Snake River Watershed (St. Croix Basin)

Watershed Restoration and Protection Strategy Report

A summary of watershed conditions and restoration and protection strategies for the Snake River Watershed

August 2014

wq-ws4-04

*** Disclaimer**

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), the information will be updated according to the statutorily required elements of a Watershed Restoration and Protection Strategy Report.

Table of Contents

Tables

Figures

Project Partners

All of the following organizations and agencies contributed to the development of the Snake River Watershed Restoration and Protection Strategies document.

Aitkin Soil and Water Conservation District

Kanabec Soil and Water Conservation District

Mille Lacs Soil and Water Conservation District

Pine Soil and Water Conservation District

Snake River Watershed Management Joint Powers Board (representing the counties of Aitkin, Kanabec, Mille Lacs, and Pine)

Snake River Watershed Citizen Advisory Committee

Local Counties

Local Lake Associations and Lake Improvement District

St. Croix River Association

The Nature Conservancy

Wenck Associates, Inc.

Minnesota Department of Natural Resources

Minnesota Pollution Control Agency

Natural Resources Conservation Service

U.S. Department of Agriculture

And the locally interested citizens

Key Terms

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

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

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

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 St. Croix Basin is assigned a HUC-4 of 0703 and the Snake River Watershed is assigned a HUC-8 of 07030004.

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

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

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

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

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

Stressor (or Biological Stressor): This is a broad term that includes both pollutant sources and 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 cycle that addresses both restoration and protection.

As part of the watershed approach, waters not meeting state standards are still listed as impaired and Total Maximum Daily Load (TMDL) studies are performed, as they have been in the past, but in addition the watershed approach process 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 Watershed Restoration and Protection Strategies (WRAPS) 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:
  - *Snake River Watershed Monitoring and Assessment Report Draft - 2008*
  - *Groundhouse River Total Maximum Daily Loads for Fecal Coliform and Biota (Sediment) Impairments - 2009*
  - *Ann River Watershed Bacteria, Nutrient, and Biota TMDL - 2013*
  - *Mud Creek Biotic Stressor Identification Report - 2013*
  - *Snake River Watershed Total Maximum Daily Load - 2014*

Scope

- Impacts to aquatic recreation and impacts to aquatic life in streams
- Impacts to aquatic recreation in lakes
- Create strategies for restoration and protection of watershed resources such as forested land, wetlands, native and endangered plant and biotic communities, and other priority natural resources and ecosystems

Audience

- Local working groups (local county, city and township governments, SWCDs, watershed management groups, etc.)
- Locally interested citizens
- State agencies (MPCA, DNR, BWSR, etc.)

1. Watershed Background & Description

The Snake River watershed is an 8-digit hydrologic unit (HUC) located in the St. Croix River Basin. The watershed is approximately 1,006 square miles, or 643,534 acres, in extent and overlies six counties including Aitkin, Kanabec, Mille Lacs, Pine, Chisago and Isanti. The headwaters of the Snake River are located in southeastern Aitkin County. The northern part of the watershed is located in what is known as the Northern Lakes and Forest Ecoregion and is dominated by forests and wetlands. The southern portion of the watershed is located in the North Central Hardwood Forest ecoregion and is a mixture of forest, grassland, pasture/hay and cropland (Figure 1 and Table 1). A majority of livestock animals and feedlots are concentrated in the southern half of the watershed (Figure 2). The Snake River watershed contains eight separate 10-digit HUC watersheds, which include: Upper Snake, Middle Snake, Knife River, Mud Creek, Groundhouse River, Pokegama Creek, Ann River and Lower Snake River. The Snake River flows south to east to its confluence with the St. Croix River in Pine County, MN.

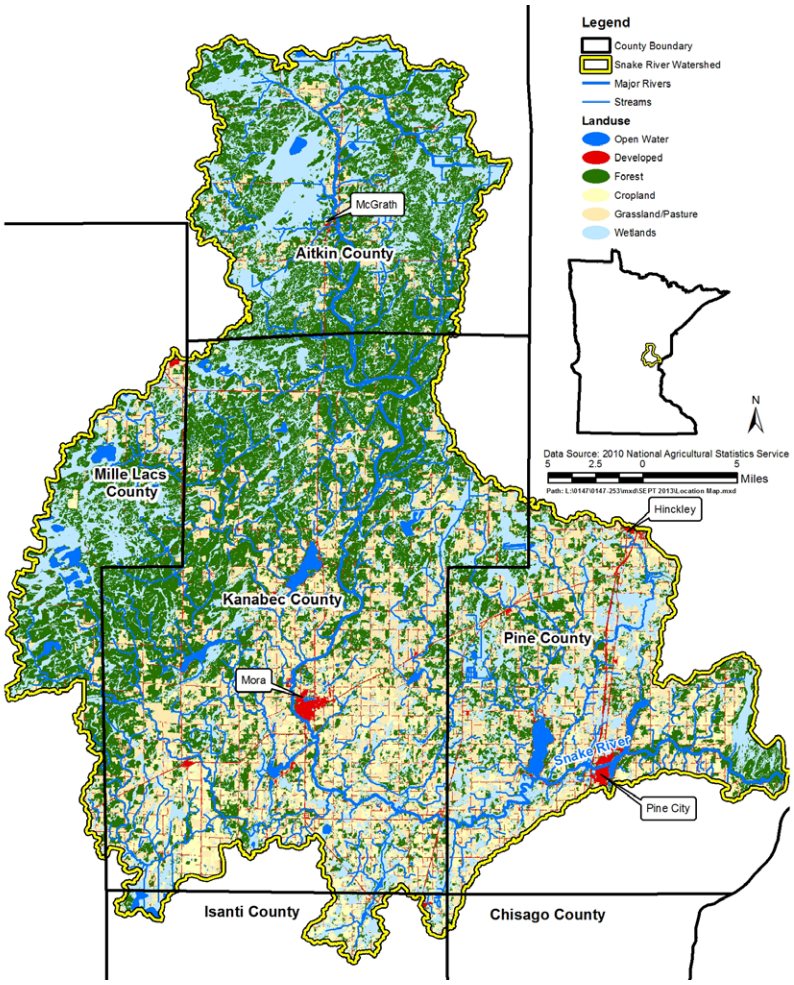


Figure 1. Snake River Watershed Land cover (NASS, 2010).

Table 1. Land cover in the Snake River Watershed

Landuse Category	Acres	Percent
Forest	239,569	37%
Wetlands	187,878	29%
Grassland/Pasture	147,254	23%
Cropland	33,189	5%
Developed	20,640	3%
Open Water	15,004	3%

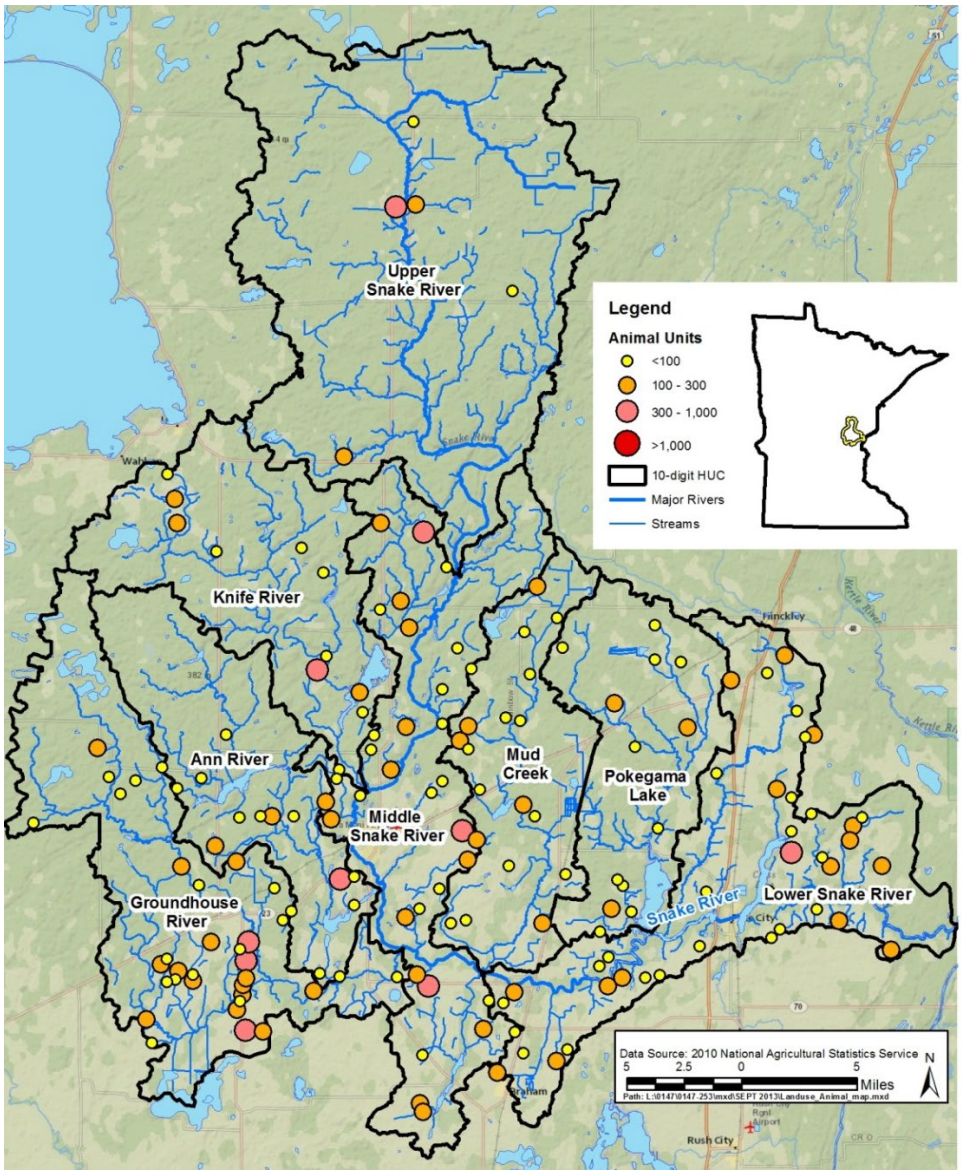


Figure 2. Snake River Watershed Feedlots and 10 digit HUC Watersheds.

Additional Snake River Watershed Resources

Past MPCA studies regarding assessment, TMDLs, and implementation in the Snake River Watershed can be found at: http://www.pca.state.mn.us/qzqhdd0

Minnesota (DNR) Watershed Assessment Mapbook for the Snake River Watershed: http://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/wsmb36.pdf

Natural Resources Conservation Service's (NRCS) Rapid Watershed Assessment: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022261.pdf

2. Watershed Conditions

The Snake River watershed has a wetland and forest dominated headwater region, characterized by generally good water quality in both lakes and streams and no impairments.

As the landscape and land use change in the middle and south portion of the watershed, so does the water quality. These changes begin near the Knife River watershed and the City of Mora as the land use transitions from forestland to a pasture dominated landscape with some cropland.

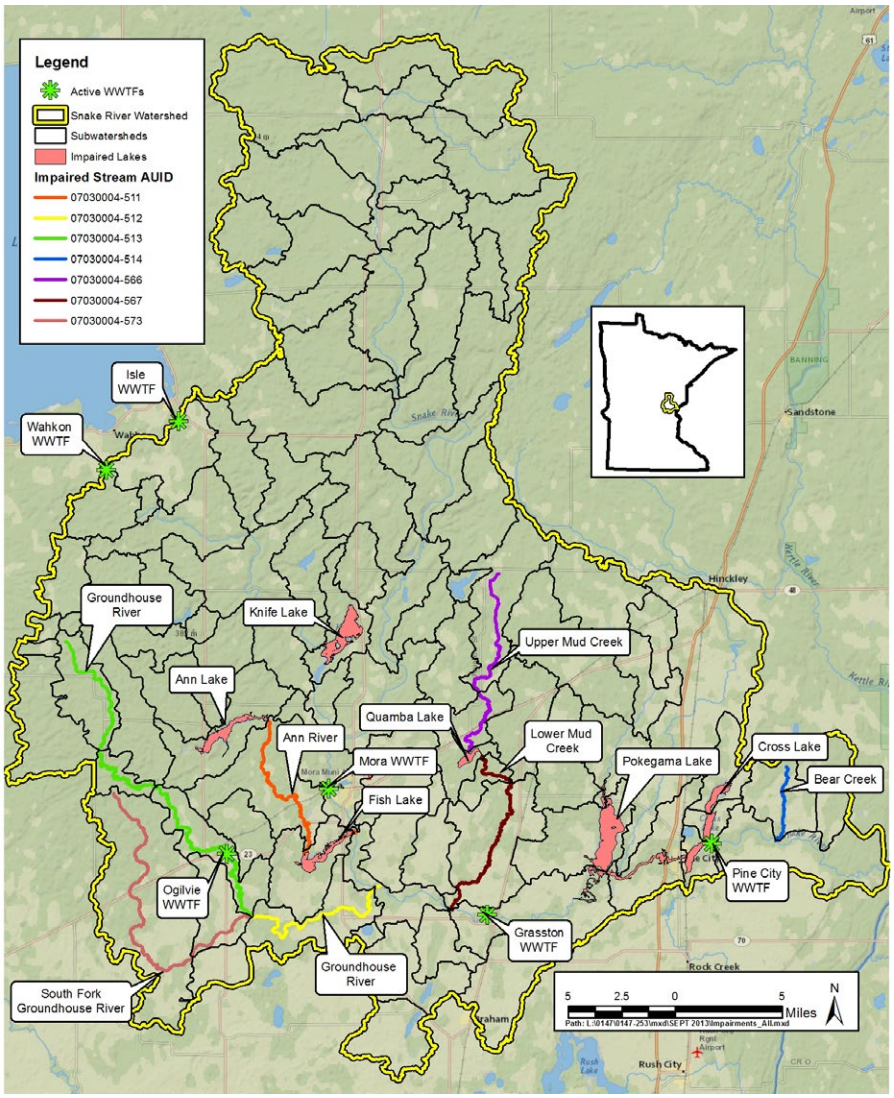


Figure 3. Impaired Lakes and Stream Reaches in the Snake River Watershed.

Of the 87 lakes and 128 stream segments referred to as Assessment Unit IDs (AUIDs) in the watershed, not all were able to be assessed due to insufficient data, limited resource waters, or predominantly channelized stream reaches. The condition of these streams and lakes including associated pollutant sources are detailed in the following sections.

2.1 Condition Status

Stream condition throughout the watershed was assessed using a range of parameters including fish and invertebrate index of biotic integrity (IBI), fecal coliform and *E. coli*, dissolved oxygen and turbidity.

Water quality measurements from streams were compared to state water quality standards. Stream conditions and impairment assessment for all Snake River watershed AUIDs are summarized in tables in Appendix A. In general, stream and lake quality decreases from north to south in the Snake River watershed. The headwaters of the watershed for the most part are unimpaired and supporting both aquatic life and aquatic recreation. All stream and lake water quality impairments are concentrated in the middle and south portions of the watershed.

While the overall stream condition and health was monitored as part of the Snake River watershed assessment in 2006, this was watershed was the pilot of what is now the MPCA's Intensive Watershed Monitoring Approach. During that time the primary focus was the chemical and biology health of the streams in the watershed and not as much focus on lakes. However, in recent years the MPCA has further refined the watershed approach for streams, and has started to include lakes if they meet the necessary criteria. For more information on MPCA's current approach see the Intensive Watershed Monitoring website: http://www.pca.state.mn.us/lupg907.

All of the streams and lakes in the Snake River watershed that have been placed on the State of Minnesota's 303(d) list of impaired waters have received TMDL allocations which are summarized in Section 2.4 of this report. Some of the waterbodies in the Snake River watershed are impaired for mercury; however, this report does not cover toxic pollutants. For more information on mercury impairments see the statewide mercury TMDL at: http://www.pca.state.mn.us/wfhy9efl.

One of the objectives of this WRAPS report is to identify waterbodies in need of protection. Waters that have been assessed and fully support aquatic life and recreation or have not been assessed are subject to protection efforts. More on protection considerations will be covered in Section 2.5.

Streams

Of the 128 stream AUIDs in the Snake watershed, 54 reaches were assessed for biotic integrity and 19 were found to fully support aquatic life (Appendix A). Four of the assessed reaches were identified as impaired for aquatic life while 31 of the reaches were found to be intermittent streams and/or have insufficient data to determine aquatic life impairment.

The MPCA, Snake River Watershed Management Board (SRWMB), counties, local Soil and Water Conservation Districts (SWCDs), and lake associations have conducted periodic and routine sampling for conventional pollutants at various main-stem and tributary monitoring stations throughout the watershed. Through this sampling, seven reaches were identified as impaired for fecal coliform/*E. coli* bacteria.

Lakes

All 87 of the lakes in the Snake River watershed are classified as class 2B waters for which aquatic life and recreation are the protected beneficial uses. Minnesota standards for all class 2 waters states

"…there shall be no material increase in undesirable slime growths or aquatic plants including algae." In order to evaluate whether a lake is in an impaired condition the MPCA developed "numeric translators" for the narrative standard for purposes of determining which lakes should be included in the section 303(d) list as being impaired for nutrients. Of the lakes in the Snake River watershed that were assessed, six were identified as being impaired for nutrients (Appendix B).

2.2 Water Quality Trends

Stream flow data and stream and lake water quality data have been collected periodically by various groups throughout the Snake River watershed. Intensive lake water quality monitoring was performed in recent years for use in TMDL analysis, however long-term monitoring records are inconsistent and do not provide a sufficient dataset for reliable trend analysis.

Snake River monitoring station S000-198, located at the outlet of Cross Lake, is the most down-stream Snake River monitoring station with good water quality and flow monitoring data. The ten-year monitoring record at this site also showed inconsistency in the number of months and years of data collection. A Seasonal Kendall test was performed on the dataset from this site which compares water quality data at different time periods or seasons across years to determine the presence of a trend (Malca, 2009). Results from this analysis indicate "No Trend" for the major water quality parameters collected (TKN, NO_2+NO3, TP, Ortho-P and TSS). It was concluded that either the data from this site is neither increasing nor decreasing, or data gaps in 2000, 2003, 2006 and 2007 influenced the trend analysis results. Ongoing flow and water quality monitoring should continue at this site so that loading and future trend analysis may be performed as BMPs are implemented and adopted throughout the watershed.

For more water quality trend data see the Snake River Watershed 10 year Water Quality Stream Monitoring Report (1998-2008) on the Snake River Watershed Management Board's website.

2.3 Stressors and Sources

In order to develop appropriate strategies for restoring or protecting waterbodies the stressors and/or sources impacting or threatening them must be identified and evaluated. Biological stressor identification is done for streams with either fish or macroinvertebrate biota impairments and encompasses both evaluation of pollutant 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

There are four stream reaches in the Snake River watershed impaired for aquatic life due to poor biological communities. In order to identify probable stressors causing these impairments, an intensive field survey and data evaluation was conducted by the MPCA. The resulting Stressor ID Reports provide detailed information and weight of evidence analysis to link stressors to the impairments. Potential candidate causes of the impairments that were ruled out based on a review of available data include: pH; turbidity/TSS; stream temperature; chloride toxicity; pesticides; and heavy metals toxicity. The following stressors that are potential candidate causes were examined in more detail: loss of habitat due to excess deposited and bedded sediment; low dissolved oxygen concentrations; degraded riparian habitat; loss of connectivity and altered hydrology, both due to ditching in the watershed and on the stream itself. Table 2 summarizes the primary stressors for the Snake River impaired reaches identified in the Groundhouse River, Ann River and Mud Creek Stressor Identification Reports.

Table 2. Primary stressors to aquatic Life in biologically-impaired reaches in the Snake River Watershed.

HUC-10 Subwater-shed	AUID (Last 3 digits)	Stream	Reach Description	Biological Impairment	Primary Stressor								
					Dissolved Oxygen	Nitrate	Phosphorus	Sedimentation	Connectivity	Altered Hydrology	Habitat	Riparian Disturbance	Toxicity
Groundhouse River	513	Groundhouse River	Headwaters to South Fork Groundhouse River	Fish & Macroinvert.			™	~				~	
	573	South Fork Groundhouse River	Headwaters to Groundhouse River	Fish & Macroinvert.			™	~				~	
Ann River	511	Ann River	Ann Lake to Snake River	Fish & Macroinvert.	™			~	›	™	›	~	
Mud Creek	566	Mud Creek	Headwaters to Quamba Lake	Fish & Macroinvert.	›			~	™	™	›	›	

Key: ~ = High › = Moderate ™ = Low

Snake River Watershed Stressor ID Reports

Groundhouse River Watershed Stressor ID: http://www.pca.state.mn.us/clyp9f9

Ann River Watershed Stressor ID: http://www.pca.state.mn.us/aj0r9f3

Mud Creek Watershed Stressor ID: http://www.pca.state.mn.us/hqzq9ff

Pollutant sources

Pollutant sources vary by subwatershed and by stream segment depending on upstream permitted point source dischargers and surrounding land use and other nonpoint sources throughout the watershed. The primary pollutant sources in the impaired stream/lake watersheds were identified and discussed in the Groundhouse River, Ann River and Snake River TMDL reports and are summarized in Table 3 and Table 4. There are no Municipal Separate Storm Sewer Systems (MS4s) in the Snake River watershed and smaller municipalities/urban areas account for only 3% of the landuse in the Snake River watershed (Table 1). Thus, pollutant loading to the impaired waterbodies and the Snake River as a whole from urban land is relatively small compared to other sources. There are 6 active wastewater treatment facilities in the Snake River Watershed (Figure 3 and Table 3). The Ogilvie wastewater treatment facility was given bacteria and TSS allocations as part of the Groundhouse River TMDL and it was determined loading from this facility is small and is not believed to be major contributor to the impaired reaches. All of the wastewater treatment facilities are located upstream of Cross Lake and were allocated for phosphorus as part of the Lake St. Croix TMDL and the Snake River TMDL projects. It was determined these facilities collectively contribute about 45 pounds (<1% of total to lake) of phosphorus loading through diffusive flux from the Snake River and Cross Lake's south basin. Thus, a majority of pollutant loading to all impaired streams and lakes in the Snake River watershed comes from the nonpoint sources outlined in Table 4.

Table 3. Point sources in the Snake River Watershed.

HUC-10 Subwatershed	Point Source			Pollutant reduction needed beyond current permit conditions/limits?	Notes
	Name	Permit #	Type		
Knife River	Wahkon WWTP	MNG580051	Municipal wastewater	Yes (TP)	Allocated (TP) as part of the Cross Lake TMDL study (Wenck, 2013). Facility must adopt phosphorus categorical limits in Lake St. Croix TMDL (MPCA and Wisconsin DNR, 2012)
	Isle WWTP	MN0023809	Municipal wastewater	Yes (TP)	
Middle Snake River	Mora WWTP	MN0021156	Municipal wastewater	Yes (TP)	
Groundhouse River	Ogilvie WWTP	MN0021997	Municipal wastewater	Yes (TP)	Allocated as part of the Groundhouse River TMDL (Tetra Tech, 2009) and Cross Lake (TP) TMDL study (Wenck, 2013). Facility must adopt phosphorus categorical limits in Lake St. Croix TMDL (MPCA and Wisconsin DNR, 2012)
Lower Snake River	Grasston WWTP	MNG580052	Municipal wastewater	Yes (TP)	Allocated as part of the Cross Lake (TP) TMDL study (Wenck, 2013). Facility must adopt phosphorus categorical limits in Lake St. Croix TMDL (MPCA and Wisconsin DNR, 2012)
	Pine City WWTP	MN0021784	Municipal wastewater	Yes (TP)	Facility allocated for phosphorus as part of the Lake St. Croix TMDL (MPCA and Wisconsin DNR, 2012)

Table 4. Nonpoint sources in the Snake River Watershed.

HUC-10 Sub-watershed	Stream/Reach (AUID) or Lake (ID)	Pollutant	Pollutant Sources*												
			Fertilizer & manure run-off	Livestock overgrazing in riparian	Failing septic systems	Wildlife	Runoff from urban stormwater and near-shore development	Wetlands	Internal Loading (sediments)	Atmosphere	Groundwater	Point Sources (WWTFs)	Forest Land	Upstream Lake(s)	Streambank/Channel
Knife River	Knife Lake (33-0028)	TP	›	~	™		™	?	~	™		™	™		
Ann River	Ann River (511)	Bacteria	›	~	™	™									
	Ann River (511)	Sediment		~											~
	Ann Lake (33-0040)	TP	›	›	™		™	?	~	™			›		
	Fish Lake (33-0036)	TP	›	~	›		™	?	›	™			™	~	
Groundhouse River	Groundhouse River (512)	Bacteria	›	~	›	™									
	Groundhouse River (513)	Bacteria	›	~	›	™									
		Sediment		~											~
	South Fork Groundhouse River (573)	Bacteria	›	~	›	™									
		Sediment		~											~
Mud Creek	Mud Creek (566)	Bacteria	›	~	›	™									
		Sediment		~											~
	Mud Creek (567)	Bacteria	›	~	›	™								™	
	Quamba Lake (33-0015)	TP	›	~	›		™	?	›	™			™		
Pokegama Lake	Pokegama Lake (58-0142)	TP	›	~	™		™	?	~				™		
Lower Snake River	Bear Creek (514)	Bacteria	›	~	›	™									
	Cross Lake (58-0119)	TP	›	›	™		›	?	~			™	™	›	

Key: ~ = High › = Moderate ™ = Low ? = unknown

* Relative magnitudes of contributing sources are indicated based on results from TMDL studies.

2.4 TMDL Summary

There are six impaired lakes and seven impaired stream reaches in the Snake River watershed that have received Total Maximum Daily Load (TMDL) allocations through the following TMDL studies: Groundhouse River Total Maximum Daily Loads for Fecal Coliform and Biota (Sediment) Impairments (Tetra Tech, 2009); Ann River Watershed Bacteria, Nutrient, and Biota TMDL (Wenck Associates, 2013a); and the Snake River Watershed TMDL study (Wenck Associates, 2013b). TMDL allocations and pollutant load reductions from current conditions for each lake and stream reach are summarized in Table 5 and Table 6. Section 3 of this report identifies the high priority pollutant loading areas and recommended restoration strategies to achieve the reductions required for these impaired lakes/reaches.

It should also be noted that the Snake River watershed is one of several major watersheds that drain to Lake St. Croix which is impaired due to excess nutrients. In August of 2012, a TMDL for Lake St. Croix was approved by EPA. This TMDL calls for a 20% phosphorus reduction from the Snake River watershed in order for Lake St. Croix to meet water quality standards. Individual phosphorus reductions requirements for the Snake River impaired lakes ranged from 39% to 74%. Lake St. Croix's 20% load reduction goal for the entire Snake River will be achieved as long as each impaired lake in the Snake River watershed is able to achieve its targeted TMDL phosphorus reduction.

Table 5. Allocation summary for all completed Lake TMDLs in the Snake River Watershed.

			Allocations (lbs/year)										
			Wasteload Allocation			Load Allocation					MOS	RC	
HUC-10	Lake (ID)	Pollutant	WWTFs	Construction & Industrial Stormwater	MS4 Communities	Watershed Load	Internal Load	Upstream Lakes	Diffusive Flux	Atmosphere	Margin of Safety	Reserve Capacity	Percent Reduction[1]
Knife River	Knife Lake (33-0028)	TP	978	121	--	7,639	1,297	--	--	301	547	47	45%
Ann River	Ann Lake (33-0040)	TP	--	115	--	5,605	1,400	--	--	185	384	--	39%
	Fish Lake (33-0036)	TP	--	121	--	2,177	258	4,586	--	100	805	--	42%
Mud Creek	Quamba Lake (33-0015)	TP	--	55	--	3,516	113	--	--	54	197	--	46%
Pokegama	Pokegama Lake (58-0142)	TP	--	108	--	6,832	1,356	--	--	362	456	--	74%
Lower Snake River	Cross Lake[2] (58-0119)	TP	29	42	--	1,220	3,053	--	1,947	147	339	7	47%

[1]Total percent reduction (all sources) from existing conditions to meet TMDL allocations
[2]Cross Lake TMDL allocations are for the lake's central and north basins. All TP loading from the Snake River was allocated as diffusive flux from the south basin.

Table 6. Allocation summary for all completed bacteria and sediment TMDLs in the Snake River Watershed.

HUC-10	Stream/Reach (AUID)	Pollutant	Flow Zone	E. coli Allocations (billions organisms/day) Sediment Allocations (tons/year)				Percent Reduction[1]
				Wasteload Allocation		Load Allocation	MOS	
				WWTFs	Regulated Stormwater (CSW/ISW/MS4)	Watershed Load	Margin of Safety	
Ann River	Ann River (511)	*E. coli*	Very High	--	--	606.7	31.9	0%
			High	--	--	139.2	7.3	12%
			Mid	--	--	48.7	2.6	67%
			Low	--	--	25.6	1.4	41%
			Dry	--	--	15.0	0.8	52%
	Ann River (511)	Bedded Sediment	Annual Average	--	2	763 (watershed) 407 (streambank)	45	44%
Groundhouse River	Groundhouse River (512)	Fecal coliform	Very High	1.7	--	1,841.1	97.0	92%
			High	1.7	--	1,191.8	62.8	52%
			Mid	1.7	--	200.0	10.6	23%
			Low	1.7	--	132.6	7.1	42%
			Dry	1.7	--	33.2	1.8	65%
	Groundhouse River (513)	Fecal coliform	Very High	1.7	--	1,043.2	55.0	65%
			High	1.7	--	414.3	21.9	0%
			Mid	1.7	--	112.7	6.0	13%
			Low	1.7	--	84.2	4.5	67%
			Dry	1.7	--	22.2	1.3	0%
		Bedded Sediment	Annual Average	15.8	5.7	4,182.0	Implicit	31%
	South Fork Groundhouse River (573)	Fecal coliform	Very High	--	--	711.4	37.4	91%
			High	--	--	460.8	24.3	91%
			Mid	--	--	126.7	6.7	44%
			Low	--	--	41.2	2.4	56%
			Dry	--	--	17.3	0.9	35%
		Bedded Sediment	Annual Average	--	5.4	4,031.2	Implicit	39%
Mud Creek	Mud Creek (566)	*E. coli*	Very High	--	--	335.5	17.7	0%
			High	--	--	63.5	3.3	0%
			Mid	--	--	21.3	1.1	0%
			Low	--	--	10.4	0.6	44%
			Dry	--	--	6.2	0.3	73%

HUC-10	Stream/Reach (AUID)	Pollutant	Flow Zone	E. coli Allocations (billions organisms/day) Sediment Allocations (tons/year)				Percent Reduction[1]
				Wasteload Allocation		Load Allocation	MOS	
				WWTFs	Regulated Stormwater (CSW/ISW/MS4)	Watershed Load	Margin of Safety	
Mud Creek cont'd	Mud Creek (566)	Bedded Sediment	Average Annual	--	3	49 (watershed) 41 (streambank)	5	67%
Mud Creek	Mud Creek (567)	*E. coli*	Very High	--	--	1,366.4	71.9	0%
			High	--	--	184.0	9.7	9%
			Mid	--	--	43.7	2.3	31%
			Low	--	--	18.5	1.0	0%
			Dry	--	--	9.3	0.5	64%
Lower Snake River	Bear Creek (514)	*E. coli*	Very High	--	--	58.4	3.1	0%
			High	--	--	18.3	1.0	60%
			Mid	--	--	7.3	0.4	72%
			Low	--	--	4.4	0.2	52%
			Dry	--	--	2.9	0.2	43%

[1]Total percent reduction (all sources) from existing conditions to meet TMDL allocations

2.5 Protection Considerations

The Snake River watershed supports a diverse range of aquatic species including fish and freshwater mussels, as well as a number of terrestrial threatened and endangered species (The Nature Conservancy, 2009). The watershed is also home to several outstanding resources such as the Mille Lacs Wildlife Management Area, the Solana State Forest, and the Rum River State Forest, which provide critical habitat for many species and support recreational activities such as hiking, fishing, and wildlife viewing. To date, a majority of the management efforts within the Snake River watershed has focused on restoring the watershed's impaired water bodies by setting pollutant load reduction goals and targeting and implementing best management practices (BMPs) throughout the impaired watersheds. There are several non-impaired water bodies (Appendices A and B) in the Snake River watershed that are threatened by decreased water quality, invasive species, forest fragmentation, increased flooding events, road and utility development, residential development and climate change. Several entities such as the local SWCDs, lake associations, SRWMB, MPCA, DNR, Minnesota Board of Water and Soil Resources (BWSR) and The Nature Conservancy have been working to monitor, assess and protect biodiversity and the ecology of Snake River's non-impaired waterbodies and watersheds. Going forward,

protection efforts by these entities will become increasingly important as the aforementioned stressors continue to threaten resources throughout the watershed.

In 2009, The Nature Conservancy prepared a Conservation Action Plan for the Snake River watershed that provided a complete assessment of terrestrial and aquatic ecosystems within the watershed, and identifies conservation targets and potential threats to those targets (The Nature Conservancy, 2009). Additionally, in 2013 the United States Environmental Protection Agency (EPA) contracted with the CADMUS Group to assist local and state agencies in developing a Healthy Watersheds Report for the Snake River Watershed. One of the many things the CADMUS Group did was to perform a review of protection efforts in the Snake River Watershed to assist the state and collaborators in long-term watershed protection efforts (CADMUS, 2013). Results of these reports produced the following recommendations for protection planning in the Snake River watershed:

- Conduct a detailed review of city, township, county, and state ordinances to identify opportunities to strengthen protection throughout the watershed
- Encourage civic engagement and collaboration and coordination among state agencies, conservation groups, counties, and watershed organizations to strengthen watershed protection efforts
- Conduct a detailed systems-based analysis using existing datasets and tools to prioritize specific areas for protection. Specifically identify those lands most important for keeping existing healthy water reaches from degrading
- Use broad education and civic engagement strategies to explore and develop potential landowner incentives (e.g. conservation easements) to conserve areas identified as being most important to protect water quality
- Develop pilot programs for targeted landowner incentives to protect healthy water reaches and secure funding for implementation. Then, expand these pilot programs as warranted based on participation/success
- Develop an inventory of culverts and dams within the watershed and prioritize them for restoration or removal to improve aquatic connectivity
- Assess the presence and prevalence of invasive species within the watershed and develop strategies to prevent the spread of invasive species that have the potential to negatively impact high priority resources or threatened species
- Identify and support strategies and management plans needed to protect native biological communities (e.g. lake sturgeon and mussels)
- Promote adoption of more protective shoreland management standards at local and state levels, including support for expanded critical habitat/sensitive area designation and public/private protection programs for shoreland
- Promote ecologically-based forest management and protect large-block forests from fragmentation through easements, certification and outreach

3. Prioritizing and Implementing Restoration and Protection

The Clean Water Legacy Act (CWLA) requires that the WRAPS report 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.

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.

3.1 Targeting of Geographic Areas

Various datasets and GIS tools were developed through the Snake River watershed assessment process and the TMDL reports that can be used to identify degraded waterbodies and potential areas to implement restoration strategies. Since 1996, there have been over 308 fish and invertebrate IBI assessments conducted on over 54 reaches throughout the Snake River watershed. Results of these assessments (Figure 6 and Figure 8) can help identify potential restoration areas that have impaired or threatened aquatic communities due to poor habitat conditions or other stressors. The Human Disturbance Score (Table 7 and Figure 4) is a GIS-based tool that combines five factors to measure the intensity of human impact on the landscape. This tool may be used to inform whether an emphasis on restoration or protection projects may be needed in certain watersheds. Additionally, two GIS-based models were developed as part of the Snake River Watershed TMDL source assessment that will help managers identify high bacteria and phosphorus pollutant loading areas for restoration activities (Table 7, Figures 5 and 6).

There are also a number of tools, assessments and resources available to help identify high-valued land and sensitive areas throughout the Snake River watershed that could be targeted for protection. A summary of these resources is presented in Table 8, Figure 9 through 13. These resources were developed by various groups and agencies including BSWR, The Nature Conservancy and the DNR. More detailed information on each effort/tool can be obtained from the sources cited in Table 8. It is important to point out that these tools were developed using a wide range of input datasets with different protection initiatives in mind, ranging from altered streams/ditch identification to terrestrial biodiversity.

Recently, the Minnesota DNR developed the Watershed Health Assessment Framework (WHAF) which provides a comprehensive overview of the ecological health of Minnesota's watersheds). The WHAF is

based on a “whole-system” approach that explores how all parts of the system work together to provide a healthy watershed. The WHAF divides the watershed’s ecological processes into five components: biology, connectivity, geomorphology, and hydrology and water quality. A suite of watershed health index scores have been calculated that represent many of the ecological relationships within and between the five components. These scores have been built into a statewide GIS database that is compared across Minnesota to provide a baseline health condition report for each of the 81 major watersheds in the state. The DNR has applied the condition report to larger (HUC-8) watersheds, and more recently has applied the framework at smaller (HUC-12) subwatershed levels. Moving forward, the WHAF will be a helpful resource in monitoring and assessing the health of the Snake River watershed as restoration and protection practices are implemented.

Table 7. Tools for prioritizing and targeting watershed restoration efforts.

Tool	Description	How can/will the analysis tool be used?	Notes	Link to Information and data
Human Disturbance Score (HDS)	A general overview of intensity of human-related activity in a watershed as measured by five factors including: watershed land cover, riparian land cover, point sources, feedlots, and extent of stream channelization	This score gives a quantitative measure of human-related activity in a watershed that can inform whether an emphasis on restoration or protection projects is needed. This tool may be used to identify highly impacted areas within the watershed.		
Generalized Watershed Loading Function (GWLF)	A GIS-based continuous simulation model which uses daily weather data to calculated water balance and simulate runoff, sediment and nutrient loading.	Simulates runoff, sediment, and nutrient loads from a watershed, or sub-watersheds, given variable size source areas (i.e. agriculture, forested, and urban land). Daily, monthly, or annual output allow for calculation of total flow and pollutant loading as well as spatial identification of high-loading areas and subwatersheds. This tool will be used to identify high phosphorus loading areas in the watershed	Originally developed in 1987, the model has been incorporated into a GIS interface (AVGWLF) developed and maintained by Penn State University (Evans et al. 2008)	http://www.avgwlf.psu.edu/
Watershed Bacteria Production by Source	Uses literature rates and available data/estimates of all known bacteria sources in the watershed to calculate total watershed bacteria production. Bacteria sources for this assessment include: wildlife (primarily birds and deer), feedlot and livestock, total septic systems and estimated failure rates, wastewater treatment facility effluent, and pet populations for urban areas.	This tool helps estimate the total amount of bacteria produced in a given watershed or subwatershed. On a large watershed scale, results are helpful in identifying subwatersheds with higher rates of bacteria production to focus monitoring efforts and potential BMPs.	Bacteria production analysis was originally developed to aid TMDL source assessment for the Ann River and Snake River Watershed *E. coli* impaired reaches. This analysis was extended to include all Snake River sub-watersheds (non-impaired reaches) for use in the WRAPS report.	
Fish and Macroinvertebrate IBI Scores	The Index of Biotic Integrity (IBI) is a biological assessment tool developed in many regions for assessing health of streams, lakes and river systems. It incorporates a set of metrics that are combined to provide a community-level assessment of stream biological conditions.	IBI scores can be used to identify and determine potentially impaired stream reaches. In general, high quality streams exhibit high diversity both in the number of fish/macroinvertebrate species or feeding groups represented and in the balance among them. A healthy biotic community is rarely dominated by a few species, particularly not by species that tolerate significant disturbance. These maps will be used to identify and target areas with low biodiversity for watershed and in-channel restoration activities.		

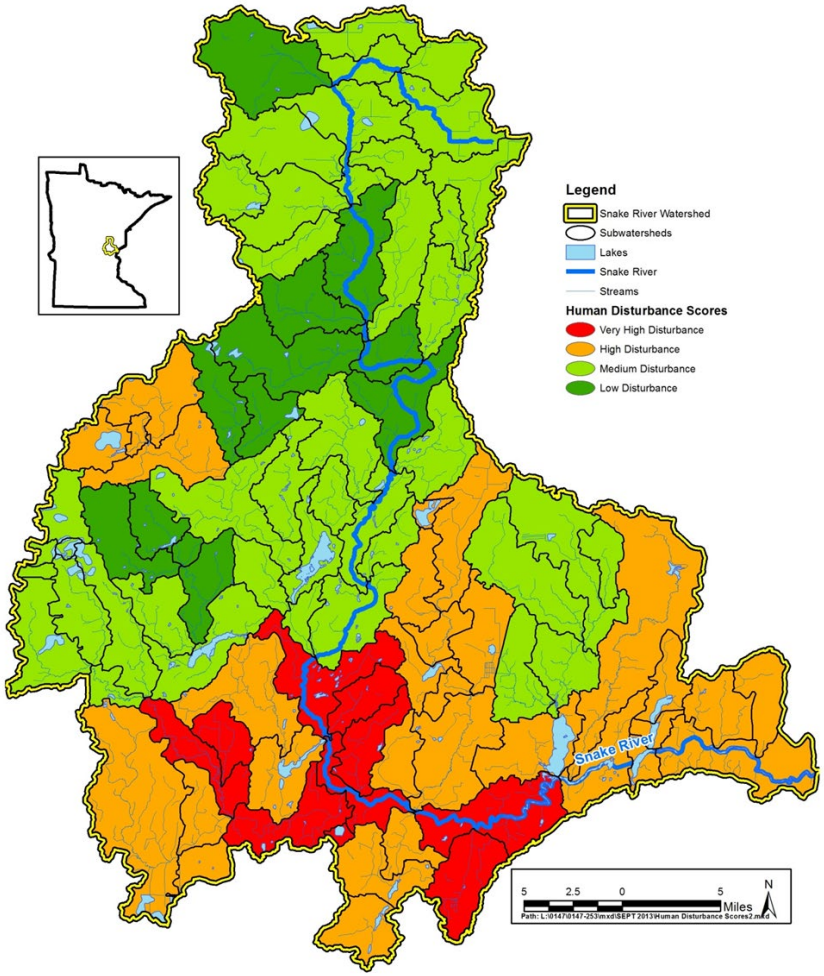


Figure 4. Human Disturbance scores in the Snake River Watershed.

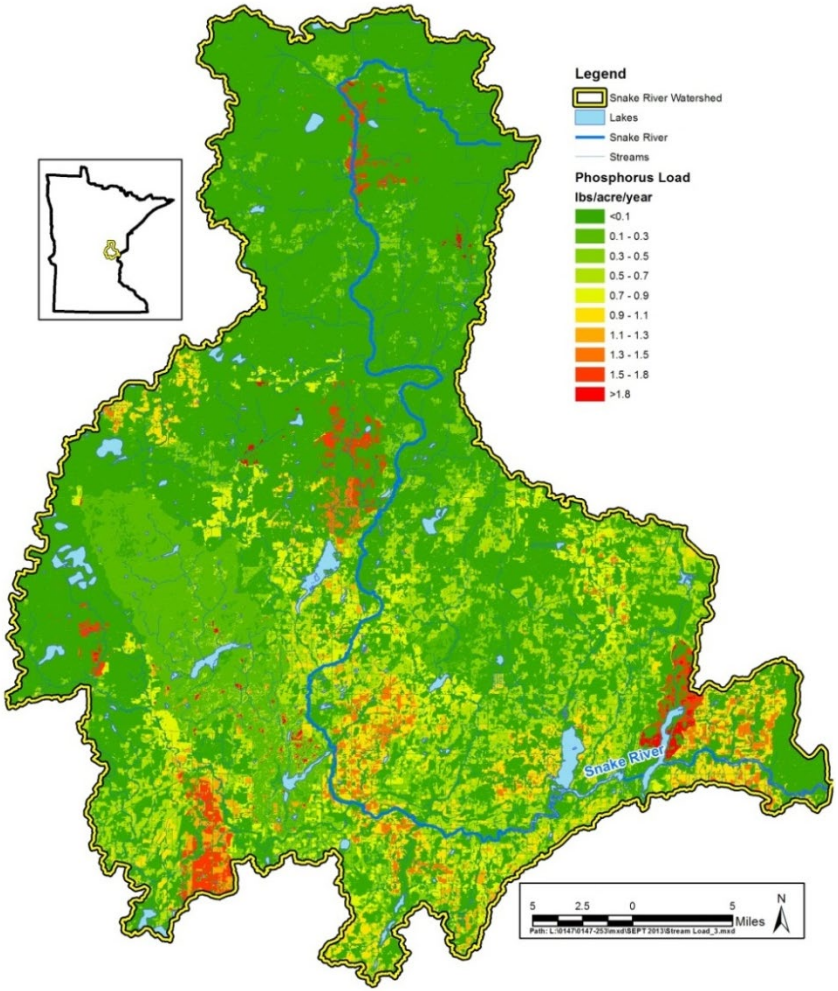


Figure 5. GWLF predicted Phosphorus loading in the Snake River Watershed.

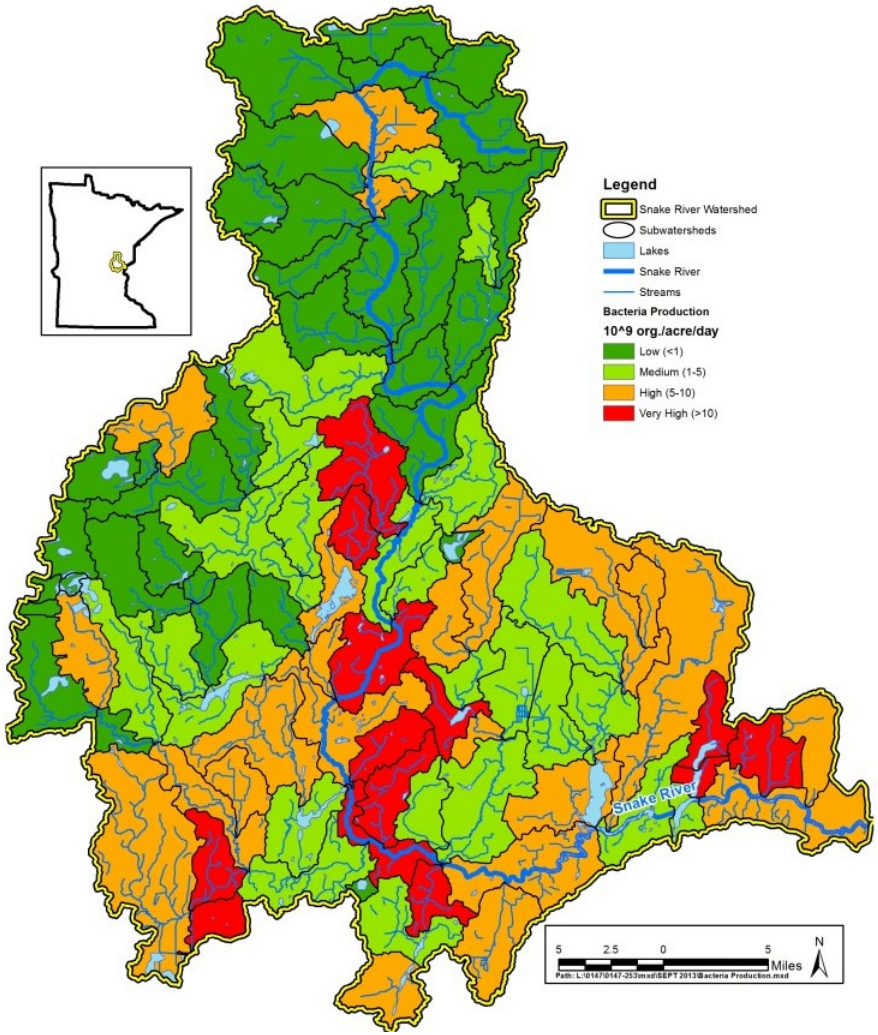


Figure 7. Snake River Watershed bacteria production by subwatershed.

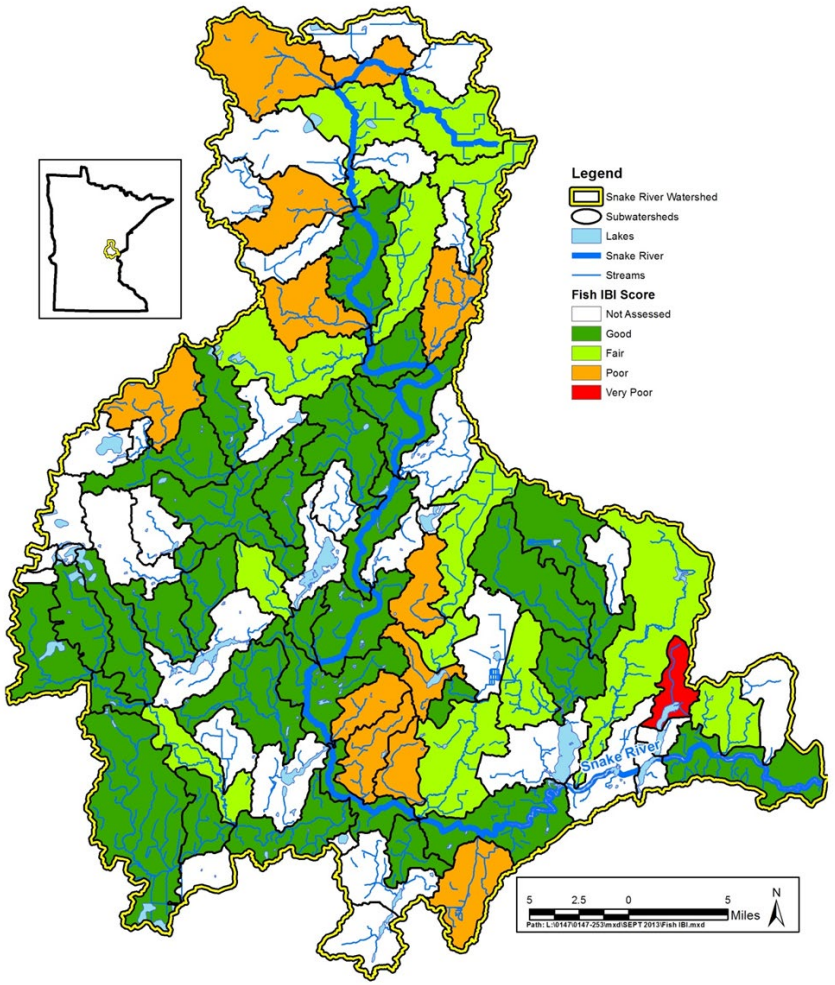


Figure 6. Fish IBI scores for several assessed reaches throughout the Snake River Watershed.

*For this map, fish IBI scores were color coded based on comparison to minimally impacted streams of similar stream types in Minnesota's central river region. Average fish IBI scores were used for reaches with multiple fish IBI assessments.

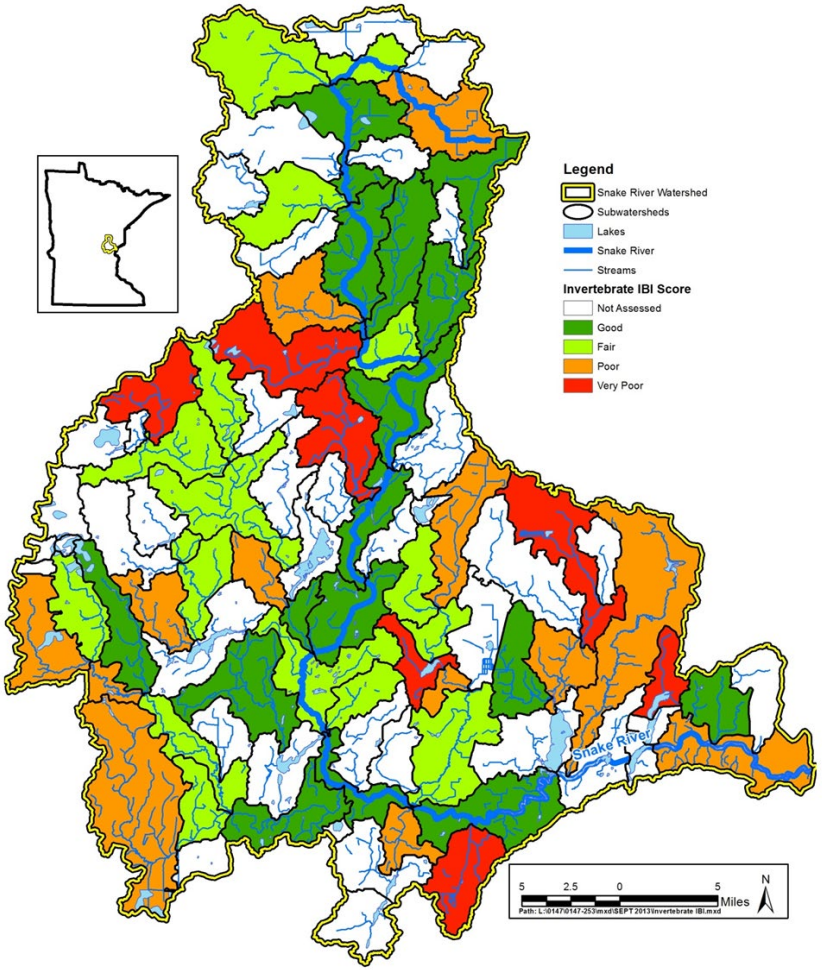


Figure 8. Macroinvertebrate IBI scores for several assessed reaches throughout the Snake River Watershed.

*For this map, macroinvertebrate IBI scores were color coded based on comparison to minimally impacted streams of similar stream types in Minnesota's central river region. Average invertebrate IBI scores were used for reaches with multiple invertebrate IBI assessments

Table 8. Example tools and analyses for prioritizing and targeting protection efforts in the Snake River Watershed.

Tool	Description	How can/will the analysis tool be used?	Notes	Link to Information and data
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. The 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. This tool will be used to identify areas with high restoration/protection benefits	GIS layers are available on the BWSR website.	MBWSR, 2011
Snake River Watershed Ditch Identification	The DNR 1:24K stream layer was sorted and classified based on stream type. Stream segments that were classified as ditches were removed and displayed on maps showing federal, state and county owned land.	This analysis was performed to help identify old, unmaintained ditches on public lands (or private land with willing landowners) that could be properly abandoned without negative impact to downstream private landowners. Abandoning ditches may provide pollution and flooding reduction benefits and potential habitat improvements.	GIS data and methodology documents available from the Nature Conservancy. Contact: rich_johnson@TNC.ORG	
Snake River Aquatic Biodiversity Targets	This model uses information on natural communities and species, upstream and local watershed condition, and stream connectivity to estimate the potential value of riparian and upland land in protecting existing high quality stream and lake habitat in the basin	This tool integrates numerous data sets to develop an overall score for each area based on its contribution to aquatic habitat. The higher the score, the higher the habitat value. The tool will be used to help inform protection priorities and strategies within the Snake River watershed.	GIS data and methodology documents available from the Nature Conservancy. Contact: rich_johnson@TNC.ORG	
Snake River Terrestrial Biodiversity Targets	This model uses information on target natural communities and species, general habitat quality, and proximity to other high-quality and protected lands to identify sites with the highest terrestrial habitat value.	This tool integrates numerous data sets to develop an overall score for each area based on its contribution to terrestrial habitat. The higher the score, the higher the habitat value. The tool will also be used to help inform protection priorities and strategies within the Snake River watershed.	GIS data and methodology documents available from the Nature Conservancy. Contact: rich_johnson@TNC.ORG	
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. This tool can be used to help guide conservation (protection) prioritization within the Snake River watershed.	Assistance through the DNR (Paul Radomski) may be available	FCEMB, 2012

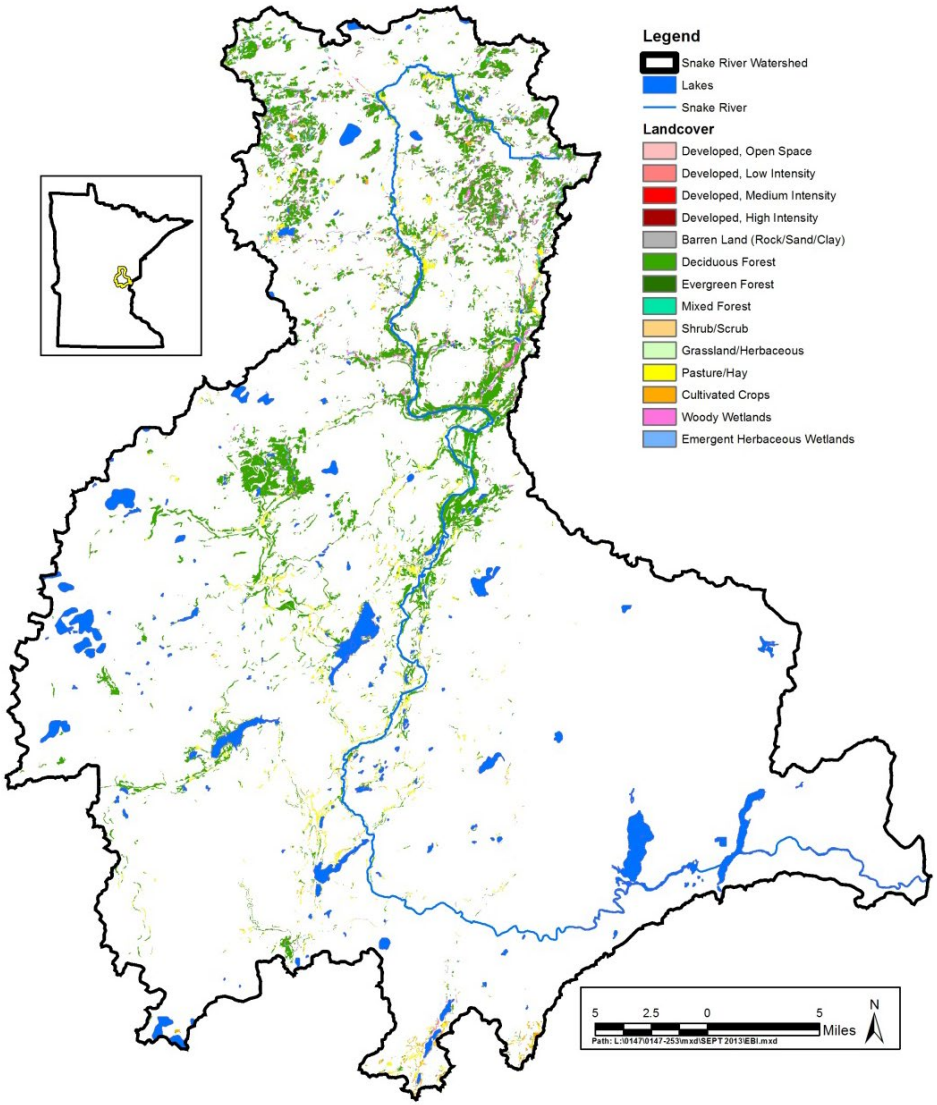


Figure 10. Board of Soil and Water Resources Environmental Benefits Index (EBI) tool Top 10% priority areas within the Snake River Watershed. (BWSR, 2011 and Cadmus, 2013)

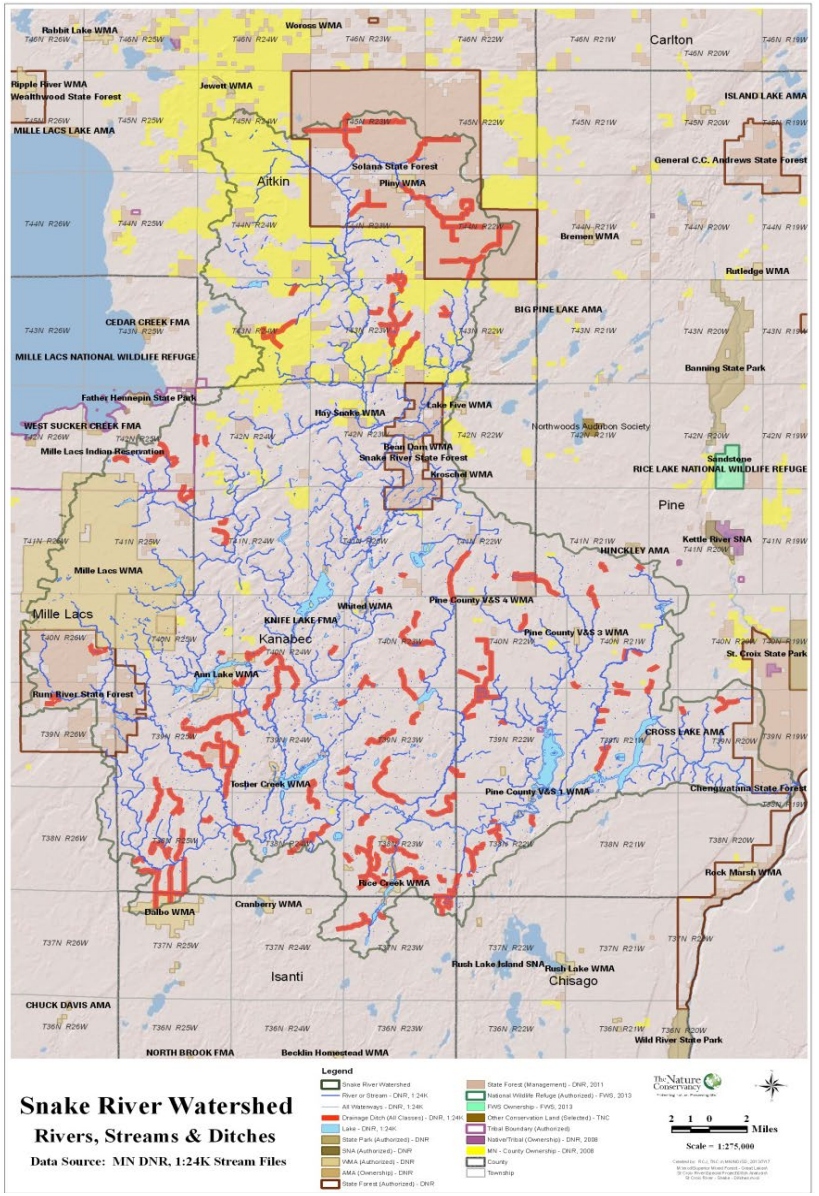


Figure 9. Ditches in the Snake River Watershed. (Source: The Nature Conservancy)

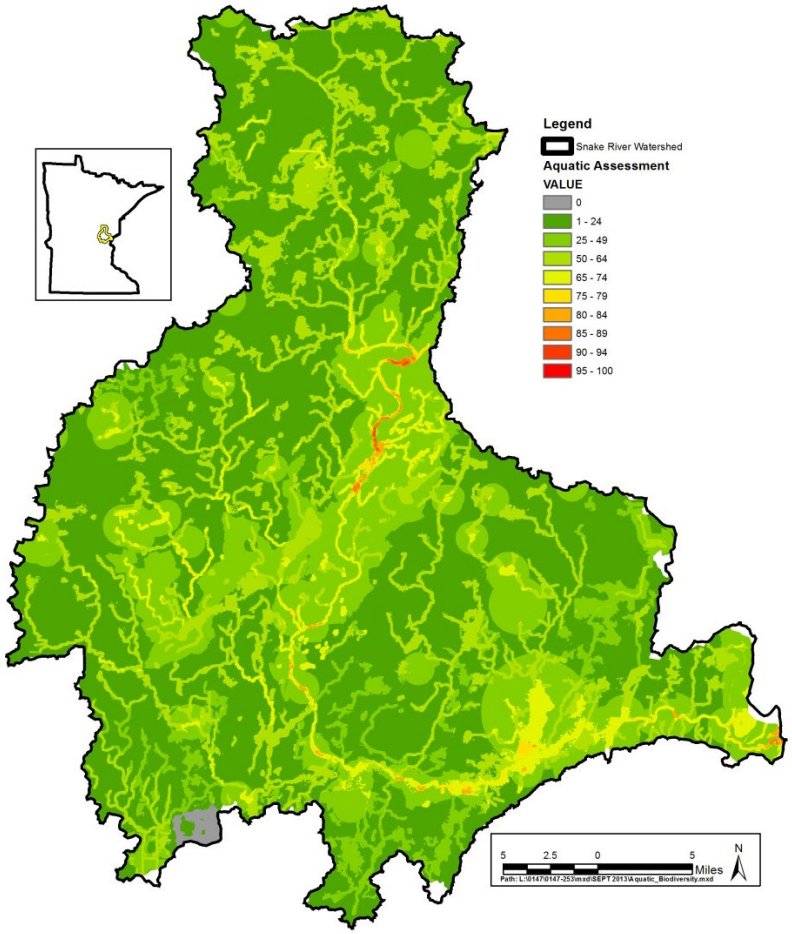


Figure 12. Aquatic biodiversity targets in the Snake River Watershed. (Source: Johnson et al. 2013a)

*Higher scores (red) indicate areas of higher aquatic biodiversity and may be prioritized for protection

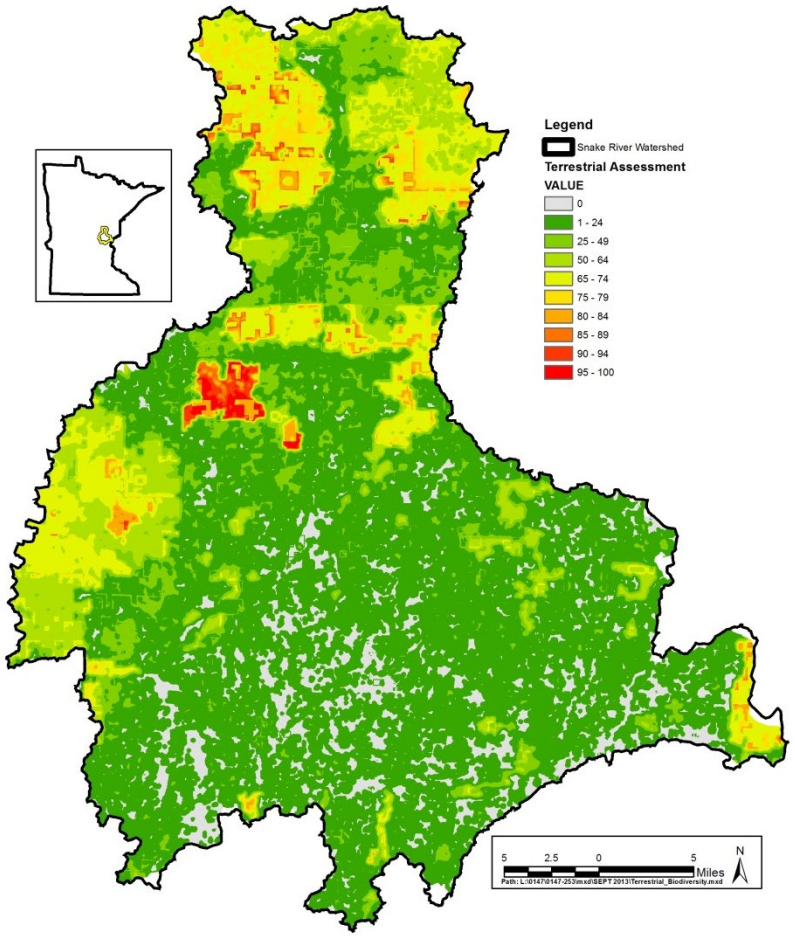


Figure 11. Terrestrial biodiversity targets in the Snake River Watershed. (Source: Johnson et al. 2013b)

* Higher scores (red) indicate areas of higher terrestrial biodiversity and may be prioritized for protection

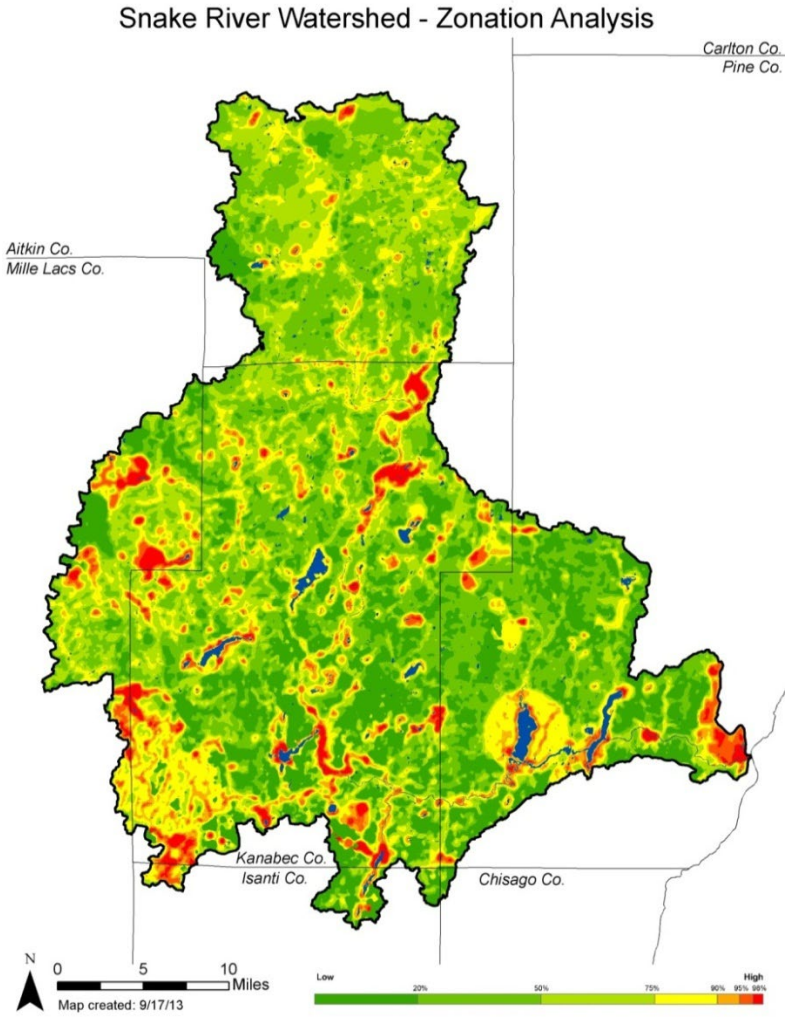
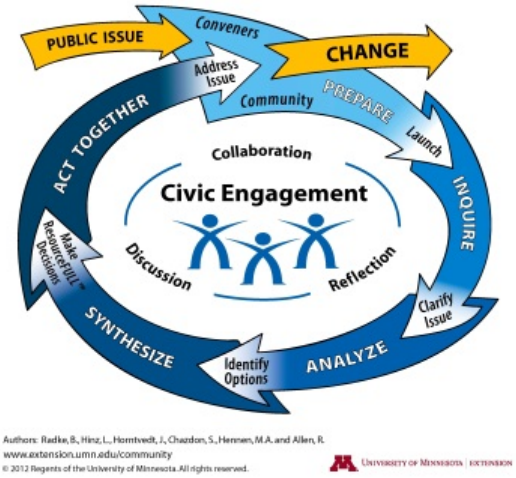


Figure 13. Priority protection areas in the Snake River Watershed identified through the zonation process. (Source: Paul Radomski, DNR).

* Red and orange areas indicate higher priority areas for protection.

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. Further information on civic engagement is available at: http://www1.extension.umn.edu/community/civic-engagement/



Accomplishments and Future Plans

Within the Snake River watershed local organizations have been successfully interacting and engaging with citizens throughout the watershed. One example of this is the involvement of the Snake River Watershed Management Board Citizen Advisory Committee (CAC). This group, which is made up of interested landowners, lake association members, SWCD Board Supervisors and any interested citizen, meets monthly to discuss activities and issues within the watershed. The CAC is the sounding Committee for local projects, and ultimately can decide if a specific land practice is funded with SRWMB funds.

Other examples of successful local involvement that have occurred include the strong local interest in the TMDL projects that have taken place in the Snake River watershed. It is not uncommon at local open houses or meetings to have 20 to 40 interested citizens. There are also very strong organizations like the Cross Lake Association and the Pokegama Lake Association which have continued to be strong advocates for each of their lakes and the watershed.

Other groups have also emerged over the past few years because growing concerns over water quality. One example of this is the Ann River Watershed Alliance. As local knowledge and concerns about water quality in the watershed continue to grow groups like this will continue to emerge and will be supported by local organizations as advocates for the watershed.

Future Plans

With a lot of efforts already going on in the watershed over the past several years it will be important to keep the local citizens engaged and informed in the implementation process of this WRAPS document and Local Water Plans. The future success of this document and meeting the TMDL reductions will be

dependent upon keeping local citizens and local, state, and federal agencies involved in the watershed. One effort that has been underway with the Kanabec SWCD, Mille Lacs SWCD, Pine SWCD and Mille Lacs NRCS, has been to receive training on Civic Governance.

The Civic Governance training provides local staff with leadership skills and tools for Organizing Civic Leadership within their jurisdictions. The training is based on Civic Principles, Standards and Disciplines that are sustainable for achieving water quality goals in the St. Croix Basin (see Table 9)

3.3 Restoration & Protection Strategies

The 5 restoration tools presented in Table 7 were overlaid and combined into one map by assigning weighted values (1 = low impact/pollutant loading; 4 = Very High impact/pollutant loading) to all 12-digit HUC subwatersheds in each map. The weighted values were determined based on the four category breaks (low to high) presented in Figures 5 through 8. Thus, the final map (Figure 14) represents the sum of all four individual maps/tools. This exercise is intended to give a general sense of which areas in the watershed should be targeted for restoration, and those that should be targeted for protection. Results of the final overlay were divided into four management categories:

High Priority Restoration – Two or more of the assessment tools/maps indicate very high degradation/impact and pollutant loading. These subwatersheds should be considered high priority for restoration and BMP implementation planning

Moderate Priority Restoration – Two or more of the assessment tools/maps indicate high to very high degradation/impact and pollutant loading. These subwatersheds should be considered a moderate to high priority for restoration and BMP implementation planning.

Monitor/Protect – Most of the assessment tools/maps indicate moderate to low levels of degradation/impact and pollutant loading. These subwatersheds should be monitored and protected to ensure resources do not become degraded or impaired.

Protection – Most of the assessment tools/maps currently indicate low levels of degradation/impact and pollutant loading. These subwatersheds should be targeted for protection planning.

It should be pointed out that these groupings and analyses are intended to help identify general areas, (12-digit HUC watersheds) where restoration and protection planning/efforts may focus. Thus, conducting more detailed analyses within each subwatershed will need to be done to help watershed organizations and state agencies better target specific BMPs, programs and funding activities.

Through the Snake River watershed TMDL and WRAPS projects, a team of local water quality professionals, referred to as the Technical Advisory Group (TAG), was assembled to develop broad strategies to restore and protect water quality in the watershed. Members of the TAG included staff from the MPCA, BWSR, local Natural Resources Conservation Services (NRCS), The Nature Conservancy, Minnesota DNR, SRWMB, Mille Lacs SWCD, Pine SWCD, Kanabec SWCD and local lake association

groups. The development of the broad restoration and protection strategies by these groups drew on several resources including: monitoring and assessment and stressor identification (previously discussed in this report), an analysis of the pollutant reduction necessary to meet water quality standards (Groundhouse, Ann River, and Snake River TMDL studies), and the restoration and protection assessment mapping discussed above. The final list of broad restoration and protection strategies for each 10-digit HUC in the Snake River watershed is presented in Table 9. These strategies represent first priorities. 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 Restoration and Protection strategies presented in Table 9 (Red = Restoration Strategies and Green = Protection Strategies) are intended to be further refined and applied by local working groups to target conservation practices. The strategies can be further refined (i.e. spatially targeted) using any number of tools available, some of which are presented and discussed throughout this report. 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.

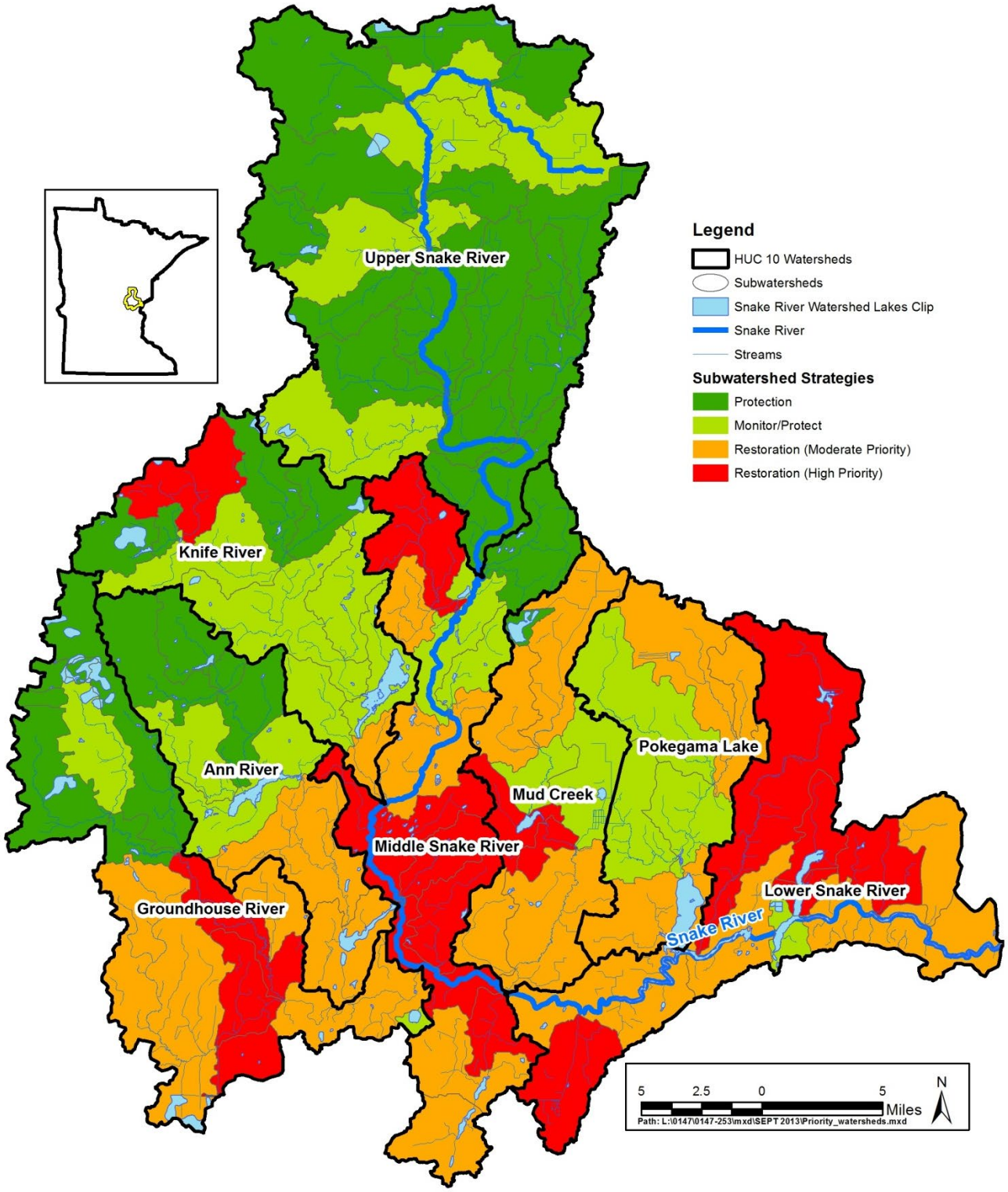


Figure 14. Subwatershed targeting in the Snake River Watershed for Restoration and Protection Planning.

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Table 9. Strategies and Actions proposed for the Snake River Watershed.

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals/ Targets/ Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Upper Snake River	All non-impaired Streams and Lakes HUC	Kanabec Aitkin	-	-	-	Monitor/Protect 15 sub-watersheds Protection 5 sub-watersheds	Forestry management	Develop forestry management plans on all private forest land in watershed		•	•				•			2035	Complete 10 plans
							Conservation easements	Develop 3-6 conservation easements with landowners	•	•	•		•		•	•			Develop 3 easements
							Wetland restorations	Implement 3-6 wetland restorations in drained and impacted wetland areas	•	•			•		•				Implement 3 wetland restorations
							Ditch abandonment	Where possible – ID those in public land	•	•					•	•			Complete ID process
							Dam/culvert assessment	Inventory all dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage	•	•	•				•				Complete the inventory and assessment process
							Livestock/Pasture/Feed lot management	Establish 3-6 managed access control areas near streams	•	•			•						Implement 3 access control areas
								Establish 3-6 livestock – heavy use stream crossing protection areas											3 heavy use crossings
								Establish 1-2 livestock – alternative watering sources											1 alternative watering sources for BMPs
							Grazing management	Develop 4-8 grazing management plans		•			•						Implement 4 grazing plans
							Enhance/improve riparian buffers	Implement 2-4 riparian buffers	•	•	•	•	•	•	•	•	•		Implement 2 riparian buffers and 2 roadside erosion control BMPs
							Roadside erosion control at stream crossings	2-4 roadside erosion control projects											
							Shoreline protection	Promote, educate and install 3-6 responsible shoreline plantings/buffers/setbacks/bank stabilizations	•	•	•	•	•	•	•	•	•		Implement 3 shoreline planting/bank stabilization BMPs
Knife River	Knife Lake (33-0028)	Mille Lacs Kanabec	TP	Internal P: 6,764 lbs Watershed P: 11,200 lbs Septic P: 555 lbs	<u>Reductions:</u> Internal P: 1,299 lbs Watershed P: 7,222 lbs Septic P: 0 lbs	High Priority Restoration 1 subwatershed Moderate Priority Restoration 1 subwatershed	Livestock/Pasture/Feed lot management	Establish 3-6 livestock - managed access areas	•	•			•						2035	3 managed access control areas
								Establish 2-4 livestock – heavy use stream crossing protection areas in selected areas											2 heavy use crossings
								Establish 1-2 livestock – alternative watering sources											1 alternative watering source
								Implement 3-6 pastureland runoff controls, buffers near streams	•	•			•						Implement 3 BMPs
								Programs/funding for 2-4 feedlot runoff treatment, control and storage BMPs	•	•			•						Implement 2 BMPs
							Cropland and manure management	Promote/educate agronomic rates and chemical addition of manure	•	•			•						Develop and promote educational resources/information
								Provide resources/education for soil nutrient testing and spreading in sensitive areas	•	•			•						Develop and promote educational resources/information

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Knife River Cont'd	Knife Lake (33-0028)	Mille Lacs Kanabec	TP	Knife Lake Internal P: 6,764 lbs Watershed P: 11,689 lbs Septic P: 60 lbs	Knife Lake Target: Internal P: 1,297 lbs Watershed P: 7,639 lbs Septic P: 0 lbs	High Priority Restoration 1 subwatershed Moderate Priority Restoration 1 subwatershed	Cropland and manure management	Promote/educate/implement	•	•			•					2035	Develop and promote educational resources/information
								4-8 conservation and reduced tillage BMPs											4 reduced tillage BMPs,
								2-4 cover crop BMPs											implement 2 cover crop BMPs
								Implement 1-2 water and sediment control basins											one water and sediment control basin
							Septic system upgrades	ID and upgrade all ITPHS threat systems			•								Complete ID process and upgrades
								ID and upgrade all non-conforming systems near streams/waterways			•								Complete 50% of the ID process and upgrades
							In- lake Sediment P release	Complete in-lake sed. inactivation feasibility study and treatment for Knife Lake	•	•				•	•		•		Complete feasibility study
							Lake vegetation management	Adopt and implement management plan for Knife Lake curly-leaf pondweed treatments							•		•		Update or complete management plan
							Shoreline protection	Promote, educate and install 5-10 responsible shoreline plantings, buffers, setbacks, bank stabilizations	•	•					•		•		Implement 5 BMPs
							Wetland Restorations	Implement 3-6 wetland restorations		•					•				Implement 3 BMPs
							Roadside erosion control at stream crossings	Implement 3-6 roadside erosion control projects		•	•				•				Implement 3 BMPs
							Soil Health	Promote and educate healthy soil practices, landowners adopt at least 2-4 practices	•	•			•						Implement 2 practices
	All non-impaired Streams and Lakes HUC	Mille Lacs Kanabec	-	-	-	Monitor/Protect 4 subwatersheds Protection 4 subwatersheds	Forestry management	Develop 3-6 forestry management plans	•	•			•		•			2035	Complete 3 plans
							Conservation easements	Develop2-4 conservation easements with landowners	•	•	•				•	•			Develop 2 easements
							Ditch abandonment	Where possible – ID those in public land and complete abandonment process where applicable							•	•			Complete ID process
							Dam/culvert assessment	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage		•	•				•				Complete inventory process

HUC-10 Watershed	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 / Reductions	Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement: SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations	Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
Ann River	Ann Lake (33-0040) Fish Lake (33-0036) Ann River (-511)	Mille Lacs Kanabec	Lakes: Nutrients River: E. coli Bedded - Sediment Connectivity Lack of Habitat	Ann Lake Internal P: 5,496 lbs Watershed P: 5,822 lbs Septic P: 445 lbs Fish Lake Internal P: 1,425 lbs Watershed P: 4,688 lbs Septic P: 904 lbs Ann River *E. coli* Loads Very High Flows: 57 cfu/100mL High Flows: 143 cfu/100mL Mid Flows: 381 cfu/100mL Low Flows: 213 cfu/100mL Dry Flows: 261 cfu/100mL Ann River Bedded Sediment Load Watershed Sediment: 763 tons Streambank Sediment: 1,317 tons	Ann Lake Target Internal P: 1,400 lbs Watershed P: 5,605 lbs Septic P: 0 lbs Fish Lake Reductions Internal: 258 lbs Watershed: 2,177 lbs Septics: 0 lbs Ann River *E. coli* Reductions Very High Flows: no reduction High Flows: 12% reduction Mid Flows: 67% reduction Low Flows: 41% reduction Dry Flows: 52% reduction Ann River Bedded Sediment Load Reductions Watershed Sediment: 763 tons Streambank Sediment: 407 tons	2 Moderate Priority Restoration subwatersheds	Livestock/Pasture/Feed lot Management	50% of the unprotected riparian areas along Ann River restored with vegetative buffers, cattle access control areas, heavy use protection – stream crossing areas, alternative watering sources, and rotational grazing methods, where applicable.	•	•			•					2035	At least 15 BMPs to be completed
							Cropland and manure management	50% of the high eroded cropland areas will be protected by implementing the following practices: sediment and water control structures and basins, cover crops, conservation and reduced tillage methods, grassed waterways and lined waterways and channels	•	•				•						At least 15 BMPs to be completed
								At least 50% of the cropland areas managed for manure		•			•							At least 10 BMPs to be completed
								75% of the farmsteads needing treatment, manure runoff control and manure storage in compliance by implementing feedlot runoff treatment and control methods and manure storage facilities	•	•			•							At least 10 BMPs to be completed
							Septic system upgrades	ID and upgrade 100% of the imminent threat systems and septics in the shoreland areas			•						•			Upgrades through point of sale
							Streambank restoration	Target 75% of the unprotected streambanks in Ann River for restoration and habitat improvement: bank stabilization, re-meanders, substrate installation, fine sediment removal etc.	•	•			•		•					At least 10 BMPs to be completed
							Roadside erosion control at stream crossings	50% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing erosion and flow control measures at/near culvert inlets and outlets		•										At least 6 BMPs to be completed
							In-lake Sediment P release	Feasibility (options) study and treatment for Ann Lake	•	•							•			Complete feasibility study
							Lake vegetation management	Lake management plan for Ann/Fish curly-leaf pondweed treatments						•			•			Complete or update management plans
							Shoreline protection	Promote/educate and implement 5-10 responsible shoreline plantings/buffers/setbacks		•				•			•			Implement 5 BMPs
							Dam/culvert inventory/upgrades	Inventory of all dams and culverts to assess problem sites that need replacement/improvement		•	•			•						Complete inventory
							Wetland restorations	Implement 5-10 wetland restorations		•			•							Implement 5 BMPs

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement								Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations	
Ann River cont'd	All non-impaired Streams and Lakes HUC	Mille Lacs Kanabec	-	-	-	2 Monitor/Protect subwatersheds 4 Protection subwatersheds	Forestry management	Develop 3-6 forestry management plans	•	•	•				•			2035	Complete 3 plans
							Conservation easements	Develop 2-4 easements where possible	•	•					•	•			Develop 2 easements
							Ditch abandonment	Where possible – ID those in public land and begin abandonment process	•	•	•				•	•			Complete ID process
Groundhouse River	Groundhouse River (-512) Groundhouse River (-513) South Fork Groundhouse River (-573)	Mille Lacs Kanabec Isanti	(-512): Fecal Coliform (-513): Fecal Coliform Bedded Sediment Riparian Disturbance (-573): Fecal Coliform Bedded Sediment Riparian Disturbance	(-512): Fecal Coliform Very High Flows: 2,500 cfu/100mL High Flows: 417 cfu/100mL Mid Flows: 260 cfu/100mL Low Flows: 345 cfu/100mL Dry Flows: 571 cfu/100mL (-513) Fecal Coliform Very High Flows: 571 cfu/100mL High Flows: 39 cfu/100mL Mid Flows: 230 cfu/100mL Low Flows: 606 cfu/100mL Dry Flows: 47 cfu/100mL (-573): Fecal Coliform Very High Flows: 2,222 cfu/100mL High Flows: 2,222 cfu/100mL Mid Flows: 357 cfu/100mL Low Flows: 455 cfu/100mL Dry Flows: 308 cfu/100mL	(-512): Fecal Coliform Percent Reductions Very High Flows: 92% High Flows: 52% Mid Flows: 23% Low Flows: 42% Dry Flows: 65% (-513): Fecal Coliform Percent Reductions Very High Flows: 65% High Flows: 0% Mid Flows: 13% Low Flows: 67% Dry Flows: 0% (-513) Bedded Sediment Reduction Watershed Sediment: 4,182.0 ton/yr (-573): Fecal Coliform Percent Reductions Very High Flows: 91% High Flows: 91% Mid Flows: 44% Low Flows: 56% Dry Flows: 35% (-573) Bedded Sediment Reduction Watershed Sediment: 4,031.20 ton/yr.	3 High Priority Restoration subwatersheds 3 Moderate Priority Restoration subwatersheds	Livestock/Pasture/Feedlot management	Establish 2-4 livestock managed access control areas near streams	•	•			•				2035	2 access control area BMPs
								Establish 2-4 livestock – heavy use stream crossing protection areas	•	•			•						2 heavy use crossings BMPs
								Establish 1-2 livestock alternative watering sources	•	•			•						1 alternative watering source BMP
								Implement 3-6 pastureland runoff controls, buffers near streams	•	•			•						Implement 3 BMPs
								Programs/funding for 2-4 feedlot runoff treatment, control and storage BMPs	•	•			•						Implement 2 BMPs
							Cropland and manure management	Promote/educate agronomic rates and chemical addition of manure	•	•			•						Develop and promote educational resources and information
								Provide resources/education for soil nutrient testing and spreading in sensitive areas	•	•			•						Develop and promote educational resources/information
								Promote/educate/implement conservation and reduced tillage BMPs	•	•			•						Develop and promote educational resources/information
								Establish 5-10 conservation and reduced tillage BMPs	•	•			•						Implement 5 reduced tillage BMPs
								Establish 3-6 cover crop BMPs	•	•			•						3 cover crop BMPs
								Implement 3-6 water and sediment control basins	•	•			•						Install up to 3 water and sediment control basins
							Septic system upgrades	ID and upgrade all ITPHS threat systems	•	•	•								Complete ID process and begin upgrades
								ID and upgrade all non-conforming systems near streams/waterways	•	•	•								Complete 50% of ID process and upgrades
							Streambank restoration	Target 75% of the unprotected streambanks throughout watershed for restoration and habitat improvements: bank stabilization, re-meanders, substrate installation, fine sediment removal etc.	•	•			•		•				At least 5 BMPs to be completed
							Roadside erosion control at stream crossings	Target 50% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing flow and erosion control measures at/near culvert inlets and outlets	•	•									At least 3 BMPs to be completed
							Dam/culvert inventory/upgrades	Inventory of all dams and culverts to assess problem sites that need replacement/improvement	•	•	•				•				Complete inventory

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Groundhouse River cont'd	All non-impaired Streams and Lakes HUC	Kanabec Mille Lacs	-	-	-	4 Monitor/Protect subwatersheds 5 Protection subwatersheds	Forestry Management	Develop 3-6 forestry management plans	•	•	•				•			2035	Complete up to 3 plans
							Conservation easements	Develop 1-2 conservation easements with landowners	•	•	•				•	•			Develop 1 easement
							Wetland restorations	Implement 2-4 wetland restorations	•	•	•		•		•				Implement up to 2 BMPs
							Ditch abandonment	Where possible – ID those in public land	•	•	•				•	•			Complete ID process
Mud Creek	Quamba Lake (33-0015) Upper Mud Creek (-566) Lower Mud Creek (-567)	Kanabec Pine	<u>Quamba Lake:</u> TP <u>Upper Mud Creek (-566):</u> E. coli <u>Lower Mud Creek (-567):</u> E. coli Biota – Sediment Connectivity Altered Hydrology Dissolved Oxygen Habitat Riparian Disturbance	<u>Quamba Lake</u> Internal P: 1,347 lbs Watershed P: 5,490 lbs Septic P: 15 lbs <u>Upper Mud Creek *E. coli* (-566)</u>: Very High Flows: 26 cfu/100mL High Flows: 76 cfu/100mL Mid Flows: 125 cfu/100mL Low Flows: 225 cfu/100mL Dry Flows: 460 cfu/100mL <u>Lower Mud Creek Bedded Sediment</u> Watershed Sediment: 49 tons Streambank Sediment: 225 tons <u>Lower Mud Creek *E. coli* (-567)</u> Very High Flows: 46 cfu/100mL High Flows: 138 cfu/100mL Mid Flows: 183 cfu/100mL Low Flows: 120 cfu/100mL Dry Flows: 353 cfu/100mL	<u>Quamba Lake Target</u> Internal P: 113 lbs Watershed P: 3,516 lbs Septic P: 0 lbs <u>Upper Mud Creek (-566) *E. Coli* Percent Reduction</u> Very High Flows: 0% High Flows: 0% Mid Flows: 0% Low Flows: 44% Dry Flows: 73% <u>Lower Mud Creek Bedded Sediment Reduction</u> Watershed Sediment: 49 tons/yr Streambank Sediment: 41 tons/yr <u>Lower Mud Creek (-567) *E. coli* Percent Reduction</u> Very High Flows: 0% High Flows: 9% Mid Flows: 31% Low Flows: 0% Dry Flows: 64%	2 High Priority Restoration subwatersheds 4 Moderate Priority Restoration subwatersheds	Livestock/Pasture/Feed lot Management	50% of the unprotected riparian areas along Mud Creek restored with vegetative buffers, cattle access control areas, heavy use protection – stream crossing areas, alternative watering sources, and rotational grazing methods, where applicable.	•	•			•					2035	25% buffered in 10 years.
							Cropland and manure management	50% of the high eroded cropland areas will be protected by implementing the following practices: sediment and water control structures and basins, cover crops, conservation and reduced tillage methods, grassed waterways and lined waterways and channels	•	•				•					25% of fields protected in 10 years
								At least 50% of the cropland areas managed for manure	•	•			•						25% of the fields managed within 10 years
								40% of the farmsteads needing treatment, manure runoff control and manure storage in compliance by implementing feedlot runoff treatment and control methods and manure storage facilities	•	•			•						20% of the feedlots corrected in 10 years
							Septic System Upgrades	ID and upgrade 100% of the imminent threat systems and septics in the shoreland areas	•		•						•		50% of the ITPHS systems upgraded in 10 years
								Connect all properties around Quamba Lake to sanitary sewer	•	•	•			•			•		Connect all properties to sanitary sewer
							Streambank Restoration	Target 50% of the unprotected streambanks in Mud Creek for restoration and habitat improvement: bank stabilization, re-meanders, substrate installation, fine sediment removal etc.	•	•			•		•				25% of unprotected banks improved within 10 years
																			50% of unprotected banks improved within 20 years
							Roadside erosion control at stream crossings	80% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing flow and erosion control measures at/near culvert inlets and outlets	•	•	•								40% of the road crossings protected within 10 years,
							In-lake Sediment P release	Feasibility (options) study and treatment for Quamba Lake	•	•							•		Complete feasibility study

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Mud Creek cont'd		Kanabec Pine				2 High Priority Restoration subwatersheds 4 Moderate Priority Restoration subwatersheds	Lake vegetation management	Lake management plan for Quamba Lake curly-leaf pondweed treatments							•		•	2035	Complete or update management plans
							Shoreline protection	Promote/educate responsible shoreline plantings/buffers/setbacks	•	•					•		•		Shoreline education presentations and mailings
							Dam/culvert inventory/upgrades	Inventory of all dams and culverts to assess problem sites that need replacement/improvement, begin replacement/upgrade process	•	•	•				•				40% of the dams and culverts inventoried in 10 years
							Wetland Restorations	Identify and restore all degraded or impacted wetlands that release phosphorus	•	•			•		•				25% of degraded wetlands restored within 10 years
	All non-impaired Streams and Lakes HUC	Kanabec Pine	-	-	-	1 Monitor/Protect subwatershed 2 Protection subwatersheds	Forestry management	Develop forestry management plans for all private forest land in watershed	•	•	•				•			2035	Develop management plans for 25% of forest land within 10 years
							Conservation easements	Obtain at least 10 conservation easements	•	•					•	•			At least 5 conservation easements within 10 years
							Ditch abandonment	Where possible – ID those in public land	•	•					•	•			Complete ID process
							Dam/culvert assessment	Inventory all dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage, replace/upgrade all problem dams/culverts	•	•	•				•				50% of the dams and culverts inventoried in 10 years
Middle Snake River		Kanabec Isanti	-	-	-	6 High Priority Restoration subwatersheds 4 Moderate Priority Restoration subwatersheds	Livestock/Pasture/Feed lot management	Establish 2-4 livestock managed access control areas near streams	•	•			•					2035	2 access control area BMPs
								Establish 2-4 livestock – heavy use stream crossing protection areas	•	•			•						2 heavy use crossing BMPs
								Establish 1-2 livestock alternative watering sources	•	•			•						1 alternative watering source
								Implement 2-4 pastureland runoff control BMPs and 2-4 buffers near streams	•	•			•						Implement 2 BMPs
								Programs/funding for 2-4 feedlot runoff treatment BMPs, and 2-4 control and storage BMPs	•	•			•						Implement 2 BMPs
							Cropland and manure management	Promote/educate agronomic rates and chemical addition of manure	•	•			•						Develop and promote educational resources and information
								Provide resources/education for soil nutrient testing and spreading in sensitive areas	•	•			•						Develop and promote educational resources and information

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Middle Snake River cont'd		Aitkin Kanabec Isanti	-	-	-	6 High Priority Restoration subwatersheds 4 Moderate Priority Restoration subwatersheds	Cropland and manure management	Promote/educate/implement	•	•			•					2035	Develop and promote educational resources, information;
								4-8 conservation and reduced tillage BMPs	•	•			•						4 reduced tillage BMPs
								2-4 cover crop BMPs	•	•			•						2 cover crop BMPs
								1-2 water and sediment control basins	•	•			•						1 water and sediment control basin
							Septic system upgrades	ID and upgrade all ITPHS threat systems	•	•	•								Complete ID process and upgrades
								ID and upgrade all non-conforming systems near streams/waterways	•	•	•								Complete 50% of the ID process and upgrades
							Roadside erosion control at stream crossings	50% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing flow and erosion control measures at/near culvert inlets and outlets	•	•	•				•				At least 3 BMPs to be completed
							City Stormwater Management (Mora)	Upgrade stormwater runoff from city streets and urban areas.	•	•		•							BMPs completed
	All non-impaired Streams and Lakes HUC	Aitkin Kanabec Isanti	-	-	-	3 Monitor/Protect subwatersheds	Forestry management	Develop 3-6 forestry management plans	•	•	•				•			2035	Complete 3 plans
							Conservation easements	Develop 2-4 conservation easements with landowners	•	•	•				•	•			Develop 2 easements
							Ditch abandonment	Where possible – ID those in public land	•	•					•	•			Complete the ID process
							Dam/culvert assessment	Inventory dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage	•	•	•				•				Complete inventory
Pokegama Lake	Pokegama Lake (58-00142)	Kanabec Pine	TP	<u>Pokegama Lake</u> Internal P: 13,203 lbs Watershed P: 18,794 lbs Septic P: 808 lbs	<u>Pokegama Lake Target</u> Internal P: 1,356 lbs Watershed P: 6,832 lbs Septic P: 0 lbs	3 Moderate Priority Restoration subwatersheds	Livestock/Pasture/Feed lot management	Establish 3-6 livestock managed access control areas near streams	•	•			•					2035	Establish at least 3 managed areas
								Implement 4-8 pastureland runoff controls, buffers near streams	•	•			•						Implement 4 stream runoff controls
								Programs/funding for 4-8 feedlot runoff treatment, control and storage	•	•			•						Establish funding for 4 feedlot runoff control projects
							Cropland and manure management	Promote/educate agronomic rates and chemical addition of manure. Hold 3-6 workshops with at least 20 landowners	•	•			•						Hold 3 workshops and work with at least 10 landowners
								Provide resources/education for soil nutrient testing and spreading in sensitive areas. Hold 3-6 workshops and work with at least 20 landowners.	•	•			•						Hold 3 workshops and work with 10 landowners

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Pokegama Lake cont'd	Pokegama Lake (58-00142)	Kanabec Pine	TP	<u>Pokegama Lake</u> Internal P: 13,203 lbs Watershed P: 18,794 lbs Septic P: 808 lbs	<u>Pokegama Lake Target</u> Internal P: 1,356 lbs Watershed P: 6,832 lbs Septic P: 0 lbs	3 Moderate Priority Restoration subwatersheds	Cropland and manure management	Promote/educate conservation and reduced tillage methods. Hold 3-6 workshops and work with at least 10 landowners	•	•			•					2035	Hold 3 workshops and work with 5 landowners
							Septic system upgrades	ID and upgrade all ITPHS threat systems	•	•	•								Upgrade at least 50% of ITPHS systems
								ID and upgrade all non-conforming systems near streams/waterways	•	•	•								ID and upgrade 50% of shoreland systems
							In-lake Sediment P release	In-lake sed. inactivation feasibility study and treatment for Pokegama Lake	•	•							•		Complete feasibility study
							Lake vegetation management	Adopt management plan for Pokegama Lake curly-leaf pondweed treatments							•		•		Adopt curly-leaf pondweed management plan
							Shoreline protection	Promote, educate and install 40 responsible shoreline plantings/buffers/setbacks	•	•					•		•		Install 20 shoreline buffers within 10 years
							Wetland restorations	Identify and restore 5-10 degraded and impacted wetlands	•	•					•		•		Restore 5 impaired wetlands
							Roadside erosion control at stream crossings	80% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing flow and erosion control measures at/near culvert inlets and outlets	•	•									Protect at least 40% of road crossings
							Dam/culvert inventory/upgrades	Inventory of all dams and culverts to assess problem sites that need replacement/improvement	•	•	•				•				Inventory and inspect 50% of all dams and culverts
	All non-impaired Streams and Lakes HUC	Kanabec Pine	-	-	-	3 Monitor/Protect subwatersheds	Forestry management	Develop 10-20 forestry management plans	•	•	•				•			2035	Develop 10 forestry management plans
							Conservation easements	Develop and acquire 2-5 conservation easements with willing landowners	•	•					•	•			Acquire at least 2 easements within 10
							Ditch abandonment	Where possible – ID those in public land	•	•					•	•			Will evaluate ditches in the watershed – however not much public land available within Pine County
Lower Snake River	Cross Lake (58-0119) Bear Creek (-514)	Kanabec Chisago Isanti Pine	<u>Cross Lake:</u> TP <u>Bear Creek:</u> *E. coli*	See next page	See next page	5 High Priority Restoration subwatersheds 4 Moderate Priority Restoration Subwatersheds	Livestock/Pasture/Feed lot management	Establish 3-6 livestock managed access control areas near streams	•	•			•					2035	Establish at least 3 access control areas
								Implement 2-4 pastureland runoff controls, and 2-4 buffers near streams	•	•			•						Implement at least 2 pasture runoff controls or stream buffers
								Programs/funding for 2-4 feedlot runoff treatment, control and storage BMPs	•	•			•						Implement at least 2 feedlot projects

HUC-10 Watershed	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 / Reductions	Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement: SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations	Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
Lower Snake River cont'd	Cross Lake (58-0119) Bear Creek (-514)	<u>Cross Lake:</u> Aitkin Chisago Kanabec Isanti Mille Lacs Pine <u>Bear Creek:</u> Pine	<u>Cross Lake:</u> TP <u>Bear Creek:</u> *E. coli*	<u>Cross Lake</u> Internal P: 8,408 lbs Watershed P: 2,356 lbs WWTF P: 45 lbs Septic P: 111 lbs <u>Bear Creek *E. coli*</u> Very High Flows: 70 cfu/100mL High Flows: 317 cfu/100mL Mid Flows: 455 cfu/100mL Low Flows: 263 cfu/100mL Dry Flows: 222 cfu/100mL	<u>Cross Lake Target</u> Internal P: 3,053 lbs Watershed P: 1,220 lbs WWTF P: 29 lbs Septic P: 0 lbs <u>Bear Creek *E. coli* Percent Reductions</u> Very High Flows: 0% High Flows: 60% Mid Flows: 72% Low Flows: 52% Dry Flows: 43%	5 High Priority Restoration subwatersheds 4 Moderate Priority Restoration Subwatersheds	Cropland and manure management	Promote/educate agronomic rates and chemical addition of manure. Work with 5-10 landowners on nutrient management and hold 2-4 workshops	•	•			•					2035	Work with 5 landowners on nutrient management and hold 2 nutrient management workshops
								Provide resources/education for soil nutrient testing and spreading in sensitive areas. Work with 5-10 on soil P spreading and send out at least 2-4 nutrient management mailings	•	•			•						Work with at least 5 landowners on soil P and spreading. Send out at least 2 nutrient management mailings
								Promote/educate conservation and reduced tillage methods. Conduct 2-4 reduced tillage workshops and work with at least 20 landowners	•	•									Conduct 2 reduced tillage workshops and work with at least 10 landowners
							Septic system upgrades	ID and upgrade all ITPHS threat systems	•	•	•								Identify and upgrade 40% of ITPHS systems in shoreland areas within 10 years
								ID and upgrade all non-conforming systems near streams/waterways	•	•	•								Identify and upgrade 40% of failing systems near streams/ water
							In-lake Sediment P release	In-lake sed. inactivation feasibility study and treatment for Cross Lake	•	•							•		Complete feasibility study
							Lake vegetation management	Adopt management plan for Cross Lake curly-leaf pondweed treatments							•		•		Adopt and implement curly-leaf pondweed management plan as soon as possible
							Shoreline protection	Promote, educate and install 40 shoreline plantings/buffers/setbacks	•	•					•		•		Install 20 shoreline buffers
								Continue to educate through mailings, presentations and demonstration site at public access											Ongoing
							Wetland restorations	Identify degraded and impacted wetlands that may be contributing phosphorus and implement wetland restorations	•	•					•		•		Identify all degraded wetlands in the watershed and begin restoration
							Roadside erosion control at stream crossings	80% of the road crossings (particularly gravel roads with culverts) over tributaries will be protected by implementing flow and erosion control measures at/near culvert inlets and outlets	•	•									Identify and protect 40% of road crossing in watershed
							Dam/culvert inventory/upgrades	Inventory of all dams and culverts to assess problem sites that need replacement/improvement. Begin upgrades/improvements	•	•	•				•				Inventory and identify all dams and culverts

HUC-10 Watershed	Waterbody and Location		Parameter (incl. non-pollutant stressors)	Water Quality		Management Category (Figure 9)	Strategies (see key below)	Estimated Scale of Adoption Needed	Entities with Primary Responsibility/Involvement									Timeline to Achieve Water Quality Standards	Interim 10-yr Milestones
	Waterbody (ID)	Location and Upstream Influence Counties		Current Conditions	Goals / Targets / Reductions				SRWMB	SWCDs	Counties	Cities	NRCS	MPCA	DNR	Nature Conservancy	Lake Associations		
Lower Snake River cont'd							Septic pumping regulation	Regulate, supervise and monitor all land application of septic waste throughout watershed (i.e. Bear Creek)			•			•				2035	Ongoing
							City Stormwater Management (Pine City)	Continue incorporating low impact development practices into construction/reconstruction projects throughout city. Install 10-20 BMPs through street reconstruction, rain gardens, or other infiltration practices	•	•		•							Install up to 10 BMPs within 10 years
	All non-impaired Streams and Lakes HUC	Kanabec Pine	-	-	-	1 Monitor/Protect Subwatershed	Forestry management	Develop 10-20 forestry management plans	•	•	•				•			2035	Develop at least 10 forest management plans within 10 years
							Conservation easements	Continue to pursue and promote conservation easements. Acquire 2-5 conservation easements	•	•					•	•			Acquire at least 2 conservation easements
							Ditch abandonment	Where possible – ID those in public land	•	•					•	•			Will evaluate ditches in the watershed – however not much public land available within Pine County
							Dam/culvert assessment	Inventory all dams and culverts to assess problem sites that need replacement/improvement to improve hydrology and fish passage. Begin improvements/upgrades	•	•	•				•				Inventory and inspect 50% of all dams and culverts
All	-	-	-	-	-	All	NPDES Point Source Compliance	As permits in the watershed are reissued, TMDL WLAs are incorporated				•		•				Ongoing	Ongoing
							Citizen engagement, outreach, education, governance and organizing	Develop a process to engage, educate and organize citizens to be local leaders to help accomplish water quality goals	•	•	•	•	•	•	•	•	•	Ongoing	Ongoing
							Future Growth/Landuse Changes	Work with local landowners and LGU's to ensure that as development or landuse changes occur; water quality is protected.	•	•	•	•		•	•	•	•	Ongoing	Ongoing
							Wetland Protection	Continue to enforce local WCA rules		•	•				•			Ongoing	Ongoing

Key for all tables: Red rows = strategies for impaired waters requiring restoration; Green rows = strategies for unimpaired waters requiring protection

Table 10. Key for strategies column

Strategy	Practices (NRCS Code)
Nonpoint Source	
Livestock, pasture and feedlot management	Managed/restricted area fencing (382 and 472), pasture runoff controls, buffers (322/390), heavy use protection-stream crossing areas, alternative watering sources, rotational grazing
Cropland and manure management	Chemical addition to manure, spreading in sensitive areas, soil P testing, nutrient management (590), conservation and reduced tilling methods (329, 345 and 346), sediment and water control structures and basins (350), cover crops (340), grassed waterways, lined waterways and channels, manure runoff control, manure storage facilities (313)
Septic Systems	Imminent threat to public health and safety (ITPHS) upgrades, septic upgrades in shoreline areas
Streambank restoration	Streambank stabilization (580), re-meanders, habitat improvement
Internal P release (lakes)	Chemical addition to lake sediment to immobilize Phosphorus release from sediment
Shoreline protection	Shoreline protection (580), natural plantings, setbacks
Wetland restorations	Restore degraded and impacted wetlands that may be P source (651)
Roadside erosion control	Flow/erosion control basins near crossings to reduce sediment/flow (638)
Dam/Culvert management	Assess culverts/dams for sizing, retention, fish passage and hydrologic function
City Stormwater management	
Forestry management	Timber stand improvement (666), early habitat succession (647)
Point Source	
NPDES point source compliance	All NPDES-permitted sources shall comply with conditions of their permits, which are written to be consistent with any assigned wasteload allocations

4. Monitoring Plan

Progress of TMDL implementation will be measured through regular monitoring efforts of water quality and total BMPs completed. This will be accomplished through the efforts of the cooperating agencies and groups discussed above. As long as sufficient funding exists, the following monitoring efforts below will be targeted. Since funding is limited for effectiveness monitoring, one avenue that could and may be used in this watershed is the Intensive Watershed Monitoring being conducted by the MPCA. This monitoring was conducted in the Snake River Watershed in 2007 and is expected to be monitored again in 2017 as part of the 10 year cycle. At a minimum this effort will help provide data at a larger scale that may not be available otherwise.

However, all efforts will be made locally to conduct and target monitor when funds and staff time are available. This monitoring will also follow the SRWMB's monitoring program; which has been in place for numerous years.

4.1 Lake Monitoring

Cross Lake, Knife Lake, Pokegama Lake, and Quamba Lake have been periodically monitored by volunteers and staff over the years. This monitoring is planned to continue to keep a record of the changing water quality as funding allows. Lakes are generally monitored for chlorophyll-a, total phosphorus, and Secchi disk transparency.

In-lake monitoring will continue as implementation activities are installed across the watersheds. These monitoring activities should continue until water quality goals are met. Some tributary monitoring has been completed on the inlets to the lakes and may be important to continue as implementation activities take place throughout the sub-watersheds.

The MN DNR will continue to conduct macrophyte and fish surveys as allowed by their regular schedule. Currently fish surveys are conducted every 5 years and macrophyte surveys are conducted as staffing and funding allow on a 10-year rotation, unless there are special situations.

4.2 Stream and Bacteria Monitoring

River and stream monitoring in the Snake River Watershed, which includes Mud Creek, Knife River, Snake River at Mora, Bear Creek, and a tributary to Cross Lake, has been coordinated largely by the Snake River Watershed Management Joint Powers Board over the last 10 years as part of two Clean Water Partnership Grants, MPCA TMDL Funds from 2010 through 2012, and other available local funds. Monitoring is being conducted on a smaller scale due to county water plans and limited funding.

Stream monitoring in the Upper Mud, Lower Mud and Bear Creeks should at a minimum continue at the most downstream site to continue to build on the current dataset and track changes based on implementation progress. At a minimum it is recommended that two *E. coli* samples be collected each

month from May through September. As BMP practices are implemented throughout the watershed it is also suggested that monitoring take place in those subwatersheds to track progress towards the TMDL.

4.3 Biological Monitoring

Continuing to monitor water quality and biota scores in the listed segments will determine whether or not stream habitat restoration measures are required to bring the watershed into compliance. At a minimum, fish and macroinvertebrate sampling should be conducted by the MPCA, MN DNR, or other agencies every five to ten years during the summer season at each established location until compliance is observed for at least two consecutive assessments. It will also be important to continue to conduct streambank assessments before and after any major stabilization BMP is implemented to track if in-stream erosion is improving, or if more work is needed.

Tracking the implementation of BMPs while continuing to monitor the biological conditions in the watershed will help local stakeholders and public agencies understand the effectiveness of the WRAPS document. If biota scores remain below the confidence intervals, further encouragement of the use of BMPs across the watershed through education and incentives will be a priority. It may also be necessary to begin funding efforts for localized BMPs such as riparian buffer and stream restoration.

5. References and Further Information

The CADMUS Group, Inc. 2013. Aquatic Ecosystem Protection Efforts in Minnesota's Snake River Watershed: Summary and Recommendations. May 2013.

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Tetra Tech. 2009. Groundhouse River TMDL Project for Fecal Coliform and Biota (Sediment) Impairments. March 2009.

Wenck Associates, Inc. 2013a. Ann River Watershed Bacteria, Nutrient, and Biota TMDL. April 2013. <

Wenck Associates, Inc. 2013b. Snake River Watershed TMDL

Snake River Watershed Reports

All Snake River watershed reports referenced in this watershed report are available at the Snake River watershed webpage: http://www.pca.state.mn.us/qzqhdd0

Appendix A: Snake River Watershed Stream Assessment Status

HUC-10 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 Snake River	507	Chelsey Brook	Headwaters to Snake River	Sup	Sup	NA	NA	NA
	508	Snake River	Headwaters to Hay Creek	Imp*	Sup	NA	NA	NA
	509	Hay Creek	Headwaters to Snake River	Sup	IF	NA	NA	NA
	516	Unnamed Creek	Unnamed Creek to Chelsey Brook	IF	Sup	NA	NA	NA
	517	Cowans Brook	Headwaters to Snake River	NA	Sup	NA	NA	NA
	520	Unnamed Creek	Unnamed Creek to Snake River	IF	Sup	NA	NA	NA
	523	Snake River	Hay Creek to Chelsey Brook	Sup	IF	NA	NA	NA
	541	Bergman Brook	Unnamed Creek to Snake River	Sup	IF	NA	NA	NA
	552	Bear Creek	Unnamed Creek to Snake River	Imp*	Sup	NA	NA	NA
	553	Bear Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	554	Bergman Brook	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	557	Unnamed Creek	Unnamed Creek to Snake River	IF	Sup	NA	NA	NA
	589	Unnamed Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	590	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	591	Unnamed Creek	Headwaters to Bergman Creek	IF	NA	NA	NA	NA
	592	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
Knife River	537	Dry Run	Dry Run to Unnamed Creek	IF	IF	NA	NA	NA
	549	Knife River	Dry Run to Knife Lake	Sup	Imp*	NA	NA	NA
	551	Knife River	Knife Lake to Snake River	Sup	Sup	NA	NA	NA
	559	Unnamed Creek	Unnamed Creek to Knife River	Sup	Sup	NA	NA	NA
	560	Bean Brook	Unnamed wetland to Knife River	Sup	NA	NA	NA	NA
	561	Unnamed Creek	Unnamed wetland to Knife Lake	NA	NA	NA	NA	NA
	562	Unnamed Creek	Unnamed Creek to Knife River	Sup	Sup	NA	NA	NA
	581	Unnamed Creek	Unnamed Creek to Bean Brook	NA	NA	NA	NA	NA
	596	Unnamed Creek	Unnamed Creek to Unnamed Creek	Sup	NA	NA	NA	NA
	597	Unnamed Creek	Headwaters to Unnamed Creek	Sup	IF	NA	NA	NA
	621	Unnamed Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	622	Unnamed Creek	Unnamed Creek to Knife River	NA	NA	NA	NA	NA

[1]Note that 01 = Aitkin County, 30 = Isanti County, 33 = Kanabec County, 48 = Mille Lacs County, 58 = Pine County, [2]Imp = impaired for impacts to aquatic recreation, Sup = fully supporting aquatic recreation, IF = insufficient data to make an assessment

HUC-10 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
Ann River	511	Ann River	Ann Lake to Snake River	Imp	Imp	NA	NA	Imp
	518	Little Ann River	Headwaters to Ann Lake	Sup	IF	NA	NA	IF
	571	Camp Creek	Unnamed Creek to Unnamed Creek	Sup	IF	NA	NA	NA
	572	Camp Creek	Unnamed Creek to Ann Lake	NA	NA	NA	NA	NA
	582	Camp Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	598	Unnamed Creek	Headwaters to Ann Lake	NA	NA	NA	NA	NA
	599	Unnamed Creek	Headwaters to Ann Lake	NA	NA	NA	NA	NA
	600	Unnamed Creek	Headwaters to Fish lake	NA	NA	NA	NA	NA
	601	Unnamed Creek	Unnamed Creek to Ann River	NA	NA	NA	NA	NA
	602	Unnamed Creek	Unnamed Creek to Ann River	NA	NA	NA	NA	NA
	603	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	604	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	605	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	633	Unnamed Creek	Headwaters to Fish Lake	NA	NA	NA	NA	NA
Groundhouse River	512	Groundhouse River	S Fork Groundhouse to Snake River	Sup	Sup	NA	NA	Imp
	513	Groundhouse River	Headwaters to S Fork Groundhouse River	Imp	Imp	NA	NA	Imp
	538	W Fork Groundhouse	Headwaters to Groundhouse River	Sup	IF	NA	NA	NA
	570	Unnamed Creek	Unnamed Creek to Groundhouse River	IF	IF	NA	NA	NA
	573	S Fork Groundhouse	Headwaters to Groundhouse River	Imp	Imp	Imp	NA	Imp
	574	Unnamed Creek	Headwaters to S Fork Groundhouse River	Sup	IF	NA	NA	NA
	579	Unnamed Creek	Headwaters to S Fork Groundhouse River	NA	NA	NA	NA	NA
	583	Unnamed Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	584	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA

HUC-10 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
Groundhouse River cont'd	585	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	606	Unnamed Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	607	Unnamed Creek	Unnamed Creek to Groundhouse River	NA	NA	NA	NA	NA
Middle Snake River	505	Snake River	Fish Lake to Groundhouse River	NA	NA	NA	NA	NA
	506	Snake River	Chelsey Brook to Knife River	Sup	Sup	NA	NA	NA
	515	Spring Brook	Headwaters to Snake River	Imp*	Sup	NA	NA	NA
	519	Unnamed Creek	Luchts Lake to Spring Lake	NA	NA	NA	NA	NA
	524	Snake River	Groundhouse River to Mud Creek	Sup	Sup	NA	NA	NA
	525	Snake River	Knife River to Fish Lake outlet	Sup	Sup	NA	NA	Sup
	558	Snowshoe Brook	Unnamed Creek to Snake River	Sup	IF	NA	NA	NA
	569	Unnamed Creek	Unnamed Creek to Snake River	Sup	NA	NA	NA	NA
	575	Rice Creek	Unnamed Creek to Snake River	Sup	IF	NA	NA	NA
	595	Unnamed Creek	Unnamed Lake to Snake River	NA	NA	NA	NA	NA
	608	Moccasin Brook	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	609	Unnamed Creek	Unnamed Creek to Snowshoe Brook	NA	NA	NA	NA	NA
	610	Snowshoe Brook	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	611	Snowshoe Brook	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	612	Snowshoe Brook	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	613	Unnamed Creek	Headwaters to Snowshoe Brook	NA	NA	NA	NA	NA
	629	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	630	Unnamed Creek	Peace Lake to Unnamed Lake	NA	NA	NA	NA	NA
Mud Creek	563	Unnamed Creek	Headwaters to Mud Creek	IF	IF	NA	NA	NA
	564	Unnamed Creek	Headwaters to Mud Lake	IF	IF	NA	NA	NA
	566	Mud Creek	Headwaters to Quamba Lake	Imp	Imp	NA	NA	Imp
	567	Mud Creek	Quamba Lake to Snake River	Imp*	Sup	NA	NA	Imp
	568	County Ditch #4	Headwaters to Mud Creek	IF	NA	NA	NA	NA
	623	County Ditch #10	Unnamed Creek to Mud Creek	NA	NA	NA	NA	NA

HUC-10 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
Mud Creek cont'd	624	Unnamed Creek	Headwaters to County Ditch #10	NA	NA	NA	NA	NA
	631	Unnamed Ditch	Headwaters to Unnamed Ditch	NA	NA	NA	NA	NA
	632	Unnamed Ditch	Unnamed ditch to Mud Creek	NA	NA	NA	NA	NA
Pokegama Lake	527	Unnamed Creek	Headwaters to Jarvis Bay	NA	NA	NA	NA	NA
	528	Unnamed Creek	Headwaters to Jarvis Bay	NA	NA	NA	NA	NA
	529	Pokegama Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	530	Pokegama Creek	Unnamed Creek to East Pokegama Creek	Sup	NA	NA	NA	NA
	531	East Pokegama Creek	Unnamed Creek to Pokegama Creek	Sup	IF	NA	NA	NA
	532	Pokegama Creek	East Pokegama Creek to Unnamed Creek	Sup	Imp*	NA	NA	NA
	533	Pokegama Creek	Unnamed Creek to Pokegama Lake	NA	NA	NA	NA	NA
	534	Unnamed Creek	Unnamed Creek to Pokegama Creek	Sup	Sup	Na	NA	NA
	535	Unnamed Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	542	East Pokegama Creek	Unnamed Creek to Unnamed Creek	NA	NA	NA	NA	NA
	543	Paul Bunyan Canal	Pokegama Lake to Unnamed River	NA	NA	NA	NA	NA
	593	Unnamed Creek	Unnamed ditch to East Pokegama Creek	Sup	IF	NA	NA	NA
	625	East Pokegama Creek	Headwaters to Unnamed Creek	NA	NA	NA	NA	NA
	626	Unnamed Creek	Headwaters to East Pokegama Creek	NA	NA	NA	NA	NA
Lower Snake River	503	Snake River	Mud Creek to Mission Creek	Sup	Sup	NA	NA	NA
	514	Bear Creek	Headwaters to Snake River	Sup	IF	NA	NA	Imp
	522	Hay Creek	Headwaters to Snake River	IF	IF	NA	NA	NA
	526	Pokegama Creek	Pokegama Lake to Snake River	NA	NA	NA	NA	IF
	544	Paul Bunyan Canal	Unnamed River to Snake River	NA	NA	NA	NA	NA
	545	Mission Creek	Headwaters to T41 R21W S25, south line	NA	NA	NA	NA	NA

HUC-10 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
Lower Snake River cont'd	546	Mission Creek	T41 R21W S36, north line to T40 R21W S1, south line	IF	IF	NA	NA	NA
	547	Mission Creek	Unnamed Lake to T39 R21W S30, west line	Imp*	Imp*	Imp*	NA	NA
	548	Mission Creek	T39 R22W S36, east line to Snake River	Imp*	IF	Imp*	NA	IF
	555	Mission Creek	T40 R21W S12, north line to Unnamed Lake	NA	NA	NA	NA	NA
	576	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	577	Unnamed Creek	Headwaters to Cross Lake	Imp*	IF	NA	NA	Imp*
	580	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	586	Snake River	Mission Creek to Cross Lake	NA	NA	NA	NA	NA
	587	Snake River	Cross Lake to St. Croix River	Sup	IF	NA	NA	Sup
	588	Unnamed Creek	Headwaters to Mission Creek	NA	NA	NA	NA	NA
	594	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	614	Unnamed Ditch	Unnamed ditch to Snake River	NA	NA	NA	NA	NA
	615	Unnamed Ditch	Headwaters to Mission Creek	NA	NA	NA	NA	NA
	616	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	617	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	618	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	619	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	620	Unnamed Creek	Headwaters to Snake River	NA	NA	NA	NA	NA
	627	Unnamed Creek	Headwaters to Cross Lake	NA	NA	NA	NA	NA
	628	Unnamed Creek	Headwaters to Cross Lake	NA	NA	NA	NA	NA

Sup = found to meet the water quality standard; Imp = does not meet the water quality standard and therefore, is impaired; Imp* = is currently listed as impaired, however MPCA is pursuing a re-categorization of this reach; IF = the data collected was insufficient to make a finding; NA = not assessed

Appendix B: Snake River Watershed Lake Assessment Status

HUC-10 Subwatershed	Lake ID[1]	Lake	Aquatic Recreation[2]
Upper Snake River	01-0025	Twenty-one	NA
	01-0064	Bear	NA
	01-0243	Unnamed	NA
	01-0298	Unnamed	NA
	01-0299	Unnamed	NA
	33-0048	Unnamed	NA
	33-0068	Neff Marsh	NA
Knife River	33-0025	Pocket Knife	NA
	33-0028	Knife	Imp
	33-0069	Unnamed	NA
	33-0070	Unnamed	NA
	33-0076	Unnamed	NA
	33-0091	Unnamed	NA
	48-0036	Ernst Pool	NA
Ann River	33-0029	Unnamed	NA
	33-0033	Devils	IF
	33-0035	Kent	NA
	33-0036	Fish	Imp
	33-0040	Ann	Imp
	33-0093	Unnamed	NA
	33-0101	Unnamed	NA
	33-0107	Unnamed	NA
	33-0109	Unnamed	NA
	33-0110	Unnamed	NA

[1]Note that 01 = Aitkin County, 30 = Isanti County, 33 = Kanabec County, 48 = Mille Lacs County, 58 = Pine County, [2]Imp = impaired for impacts to aquatic recreation, Sup = fully supporting aquatic recreation, IF = insufficient data to make an assessment

HUC-10 Subwatershed	Lake ID[1]	Lake	Aquatic Recreation[2]
Ann River cont'd	33-0118	Unnamed	NA
	48-0020	Dewitt Marsh	NA
	48-0038	Unnamed	NA
Groundhouse River	30-0243	Unnamed	NA
	33-0030	Pennington	NA
	33-0031	Erickson	NA
	33-0063	Unnamed	NA
	33-0066	Unnamed	NA
	33-0072	Unnamed	NA
	33-0111	Unnamed	NA
	48-0007	Cranberry	NA
	48-0043	Unnamed	NA
	48-0044	Unnamed	NA
	48-0046	Unnamed	NA
	48-0047	Unnamed	NA
	48-0054	Unnamed	NA
Middle Snake River	30-0057	Upper Rice	NA
	30-0059	Seventeen	NA
	33-0010	Peace	NA
	33-0011	Rice	NA
	30-0014	Twin	NA
	33-0016	Spence	NA
	33-0020	Doughnut	NA
	33-0021	Luchts	NA
	33-0022	Unnamed	NA
	33-0023	Unnamed	NA

HUC-10 Subwatershed	Lake ID[1]	Lake	Aquatic Recreation[2]
Middle Snake River cont'd	33-0024	Lake Full of Fish	NA
	33-0026	Snowshoe	NA
	33-0027	Spring	IF
	33-0034	Mora	NA
	33-0037	Telander	NA
	33-0038	Conger	NA
	33-0054	Unnamed	NA
	33-0055	Unnamed	NA
	33-0057	Unnamed	NA
	33-0060	Unnamed	NA
	33-0064	Unnamed	NA
	33-0065	Unnamed	NA
	33-0120	Unnamed	NA
Mud Creek	33-0009	Pomroy	IF
	33-0015	Quamba	Imp
	33-0017	Unnamed	NA
	33-0018	Sells	NA
	33-0019	Twin/East	NA
	33-0053	Unnamed	NA
	33-0056	Unnamed	NA
Pokegama Lake	58-0142	Pokegama	Imp
Lower Snake River	33-0012	Jones	NA
	33-0013	Grass	NA
	58-0082	Unnamed	NA
	58-0118	Devils	NA
	58-0119	Cross	Imp

HUC-10 Subwatershed	Lake ID[1]	Lake	Aquatic Recreation[2]
Lower Snake River cont'd	58-0139	Unnamed	NA
	58-0146	Unnamed	NA
	58-0165	Unnamed	NA
	58-0166	Unnamed	NA
	58-0173	Unnamed	NA
	58-0217	Unnamed	NA
	58-0218	Unnamed	NA
	58-0244	Airport Pond 4	NA
	58-0245	Airport Pond 5	NA
	58-0246	Airport Pond 6	NA

[1]Note that 01 = Aitkin County, 30 = Isanti County, 33 = Kanabec County, 48 = Mille Lacs County, 58 = Pine County
[2]Imp = impaired for impacts to aquatic recreation, Sup = fully supporting aquatic recreation, IF = insufficient data to make an assessment