Lower Wild Rice River Turbidity Total Maximum Daily Load Implementation Plan

Prepared by:

Wild Rice Watershed District
Becker County Soil and Water Conservation District
Clay County Soil and Water Conservation District
Norman County Soil and Water Conservation District
Mahnomen County Soil and Water Conservation District

Revised Version – April 20, 2011

Table of Contents

Implementation Plan Review Combined
Checklist and Comment

Reviewer______________________________

Date (first review)______________________

Date (final review)_____________________

Requirement	Location in Document	Enhancements needed for approval
a.1. geographical extent of watershed (use HUC's, stream segments, etc.)	Pages 8-9	
a.2. measurable water quality goals	Pages 12-13	
a.3. causes and sources or groups of similar sources	Pages 13-15	
b.1. description of nonpoint source management measures	Pages 19-29	
b.2. description of point source management	N/A	
c.1. estimate of load reductions for nonpoint source management measures listed in b.1	Page 26	
c.2. estimate of load reductions for point source management measures listed in b.2	N/A	
d.1. estimate of costs for nonpoint source measures	Pages 27-29	
d.2. estimate of costs for point source measures (see note 2)	N/A	

Requirement	Location in Document	Enhancements needed for approval
e. information/education component for implementing plan and assistance needed from agencies	Page 32	
f.1. schedule for implementing nonpoint source measures	Pages 27-30	
f.2. schedule for implementing point source measures	N/A	
g. a description of interim measurable milestones for implementing management measures (point source and nonpoint source) (by measure if needed)	Page 30	
h. adaptive management process- that includes set of criteria- to determine progress toward attaining nonpoint source reductions	Page 31	
i. monitoring component (see note 3)	Page 31	

Note 1. For more description of requirement, see pps 9-11 of preliminary staff draft of CWA Section 319 guidance for 03

Note 2. Point source is not included in 319 guidance, it will be a required part of Minnesota's implementation plans for TMDLs that include point source contribution. Roughly use guidance to guide approval of point source.

Note 3. See Section III.F.2 of 319 guidance for details.

Executive Summary

The Clean Water Act, Section 303(d), requires that every two years states publish a list of waters that do not meet water quality standards and do not support their designated uses. These waters are then considered to be “impaired.” Once a water body is placed on the impaired waters list, a Total Maximum Daily Load (TMDL) must be developed. The TMDL provides a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. It is the sum of the individual waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural background, a margin of safety (MOS), plus a reserve capacity (RC).

In 2006 the Minnesota Pollution Control Agency (MPCA) listed the Lower Wild Rice River as impaired for excess turbidity. This report addresses the turbidity impairment for the Wild Rice River, from the confluence with the South Branch of the Wild Rice River to the Red River of the North. Other waters within the Wild Rice River watershed listed as impaired will be addressed through subsequent TMDL reports.

The Lower Wild Rice River lies within the Wild Rice River watershed of the Red River Basin of the North. This portion of the river is 30.58 miles in length and is located entirely within Norman County, Minnesota. Land use is dominated by agricultural cropping and is extensively drained for that purpose.

The TMDL report used a flow duration curve approach to determine the pollutant loading capacity of the Lower Wild Rice River under varying flow regimes. This approach was used to calculate general allocations necessary to meet water quality standards for the impaired stream reach.

The primary contributing sources of the turbidity impairment appear to be from upland soil erosion and stream-bank erosion. The turbidity impairment can also be directly correlated with higher flows, with sediment reductions near 90 percent needed to achieve the turbidity water quality standard during moist conditions and high flows.

Mitigating the turbidity impairment for the Lower Wild Rice River will consist of two phases. Phase I will begin with the commencement of the Implementation Plan and run through the end of 2012. During this phase, activities will primarily be focused on the following activities:

- Installation of BMPs in three priority upstream subwatersheds.
- Develop stream rehabilitation plans for the beach ridge areas of the Wild Rice and South Branch of the Wild Rice Rivers.
- Intensive monitoring and sediment modeling of the contributing watershed to define spatially where the sediment is coming from, including in-channel evaluations.

The long-term goal of this implementation plan is to meet the water quality standard of 25 NTUs. However, it is recognized that this will not be accomplished during Phase 1 of the implementation plan and will likely take decades to achieve. The intent of Phase 1 of

the plan is to begin reducing sediment load with the goal of saving approximately 33,600 tons of soil annually over the 3-year duration of Phase I. To implement the plan, a series of incentive and or cost share payments will be provided for landowners who agree to voluntarily complete the activities.

Phase II on this implementation plan will commence in January of 2013 and run through the year 2022. The initial activities for Phase II will entail a detailed assessment of evaluating the effectiveness of the activities completed during Phase I. In addition, the basin wide sediment source assessment will be used to target Phase II activities to areas that area shown to provide the highest levels of sediment contribution. The implementation methods in Phase II may also be adjusted from Phase I based on the availability of funding and the most effective technologies available at that time.

TMDL Report Overview

Section 303(d) of the Clean Water Act provides authority for completing Total Maximum Daily Loads (TMDLs) to achieve state water quality standards and/or designated uses.

A TMDL is a calculation of the maximum amount of pollutant that a water body can receive and still meet water quality standards and/or designated uses. A TMDL is the sum of the loads of a single pollutant from all contributing point and nonpoint sources. TMDLs are approved by the U.S. Environmental Protection Agency (EPA) based on the following elements. That they:

1. Are designed for applicable water quality criteria;
2. Include a total allowable load as well as individual waste load allocations;
3. Consider the impacts of background pollutant contributions;
4. Consider critical environmental conditions;
5. Consider seasonal environmental variations;
6. Include a margin of safety;
7. Provide opportunity for public participation; and
8. Have a reasonable assurance that the TMDL can be met.

In general, the TMDL is developed according to the following relationship:

$$TMDL = WLA + LA + MOS + RC$$

Where:

WLA = wasteload allocation; the portion of the TMDL allocated to existing or future point sources of the relevant pollutant;

LA = load allocation, or the portion of the TMDL allocated to existing or future nonpoint sources of the relevant pollutant. The load allocation may also encompass “natural background” contributions;

MOS = margin of safety, or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of loading capacity *(USEPA, 1999)*; and

RC = reserve capacity, an allocation for future growth. This is an MPCA-required element, if applicable, for TMDLs.

Background Information

Lower Wild Rice River Listing Information

This TMDL Implementation plan applies to the turbidity impairment for the Wild Rice River, from the confluence with the South Branch of the Wild Rice River to the Red River of the North (Lower Wild Rice River). The Lower Wild Rice River was originally listed as impaired for turbidity in Minnesota's 2006 303(d) List of Impaired Waters. The following lists additional 303(d) listing information regarding the reach.

A summary of the information included in List of Impaired Waters for the Lower Wild Rice River is provided in Table 1.

Table 1 – Lower Wild Rice River Identification

REACH NAME ON 303(D) LIST / DESCRIPTION	ASSESSMENT UNIT ID	YEAR LISTED	POLLUTANT OR STRESSOR	AFFECTED USE	WATERSHED / HUC
Wild Rice River / South Branch to Red River of the North	09020108-501	2006	Turbidity	Aquatic Life	09020108

The Lower Wild Rice River was assessed to be impaired based on water quality monitoring conducted by the Minnesota Pollution Control Agency (MPCA) for the monitoring stations listed in Table 2. These stations were monitored in 2001 and 2003.

Essentially, listings occur when greater than ten percent of data points collected within the previous ten-year period exceed the 25 nephelometric turbidity units (NTUs) standard (or equivalent values for total suspended solids or transparency tube data). Impairment assessment procedures for turbidity are provided in *The Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment (MPCA, 2007).*

A summary of the information used to include the stream reach on the List of Impaired Waters is provided in Table 2.

Table 2 – Lower Wild Rice River Assessment Summary

MONITORING STATIONS USED FOR ASSESSMENT – ID #	MONITORING STATIONS USED FOR ASSESSMENT – LOCATION DESCRIPTION	PARAMETERS MEASURED	NUMBER OF SAMPLES	NUMBER OF EXCEEDENCES OF WATER QUALITY STANDARD	NUMBER OF YEARS OF DATA / DATA COLLECTION YEARS
S000-216	Wild Rice River, bridge on USH-75 North of Hendrum, Minnesota	Turbidity	7	6	1/2001
S002-102	Wild Rice River at County Road 25, .8 Miles East of Hendrum, Minnesota	Turbidity Transparency tube	8 8	8 8	1/2003 1/2003

Lower Wild Rice River Geographic Location

The Lower Wild Rice River is part of the Wild Rice River watershed of the larger Red River Basin of the North. This portion of the river is 30.58 miles in length and is located entirely within Norman County, Minnesota. The Wild Rice River watershed encompasses just over one million acres and is located in Clearwater, Mahnomen, Becker, Norman and Clay counties. The watershed lies within three ecoregions. The headwaters, middle portion and Lower reach of the watershed receive drainage from the Northern Lakes and Forests, North Central Hardwood Forest, and the Red River Valley ecoregions respectively.

The location of the Lower Wild Rice River within Minnesota and within the Wild Rice River watershed is shown in Figures 1 and 2, respectively.

Figure 1 – Map of Lower Wild Rice River within Minnesota

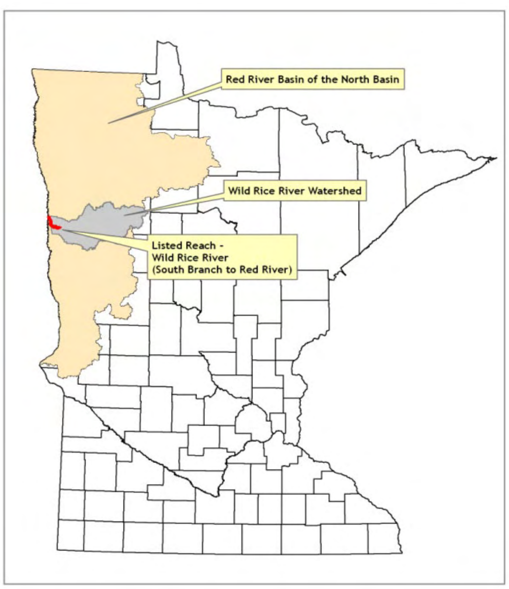
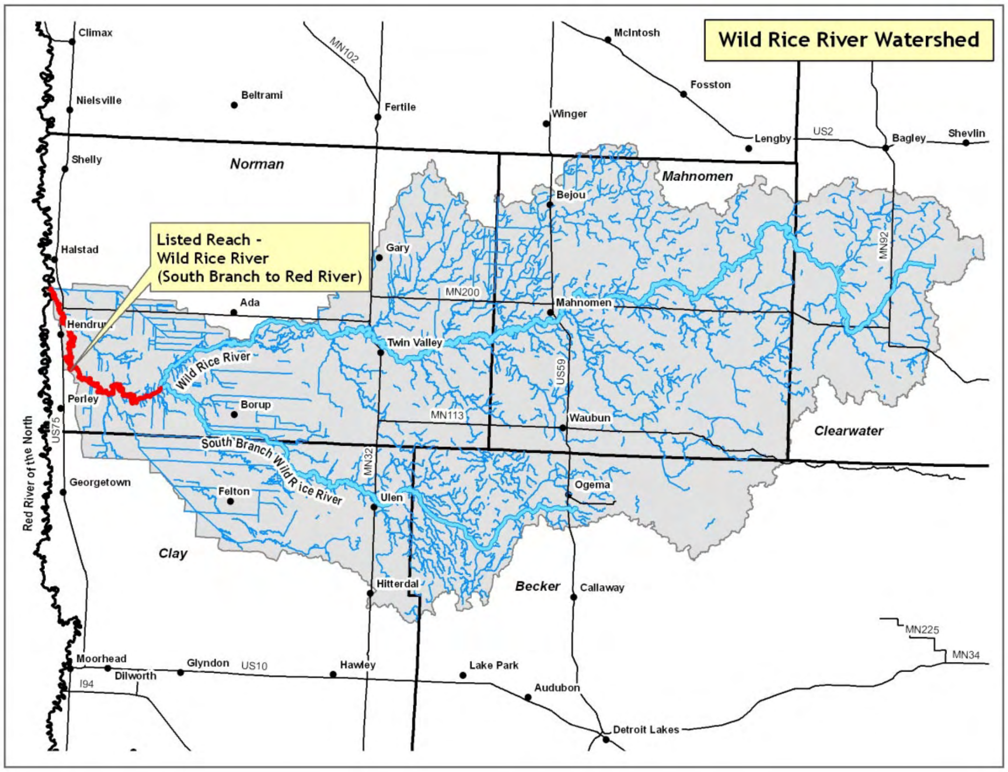


Figure 2 – Map of Lower Wild Rice River within Watershed



Land Cover

The land cover of the Wild Rice River watershed as provided by the National Land Cover Dataset, 2001, is shown in Figure 3, with the number of acres of each land cover type provided in Table 3.

Figure 3 – Map of Land Cover for the Wild Rice River Watershed

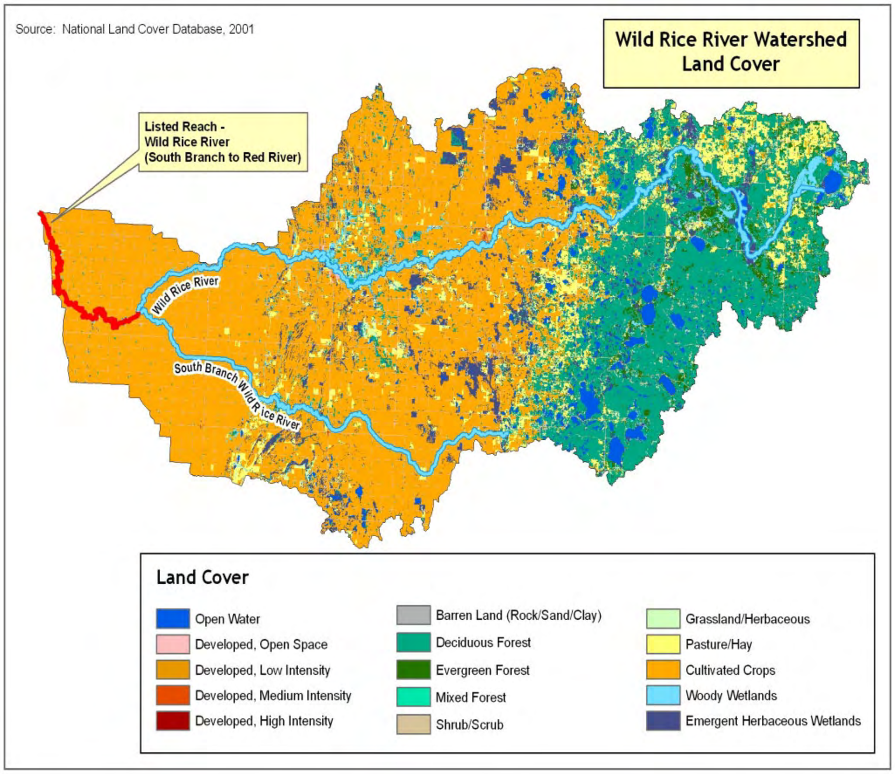


Table 3 – Acres of Land Cover for Wild Rice River Watershed

Category	Area, acres	Percent
Open Water	36,761	3.53 percent
Developed, Open Space	33,645	3.23 percent
Developed, Low Intensity	3,564	0.34 percent
Developed, Medium Intensity	351	0.03 percent
Developed, High Intensity	42	0.00 percent
Barren Land (Rock/Sand/Clay)	305	0.03 percent
Deciduous Forest	207,138	19.87 percent
Evergreen Forest	29,845	2.86 percent
Mixed Forest	705	0.07 percent
Shrub/Scrub	6,795	0.65 percent
Grassland/Herbaceous	15,121	1.45 percent
Pasture/Hay	69,864	6.70 percent
Cultivated Crops	549,550	52.71 percent
Woody Wetlands	22,347	2.14 percent
Emergent Herbaceous Wetlands	66,639	6.39 percent
Total	**1,042,672**	**100 percent**

Watershed Characteristics *(Wild Rice Watershed District, 2003)*

Geomorphology – The Lower Wild Rice River lies within physiographic region known as the Glacial Lake Plain, which is part of historic Glacial Lake Agassiz. This region is characterized by flat, extremely level deposits of lake sediments. The Lower Wild Rice River is generally contained by low banks and has for the most part high sinuosity.

Soils – The upland soils of the Lower Wild Rice River tend to be clays of low permeability, with poor internal drainage. The streambed substrates include a finer mixture of sand and silt.

Cropping – Cropping dominates the land use of the Lower Wild Rice River. In Norman County, where the Lower Wild Rice River is located wheat, soy beans and sugar beats make up the majority of the crops. The United States Department of Agriculture's National Agricultural Statistics Service (NASS) 2002 Census reported that 152,949 acres of wheat, 141,336 acres of soybeans, and 42,787 acres of sugar beats were harvested. Corn is also part of the planted acres in Norman County and is becoming increasingly more common. According to the NASS 2002 Census, the number of corn acres harvested from 2002 (17,900 acres harvested) to 2007 (71,300 acres harvested) increased by 53,400 acres. The United States Department of Agriculture's Farm Service Agency's Conservation Reserve Program (CRP) Monthly Report indicates that as of May 16, 2008, in Norman County 51,716 acres of cropland were enrolled in the CRP. Of those acres, 33,010 are part of CRP contracts which are due to expire between the years 2008 and 2013.

Drainage – The upland of the Lower Wild Rice River is heavily drained by both ditch and/or tile drainage systems, with ditch systems being dominant. This area is subject to extensive flooding during runoff events.

Water Quality Goals

Water Quality Standard for Turbidity

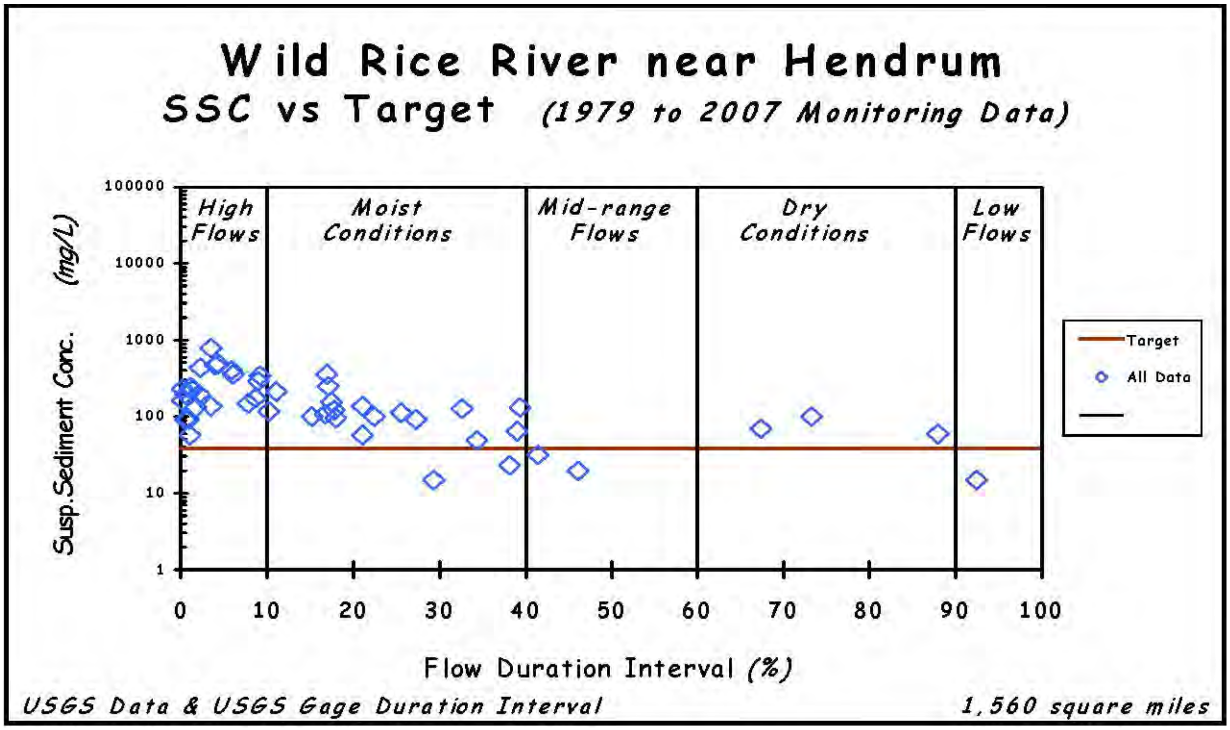
The turbidity water quality standard found in Minn. R. 7050.0222 for 2B and 3B water is 25 NTUs.

Turbidity in water is caused by suspended sediment, organic material, dissolved salts and stains that scatter light in the water column making the water appear cloudy. Excess turbidity can degrade aesthetic qualities of water bodies, increase the cost of treatment for drinking or food processing uses, and can harm aquatic life. Aquatic organisms may have trouble finding food, gill function may be affected and spawning beds may be covered.

Degree of Impairment

Based on the available data the turbidity impairment in the watershed appears to be "major" when viewed across the entire sampling season. All of the turbidity readings taken during the open water season were 25 NTU or higher (Figure 4). The only turbidity measurements that were less than 25 NTU, of which there were five, were sampled during the winter season (December – March).

Figure 4 – All SSC Data in Relation to the Target of 38 mg/l SSC



Numeric Water Quality Target

Turbidity cannot be converted into loads because it is a dimensionless unit. To use the 25 NTU turbidity standard in a load allocation scenario, a relationship between turbidity and SSC was developed during the TMDL study. To develop this relationship, field sampling conducted through a partnership between the WRWD and USGS along the Wild Rice River in 2007 was used. This sampling included "paired" measurements of turbidity and SSC, along with several other water quality variables. Using the paired turbidity and SSC measurements for three sites on the Wild Rice River (Hendrum, Ada, and Twin Valley), a simple regression technique was used to predict SSC based on turbidity. This regression technique resulted in a value of **38 mg/L for the 25 NTU-SSC equivalent**.

The long-term goal of this implementation plan is to meet the water quality standard of 25 NTUs. However, it is recognized that this will not be accomplished during Phase 1 of the implementation plan and will likely take decades to achieve. The intent of Phase 1 of the plan is to begin reducing sediment load with the goal of saving approximately 33,600 tons of soil annually over the 3-year duration of Phase I.

Turbidity Sources

Point Sources

Point sources are the portion of the TMDL that make up the Waste Load Allocation (WLA). Point sources, for the purpose of this plan, are those facilities/entities that discharge or potentially discharge solids to surface water or otherwise may contribute to excess turbidity and require a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit (i.e. water quality permit from the MPCA). In the Wild Rice River watershed, the potential point sources include, municipal wastewater treatment facilities, industrial facilities, concentrated animal feeding operations and construction activities. There are no communities subject to municipal separate storm sewer (MS4) NPDES/SDS permit requirements.

Municipal Wastewater Treatment Facilities - There are ten municipal wastewater treatment facilities (WWTFs) located within the Wild Rice River watershed and include the cities of; Bejou, Borup, Felton, Gary, Hendrum, Mahnomen, Ogema, Twin Valley, Ulen, and Waubun. The individual WLAs was calculated for each of the ten WWTFs (Table 4). Ongoing efforts by the cities as well as continued regulatory oversight by MPCA should maintain the WWTFs as a very minor contributor to the turbidity impairment.

Table 4 – WWTFs and WLAs in the Wild Rice River Watershed

City	TSS WLA in lbs/day	TSS WLA in tons/day
Bejou	57.2	0.03
Borup	41.8	0.02
Felton	83.6	0.04
Gary	92.4	0.05
Hendrum	305.8	0.15
Mahnomen	1548.8	0.77
Ogema	77.0	0.04
Twin Valley	338.8	0.17
Ulen	321.2	0.16
Waubon	176.0	0.09
Total	**3043**	**1.5 tons/day**

Construction Activities - The pollutant load from construction stormwater was estimated to be less than one-percent of the TMDL during the TMDL study. Currently all construction activities disturbing one acre or more of soil require a Construction General Permit under the NPDES program. This requires the applicant to properly select, install and maintain all BMPs required under the permit.

Industrial Facilities – There are two industrial facilities located within the Wild Rice River watershed and include Ames Sand & Gravel - B-B Felton Site and Border States Paving/Marvin/Gordon Pits. Both facilities have NPDES/SDS permit coverage under the State of Minnesota General Permit for Construction Sand and Gravel, Aggregate and Hot Mix Asphalt (Permit Number MNG490000). The pollutant load from industrial stormwater activities such as these was considered to be less than one-percent of the TMDL in the TMDL report.

Concentrated Animal Feeding Operations – There are two Concentrated Animal Feeding Operations (CAFOs) located within the Wild Rice River watershed and include

Burkel Turkey Farms, Inc. and Maple Leaf Enterprises, Inc. Both CAFOs have NPDES/SDS permit coverage under the State of Minnesota General Livestock Production Permit. These CAFOs are assigned a zero WLA. This is consistent with the conditions of the permit, which allows no discharge of pollutants from the production area of the CAFOs.

Non-point Sources

Non-point sources are the portion of the TMDL that make up the Load Allocation (LA). Non-point sources are not subject to NPDES/SDS permit requirements. They can include background sources, such as natural soil erosion from stream channel and upland areas. They can also include runoff from agricultural lands and non-NPDES/SDS permitted stormwater runoff. In an agricultural watershed setting, such as the Wild Rice River watershed, non-point sources dominate the sediment load and are the primary areas designated for load reduction activities.

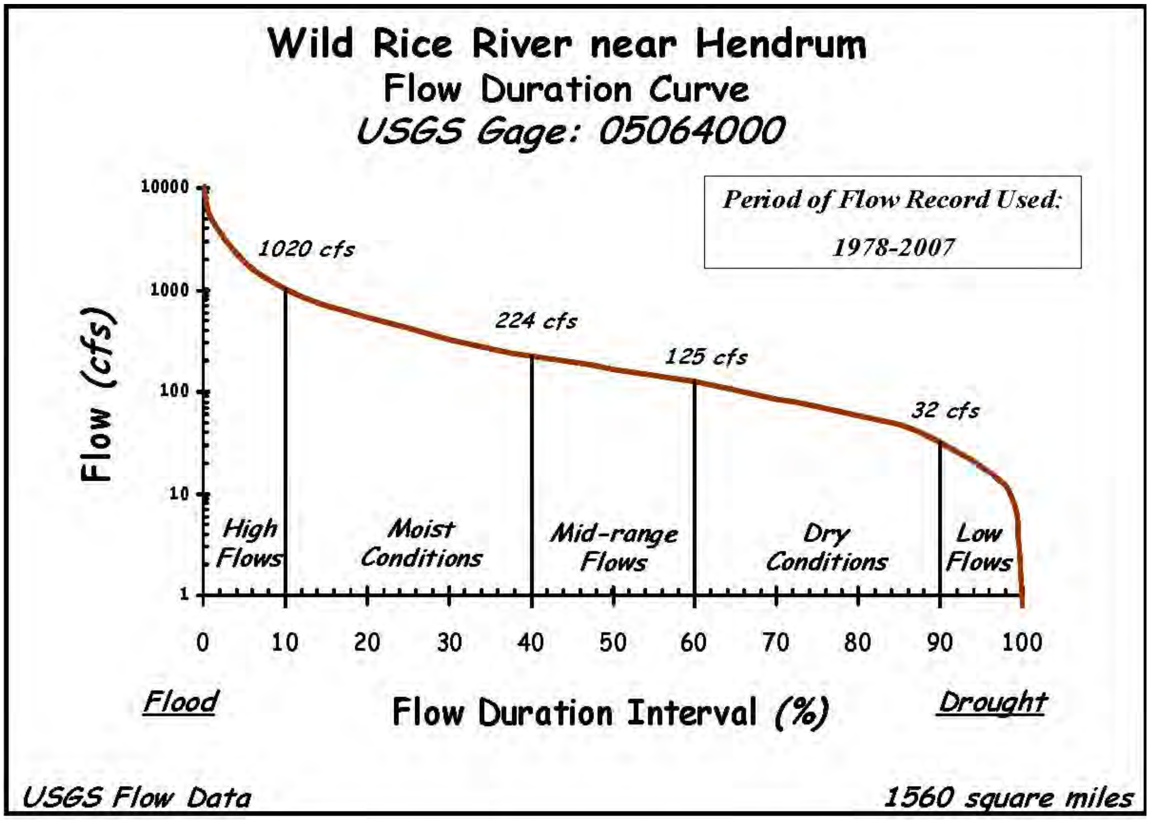
In the Wild Rice River watershed, the sediment from non-point sources comes from two general areas, upland soil erosion and stream-bank erosion. Both sources are known to contribute with the more significant source varying depending on precipitation, flow, and time of the year

Load Reduction Goals of Lower Wild Rice River

Flow and Load Duration Curves

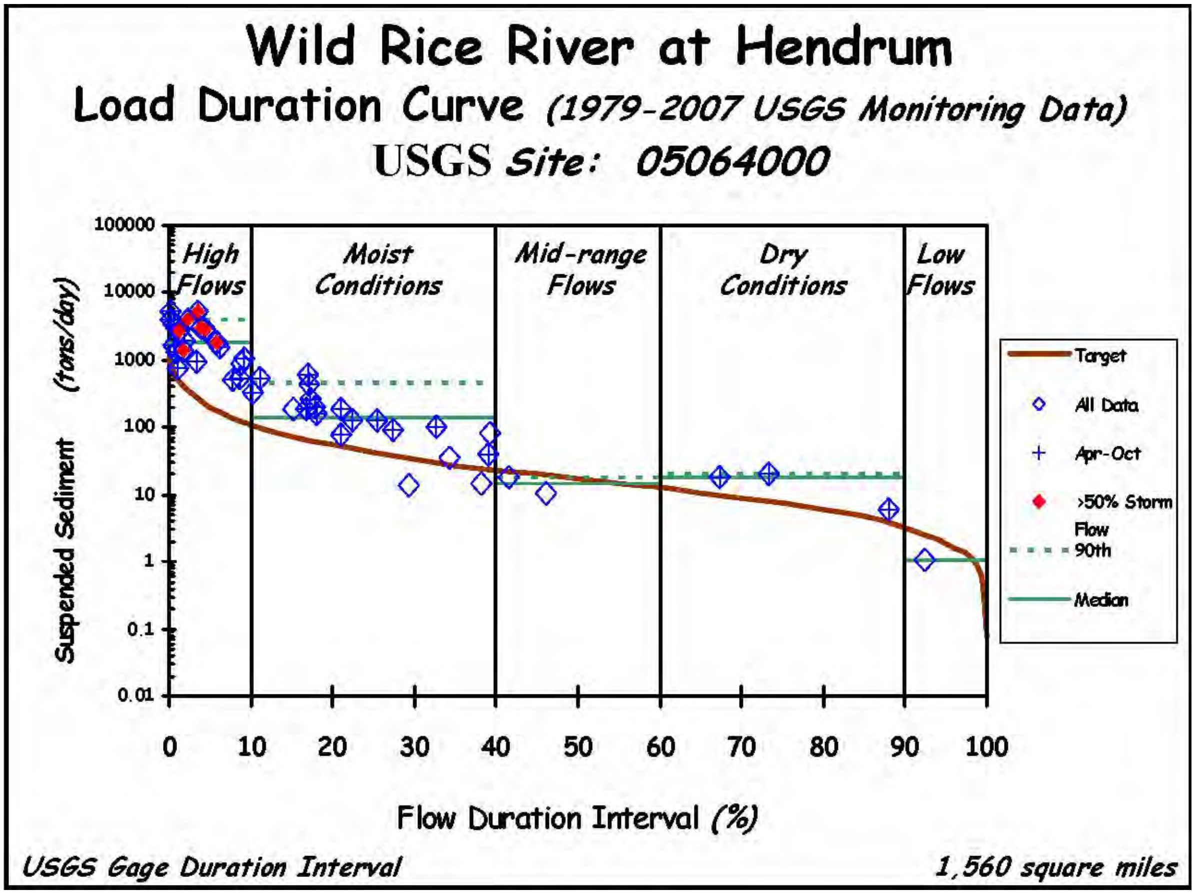
A flow duration curve was completed for the Wild Rice River gage site near Hendrum for the flow period of 1978-2007 (Figure 5). This curve was grouped into several broad categories or zones: one representing ***<u>high flows</u> (0-10 percent),*** another for ***<u>moist conditions</u> (10-40 percent),*** one covering ***<u>mid-range flows</u> (40-60 percent),*** another for ***<u>dry conditions</u> (60-90 percent),*** and one representing ***<u>low flows</u> (90-100 percent).***

Figure 5 – Flow Duration Curve for USGS Site 05604000



Given that the maximum load that can be carried in the river (i.e., the TMDL) at any given time is directly calculated as the target concentration times flow, the maximum load on any individual day is determined by the daily flow present. The TMDL is shown graphically as a load duration curve (Figure 6) where the flow values for each flow duration interval are multiplied by the target SSC concentration of 38 mg/l. To specify the TMDL as selected discrete values, the median flow duration interval for the flow duration zones can be used to represent the loading capacity for each zone. The total loads of SSC allowable in the Wild Rice River at Hendrum for the low flow, dry conditions, mid-range flows, moist conditions, and high flow zones are 1.8, 7.3, 16.9, 42.8, and 195.7 tons per day, respectively.

Figure 6 – Load Duration Curve for USGS Site 05604000



Methodology for Margin of Safety

The purpose of the Margin of Safety (MOS) is to account for any uncertainty that the allocations will result in attainment of water quality standards. Because the allocations are a direct function of daily flows, accounting for potential flow variability is an appropriate way to address the MOS. This was done within each of the four highest flow zones. The MOS was calculated as the difference between the loads corresponding to the median flow and minimum flow in each zone. This method for calculating the MOS is described in *An Approach for Using Load Duration Curves in the Development of TMDLs (USEPA, 2007).*

Reserve Capacity

According to data from the 2000 US Census, from 1990 to 2000, four of the ten cities in the watershed have declined in population. The other six cities have increased in population from a range of 1.9 percent to 7.5 percent. All ten of the WWTFs in the watershed are operating well below the mass loading limits (WLA) assigned to them in their NPDES permits. Also, according to MPCA municipal point source permitting staff, there are no plans for any new or expanded wastewater discharges.

As a result of these facts, there will be no reserve capacity figured into the WLA of this TMDL. The key elements of this TMDL now and into the future are non-point source load reductions.

Percent Load Reductions Required

The total loads of SSC allowable in the Wild Rice River at Hendrum for the low flow, dry conditions, mid-range flows, moist conditions, and high flow zones as described earlier were 1.8, 7.3, 16.9, 42.8, and 195.7 tons per day, respectively. Reducing these allowable loading by the established MOS and Reserve Capacity results in the remaining allowable daily loadings for the combination of point and nonpoint sources.

Table 5 – Wild Rice River near Hendrum Suspended Sediment Loading Capacities and Estimated Percent Reductions Required (AUID: 09020108-501)

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Tons/day				
TOTAL DAILY LOADING CAPACITY	195.7	42.8	16.9	7.3	1.8
minus Established Margin of Safety	91.2	19.9	4.1	3.9	Implicit
minus Established Reserve Capacity	0	0	0	0	0
REMAINING ALLOWABLE DAILY LOAD (Point and Non-Point Sources)	104.5	22.9	12.8	3.4	**
Calculated Median Loading in Zone (Figure 7)	1724.0	126.3	14.4	19.2	1.0
Maximum Observed Loading in Zone (Figure 7)	4068.7	430.4	17.7	20.0	1.0
Percent Reduction Required (Median)	94%	82%	11%	82%	**
Percent Reduction Required (Maximum)	97%	95%	28%	84%	**

Point Source (Wasteload Allocation) - WLA

Municipal Wastewater Treatment Facilities

For the purpose of summarizing the load allocations, the ten WWTFs were lumped into one WWTF allocation. The WLA was determined based on the permitted daily load of TSS. This was estimated to be 1.5 tons/day (TSS).

Construction and Industrial Stormwater

Construction stormwater and industrial stormwater are lumped together into a categorical WLA based on an approximation of the land area covered by those activities. For this TMDL a figure of 0.34 percent was calculated for all five of the flow zones.

Since both of these activities are currently permitted by the MPCA, no load reductions measures were included in the implementation plan for point source.

Nonpoint Source (Load Allocation)

Once the WLA and MOS were determined for a given reach and flow zone, the remaining loading capacity was considered LA. The LA includes non-point pollution sources that are not subject to NPDES permit requirements, as well as "natural background" sources. It is widely accepted that the non-point pollution sources for this reach of the river originate from eroded soil and from erosion of stream-bank sediments.

Since no load reductions are expected from the point sources, it is estimated that generally a 80-94% reduction in the loading from nonpoint sources will be required.

Summary of Loading Capacity

Table 6 provides the daily SSC loading capacities for the Lower Wild Rice River, as well as the WLA, LA and MOS from the TMDL study.

Table 6 – Wild Rice River near Hendrum. Suspended Sediment Loading Capacities and Allocations (AUID: 09020108-501)

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Tons/day				
TOTAL DAILY L0ADING CAPACITY	195.7	42.8	16.9	7.3	1.8
Wasteload Allocation					
Permitted Wastewater Treatment Facilities*	1.5	1.5	1.5	1.5	**
NPDES Construction and Industrial Stormwater	0.7	0.15	0.06	0.03	0.006
Load Allocation	102.3	21.25	11.24	1.87	**
Margin of Safety	91.2	19.9	4.1	3.9	Implicit
	Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY	100 %	100 %	100 %	100 %	100 %
Wasteload Allocation					
Permitted Wastewater Treatment Facilities*	0.8 %	3.5 %	8.9 %	20.6 %	**
NPDES Construction and Industrial Stormwater	0.34%	0.34%	0.34%	0.34%	0.34%
Load Allocation	52.26%	49.66%	66.56%	25.66%	**
Margin of Safety	46.6 %	46.5 %	24.2 %	53.4 %	Implicit

*** Facilities are listed in Table 4, the results are in tons/day of TSS**
**** See the Methodology Section above for the allocations in the low flow zone.**

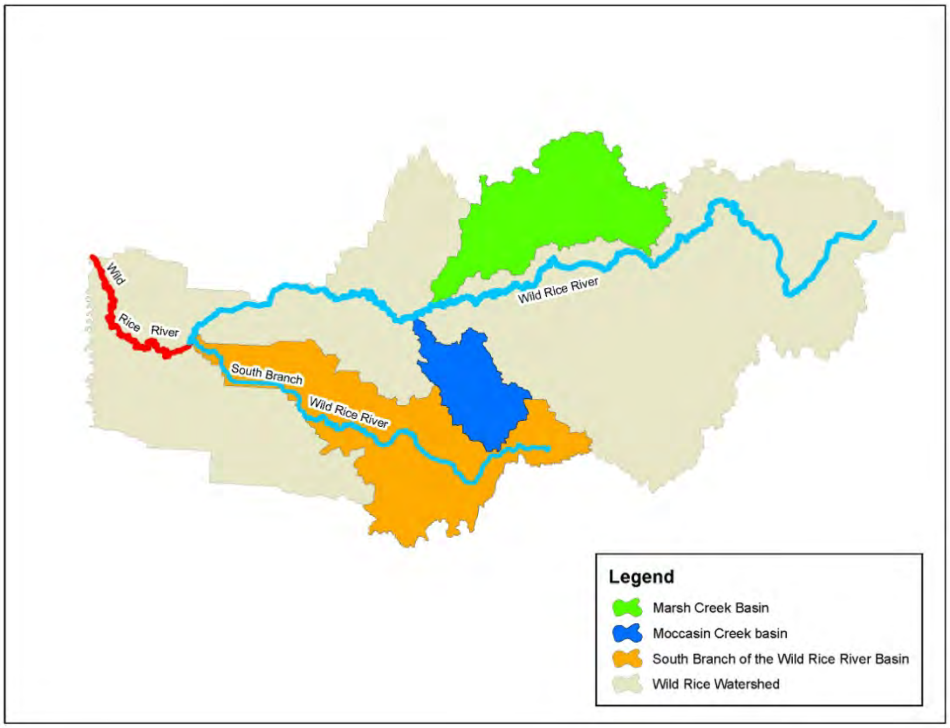
Implementation Process Overview

The implementation plan for the Lower Wild Rice Ricer will be a cooperative plan requiring participation from a number of local, state, and federal agencies. However the core implementation partners will be the Becker, Clay, Norman, and Mahnomen SWCDs along with the Wild Rice Watershed District. The Wild Rice Watershed District will serve as the "umbrella" entity to coordinate meetings, complete annual reports, and other general administrative roles. The partnering SWCDs will be expected to participate in all planning and team meetings; and to work directly with the area landowners to encourage and facilitate the installation of the proposed implementation BMP activities.

Mitigating the turbidity impairment for the Lower Wild Rice River will consist of two phases. Phase I will begin with the commencement of the Implementation Plan and run through the end of 2012. During this phase, activities will primarily be focused on the following activities:

- Installation of BMPs in three priority upstream subwatersheds. These priority subwatersheds were chosen to allow the implementation activities to be focused, since the overall contributing watershed to the Lower Wild Rice River is so large. Sediment loading reductions in these subwatersheds will in turn resulting in sediment load reductions on the Lower Wild Rice River downstream. Ultimately to achieve the required sediment loading, similar activities will be needed in most, if not all, the other contributing upstream subwatersheds. Note that additional priority will be given to BMPs installed within 1-mile of the mainstem channel in each subwatershed (i.e. South Branch of the Wild Rice River,…), within ½-mile of tributaries exceeding 5 square miles of drainage area leading into the mainstem channel, or within 120-ft either side of any other man-made ditch.
    - South Branch of Wild Rice River (Approx. 248 SM)
    - Moccasin Creek (Approx. 67 SM),
    - Marsh Creek (Approx. 166 SM).
- Develop stream rehabilitation plans for the beach ridge areas of the Wild Rice and South Branch of the Wild Rice Rivers.
- Intensive monitoring and sediment modeling of the contributing watershed to define spatially where the sediment is coming from, including in-channel evaluations.

Figure 7 – Map of Three Priority Subwatersheds



All proposed Phase I activities are consistent with the Local Water Management Plans of the SWCDs and the Wild Rice Watershed District Water Management Plan.

Phase II on this implementation plan will commence in January of 2013 and run through the year 2022. The initial activities for Phase II will entail a detailed assessment of evaluating the effectiveness of the activities completed during Phase I. In addition, the basinwide sediment source assessment will be used to target Phase II activities to areas that area shown to provide the highest levels of sediment contribution. The implementation methods in Phase II may also be adjusted from Phase I based on the availability of funding and the most effective technologies available at that time.

Implementation Practices

Proposed Phase 1 Implementation Activities

- Agricultural Conservation Practices and BMPs within Priority Subwatersheds. Note that the estimated soil savings for each of these practices are listed in Table 7. These estimates were made by local Soil and Watershed Conservation staff based on past of experience of the estimated soil loss amount determined on similar type projects using the Revised Universal Soil Loss Equation (RUSLE2) and/or NRCS Wind Erosion Equation (WEQ). These estimates are included for planning purposes only since the exact location and parameters (soil types,…) of each practice is not known. During the actual implementation process the actual amount of soil savings will be estimated using RSULE2 and/or WEQ based on the actual project location. The calculated amounts will be reported in the annual report of progress.

- Stream Barbs

  STREAMBANK AND SHORELINE PROTECTION
  NRCS CODE 580

  DEFINITION
  Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries.

  PROJECTED SOIL LOSS METHODOLGY
  Stream bank erosion is based on an engineering function, calculated by the total cubic yards of erosion from the stream bank converted to acres. The erosion estimates come from SWCD staff experience on previously installed practices.

- Jetties

  STREAM CHANNEL STABILIZATION
  NRCS CODE 584

  DEFINITION
  Stabilizing the channel of a stream with suitable structures.

  PROJECTED SOIL LOSS METHODOLGY
  Stream bed erosion is based on an engineering function, calculated by the total cubic yards of erosion from the stream bed converted to acres. The erosion estimates come from SWCD staff experience on previously installed practices.

- Buffer Strips

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Location: Minimum of 33-ft and Maximum of 120-ft width
  Duration: Must remain in effect for a minimum of 15 years.

  RIPARIAN HERBACEOUS COVER
  NRCS CODE 390

  DEFINITION
  Grasses, grass-like plants and forbs that are tolerant of intermittent flooding or saturated soils and that are established or managed in the transitional zone between terrestrial and aquatic habitats.

  PROJECTED SOIL LOSS METHODOLGY
  Buffers are calculated on land conversion from cropland to permanent vegetation and an intercept function from the upland into the water body. The erosion, calculation is based on the Revised Universal Soil Loss Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

  RIPARIAN FOREST BUFFER
  NRCS CODE 391

  DEFINITION
  An area of trees, shrubs and other vegetation located in areas adjacent to and upgradient from water bodies.

The riparian buffer strip will be most effective when used as a component of a total resource management system including nutrient management, pest management, and erosion, runoff and sediment control practices.

PROJECTED SOIL LOSS METHODOLGY
Buffers are calculated on land conversion from cropland to permanent vegetation and an intercept function from the upland into the water body. The erosion, calculation is based on the Revised Universal Soil Loss Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

- Field Windbreaks

IMPLEMENTATION INCENTIVE REQUIREMENTS:
Duration: Must remain in effect for a minimum of 15 years.

TREE/SHRUB ESTABLISHMENT
NRCS CODE 612

DEFINITION
Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

PROJECTED SOIL LOSS METHODOLGY
The soil loss is calculated by taking 10 times the height of the tree to establish a protection zone. The soil erosion is then calculated with the Wind Erosion Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

- Water and Sediment Control Structures

IMPLEMENTATION INCENTIVE REQUIREMENTS:
Duration: Must remain in effect for a minimum of 25 years.
Location/Installation Criteria:

Within Priority Area:
- Incentive payment shall cover 100% of installation costs if installed within identified priority area and in combination with other buffers.
- If no buffers area installed, incentive payment will be limited to 90% of costs.

Outside Priority Area:
- Incentive payment shall cover 90% of installation costs if installed within outside of priority area and in combination with other buffers.
- If no buffers area installed, incentive payment will be limited to 75% of costs.

WATER AND SEDIMENT CONTROL BASIN
NRCS CODE 638

DEFINITION
An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and water detention basin.

PROJECTED SOIL LOSS METHODOLGY
The soil loss is calculated on sheet erosion from a 40 acre sub watershed draining into the Water and Sediment Control Basin. The erosion is calculated using the Revised Universal Soil Loss Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Wildlife Habitat</u>

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Duration: Must remain in effect for a minimum of 30 years.
  Location: Must be within priority area.

  RESTORATION AND MANAGEMENT OF DECLINING HABITATS
  NRCS Code 643

  DEFINITION
  Restoring and managing rare and declining habitats and associated wildlife species to conserve biodiversity.

  PROJECTED SOIL LOSS METHODOLGY
  Soil loss is calculated on land conversion from cropland to permanent vegetation. The erosion calculation is based on the Revised Universal Soil Loss Equation or the Wind Erosion Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Wetland Restoration</u>

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Type: Wetland should be Level 1 and 2 projects (primarily ditch plugs or tile breaks)
  Location: Incentive would only be eligible to non-Easement Area

  WETLAND RESTORATION
  NRCS CODE 657

  DEFINITION
  The rehabilitation of a degraded wetland or the reestablishment of a wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition that existed prior to modification to the extent practicable.

  PROJECTED SOIL LOSS METHODOLGY
  Soil loss is calculated on land conversion from cropland to permanent vegetation. The erosion calculation is based on the Revised Universal Soil Loss Equation or the Wind Erosion Equation. There is an erosion control function by reducing water volume downstream. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Grass Waterways</u>

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Duration: Must remain in effect for a minimum of 25 years.

  GRASSED WATERWAY
  NRCS CODE 412

  DEFINITION
  A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.

  PROJECTED SOIL LOSS METHODOLGY
  The soil loss is calculated on an engineering function taking the length, width and depth of the gully, there is also a land conversion function from cropland to permanent vegetation and a intercept function from the cropland into the grass waterway. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Cropland to Grazing System</u>

  PASTURE AND HAY PLANTING
  NRCS CODE 512

  DEFINITION
  Establishing native or introduced forage species.

  PROJECTED SOIL LOSS METHODOLGY
  Soil loss is calculated on land conversion from cropland to permanent vegetation. The erosion calculation is based on the Revised Universal Soil Loss Equation or the Wind Erosion Equation. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Side Inlets</u>

  Installation of culvert structures where field ditches enter into larger drainage ditches. In many instances, head cutting is occuring at these locations. The installation of side inlets will eliminate the future headcut potential and also reduce sedimentation from leaving the field.

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Duration: Must remain in effect for a minimum of 25 years.
  Incentive Payment: Incentive payment may pay up to $1500 per side inlet, however should not exceed 100% of installation cost when combined with all available programs.

  GRADE STABILIZATION STRUCTURE
  NRCS CODE 410

  DEFINITION
  A structure used to control the grade and head cutting in natural or artificial channels.

  PROJECTED SOIL LOSS METHODOLGY
  The soil loss is calculated on an engineering function taking the length, width, and depth of the gully and the Revised Universal Soil Loss Equation within the drainage area of the Grade Stabilization Structure.. The erosion estimates come from SWCD staff experience on previously installed practices.

- <u>Water Retention/Detention</u>
  - Installation of flow control retention/detention structures/dams to reduce peak flows and reduce flashiness of streams. This flow moderation will reduce stream power during flooding events reducing downstream erosion and resultant sedimentation.

  IMPLEMENTATION INCENTIVE REQUIREMENTS:
  Duration: Must remain in effect for a minimum of 35 years.

  STRUCTURE FOR WATER CONTROL
  NRCS CODE 587

  DEFINITION
  A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

PROJECTED SOIL LOSS METHODOLGY
Soil loss is calculated on four factors, on-site gully reduction, land conversion from cropland to permanent vegetation, upstream reductions by settling and downstream protection by volume reductions. The erosion estimates come from SWCD staff and engineering experience on previously installed practices.

- Basinwide sediment source assessment
  - Determine spatially where sediment impairing Lower Wild Rice River is coming from. This determination will identify/separate the channel and watershed portions. This is expected to include baseline monitoring, field surveys, watershed yield modeling, channel transport modeling, and documentation. This will include a development of a watershed yield model (i.e. SWAT,…) and also and in-channel sediment source/transport model.
- Channel Stabilization/Rehabilitation Planning
  - Develop stream rehabilitation plans for the beach ridge areas of the Wild Rice and South Branch of the Wild Rice Rivers

Estimated Phase 1 Load Reduction by Practice

Table 7 - Estimated Phase 1 Implementation Activity Soil Saving Estimates

	Soil Loss per acre Before	Soil Loss per acre After	Soil Saved per acre	Acres Treated	Annual Tons Soil Saved	Design Practice Life	Tons Saved Over Practice Life
Practice A - Stream Barbs	10	3	7	3	21	25	525
Practice B - Jetties	10	3	7	3	21	25	525
Practice C - Buffer strips	10	2	8	100	800	15	12,000
Practice D - Field Windbreaks	10	3	7	960	6,720	25	168,000
Practice E - Water and Sediment Control Basins	10	3	7	300	2,100	25	52,500
Practice F - Wildlife Habitat	10	3	7	500	3,500	30	105,000
Practice G - Wetland Restoration	10	3	7	300	2,100	35	73,500
Practice H - Grass Waterways	10	2	8	4	32	25	800
Practice I - Cropland to Grazing Systems	10	1	9	140	1,260	10	12,600
Practice J - Side Inlets	10	3	7	1,440	10,080	25	252,000
Practice K - Water Retention/Detention(1)	10	3	7	1,000	7,000	35	245,000
Annual Soil Saved (tons) =					33,634		

(1) - Only accounts for sediment saving resulting for landuse changes within the upstream the flood pool and does not account for additional sediment loading reductions that will result from reduction of downstream erosion.

Phase 1 Schedule, Responsible Agency, and Financial Assistance Needed

Implementation and coordination of these types of activities will require a collaborative effort by many organizations and individuals if reductions in sediment loading to the Wild Rice River are to be achieved. Potential partners for this watershed effort may include:

- Land Owners
- Wild Rice Watershed District
- Minnesota Pollution Control Agency
- Minnesota Department of Natural Resources
- Minnesota Board of Water and Soil Resources
- Soil and Water Conservation Districts
- Natural Resource Conservation Service
- County Water Planning
- Minnesota Extension Service
- United States Geological Survey
- Other Organizations

The following table shows the practices, lead organization responsible for implementation and potential funding mechanism for each of the Phase 1 BMP activities.

Table 8 – Proposed Phase 1 BMP Implementation Incentive Activity Costs

Practice	Unit	Total Goal	2010 Goal	2011 Goal	2012 Goal	Existing Programs	Additional Incentive Payment	Total Additional Incentive Required	Potential Incentive Payment Source	Implementation Lead
Practice A - Stream Barbs	EA	10	2	4	4	USDA EQIP	$2,000	$20,000	319, CWL, Other	SWCD
Practice B - Jetties	EA	5	1	2	2	USDA EQIP	$2,000	$10,000	319, CWL, Other	SWCD
Practice C - Buffer strips	AC	100	20	40	40	USDA CRP and RIM	$1,280	$128,000	319, CWL, Other	SWCD
Practice D - Field Windbreaks	AC	20	4	8	8	USDA CRP	$500	$10,000	319, CWL, Other	SWCD
Practice E - Water and Sediment Control Basins	EA	40	8	16	16	USDA EQIP	$1,000	$40,000	319, CWL, Other	SWCD

Practice F - Wildlife Habitat	AC	500	100	200	200	USDA WHIP	$0	$0	319, CWL, Other	SWCD
Practice G - Wetland Restoration	AC	300	60	120	120	USDA WRP	$1,200	$360,000	None	SWCD
Practice H - Grass Waterways	AC	4	1	2	1	USDA EQIP	$1,200	$4,800	319, CWL, Other	SWCD
Practice I - Cropland to Grazing Systems	AC	140	28	56	56	USDA EQIP	$0	$0	None	SWCD
Practice J - Side Inlets	EA	36	7	15	14	USDA EQIP	$1,500	$54,000	319, CWL, Other	Drainage Authority
Practice K - Water Retention/ Detention	AF	1000	200	400	400	Varies	$1,200	$1,200,000	319, CWL, Other	WRWD
Total Additional Incentive Required =								$1,826,800		

Table 9 – Proposed Phase 1 BMP Implementation Cost-Share

Practice	Unit	Total Goal	2010 Goal	2011 Goal	2012 Goal	Existing Programs	75% Maximum Cost-share	Total Cost-Share Required	Potential Cost-Share Source	Implementation Lead
Practice A - Stream Barbs	EA	8	N/A	4	4	USDA EQIP	$3,000	$8,000	319, CWL, Other	SWCD
Practice B - Jetties	EA	4	N/A	2	2	USDA EQIP	$3,000	$12,000	319, CWL, Other	SWCD
Practice C - Buffer strips	AC	80	N/A	40	40	USDA CRP and RIM	$750	$60,000	319, CWL, Other	SWCD
Practice D - Field Windbreaks	AC	16	N/A	8	8	USDA CRP	$375	$6,000	319, CWL, Other	SWCD
Practice E - Water and Sediment Control Basins	EA	32	N/A	16	16	USDA EQIP	$4,125	$132,000	319, CWL, Other	SWCD
Practice F - Wildlife Habitat	AC	400	N/A	200	200	USDA WHIP	$750	$300,000	319, CWL, Other	SWCD

Practice G - Wetland Restoration	AC	240	N/A	120	120	USDA WRP	$900	$216,000	None	SWCD
Practice H - Grass Waterways	AC	3	N/A	2	1	USDA EQIP	$1,125	$3,375	319, CWL, Other	SWCD
Practice I - Cropland to Grazing Systems	AC	112	N/A	56	56	USDA EQIP	$375	$42,000	None	SWCD
Practice J - Side Inlets	EA	29	N/A	15	14	USDA EQIP	$3,750	$108,750	319, CWL, Other	Drainage Authority
Practice K - Water Retention/ Detention	AF	800	N/A	400	400	Varies	$900	$720,000	319, CWL, Other	WRWD

Total Additional Cost Share Required = $ 1,608,125.00

Note that incentive and cost share payments listed in Table No. 8 and 9 should be considered "Not to Exceed" incentive and Cost Share amounts. Adjustments to the actual incentive and cost share payment amount may need to be made during implementation due to funding limitations.

In addition to the BMP installations explained in Table No. 8 and 9, the following table lists the additional Phase 1 activities, estimated cost, organization responsible for implementation and the potential funding mechanism for each of the Phase 1 BMP activities.

Implementation activities do not address tile drainage as virtually all tile drainage within the project area are subsurface and do not have surface intakes. Without surface intakes, they do not contribute substantially to turbidity issues in the receiving waters.

Table 10 – Additional Phase 1 Activity Costs

Activity	Schedule	Anticipated Total Cost	Additional Funding Required	Potential Funding Partners
Basin Wide Sediment Source Analysis				
Intensive Monitoring	2012	$150-200,000	$150-200,000	MPCA, MnDNR, WRWD, USGS, Others
Watershed Yield Model (i.e. SWAT,…)	2012	$100,000	$100,000	MPCA, NRCS, WRWD, Others
In-channel Sediment Source/Transport Model	2012	$100,000	$100,000	MPCA, MnDNR, NRCS, WRWD, Others
Channel Stabilization/Rehabilitation Planning	2010-2012	$150-200,000	$150-200,000	MPCA, MnDNR, NRCS, WRWD, Others

Phase BMP Activity Assessments / Monitoring	2010-2012	$45,200.	$20,520	MPCA, USGS, Others
Public Information/ Education/ Outreach	2010-2012	$20,000	$20,000	WRWD, SWCD, MPCA
Phase II Implementation Plan Development	2012	6,000	6,000	WRWD, SWCD, MPCA
Total Additional Funding Required =			$540,520-$640,520	

Proposed Phase 2 Implementation Activities

The implementation activities of Phase II will be defined when this implementation plan is updated near the end of Phase I. The initial activities for Phase II will entail a detailed assessment of evaluating the effectiveness of the activities completed during Phase I. In addition, the basinwide sediment source assessment will be used to target Phase II activities to areas that area shown to provide the highest levels of sediment contribution. The implementation methods in Phase II may also be adjusted from Phase I based on the availability of funding and the most effective technologies available at that time.

Interim Measurable Milestones for Effectiveness

An assessment report of the implementation progress will be completed at the end of each year during Phase 1 by Wild Rice Watershed District with assistance from each participating SWCD. This assessment will list the percentage of each implementation practice implemented as well as an estimate of total resultant sediment load reduction. This assessment will be checked against the proposed schedule presented in Tables 8 and 9.

Monitoring Activities

There are several ongoing monitoring activities occurring in the Wild Rice River watershed and many are planned to continue into the future. Some of these monitoring activities include the Red River Basin's River Watch and the MPCA's Milestone and condition monitoring.

Two additional monitoring efforts will be used to track progress towards the achievement of the TMDL for the Lower Wild Rice River during Phase 1. The first will be lead by the Wild Rice Watershed District in cooperation with the United States Geological Survey. This effort will monitor suspended sediment, flow, turbidity and several other constituents at 3 locations on the Wild Rice River and 2 locations on the South Branch of the Wild Rice River. The total cost of this effort is estimated at $40,000 per year. The USGS has already committed to contribute 50% of these costs. The second effort will be lead by the Norman and Mahnomen County Soil and Water Conservation District. This effort will test turbidity, pH, transparency, and several other constituents at the outlets of the 3 priority subwatersheds (South Branch, Moccasin Creek, and Marsh Creek). The total cost of this monitoring is estimated at $5,200 per year.

In addition, a detailed monitoring plan, which will include monitoring site locations, sampling schedules and responsible parties, will be developed as one of the Phase I activities. Information from this monitoring will be used to calibrate the basin-wide sediment source assessment.

Adaptive Management Process

The implementation plan for the Lower Wild Rice River has been established in a "phased" approach. The first phase will generally involve the installation of BMPs in three priority subwatershed, monitoring and annual reporting on progress, and spatial identification of priority areas for future implementation activities. Phase I is scheduled to last approximately three years as presented in Tables 8 and 9, however annually progress to date will be reviewed and the approach updated based on the outcomes during that year. This adaptive management approach to future implementation will ensure the effectiveness of the sediment reduction measures proposed in Phase 1.

Completing the activities included in Phase I will be essential to determining the framework of how Phase II will be set up. The monitoring and basinwide sediment source analysis work proposed in Phase I, is expected to allow more effective targeting of future sediment reduction activities in Phase II.

In addition, depending on how successful the BMPs implementation process is during Phase I, the BMP practice types, incentive payments, and public outreach process may be changed in Phase II, Any individual BMP practice goal that is not at least 75% obtained during the 3-year period of Phase I, will be reviewed during the development of the Phase II plan.

Public Information and Education

Brochures about the implementation plan and BMPs will be prepared by the Wild Rice Watershed District to circulate to all land owners and operators within the project area early during the first year of Phase I. In addition, during Phase I, SWCD staff will make individual contacts with land owners and operators within the priority subwateshed areas to discuss available programs and conservation opportunities identified in the plan. It is anticipate that this will involve contacts with approximately 100 individuals annually.

Annually, a summary of all the implementation progress will be published in an annual report of progress. In addition, a public meeting will be held annually to provide a presentation of progress throughout the last year and anticipated implementation plans for the next year. This presentation will be given jointly by the Wild Rice Watershed District and participating SWCDs.

Literature Cited/Referenced

Minnesota Pollution Control Agency. 2007. The Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment. http://www.pca.state.mn.us/publications/wq-iw1-04.pdf

US Environmental Protection Agency. 1999. Protocol for Developing Sediment TMDLs, First Edition EPA 841-B-99-004. Washington, D.C.

US Environmental Protection Agency. 2007. An Approach for Using Load Duration Curves in the Development of TMDLs, EPA 841-B-07-006. Washington, D.C.

Wild Rice Watershed District. 2003. Wild Rice Watershed District, Watershed Management Plan.

Minnesota Pollution Control Agency. 2009. Lower Wild Rice River Turbidity, Draft Total Maximum Daily Load Report. http://www.pca.state.mn.us/publications/wq-iw5-03b.pdf

Becker, Clay, Clearwater, Mahnomen, and Norman County SWCDs. Local Water Management Plans