results were minor. The connectivity distance can be conservation feature-specific; for example, if a species' dispersal capability or fragmentation vulnerability was known, then a species-specific parameter could be explicitly used. We did not use distributing smoothing for alternative land uses or economic features (row crop lands, pasture/hay lands, urban areas, and the NWR).

The data layers used in the analysis are found in Table 28 (n=17), and each layer was on the same grid with a resolution of 30 by 30m. We used high-resolution data to maximize conservation planning realism and for greater practicality in local government conservation planning and implementation.

The last step in the prioritization was the synthesis of the Zonation results with local land managers' experiences. It is important to link the quantitative model output with critically important local knowledge to derive final priority maps. This synthesis was accomplished by holding a mapping workshop, where local land managers participated in a review and revision of model output based on their expert opinion. The workshop used the Zonation protection and restoration priority maps displayed at a subwatershed scale (catchments) to allow review at a fine scale.

Table 28 Data Layers used in Zonation Analysis for the Mississippi River (St. Cloud) Watershed

Category Types	Variable Name	Description and Notes
Water Quality	Hydrological Simulation Program - Fortran (HSPF)	HSPF has not been completed for the Mississippi River (St. Cloud) Watershed in time for inclusion as part of this WRAPS Report. As such, this variable is missing from this zonation model.
	Impaired waters	Catchments upstream of (i.e. contributing to) nutrient impaired lakes within the watershed (as identified by the MPCA)
	Completed/Approved TMDLs	
	Water Quality Risk	The potential for an area to deliver sediment and/or nutrients to surface waters. Areas with high potential for overland flow (based on terrain analysis) and near surface waters (pasted on proximity analysis) will have high water quality risk values. The variable is from the Board of Water and Soil Resources' (BWSR) and the University of Minnesota's (UMN) Environmental Benefits Index (EBI). The MPCA has completed this analysis for the watershed.
	Drinking Water Management Supply Area Vulnerability	The likelihood for a potential contaminant source within the drinking water supply management area to contaminate a public water supply well. This likelihood is based on the aquifer's inherent geologic sensitivity and the composition of the groundwater.
	Groundwater Contamination Susceptibility	The relative susceptibility of an area to groundwater contamination based on soil type, aquifer makeup, and recharge potential
	Wellhead Protection Areas	From the Minnesota Department of Health
	Pollution Sensitivity of Near-Surface Materials	From the DNR's Hydro-geologic Atlas
	Human Disturbance Score	Gradient of human disturbance, completed by MPCA
Hydrology & Geomorphology	Restorable Wetlands	Drained, potentially restorable wetlands in agricultural landscapes
	Existing Wetlands	Remaining wetlands as documented by the National Wetland Inventory
	Highly Erodible Land / Potential Highly Erodible Land	Natural Resource Conservation Service (NRCS) soil data layer
	Soil Erosion Risk	Susceptibility of soils to erosion. This variable is from the BWSR's and UMN's EBI, and can be calculated from a subset of the universal soil lass equation.
	Stream Riparian Areas	Stream riparian and potential flood zones (based on location, elevation and soil type)
	Ditches	
	Floodplain Mapping	
	Shorelands	Land within 1,000 feet of lake shore
Biology	Ecological Patches and Connections	Generally large, intact and native or "semi-natural" terrestrial habitat patches and ecological corridors between these patches
	Rare Features	Locations of species currently tracked by the DNR including endangered, threatened and special concern plant and animal species as well as animal aggregation sites
	Site of Biodiversity Significance	Areas with varying levels of native biodiversity that may contain high quality native plant communities, rare plants, rare animals and/or animal aggregations. Identified by MN Biological Survey.
	Native Prairie	Intact native prairies.
	Prairie Core Areas	Areas with concentrations of native prairie and grasslands
	US Fish & Wildlife Service (USFWS) Priority Wetlands	Wetland complexes with the potential to impact populations of focal species (black terns, migrant shorebirds, ducks and pheasants). Factors include integrity of the surrounding wetland complex, the juxtaposition of wetland and grassland areas, and the potential for water quality enhancement benefits for shallow lakes.

Category Types	Variable Name	Description and Notes
	USFWS Priority Grasslands	Grassland complexes with the potential to impact populations of focal species (marbled godwit, nongame birds, migrant shorebirds, ducks, and pheasants). Factors include integrity of the grassland patch, the surrounding landscape context (% grassland and terrain relief), juxtaposition of grassland and wetland, the potential for water quality enhancement benefits for shallow lakes, and the potential to create large grassland patches with minimal retirement.
Connectivity	Pasture/Hay	Land cover type is pasture or hay (areas used for livestock grazing or planted with perennial seed or hay crops)
	Cultivated Cropland	Land cover type is cultivated crops (areas used for the production of annual crops or actively tilled areas)
	MPCA Registered Feedlots	Animal units over 50 or within shoreland impact zone, provided by MPCA.
	Rural-Residential	Areas of high density residential developments, particularly around lakes
	Urban	Municipal boundaries
	Dams and Culverts	Location of dams and culverts; these water control/conveyance structures can have a large impact on watershed connectivity
	Metro Conservation Corridors	Created by the DNR in late 1990s; natural resource analysis
Other	Sherburne NWR Boundaries	Boundaries of the Sherburne National Wildlife Refuge

Results

The pairwise questionnaire survey results identified the water quality component of the value model inputs as the highest weight, followed by protecting fish and wildlife habitat; reducing flooding and erosion; enhancing connectivity, and increasing economic value (Figure 1 and Table 2).

Two priority maps were created with the Zonation value model. The first map was a protection priority map where lands were ranked as to their importance for land management activities that would provide greater protection of ecosystem functions, especially water quality (Figure 2). The second map was a restoration priority map where lands were ranked as to their importance for application of various land best management practices (Figure 3).

The protection priority map identified several general priority areas. First, high rankings were given to lands south of the Sherburne National Wildlife Refuge, including the riparian corridor to Eagle Lake and south to Big Lake. High priority rankings were also given to lands west of the city of Princeton, as well as to areas in the southwest part of the watershed, from the city of Kimball to Clearwater Lake. Finally, high rankings were calculated for lands within the numerous city drinking water wellhead protection areas.

The restoration priority map from the Zonation analysis identified at least four general areas for consideration. First, high rankings were evident in the areas in and around the Sherburne National Wildlife Refuge. Second, riparian corridors east of the city of St. Cloud were calculated to have high rankings, as did shorelands in the southern part of the watershed. Finally, as with the protection priority map, high rankings were calculated for lands in the numerous wellhead protection areas.

During a technical meeting, members determined that they would use the results of the Zonation software to assist with prioritizing as necessary. The shapefiles can be obtained by request to the Sherburne SWCD.

References

Moilanen, A., H. Kujala, and J. Leathwick. 2009. The Zonation framework and software for conservation prioritization. Pages 196-210 in A. Moilanen, K. A. Wilson, and H. P. Possingham, editors. Spatial conservation prioritization: quantitative methods and computational tools. Oxford University Press, Oxford, UK.

Rittel, H., and M. Webber. 1973. Dilemmas in a general theory of planning. Policy Sciences 4:155-169.

Saaty, T.L., and K. Peniwati. 2007. Group decision-making: Drawing out and reconciling differences. Pittsburgh, PA: RWS Publications.