# WHISKEY CREEK WATERSHED SECTION 319 NINE ELEMENT PLAN

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# WHISKEY CREEK WATERSHED SECTION 319 NINE ELEMENT PLAN

Prepared on behalf of:

**Buffalo - Red River Watershed District**
**In cooperation with**
**Wilkin Soil and Water Conservation District**
**West Otter Tail Soil and Water Conservation District**
**Natural Resources Conservation Service**
**and the**
**Minnesota Pollution Control Agency**

December 18, 2019

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# 1 EXECUTIVE SUMMARY

This plan was developed to fulfill the requirements set forth by the U.S. Environmental Protection Agency (EPA) for recipients of grants appropriated by Congress under Section 319 of the Clean Water Act (EPA 2013). The requirements emphasize the use of watershed-based plans that contain the nine minimum elements documented in the guidelines and EPA's *Handbook for Developing Watershed Plans to Restore and Protect our Waters* (EPA 2008).

The Whiskey Creek watershed encompasses an area of 157 square miles and includes several streams and ditches. The watershed is classified as a Hydrological Unit Code (HUC)-10 watershed that includes four HUC-12 subwatersheds. It is located in the Upper Red River of the North major (HUC-8 09020104) watershed.

The plan builds on the foundation of many levels of planning efforts, water quality conditions, implementation goals and activities and an evaluation approach for the watershed. With the EPA approval of the plan, the plan will set the stage to further the previous and current restoration activities and continue efforts on to achieve the water quality goals in the watershed.

This nine element plan, when fully implemented, will lead to the achievement of water quality standards in the Whiskey Creek Watershed. TMDLs for the turbidity and fecal coliform impairments were approved in 2018. The TMDLs were completed for total suspended solids and E. coli given changes in water quality standards for the pollutants. A TMDL has not been developed for dissolved oxygen (DO); however, it is expected that reducing TSS loading and associated phosphorus loads to the stream will also address low DO levels by decreasing algal growth and decomposition.

The critical areas for implementation are described in Section 6.2.7. These areas are the highest loading areas and the practices sited in these areas are expected to have the greatest impact to improve water quality. These areas that are critical to addressing the impairments will be prioritized for implementation.

The nine element plan is an iterative plan. The milestones, goals, and assessment criteria outlined in Section 8.1 create a minimum of biennial assessment points. These points allow for measuring progress, course corrections, and planning the next steps.

# 2 INTRODUCTION

## 2.1 DOCUMENT OVERVIEW

The intent of this document is to concisely address the nine elements identified in EPA's *Handbook for Developing Watershed Plans to Restore and Protect our Waters* (EPA 2008) that EPA feels are critical to preparing effective watershed plans to address nonpoint source pollution. EPA emphasizes the use of watershed-based plans containing the nine elements in Section 319 watershed projects in its guidelines for the Clean Water Act Section 319 program and grants (EPA 2013).

This plan's foundation is the data collection, analysis, and development of plans from multiple sources and scales. Most of the monitoring and planning efforts sponsored by the state (IWM, Assessments, TMDLs, WRAPS, 1W1P, etc.) are conducted and reported on as a HUC 8. These foundational efforts provide the support and understand to develop the very targeted and detailed Focus Grant Workplans for small watersheds. Instead of broad, strategies, this Focus Grant Workplan will delve into specific and targeted actions to achieve water quality goals in the Whiskey Creek Watershed.

This Grant Workplan is intended to be a living document. Through the building on the substantial foundation of previous work in this watershed, initial development of this planning method (Small Watershed Focus), first steps of the implementation of this plan, and the final data collection, this road map is intended to change, react, and correct the course of watershed implementation in the Whiskey Creek Watershed.

The intent of the nine elements and the EPA watershed planning guidelines is to provide direction in developing a sufficiently detailed plan at an appropriate scale so that problems and solutions are targeted effectively. The nine elements are listed in ***Table 1*** along with the section of this report in which each of the nine elements can be found.

**Table 1: Nine Key Elements**

| Section 319 Nine Element | Applicable Report Section |
|---|---|
| a. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. | Section 6 |
| b. An estimate of the load reductions expected from management measures. | Section 6.2 |
| c. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in element b, and a description of the critical areas in which those measures will be needed to implement this plan. | Non-Point Source: Section 5.2.2<br>Critical Areas: Section 6.2 |
| d. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan. | Section 2 |
| e. An information and education component used to enhance public understanding of the project and encourage the public's early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented. | Section 7.2 |
| f. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious. | Section 8 |
| g. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented. | Section 8 |
| h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards. | Section 8 |
| i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item h. immediately above. | Section 10 |

## 2.2 PLANNING PURPOSE AND PROCESS

The purpose of this watershed planning effort is to build upon the existing foundation, which to compile and integrate past, present, and future monitoring and implementation activities in the Whiskey Creek watershed and to achieve and measure the water quality goals for the waterbodies in the watershed. The ultimate water quality goal is to meet water quality standards. The length of time in which that will occur will vary.

This plan will incorporate detailed work for specific waterbodies. It builds off of the existing planning in the Buffalo-Red River Watershed District (BRRWD), including plans for becoming a National Water Quality Initiative (NQWI) watershed. Considerable cross interactions between various programs makes it difficult to single out any one document/plan as the complete picture for the watershed plan that fully meets EPA's nine key elements for every waterbody in the watershed. Instead, each of these plans, studies, and efforts brings more information to the table to inform the actions needed to obtain improved water quality and to ultimate reach water quality standards.

Part of the development of this plan includes synthesizing and compiling the information from these multiple scale planning efforts. Planning needs to be conducted within the existing structure of the BRRWD and framework of the partners. This Small Watershed Grant Workplan will contain more detail than planning efforts to date and bring that value to implementation efforts.

Circumstances in the watershed will continue to change. Land use will change, BMPs will be implemented, the climate will continue to change, etc., and the needs of the watershed will change based on these inputs. The milestones and intentional monitoring of progress will guide the changes needed to this plan throughout the implementation process.

## 2.3 WATERSHED MANAGEMENT TEAM

Several agencies, organizations, and individuals have been active in one or more watershed management-related activities in the Whiskey Creek watershed. A list of these with a brief description of their involvement is given in ***Table 2***.

**Table 2: Participation in Watershed Activities within the Whiskey Creek Watershed**

| Entity or Individual | Description of activity |
|---|---|
| BRRWD | Coordinate Capital Improvement Projects |
| Wilkin SWCD | Marking and Cost Share Agreements from Landowners |
| West Otter Tail SWCD | Marking and Cost Share Agreements from Landowners |
| DNR | Technical Assistance |

# 3 WHISKEY CREEK ASSESSMENT: BACKGROUND & PURPOSE

## 3.1 BACKGROUND

Whiskey Creek is a HUC-10 watershed (0902010402) covering 157 square miles (106,003 acres) watershed in west-central Minnesota. It is a subwatershed of the Upper Red River of the North watershed (HUC-8 09020104). Located in central Wilkin County, the watershed extends from northeast of Rothsay in

Otter Tail County and drains west to Whiskey Creek before flowing south to north to its confluence with the Red River of the North, 3.8 miles northwest of Kent (***Figure 1***). From there, water drains north to Lake Winnipeg in Manitoba, Canada. The water resources in the watershed are managed by the Buffalo-Red River Watershed District (BRRWD) in conjunction with local, state and federal entities.

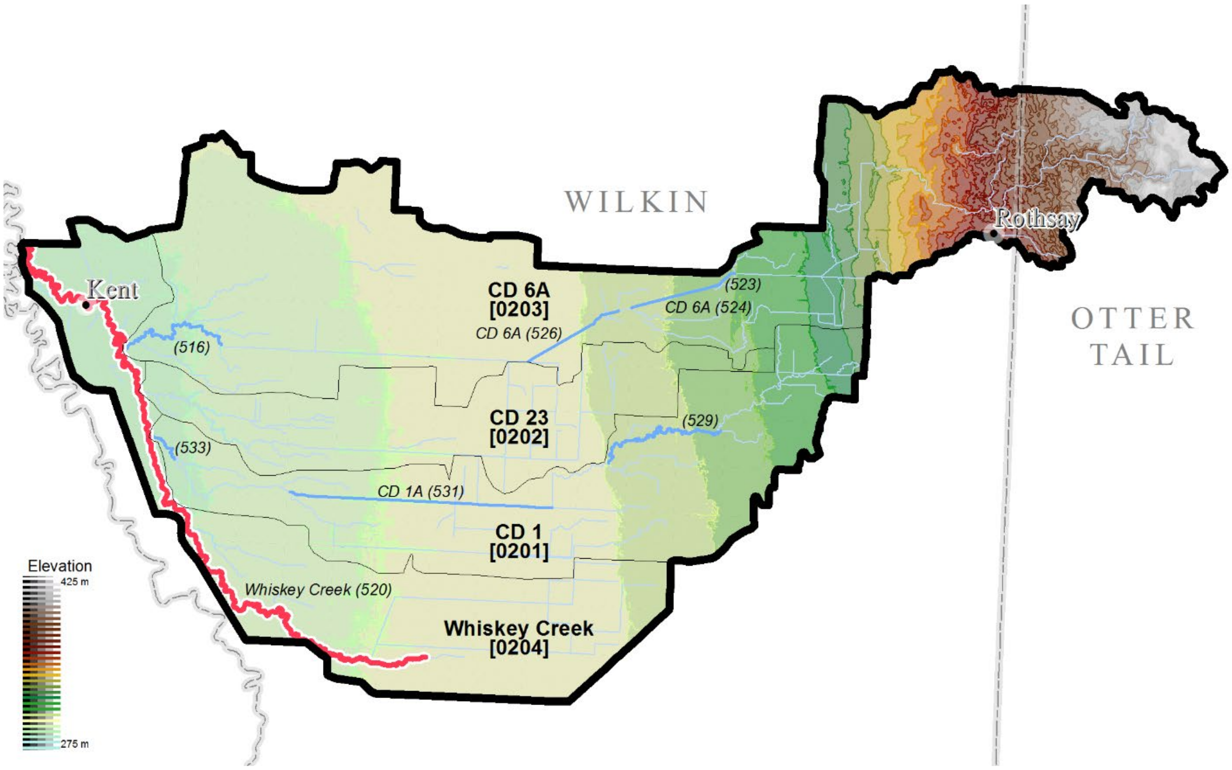


**Figure 1: Whiskey Creek Watershed**

Flowing generally south to north along the western extent of the watershed, Whiskey Creek is the primary resource of concern in the watershed. The creek is fed by a network of public and private drainages ditch systems designed to convey water from agricultural fields downstream. Generally, water quality conditions are very poor and reflect the highly altered landscape. Much of the land use is in agricultural production, watercourses are channelized or straightened, hydrology has been modified, and a there is a lack of riparian cover around ditches, streams, and wetlands.

The primary water quality resource concerns for the Whiskey Creek watershed impact aquatic life and aquatic recreation use designations. The lower reach of Whiskey Creek does not support these designated uses due to several water quality impairments including turbidity (total suspended solids); bacteria (*E. coli* & fecal coliform); low dissolved oxygen (DO); and biology - macroinvertebrate bioassessment and is the only reach listed as impaired (***Figure 2***). Seven stream reaches were assessed as having insufficient information for the determination of water quality impairment. Other stream and ditch reaches have not been assessed by the MPCA for aquatic use support.

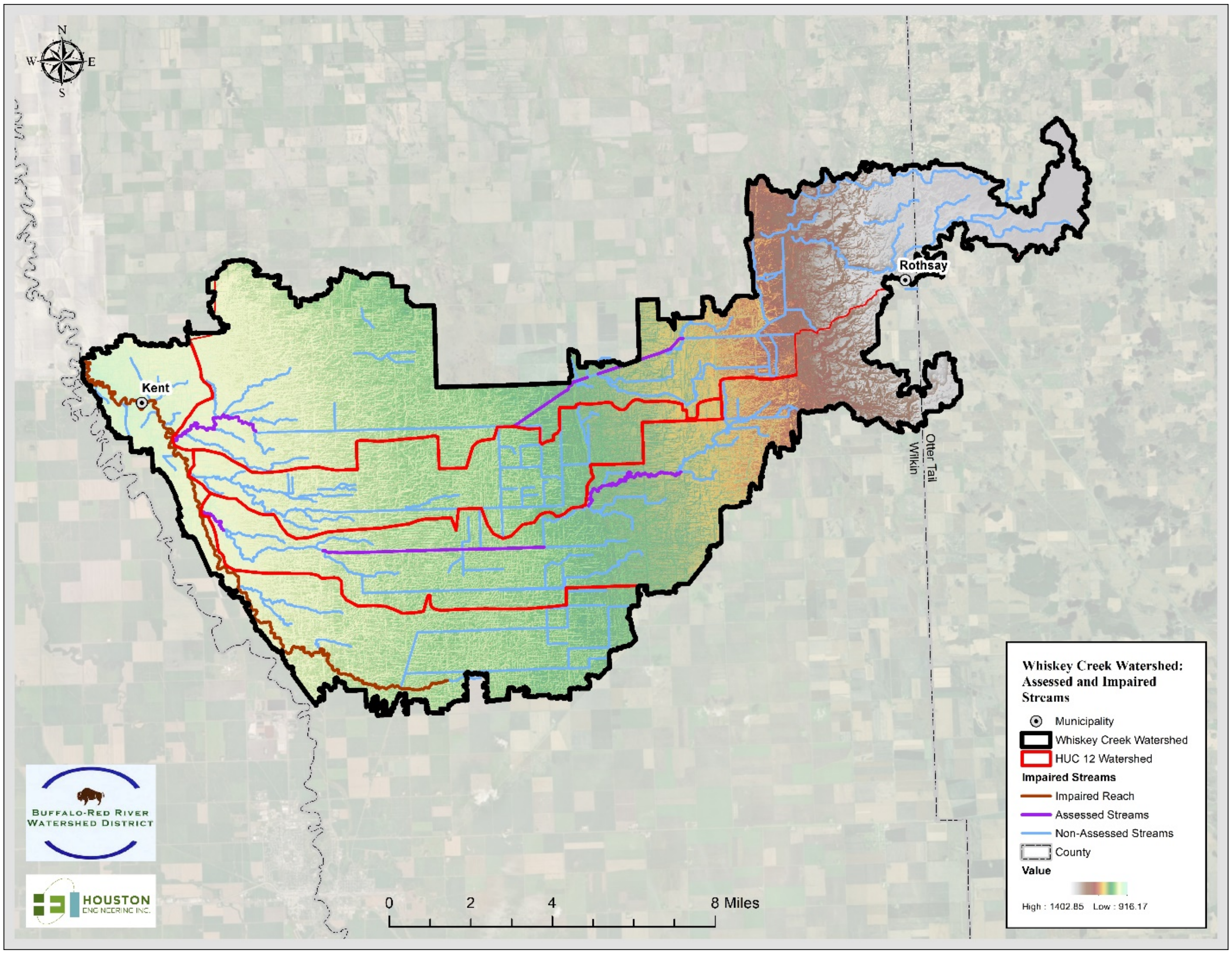


**Figure 2: Assessed and Impaired Stream Reaches**

Whiskey Creek has Total Maximum Daily Load Studies (TMDLs) for turbidity and bacteria (*E. coli*). In 2015, Minnesota transitioned from a turbidity standard to a total suspended solids standard (TSS). Thus, the TMDL study to address the turbidity impairment was developed for TSS. A future TMDL is needed to address the DO impairment. Because the primary stressor on the biological impairment for macroinvertebrates is altered hydrology, there is not a TMDL to address this impairment. The primary constituents of concern in the Whiskey Creek watershed are flow alteration (altered hydrology), habitat degradation, suspended sediment, dissolved oxygen and bacteria. Altered hydrology and habitat degradation are identified in the Upper Red River of the North Watershed Restoration and Protection Strategies Report and the TMDL Study as being stressors on aquatic life in the Whiskey Creek watershed.

## 3.2 PURPOSE AND OPPORTUNITIES

There are a number of opportunities to address these water quality concerns and make progress towards goals. Because many of these water quality concerns are interrelated, strategic actions implemented on the ground by local government staff in cooperation with state and federal agencies have the potential to address most if not all of these concerns. Addressing these concerns in the most efficient manner that leverages limited resources requires well defined water quality objectives and targeted opportunities for implementation.

The water quality objectives for Whiskey Creek area derived from state and local planning sources. The Upper Red River of the North TMDL identifies load reduction targets for TSS and *E. coli*. The Watershed Restoration and Protection Strategy (WRAPS) report outlines strategies for implementation actions to meet the TMDL load reduction targets. The BRWD is currently developing a comprehensive watershed management plan as part of the Minnesota One Watershed, One Plan program (1W1P). The plan will build on the WRAPS strategies in identifying specific goals and actions for all water quality concerns, including altered hydrology, DO and habitat as well as actions to make progress towards meeting these goals for Whiskey Creek and the other waterbodies in the BRWD. The planning effort that began in 2018 and is expected to be completed in 2020. The 1W1P will develop implementation plans for the entire Upper Red River of the North Watershed. This NWQI implementation plan provides the detailed information needed in targeting and implementing practices using NWQI EQIP funds to reduce pollutant loading.

The application for the NWQI program necessitated creating a detailed plan to use NWQI funds in the watershed. This plan was primarily focused on the implementation of that funding source. Participation in the federal Section 319 grant program requires a further detailed work plan.

Successful implementation begins with strong local partnerships, technical expertise and a clear implementation plan. The Buffalo-Red River Watershed District (BRRWD), the lead agency for plan implementation, and its partners, Wilkin Soil and Water Conservation District and the West Otter Tail Soil and Water Conservation District have a strong history of working together and engaging landowners to implement projects in the Whiskey Creek watershed.

This plan aims to build on projects already completed as well as analyses undertaken to identify water quality concerns, prioritize resources of concern and target strategic actions for implementation. Financial and technical assistance from the USDA Natural Resources Conservation Service (NRCS) will enhance the ability of local partners to work with landowners and accelerate implementation to address the water quality concerns in the Whiskey Creek watershed. Whiskey Creek was selected for this effort given its relatively recent addition to the BRRWD and the interest expressed in the past by watershed citizens to address the pollution problems in the watershed.

# 4 WATERSHED CHARACTERIZATION

## 4.1 WHISKEY CREEK WATERSHED SETTING

The Whiskey Creek watershed is a subwatershed of the Upper Red River of the North Basin, which is positioned in western Minnesota (***Figure 3***). The basin is located within the counties of Clay, Wilkin, and Otter Tail in Minnesota and the counties of Richland and Cass in North Dakota. The basin also includes seven lakes and 41 named stream assessment units. The Whiskey Creek watershed is located primarily within Wilkin County, with a small area of the northeast portion of the watershed, near Rothsay, MN, located within Otter Tail County. The watershed drains a total area of 106,003 acres.

The watershed is classified as a Hydrologic Unit Code (HUC) 10 watershed. It is divided into four HUC-12 watersheds. The HUC-10 number for the watershed is 0902010402. The HUC-12 numbers and names are as follows:

- 090201040201 – County Ditch No. 1

- o 090201040202 – County Ditch No. 23
- o 090201040203 – County Ditch No. 6-A
- o 090201040204 – Whiskey Creek

An outline of the HUC-10 watershed, HUC-12 subwatersheds, and streams is shown in ***Figure 4***.

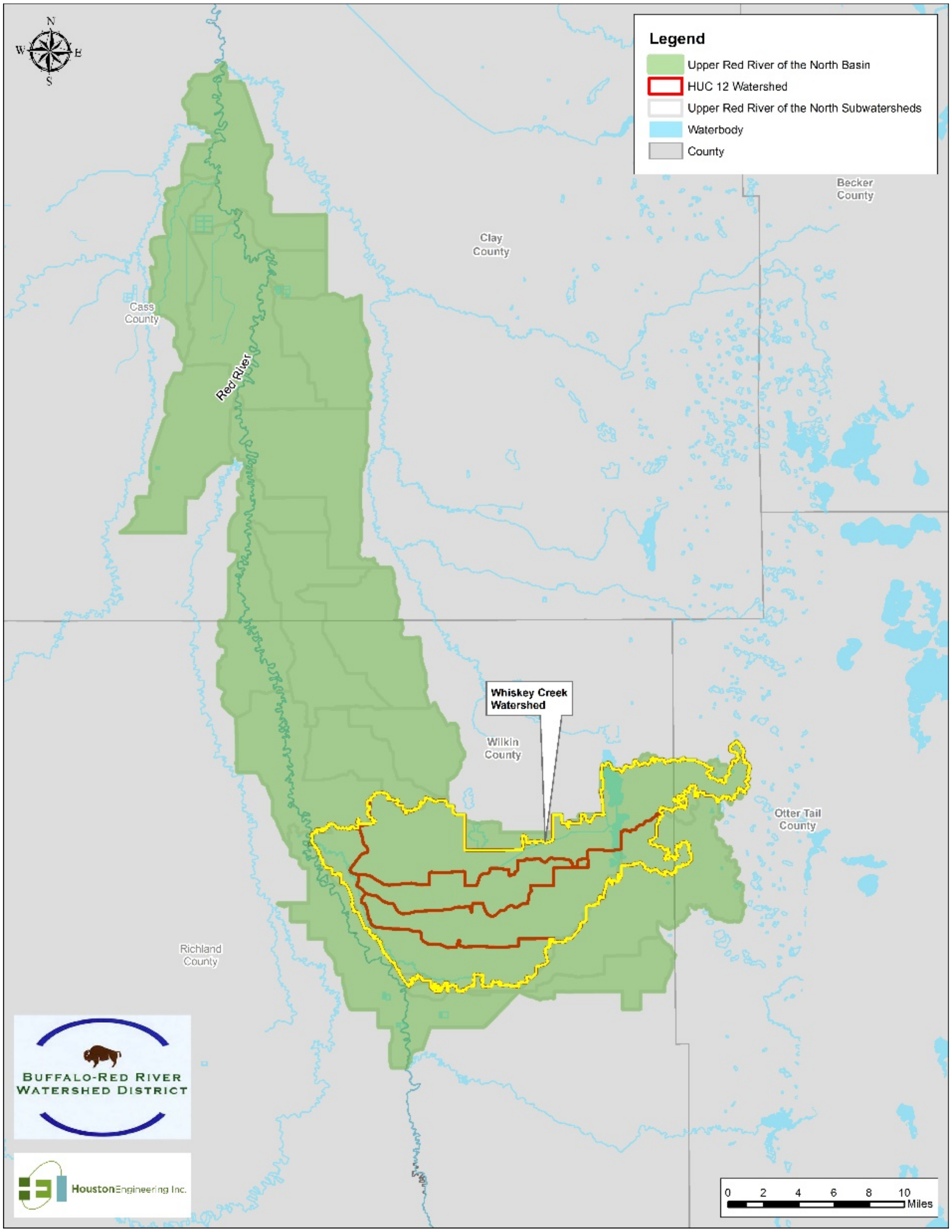


**Figure 3: Upper Red River of the North Basin**

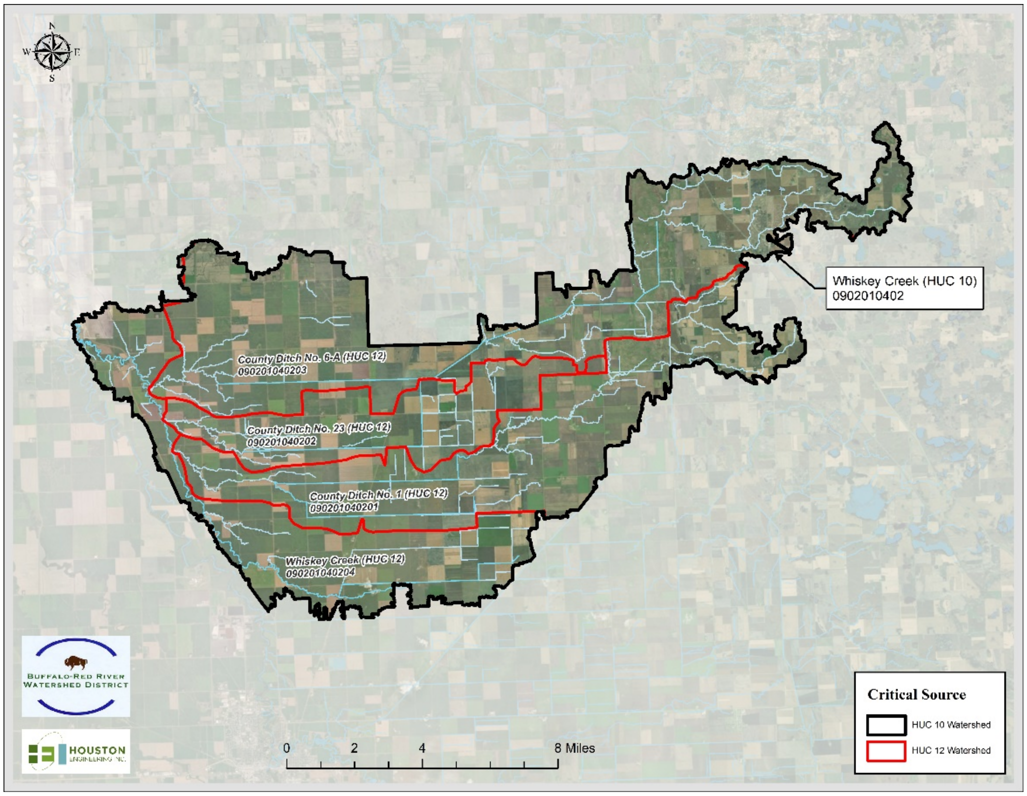


**Figure 4: Outline of Whiskey Creek Watershed, Subwatersheds, and Streams**

## 4.2 MINNESOTA ECOREGIONS

Ecoregions show areas where there is similarity in ecosystems and in the type, quantity, and quality of environmental resources. They are designed to act as a special reference for assessment, management, research, and monitoring of ecosystems and their components. Ecoregions are founded on abiotic and biotic factors such as hydrology, geology, vegetation, and wildlife. The Whiskey Creek watershed is located within the Lake Agassiz Plain ecoregion and in the Glacial Lake Agassiz Basin sub ecoregion, as shown in ***Figure 5***.

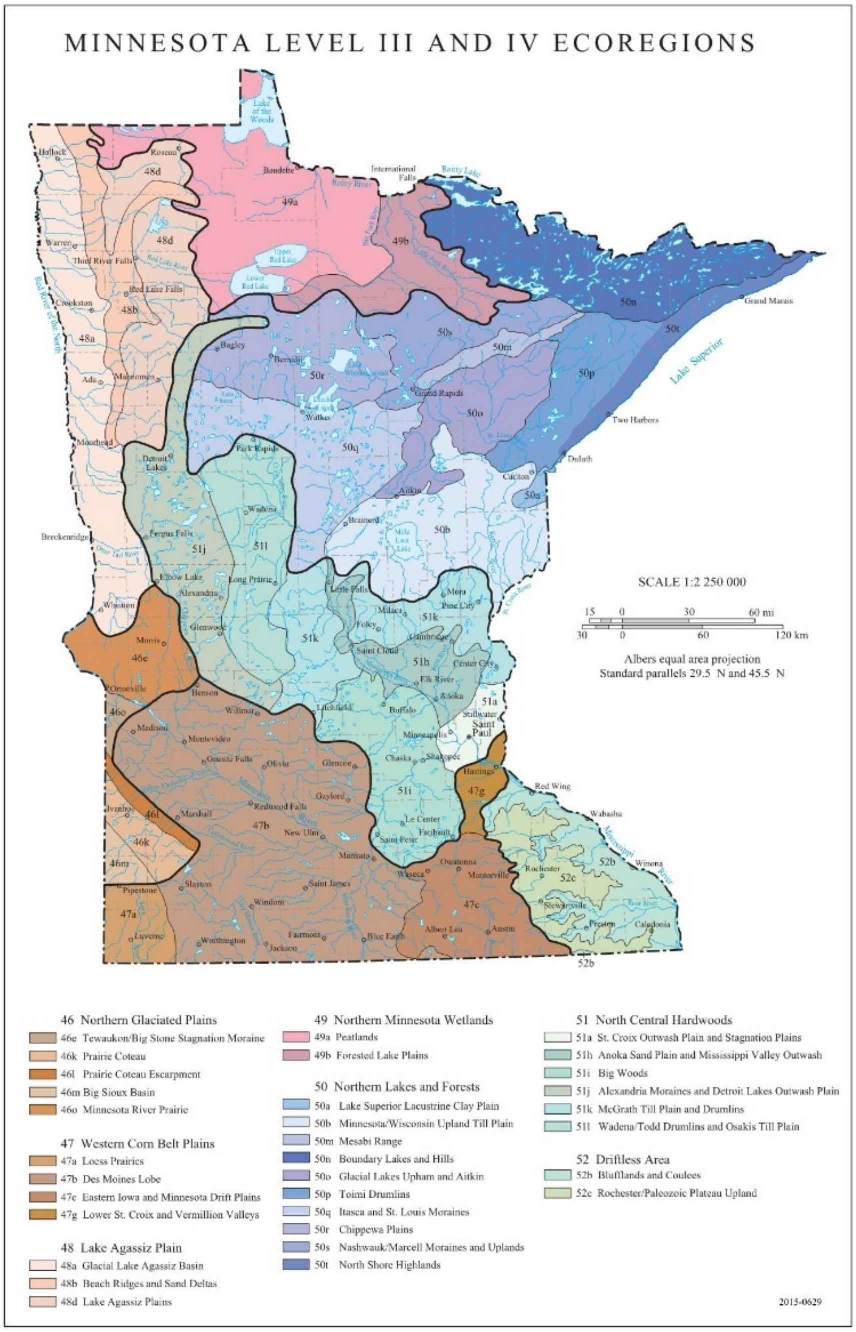


**Figure 5: Minnesota Ecoregions (US EPA)**

## 4.3 CLIMATE

Minnesota has a continental climate, with cold winters and hot summers. Given its location within the Upper Midwest, Minnesota faces a wide variety of weather and experiences distinct characteristics from all four seasons. Temperatures as low as -50 °F can occur during the winter months and can reach 100 °F and above in the summer months. Annual precipitation levels in the watershed range from 27 to 32 inches, according to the Minnesota State Climatologists Office.

## 4.4 TOPOGRAPHY, GEOLOGY AND GEOMORPHOLOGY

The watershed contains numerous wetlands and streams. The highest point within the watershed is 1,398 feet above sea level and the lowest point is 915 feet above sea level, resulting in an elevation difference of 483 feet between the highest and lowest point (***Figure 6***). The Lake Agassiz Plain ecoregion receded from the area approximately 8,000 years ago. The lake plain is characterized by fertile, deep, and fine textured soils and a flat topography (0-3% slope). The Whiskey Creek watershed is the only portion of the Upper Red River Basin that has the classic three physiographic regions. The area contains numerous wetlands and rolling topography. There are varying soils throughout the region, which were formed by glacial till deposited during the last glaciation approximately 12,000 years ago. West of the glacial moraine region and east of the lake plain region lies the beach ridge, which has a north-south corridor approximately three miles wide. This region represents the historical shorelines of Glacial Lake Agassiz.

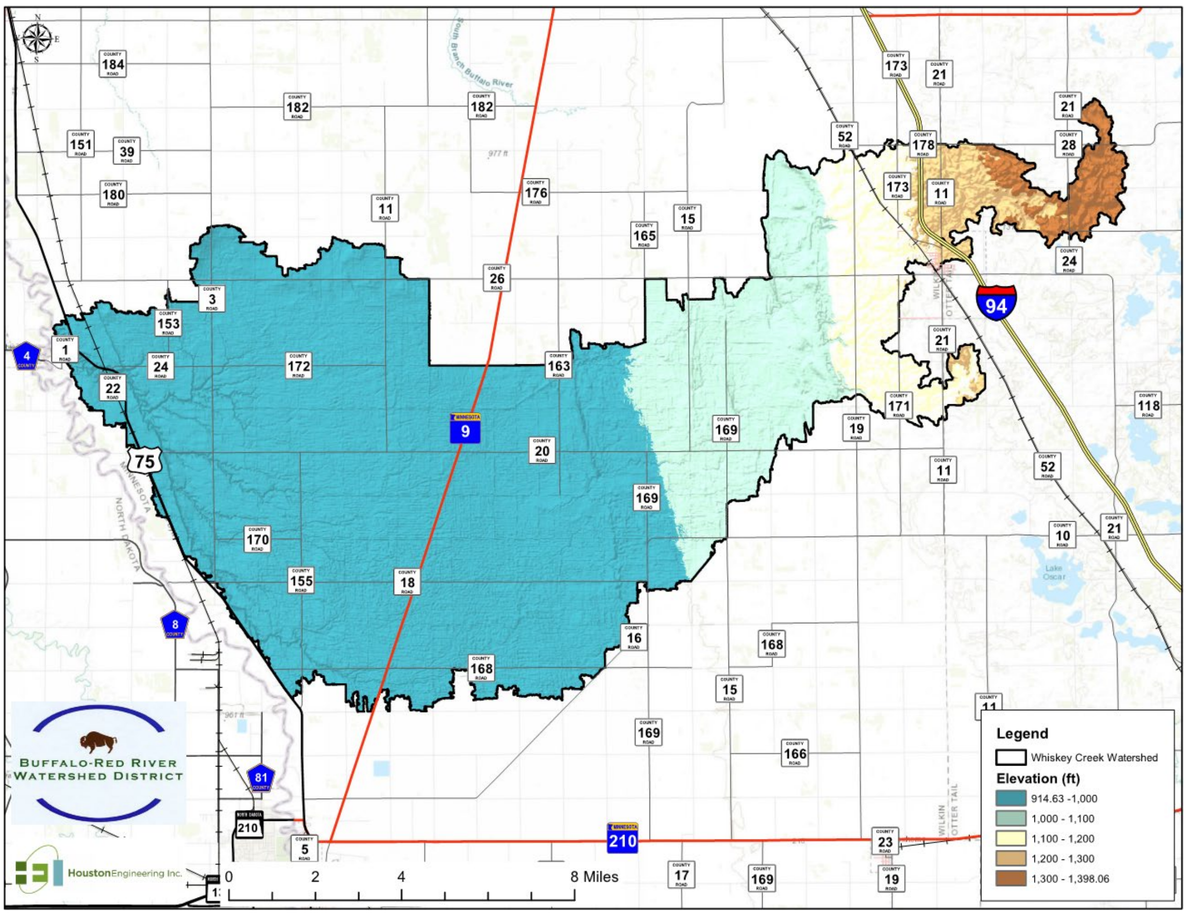


**Figure 6: Digital Elevation Model (DEM)**

## 4.5 SOIL CHARACTERISTICS

The watershed soil data was obtained from the Natural Resources Conservation Service (NRCS) SSURGO database, which has been collected by the NRCS over the course of the last century. Knowing the type of soil and its characteristics is important for management of planning practices throughout the watershed. Features such as hydric rating, hydric groups, slope, and erodibility are vital for estimating the erosion and runoff within a watershed.

## 4.5.1 HYDRAULIC SOIL GROUP

The NRCS classifies soils by Hydraulic Soil Groups, which are based on the soil's runoff potential. Hydraulic Soil Groups are classified by four categories: A, B, C, and D. The infiltration rate and transmission rate of the soil can also be estimated based on the corresponding Hydraulic Soil Group classification of the soil. ***Table 3*** offers a summary of the different Hydraulic Soil Groups and their characteristics. As shown in ***Figure 7***, the most prominent soil type within the watershed is Type C (46%).

**Table 3: Hydraulic Soil Group Characteristics**

| Hydraulic Soil Group | Runoff Potential | Infiltration Rate | Transmission Rate |
|---|---|---|---|
| A | Low | High | High |
| B | Moderately Low | Moderate | Moderate |
| C | Moderately High | Low | Low |
| D | High | Very Low | Very Low |

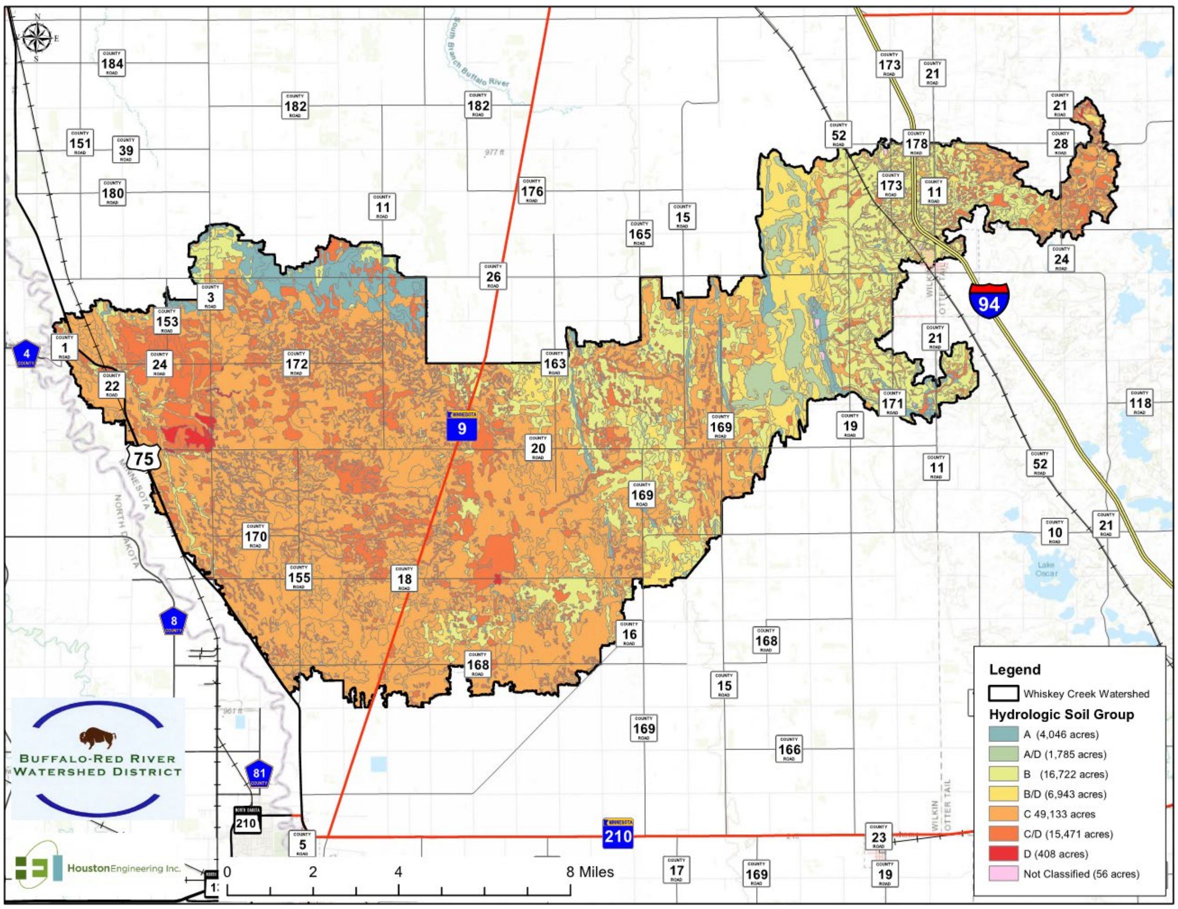


**Figure 7: Hydraulic Soil Groups**

### 4.5.2 SOIL ERODIBILITY

The soil type and slope of the terrain are factors that affect a soils susceptibility to wind and water erosion. Soil such as sand, that is course textured, is more susceptible to erosion than finer textured soils such as clay. The soil erosion factor (K) indicates how susceptible a soil is to rill and sheet erosion caused by water. Soil erodibility factors within the Whiskey Creek watershed, shown in ***Figure 8***, range from 0.02 to 0.43.

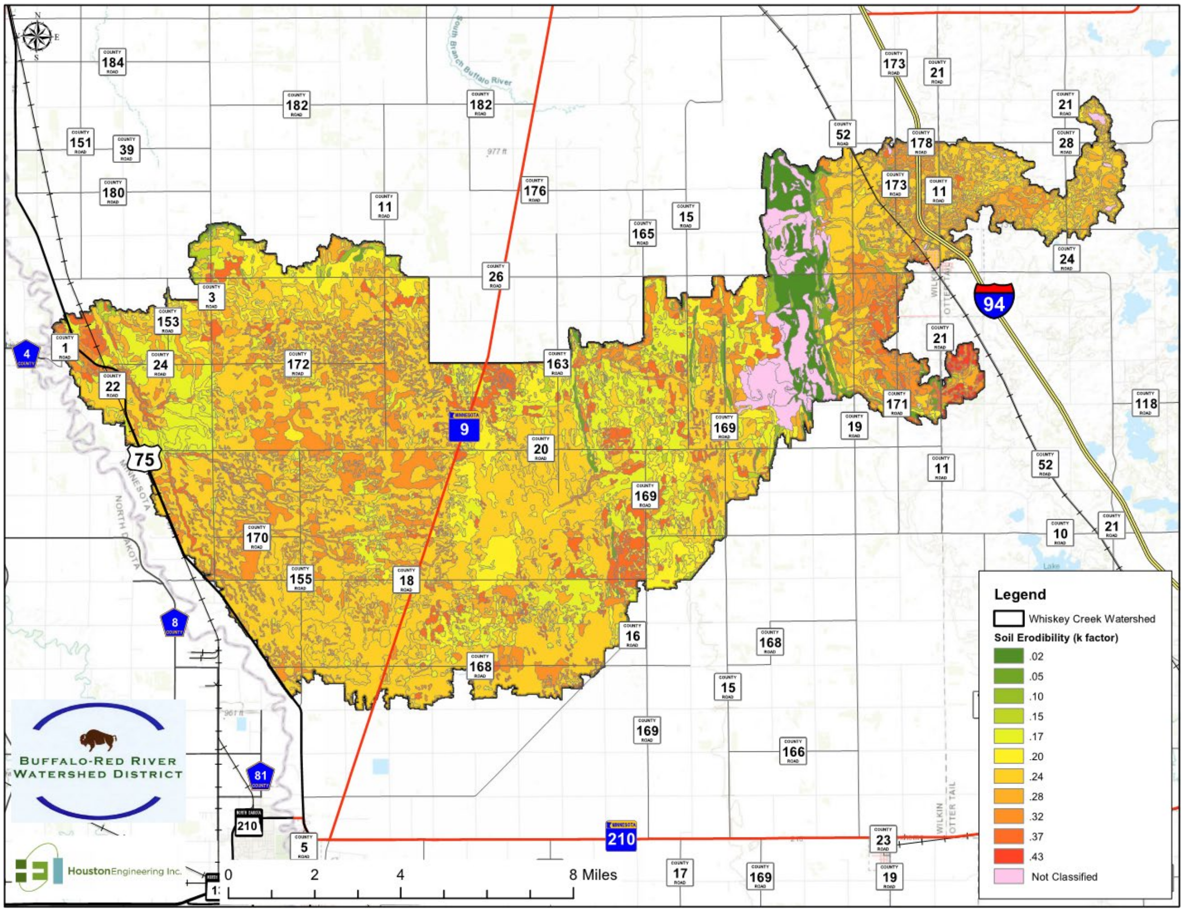


**Figure 8: Soil Erodibility**

## 4.6 LAND COVER/LAND USE

The existing land use data within the watershed was developed using 2011 NLCD. Land use has been broken out into 4 categories as shown in ***Table 4***. Most of the agricultural acres within the watershed produce corn, soybeans, wheat, or sugar beets.

**Table 4: Land Use/Land Cover Summary within Whiskey Creek Watershed**

| Land Use/Land Cover | Area (Acres) | Percent |
|---|---|---|
| Agriculture | 91,057 | 85.9% |
| Natural Background (Forests, Wetlands, Grasslands) | 9,116 | 8.6% |
| Urban | 5,512 | 5.2% |

| Land Use/Land Cover | Area (Acres) | Percent |
|---|---|---|
| Water | 318 | 0.3% |
| **Total** | **106,003** | **100%** |

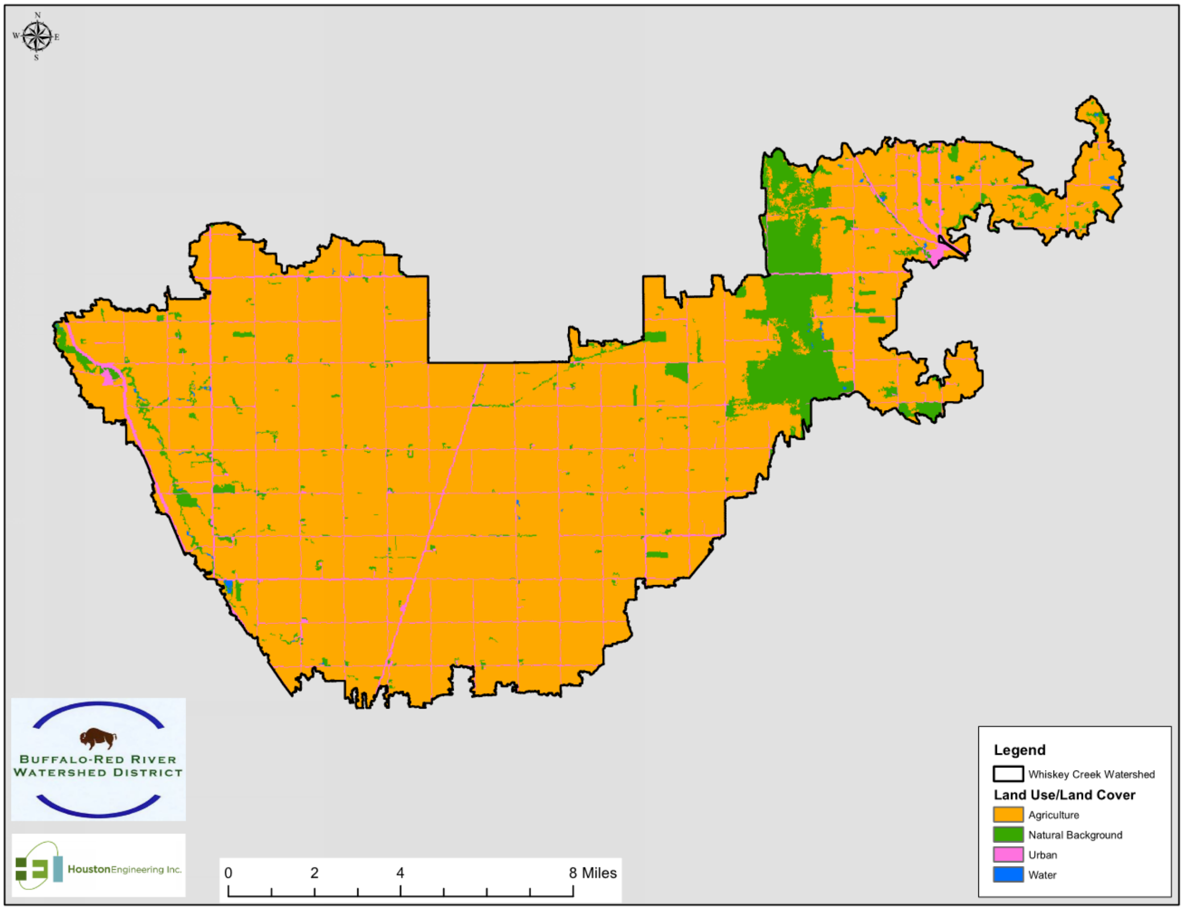


**Figure 9: Land Use/Land Cover**

## 4.7 WATERSHED JURISDICTIONS

The Whiskey Creek watershed is location within Wilkin and Otter Tail Counties. The City of Rothsay and the City of Kent are within the watershed boundary, along with the Township of Roberts, McCauleyville, Mitchell, Nordick, Connelly, Manston, Meadows, Nilsen, Tanberg, Akron, Trondhjem, and Oscar.

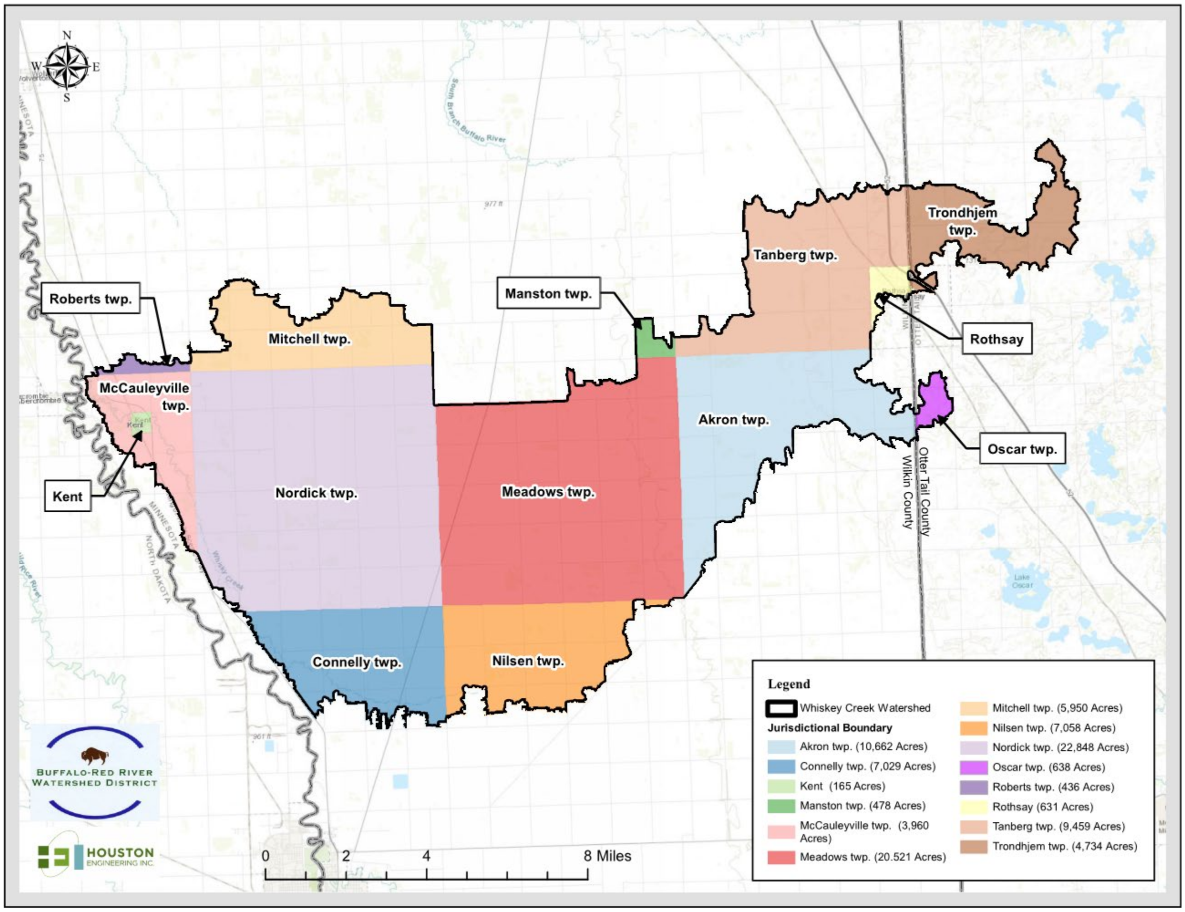


**Figure 10: Municipal Jurisdictions**

## 4.8 JURISDICTIONAL ROLES AND RESPONSIBILITIES

Many natural resources are protected by the United States through federal, state, or local law. The Clean Water Act (CWA) is the most powerful instrument in protecting water resources. The Minnesota Department of Natural Resources (MDNR) has the authority within the state to administer the provisions of the CWA. With the approval of the MDNR, the U.S. Army Corps of Engineers (USACE) regulate the wetlands through Section 401 and 404 of the CWA. The National Pollution Discharge Elimination System (NPDES) is established in Section 402, while Section 319 (Nonpoint Source Management Program) was formed to help support local and state nonpoint source efforts that were not addressed within the NPDES permits.

## 4.9 POPULATION AND ECONOMIC DEMOGRAPHICS

The Whiskey Creek watershed is a rural area with a low population rate. According to Data USA, the population of Wilkin County (the primary location of the watershed) in 2017 was approximately 6,400 people with a median household income of $52,917. The most common industries within the watershed area are manufacturing, health services, and agriculture (US Census Bureau).

# 5 HYDROLOGY AND WATER QUALITY CHARACTERIZATION

## 5.1 HYDROLOGY

### 5.1.1 SURFACE WATERS

Whiskey Creek has multiple surface waters throughout its watershed, including rivers and streams. ***Figure 11*** shows the surface waters within the watershed.

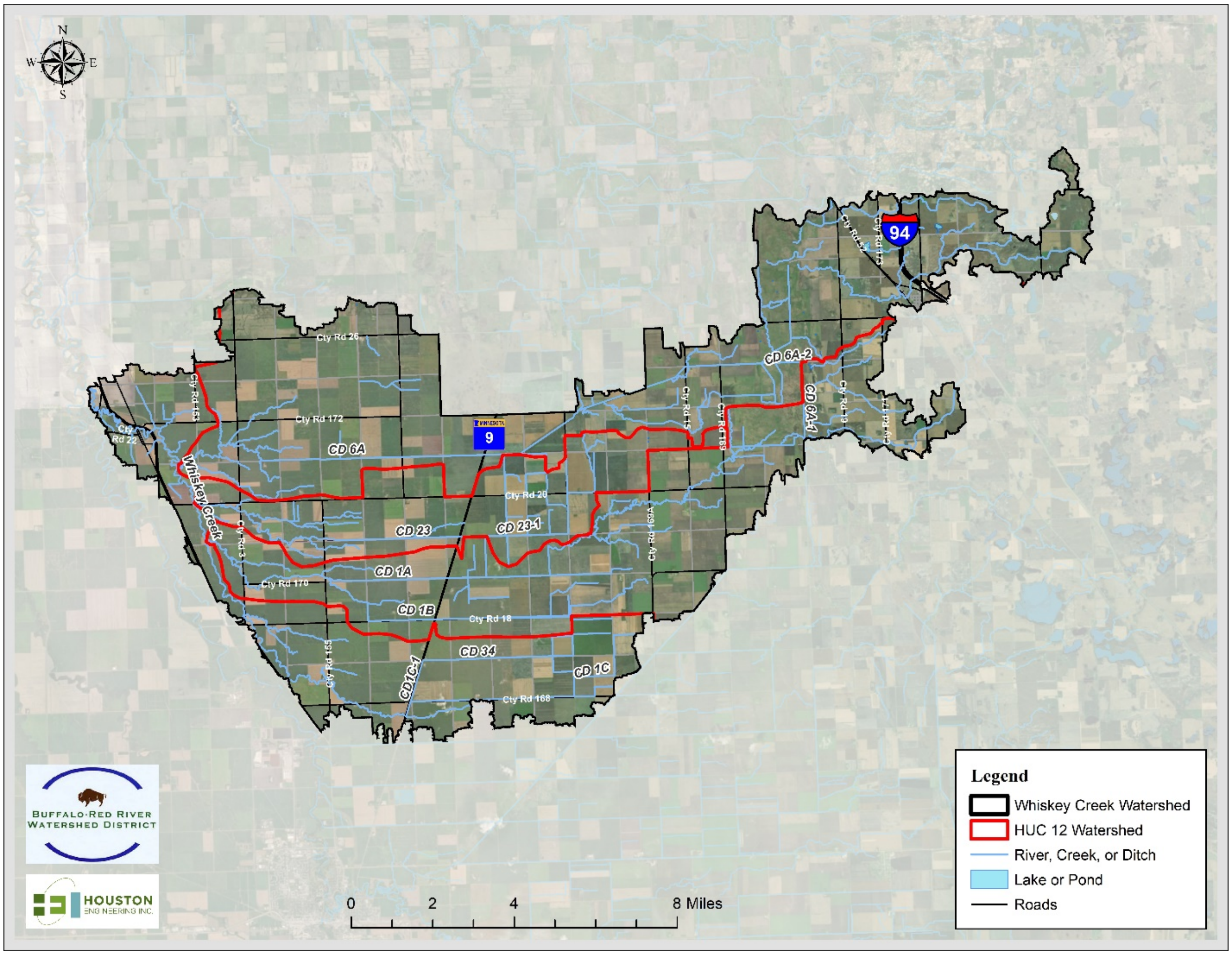


**Figure 11: Whiskey Creek Watershed Surface Waters**

#### 5.1.1.1 RIVERS AND STREAMS

Whiskey Creek begins in the southern portion of the watershed, with its headwaters starting in Section 18 of Connelly Township. Whiskey Creek then flows to the west/northwest until it discharges into the Red River of the North in Section 3 of McCauleyville Township. The hydrology of the Whiskey Creek watershed has been extensively altered through the construction of numerous legal public drainage systems along with an extensive system of private field drains (ditches and swales). This anthropogenic alteration has made most areas of the watershed well-drained, resulting in a more flashy rainfall to runoff response than what would have occurred historically. The legal public drainage systems include several county ditches that act as tributaries to the creek: Wilkin County Ditch 1A, Wilkin County Ditch 1B, Wilkin

County Ditch 1C, Wilkin County Ditch 6A, Wilkin County Ditch 23, and Wilkin County Ditch 34. Wilkin County Ditch 6A has reliable base flow, fed from the large wetland area west of Rothsay. However, the remainder of the county ditches listed are typically dry except for runoff events.

#### 5.1.1.2 LAKES

The Whiskey Creek Watershed does not contain any named lakes within its boundary.

### 5.1.2 GROUNDWATER

Base stream flows are generally fed by existing wetland areas within the watershed but are also related to the local groundwater supplies. The western portion and a few locations in the north/northeast area of the watershed shows the greatest susceptibility to groundwater contamination and is classified as "Medium Susceptibility" (***Figure 12***).

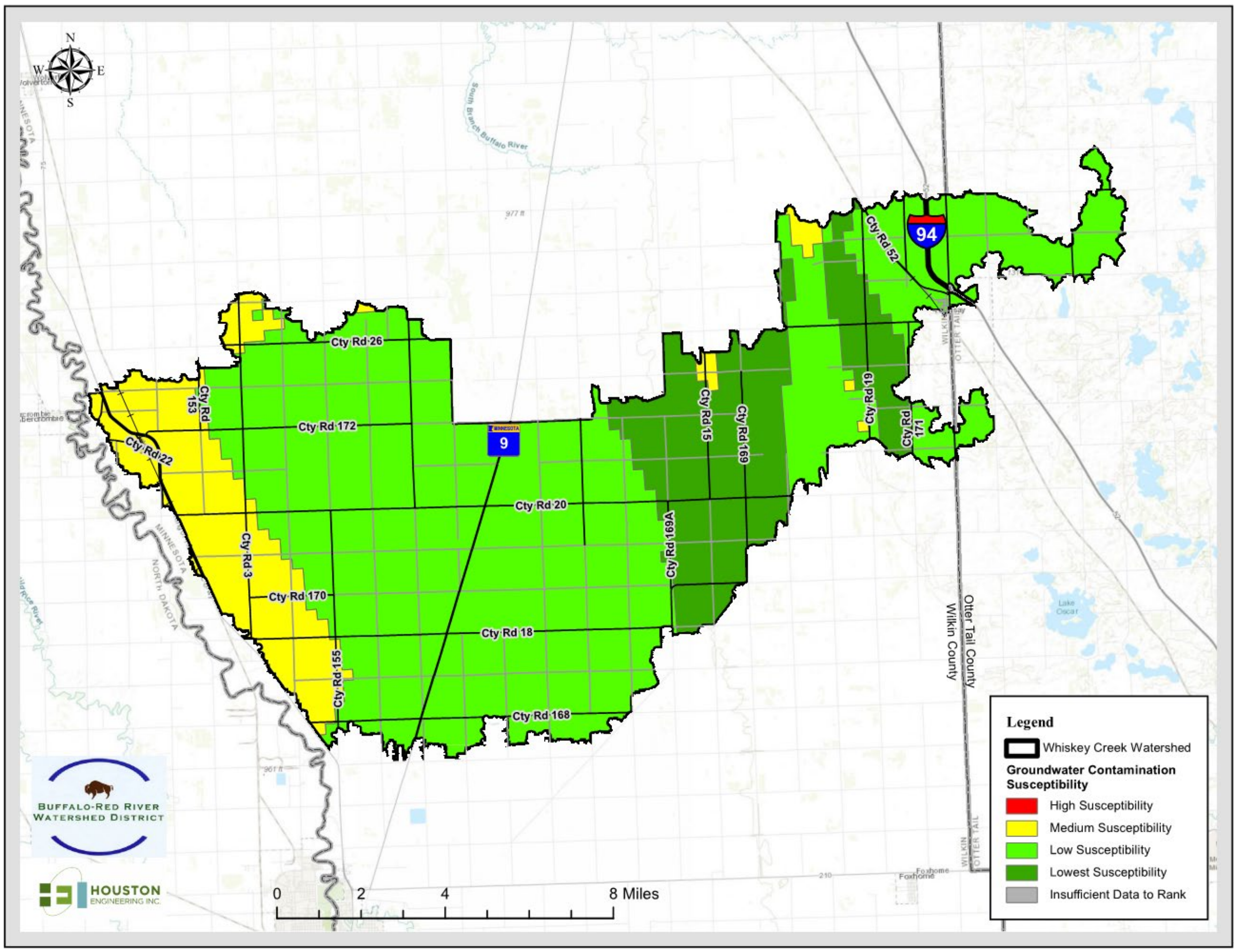


**Figure 12: Whiskey Creek Watershed Groundwater Susceptibility**

## 5.2 WATER QUALITY

The goal of the Clean Water Act, established in 1972, was to restore and maintain the physical, chemical, and biological integrity of our Nation's waters. Under the Clean Water Act, the EPA has developed national water quality criteria recommendations and has implemented pollution control programs. The

Clean Water Act made it unlawful to discharge from any point source directly into navigable waters unless a National Pollutant Discharge Elimination System (NPDES) Permit is acquired. The Clean Water Act delegates authority to states, which allowed the NPDES Permit Program to be delegated to Minnesota in 1974.

### 5.2.1 POINT SOURCES

Point sources are discharges which are collected and conveyed to a specific point, such as a stormwater pipe or wastewater treatment facility. There is one wastewater treatment facility located in Rothsay, MN that discharges into a tributary of Wilkin County Ditch 6A in the spring/early summer and again in the late fall of each year. This tributary then travels approximately 21 miles southwest to Whiskey Creek.

### 5.2.2 NON-POINT SOURCES

With more than 85 percent of the watershed being agricultural fields, non-point sources, such as row crops, produce the majority of the pollutants within the watershed. Based on the Minnesota Pollution Agencies Stressor ID Report, farming through headwater (first and second order) streams is a significant problem where gullies recut these historic small stream channels each time sufficient runoff occurs to begin the channel forming process. Farming of the floodplain is another source of sediment to the system as the unprotected soil can be easily lost to the stream flow during flood events. In-stream erosion resulting from the increased flow rates due to extensive drainage throughout the watershed is another concern. In addition, based on the water quality monitoring completed by the MPCA, total suspended sediment tends to increase as water flows downstream through the agricultural area of the watershed. The dominant land use throughout the watershed is agricultural, resulting in a high pollutant load from non-point sources.

## 5.3 PRECIPITATION – RUNOFF BUDGET

The runoff generated from the watershed was calculated using the Prioritize, Target, and Measure Application (PTMApp). The application utilizes the SCS-Curve Number method and was modeled using two different rainfall scenarios; a 2-year, 24-hour storm event and a 10-year, 24-hour storm event. Rainfall depths were determined using NOAA Atlas 14 Point Precipitation Frequency Estimates and are shown in ***Table 5***.

**Table 5: NOAA Atlas 14 Point Precipitation Frequency Estimates**

| Storm Event | Rainfall Depth (in) |
|---|---|
| 2-year, 24-hour | 2.47 |
| 10-year, 24-hour | 3.70 |

Using the SCS-Curve Number, the average runoff depth was calculated over the watershed area. ***Table 6*** shows the calculated runoff depths for each storm event, as an average depth over the watershed area.

**Table 6: Whiskey Creek Watershed Average Runoff Depth**

| Storm Event | Runoff Depth (in) |
|---|---|
| 2-year, 24-hour | 0.69 |
| 10-year, 24-hour | 1.54 |

As shown in ***Figure 13*** and ***Figure 14***, runoff depths vary by location within the watershed. This is due to varying soil types and land uses throughout the watershed.

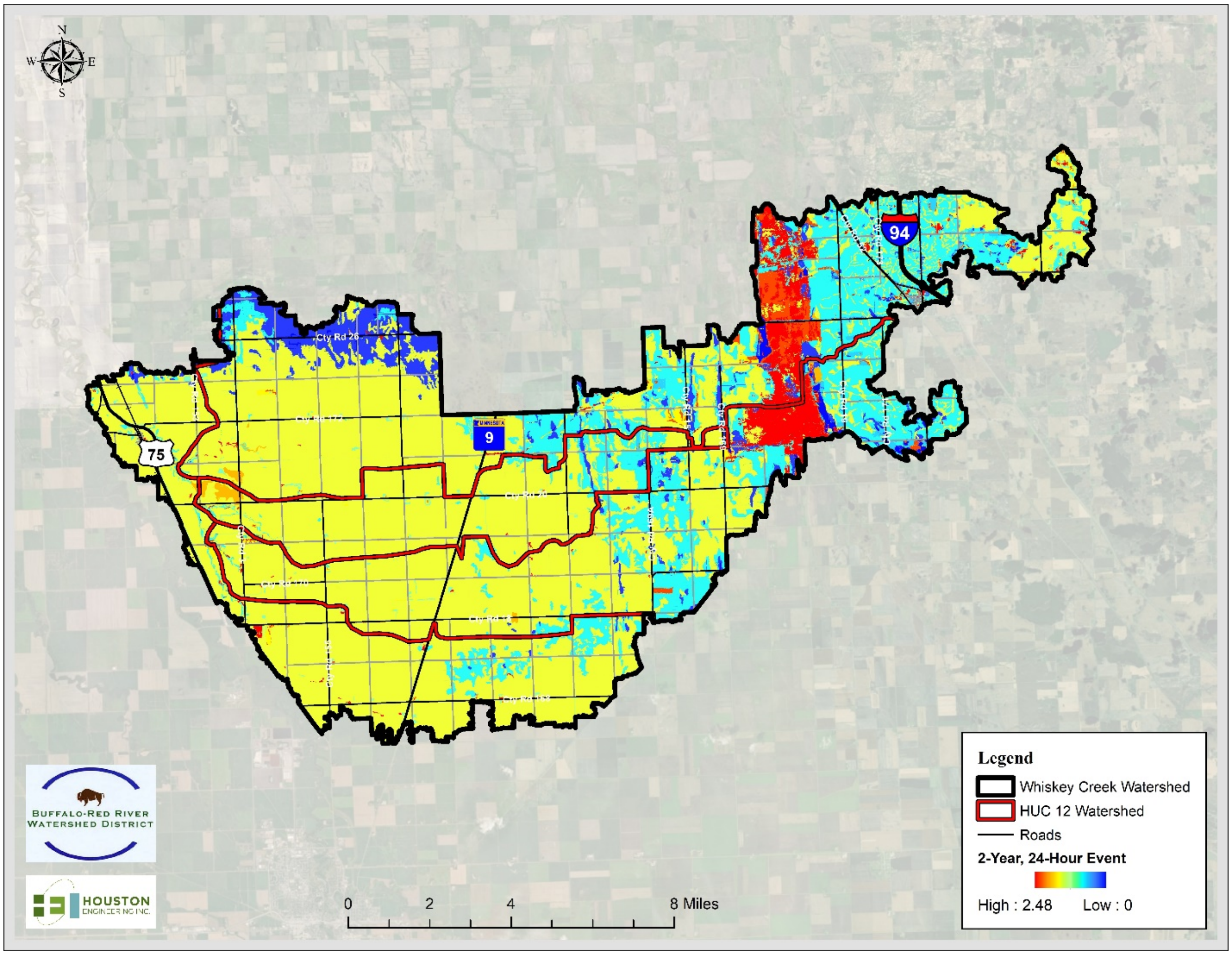


**Figure 13: Runoff Depth - 2-year, 24-hour Rainfall Event, rainfall in inches**

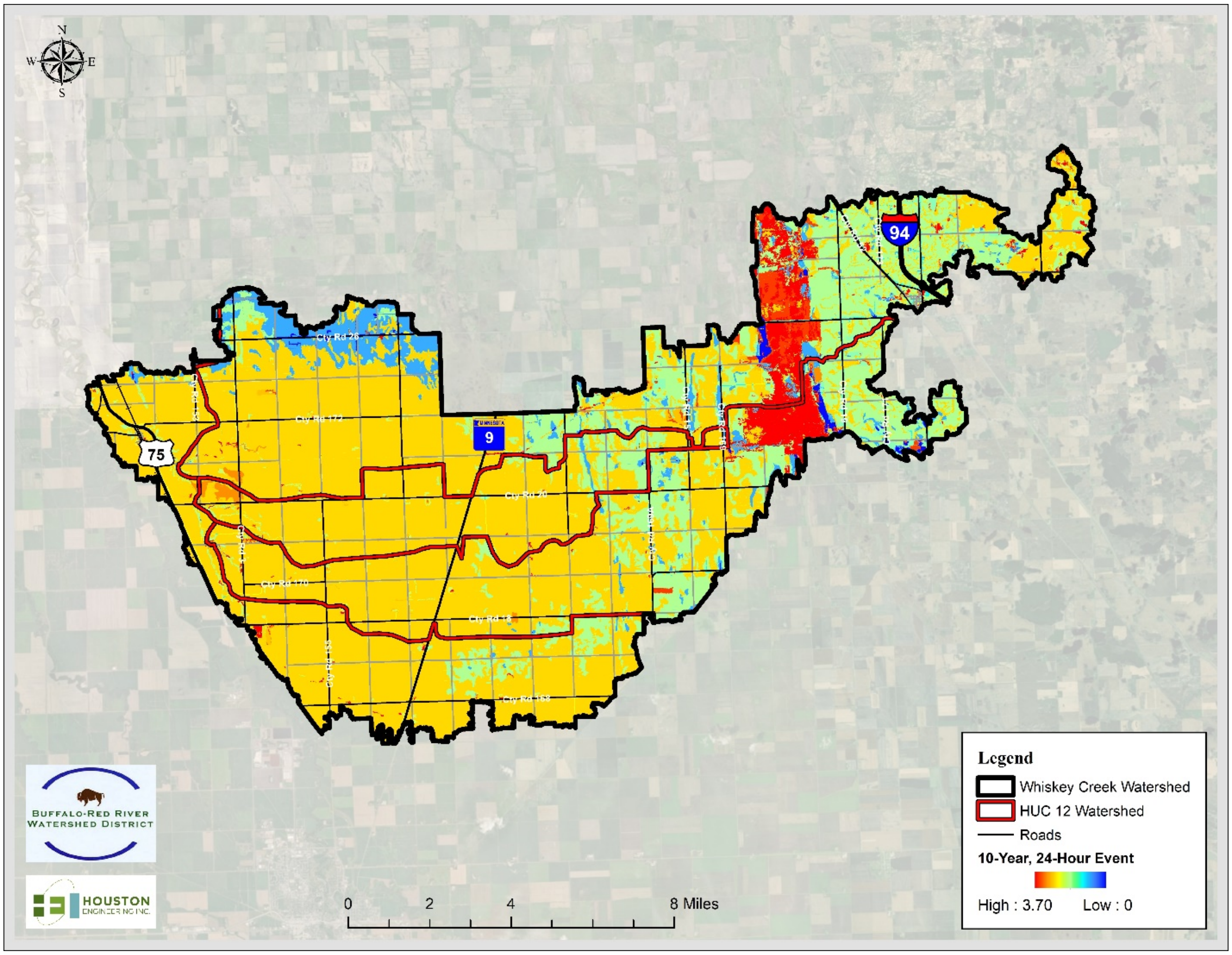


**Figure 14: Runoff Depth - 10-year, 24-hour Rainfall Event, rainfall in inches**

## 5.4 WATER QUALITY MONITORING

In 2008, the Minnesota Pollution Control Agency (MPCA) completed extensive watershed monitoring of the watershed's surface waters. Overall, the results from the exhaustive monitoring revealed the watershed is in poor condition. Eight stream reaches in the watershed had sufficient biological and/or chemistry data for the assessment of aquatic life and aquatic recreation uses by the MPCA (***Figure 2***). One reach (Whiskey Creek from confluence of Red River twenty miles upstream, 09020104-520) was assessed as impaired for aquatic life based on turbidity, low dissolved oxygen, and aquatic macroinvertebrate Index of Biotic Integrity (IBI) and aquatic recreation based on fecal coliform bacteria (***Table 7***). The reach was found to be supporting for fish IBI. The seven other reaches were determined to have insufficient information to make a determination of impairment. Twelve stream reaches were identified as channelized streams and not assessed. Even though not assessed for impairment by the MPCA, biological monitoring in these reaches generally indicated poor fish, macroinvertebrate, and habitat scores with the exception of the far northeastern corner of the watershed where fish IBI scores were good and two out of three macroinvertebrate IBIs were fair. Poor to fair habitat scores were generally due to low subcategory scores for and use, the amount of fish cover, and channel morphology.

**Table 7. Impairments and TMDL status**

| Waterbody | Description | Year listed | Affected use | Pollutant/Stressor | TMDL status |
|---|---|---|---|---|---|
| Whiskey Creek | T133 R47W S13, east line to Red River | 2012 | Aquatic life | MIBI | None |
| | | 2010 | Aquatic life | DO | None |
| | | 1996 | Aquatic life | Turbidity | 2018 |
| | | 2008 | Aquatic recreation | Fecal Coliform | 2018 |

Based on the MN Pollution Control Agencies Stressor ID Report, the majority of the streams in the Whiskey Creek watershed have been altered to promote farmland drainage and the highly altered landscape and stream channel characteristics have resulted in impaired conditions. Within the Whiskey Creek watershed, the major pollutants of concern are total suspended solids (TSS), dissolved oxygen (DO), and Escherichia coli (*E. coli*). ***Figure 15*** shows locations where water quality samples were taken within the watershed boundary.

Total Maximum Daily Loads have been completed for TSS and *E. coli* bacteria on the impaired reach. TSS and *E. coli* replace the original turbidity and fecal coliform water quality standards for which the reach was listed as impaired, respectively. TMDLs have not been completed for dissolved oxygen and macroinvertebrate IBI.

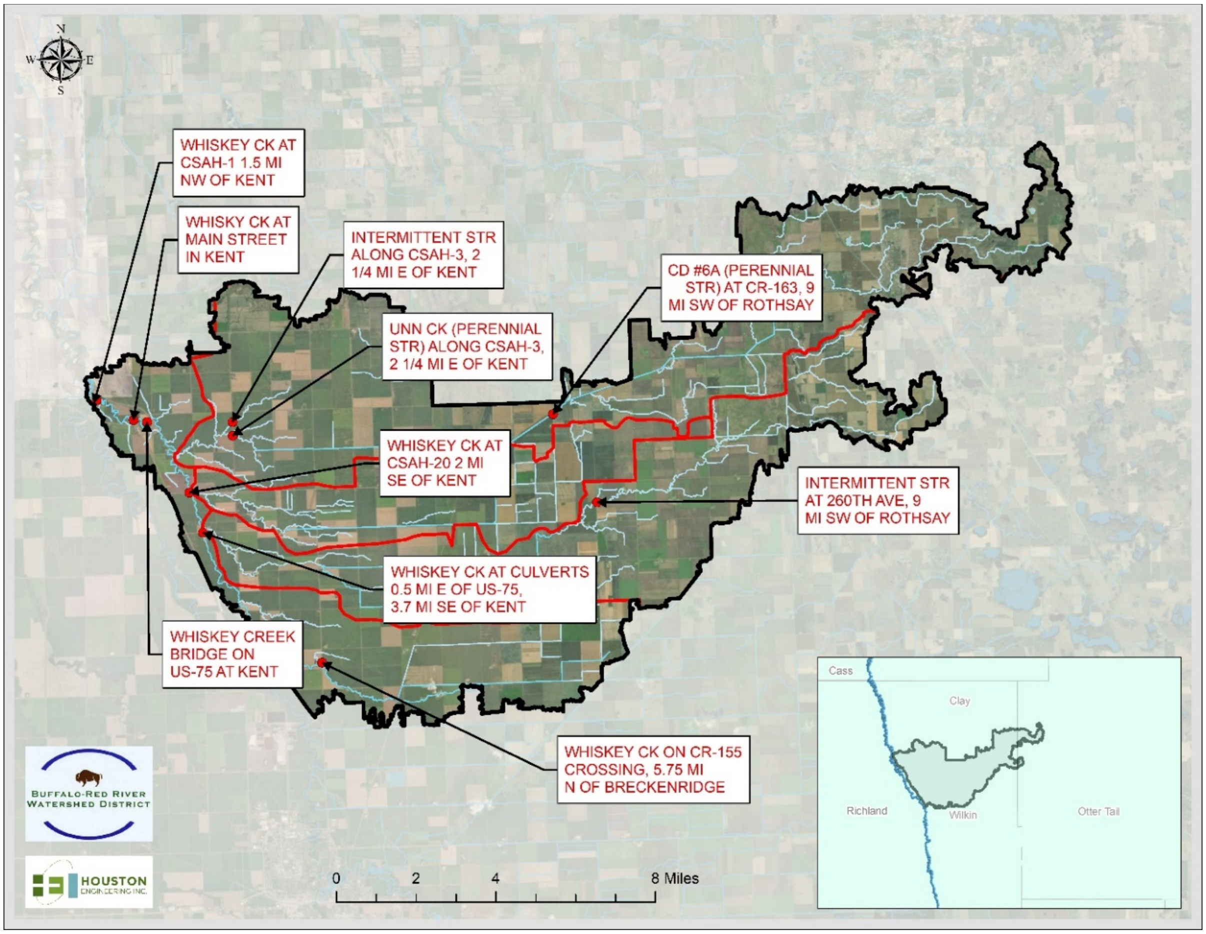


**Figure 15: Water Quality Sample Locations**

## 5.4.1 TOTAL SUSPENDED SOLIDS

The goal of future projects completed within the watershed will be to reduce the sediment loading into surface waters. Whiskey Creek was analyzed for five different flow conditions: Very Low, Low, Mid, High, and Very High. As shown in ***Table 8*****,** sediment loads need to be reduced by up to 29% for high flow conditions within the watershed. Pollutants such as TP and *E. coli* are introduced to waterways largely via sediment, so reducing sediment loads will have a positive effect on other pollutant loads as well.

**Table 8: TSS Loading Capacities and Allocations**

| TSS | Flow Conditions | | | | |
|---|---|---|---|---|---|
| | Very High | High | Mid | Low | Very Low |
| | Tons per day | | | | |
| Loading Capacity | 129.54 | 34.71 | 13.15 | 4.91 | 0.77 |
| Waste Load Allocation | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| Load Allocation | 116.38 | 31.12 | 11.73 | 4.32 | 0.60 |
| Margin of Safety | 12.95 | 3.47 | 1.31 | 0.49 | 0.08 |
| | | | | | |
| Existing Load | 171.4 | 48.9 | 14.1 | 4.5 | - |
| Estimated Load Reduction | 24% | 29% | 7% | 0% | - |

## 5.4.2 E. COLI

Water quality standards for *E. coli* apply from April through October, which is the time period when aquatic recreation occurs. The summer months are typically the time when water quality standards for *E. coli* are exceed most frequently. As shown in ***Table 9***, *E. coli* needs to be reduced by up to 64% for very high flow conditions within the watershed.

**Table 9: E. Coli Loading Capacities and Allocations**

| E. Coli | Flow Conditions | | | | |
|---|---|---|---|---|---|
| | Very High | High | Mid | Low | Very Low |
| | Geometric Mean (Billion organisms per day) | | | | |
| Loading Capacity | 2,224.09 | 570.28 | 204.99 | 83.23 | 14.80 |
| Waste Load Allocation | 2.33 | 2.33 | 2.33 | 2.33 | 2.33 |
| Load Allocation | 1,999.35 | 510.92 | 182.16 | 72.58 | 10.99 |
| Margin of Safety | 222.41 | 57.03 | 20.50 | 8.32 | 1.48 |
| | | | | | |
| Existing Load | 6,250.73 | 513.25 | 233.06 | 76.13 | 30.60 |
| Estimated Load Reduction | 64% | 0% | 12% | 0% | 52% |

The URRW TMDL identified the relative sources of *E. coli* in the Whiskey Creek Watershed (***Table 10***). However, as described in Section 6.2.4 Feedlots, the number of animals in the watershed is quite low such that the risk of *E. coli* loading from livestock is lower than shown in the TMDL. WWTF effluent is assumed to not be a source of E. coli given NPDES permit requirement for disinfection. Domestic animals and wildlife as a combined source are considered low risks of loading.

**Table 10: Relative Sources of E. coli in Whiskey Creek**

| Humans | | | Livestock | | | Wildlife | | | |
|---|---|---|---|---|---|---|---|---|---|
| WWTF Effluent | Septic Systems | Domestic Animals | Grazing | Manure | AFO Open Lots | Deer | Ducks | Geese | Other |
| ™ | ™ | ™ | ˜ | ˜ | ˜ | ™ | › | ™ | ™ |

* ˜ = high risk, › = medium risk, ™ = low risk

Malfunctioning SSTSs can be an important source of fecal contamination to surface waters. These malfunctioning SSTSs are commonly placed in two categories: Imminent Public Health Threat (IPHTs) and failing to protect groundwater (i.e., failing). IPHT indicates the system has a sewage discharge to surface water, sewage discharge to ground surface, sewage backup, or any other situation with the potential to immediately and adversely affect or threaten public health or safety. Failing to protect groundwater indicates the bottom of the system does not have the required separation to groundwater or bedrock.

***Table* 11** lists the SSTS status for Whiskey Creek from the URRW TMDL. The numbers indicate that 14% of the SSTS in the watershed have the potential to be IPHTs.

**Table 11. SSTS compliance status in the URRW.**

| Whiskey Creek Subwatershed | |
|---|---|
| Identified # of SSTSs | 625 |
| # of potentially failing SSTSs | 273 |
| # of potential IPHTs | 90 |

Research on the source and survival of E. coli in the environment is demonstrating the potential for the presence of "naturalized" or "indigenous" *E. coli* in watershed soils (Ishii et al. 2006) and ditch sediment and water (Sadowsky et al. 2010). Sadowsky et al. (2010) conducted DNA fingerprinting of *E. coli* in sediment and water samples from Seven Mile Creek, located in south-central Minnesota, and determined that over 35% of the E. coli strains present may be persistent in the environment. The authors suggested that this percentage might be used as a rough indicator of the regrowth of E. coli as a source rather than from human or animal sources. Although the result may not be transferable to other locations, they do suggest the presence of natural background *E. coli* and a fraction of *E. coli* may be present regardless of the control measures taken by traditional implementation strategies.

### 5.4.3 DISSOLVED OXYGEN

The optimum concentration for DO within a waterway is greater than 5 mg/L to avoid excess stress on aquatic life. Waterways with DO concentration less than 5 mg/L will notice a smaller, less diverse fish population. Continuous DO data was obtained by the MPCA within Whiskey Creek from July 22, 2014 to August 8, 2014. This data showed the stream failed to provide DO concentrations above the 5 mg/L standard for a significant percentage of time. ***Table 12*** shows a summary of the continuous DO data obtained within Whiskey Creek.

**Table 12: Continuous DO Summary Data for Whiskey Creek**

| Number of DO Readings | Min. DO (mg/L) | Max. DO (mg/L) | % Readings Below 5.0 mg/L DO Standard | Max. Duration Below Standard (Hours) | Avg. 24 hr. Flux (mg/L) | Max 24 hr. Flux (mg/L) |
|---|---|---|---|---|---|---|
| 1632 | 1.4 | 8.9 | 89.95 | 105 | 2.78 | 4.26 |

A TMDL was not completed for dissolved oxygen given the connection between TSS, total phosphorus (TP), and dissolved oxygen. Nonpoint source pollution controls (practices) will focus on reducing sediment loading to the stream as a means to lower TP and algal growth and increase dissolved oxygen levels. A TMDL will be considered if adequate progress is not made in increasing the dissolved oxygen levels in the stream in five to ten years.

Parts of Whiskey Creek are ephemeral and contain beaver dams, which leads to stagnant water and low DO levels. Stagnant water conditions could be improved by removing the beaver dams; however, this does not affect the ephemeral stream. Where Wilkin County Ditch 6A intersects Whiskey Creek there tends to be spring fell and a relatively short base flow. In order to approve aquatic life, Wilkin County Ditch 6A could be converted to a two-stage ditch, containing a channel for low flows and a valley for higher flows. However, this is currently not a viable option due to the prime farmland that surrounds Wilkin County Ditch 6A.

### 5.4.4 MACROINVERTEBRATE IBI

Evidence indicates that the biological impairment associated with Whiskey Creek is likely the result of altered hydrology, low DO, lack of in-stream habitat, and excess suspended sediment. The primary stressor is altered hydrology (MPCA 2017). Altered hydrology acts as a biological stressor though increased peak flows and rapid post-event reduction of flow to dry conditions. This stressor is in a large part driving the low DO stressor and appears to be having the most direct impact on the poor macroinvertebrate community inhabiting Whiskey Creek. Both excess suspended sediment and lack of in-stream habitat appear to be impacting the stream organisms, however, these are, in part, follow-on effects of altered hydrology (MPCA 2017).

A TMDL was not completed for the macroinvertebrate IBI listing given the assumption that sediment reduction and channel restoration efforts will improve the habitat and IBI scores.

# 6 RESOURCE ANALYSIS AND CRITICAL SOURCE ASSESSMENT

## 6.1 RESOURCE ANALYSIS

The nature of the impairments leading to the lack of support for aquatic life and recreation are those commonly occurring in highly modified landscapes, including an overabundance of sediment, excessive bacteria in the water, and reduced biological abundances (low fish or macroinvertebrate numbers). Pollutant reductions needed to correct impaired waters are large and will be challenging to accomplish. A coordinated, long term, sustained effort will be needed to both restore the impaired waters and to protect the others from being degraded down to an impaired condition. Required reductions for sediment (TSS) values range from 7% on the low end to as high as 29% for impaired stream segments. Required reductions for bacteria are even higher, ranging from 17% to 64% depending on stream flow conditions.

Common stressors that contribute to poor fish and aquatic insect populations include lack of fish passage (connectivity) and altered hydrology. Some examples of connectivity problems in the Upper Red River Watershed include migration barriers that are both naturally occurring (beaver dams) and manmade (e.g., perched culverts and control structures). Examples of the results of altered hydrology include increases in peak discharge and loss of base flow, as shown by a “flashy” hydrograph in many streams. This is a common occurrence in artificially drained agricultural areas.

To correct impairments and protect further degradation of aquatic resources, increased use of best management practices (BMPs) will be required for the working lands in the watershed and the management of the drainage systems. Examples for the landscape include, but are not limited to livestock management, nutrient management, field windbreaks, cover crops and perennial vegetation, residue management, riparian buffers, shoreline buffers, and ditch buffers. Examples for the waters themselves include engineered hydrologic controls, regional water retention, stream channel restoration, culvert resizing and replacement, and restoration of unconnected streams.

The Rothsay Wastewater Treatment Facility is the single NPDES point source of pollution in the watershed. The WLAs for the TSS and *E. coli* TMDLs are based on the current permitted TSS limit of 45 mg/L and fecal coliform limit of 200 organisms/100 mL. Compliance with the permit is required and will achieve the WLA. Potential bacteria loading from individual onsite septic systems will be addresses through the counties SSTS programs. According to the Upper Red River WRAPS, there are no failing SSTS in the Whiskey Creek HUC-12.

## 6.2 WATERSHED INVENTORY/CRITICAL SOURCE ASSESSMENT

The WRAPS report identified the largest relative magnitude of TSS sources in the watershed to be from flow alteration, lack of riparian vegetation, bank erosion, and upland/cropland erosion. The main contributing sources of bacteria to the creek were identified as manure runoff and livestock grazing. Wildlife was identified as a moderate potential source of bacteria, while failing septic systems and domestic animals were identified as low potential contributors.

### 6.2.1 STREAMBANK AND CHANNEL EROSION

A stream channel and bank investigation completed on streams in the watershed identified Whiskey Creek as an unstable stream. Stream stability is defined as “the ability of a stream to transport the water and sediment of its watershed in such a manner as to maintain its dimension, pattern, and profile, over time, without either aggrading or degrading” (Rosgen, 1996). Stable streams offer benefits to the watershed, which include enhanced water quality and an enriched aquatic habitat; whereas, unstable streams are often associated with water quality problems, poor aquatic habitat, and low aquatic life conditions. Suspended-sediment transport rates for stable and unstable rivers in the Lake Agassiz Plain Area of Minnesota were estimated at approximately 3 and 21 tons per year per square mile by the USDA-Agricultural Research Service, respectively. Based on these estimates, the annual sediment load of Whiskey Creek as an unstable stream would be about 3,300 tons. Actions to stabilize the stream are estimated to provide a 2,800 t/yr reduction in sediment, reducing the overall mainstem channel sediment load to 500 tons/year (Klimetz and Simon 2009). One mile of channel restoration has been completed along Whiskey Creek with the Whiskey Creek Enhancement Project planned to provide 20 miles of streambank restoration (nearly the entirety of the mainstem).

There are several locations within the watershed where streambank instability is a concern. Due to the nature of the bank failures, it is difficult quantify the annual sediment load contributed to the stream. Potential solutions to reduce streambank and ditch bank erosion include the installation of two-stage ditches, armoring the banks with riprap, or installing toe-wood debris and sod mats at bank failure areas. Increasing upland storage in the watershed to reduce peak flows would also aid in reducing bank erosion due to elevated flows. Critical areas of streambank erosion identified for targeting stream restoration work are shown in ***Figure 16***.

Most of the county ditch systems in the watershed have been retrofitted with buffers and side inlets in the last 10 years. The BRRWD and Wilkin SWCD are currently working with landowners on additional side inlet locations along Whiskey Creek and its tributaries as described in Section 6.2.2.4.

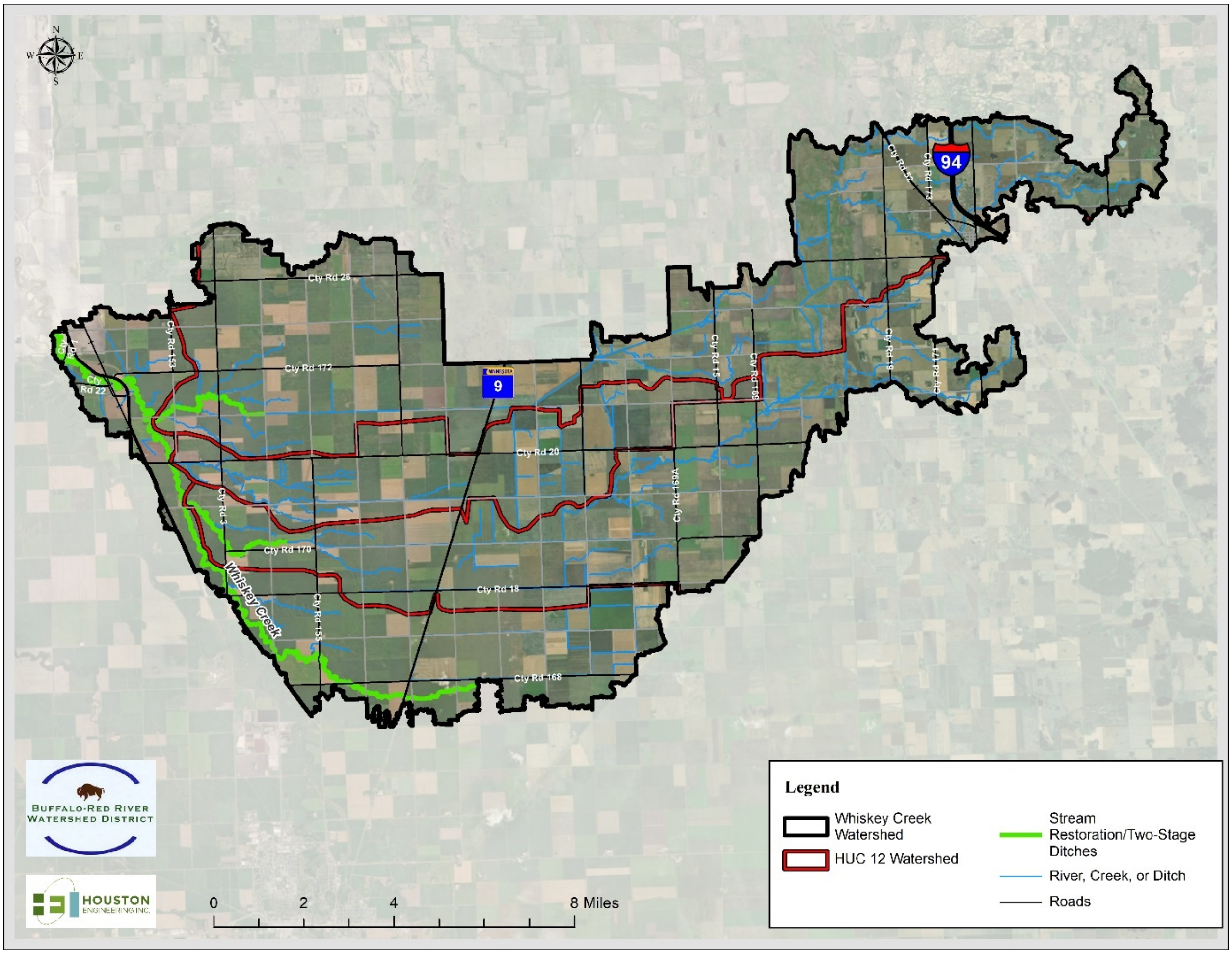


**Figure 16: Critical areas of streambank erosion for targeting stream restoration locations**

## 6.2.2 UPLAND EROSION

### 6.2.2.1 EROSION VULNERABILITY

Pollutant loading from agricultural, natural background, and urban land uses based on current conditions within the Whiskey Creek watershed were estimated with the Prioritize, Target, and Measure Application (PTMApp) model. PTMApp was also used to prioritize resources, target specific locations to place BMPs, and measure potential water quality improvements by summarizing the expected nutrient and sediment load reductions delivered to priority resources. Data obtained from the PTMApp model shows surface erosion pollutant loads within the Whiskey Creek watershed of 16,630 t/yr for sediment and 19,800 lb/yr for phosphorus.

Data obtained from the PTMApp model was used to determine areas within the watershed that are vulnerable to soil erosion. The model uses the RUSLE equation, which incorporates rainfall, erosivity, K-factor, and C-factor to analyze the existing terrain and determine the erosion vulnerability within the watershed. ***Figure 17*** shows the results obtained from the PTMApp model on a catchment scale, which helps discern what areas within the watershed have the potential to contribute the greatest sediment loading to surrounding waters in tons/acres/year. The PTMApp model shows a sediment yield within the watershed ranging from 0 tons/acres/year to 4.5 tons/acres/year on a catchment scale. This information can be used to assist with determining the most beneficial areas to implement best management practices.

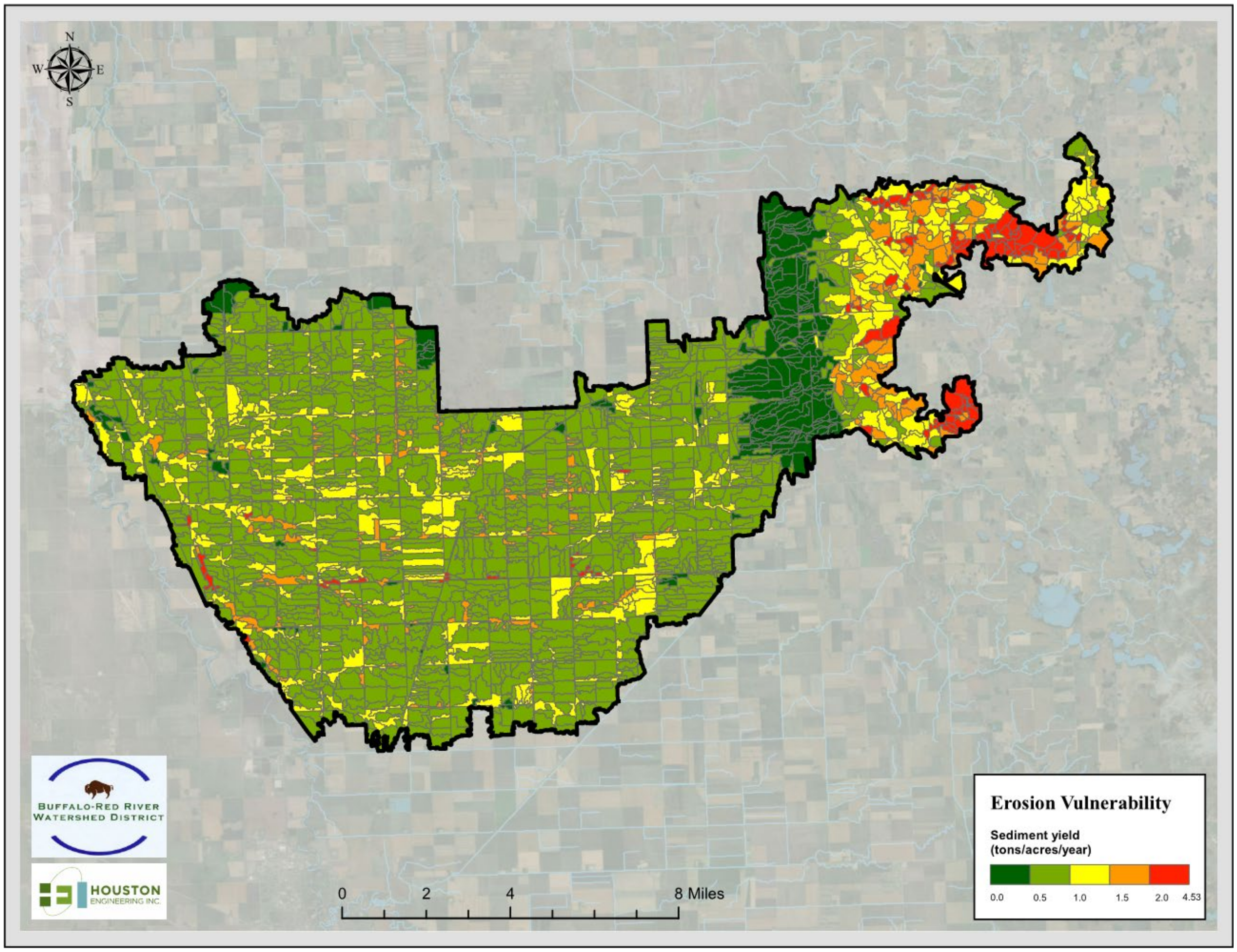


**Figure 17: Erosion Vulnerability**

#### 6.2.2.2 TILE DRAINAGE

Installation of drain tile to improve surface drainage within agricultural fields began to increase in the late 2000's within the watershed. Based on the number of permits received by the Buffalo-Red River Watershed District, it is estimated that approximately 15% of the agricultural fields within the watershed have installed drain tile. If not managed properly, tile drainage can lead to increased pollutant loads into ditches and streams. Tile drainage management systems, such as control structures, could help resolve potential nutrient load issues caused by drain tile.

#### 6.2.2.3 RIPARIAN BUFFERS/VEGETATIVE FILTER STRIPS

Riparian buffers and vegetative filter strips can be an effective method of pollutant control when installed properly. Minnesota Buffer Law requires vegetative buffers of up to 50 feet along lakes, rivers, and streams and buffers of 16.5 feet along ditches. As mandated by the State of Minnesota, all buffers were required to be established by November 1, 2018.

Expanded buffers could be installed along Whiskey Creek and its tributaries to mitigate the sediment and nutrient loading entering the stream. ***Figure 18*** shows priority areas for buffer installation that could be implemented within the watershed, with their footprint totaling approximately 70 acres.

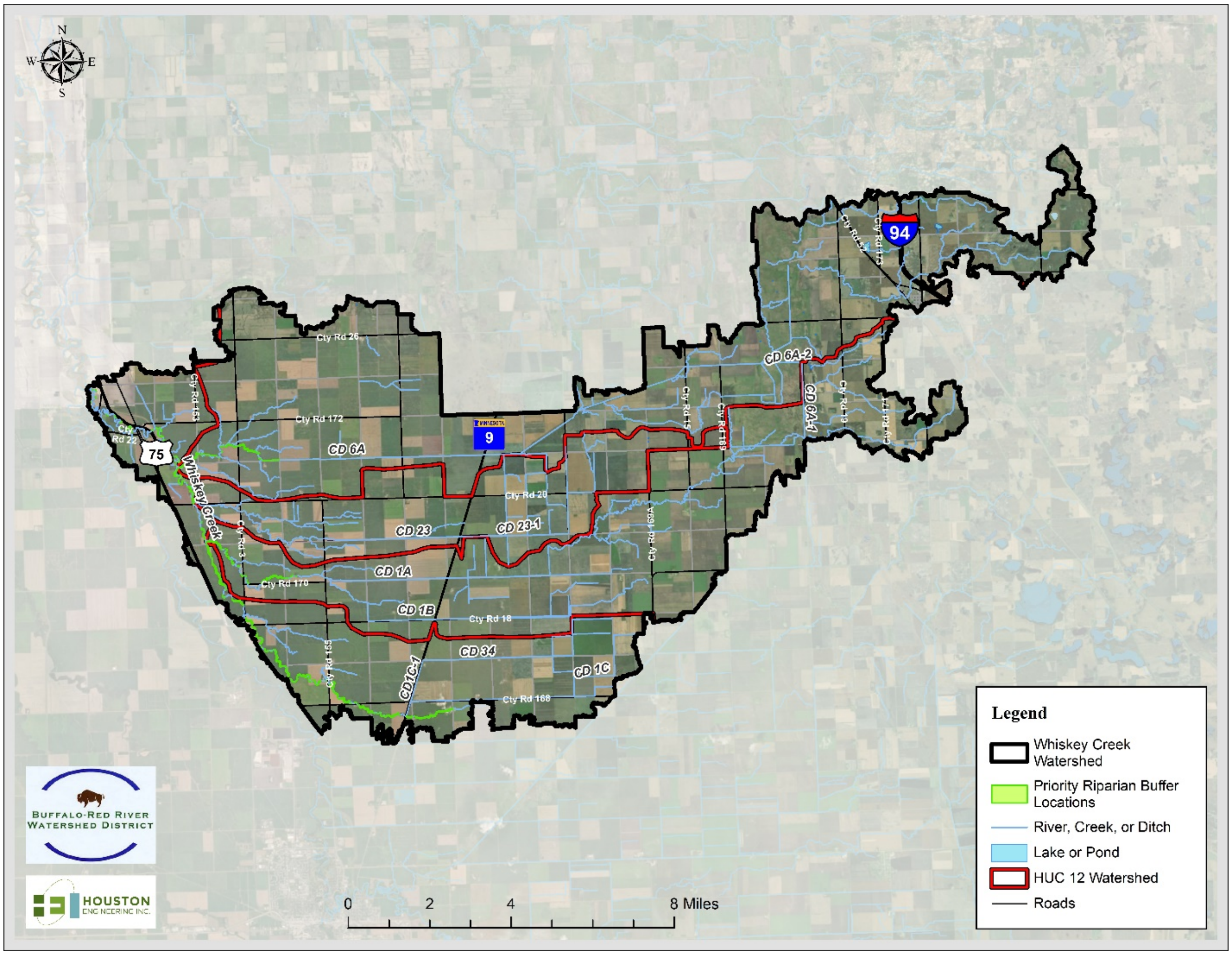


Figure 18: Proposed Riparian Buffer Locations

### 6.2.2.4 GULLY AND CONCENTRATED FLOW STABILIZATION

Existing gully erosion locations have been identified within the watershed area using stream power index (SPI). The SPI is a measure of the landscape likelihood of erosion based on the drainage area and land slope. Side inlets and sediment control basins are two best management practices commonly implemented to address areas identified by the SPI. The construction of side inlets is a preventative measure to ensure the same erosion and sediment problems that created the existing conditions do not re-occur in the future. The side inlets are strategically placed in locations to be most effective in reducing sediment and nutrient loadings resulting from gully erosion. In total, 196 locations were identified using SPI as areas where the installation would be most effective. ***Figure 19*** shows the proposed side inlet grade stabilization locations.

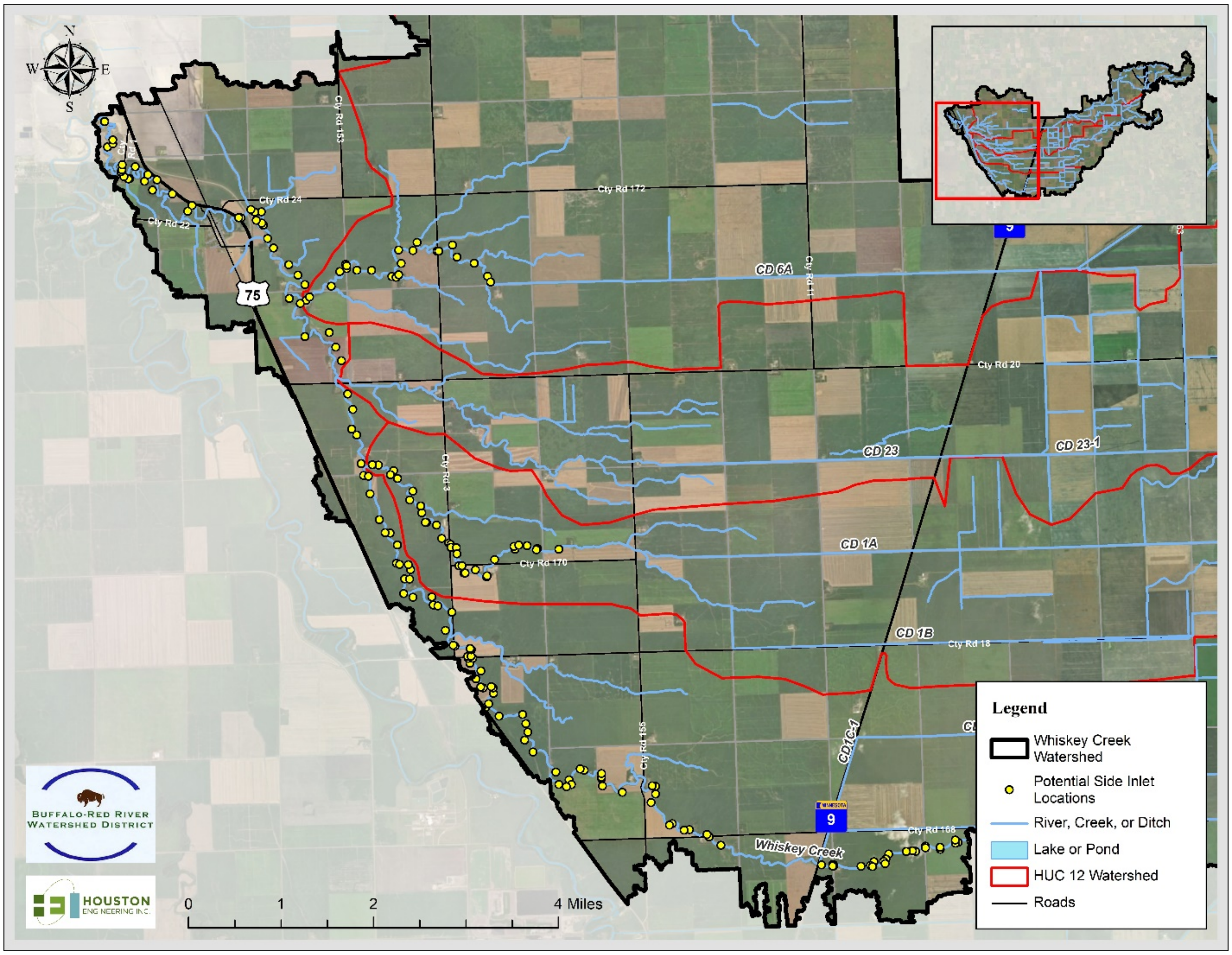


**Figure 19: Proposed Side Inlet and Sediment Control Basin Locations**

In addition to using SPI, locations within the watershed where gullies and concentrated flows are a potential concern were identified using PTMApp. ***Figure 20*** shows potential priority locations for storage and protection practices and are grouped based on their approximate cost per ton of sediment removed. Examples of these practices include water and sediment control basins (WASCOB), storage impoundments, side inlets, grassed waterways, and grade stabilization practices. Installation of a WASCOB and side inlet involves construction of embankment across the concentrated flow area and placement of culverts or drain tile to convey the flow. Storage impoundments typically involve construction of a dam or levee to allow water to pond upstream within an open area of land. The ponded water is then metered by an outlet pipe to help control flows downstream. Grassed waterways can be graded and shaped to a configuration that best fits the area and respective flows, and subsequently seeded to establish proper vegetation. Grassed waterways could coincide with installation of riparian buffers in certain locations. If all storage and protection practices shown below are implemented within the watershed, the total sediment load will be reduced by 19% from 16,630 t/yr to 13,470 t/yr. The information acquired from PTMApp and SPI is useful for identifying potential areas for conservation practice implementation; however, the results are tool generated. All potential conservation practice locations shown will need to be field verified. In addition, implementation of conservation practices will require working with landowners to determine what practice should be implemented at each location.

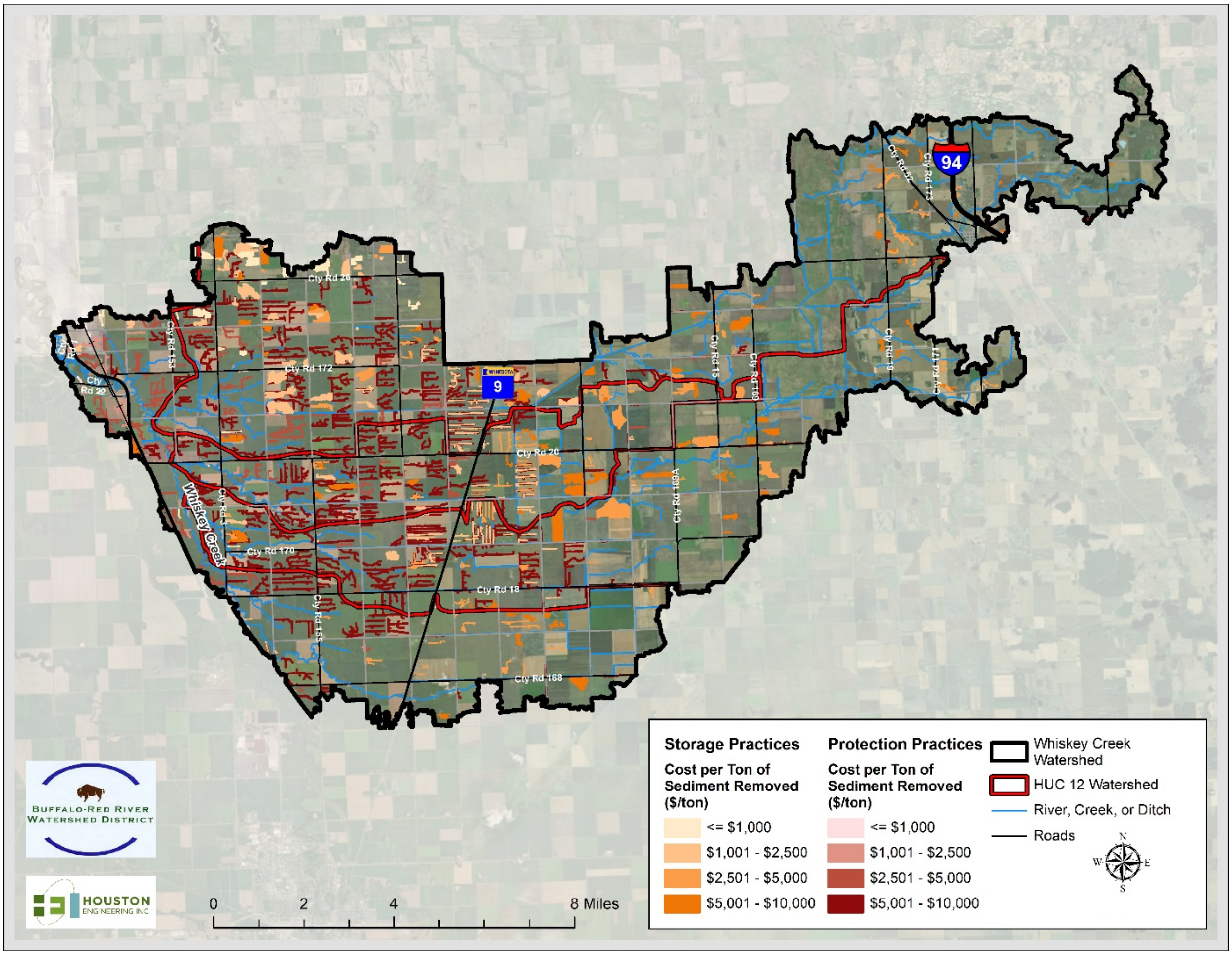


**Figure 20: Sediment Reduction Practices**

### 6.2.3 WETLANDS

The existing wetlands within the watershed have been obtained using the National Wetlands Inventory (NWI). In addition, Restorable Wetlands Inventory (RWI) have been obtained from Ducks Unlimited using the most recent data from 2012. Wetlands are an important feature of the watershed and help provide benefits to water quality, wildlife habitat, and flood control. Wetlands also help with phosphorus and sediment control, creating areas where pollutants can settle out. If wetlands are created to be used as treatment areas, they could treat the upland runoff before it enters nearby streams or rivers. Based on the obtained data, there are currently 3,418 acres of existing wetlands and 2,320 acres of potentially restorable wetlands within the Whiskey Creek watershed. However, due to extensive farming efforts within the watershed area, many of the potentially restorable wetlands identified by the RWI have a low probability of being restored in the future. ***Figure 21*** shows a map of the wetland areas within the watershed.

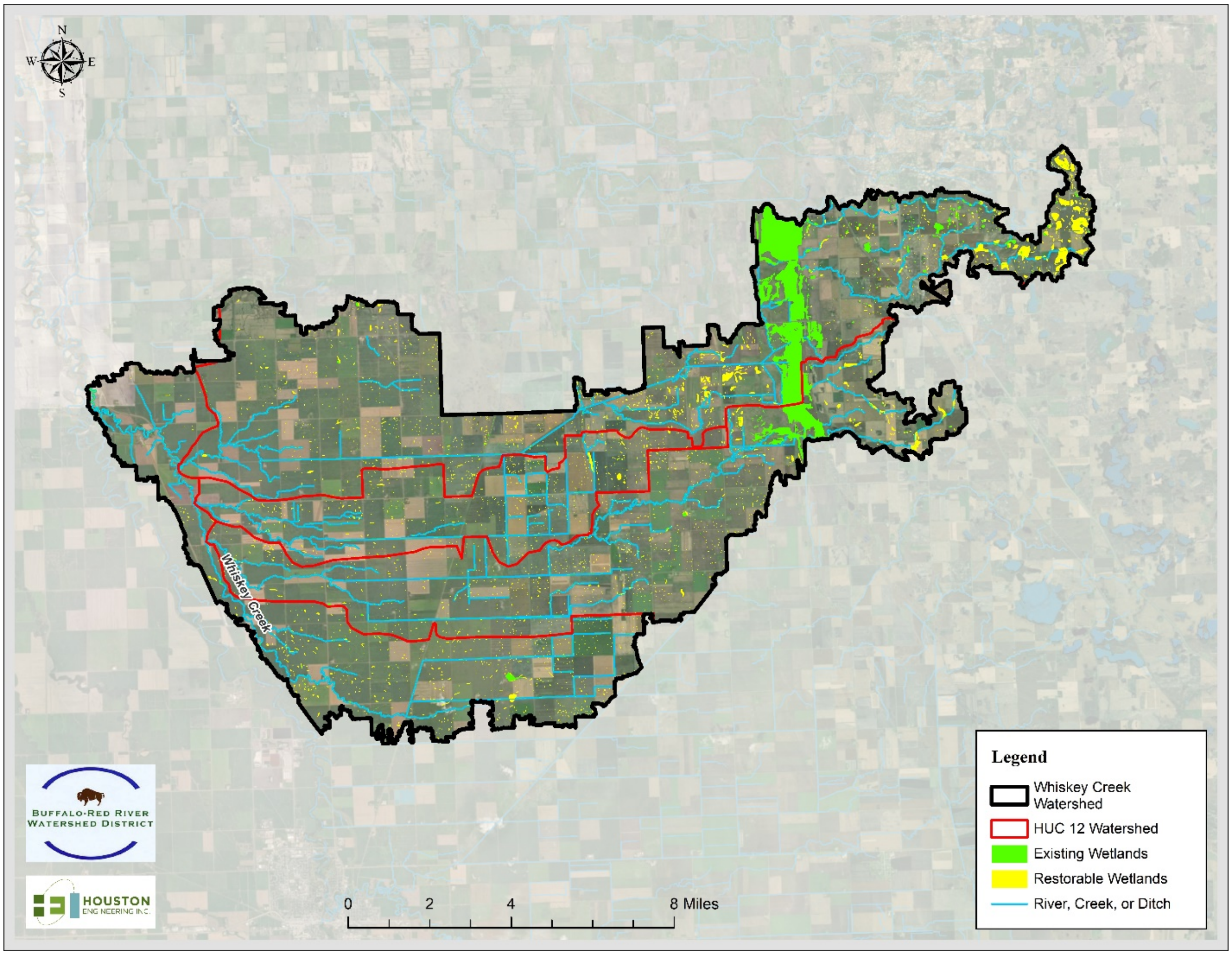


**Figure 21: Existing and Restorable Wetlands**

### 6.2.4 FEEDLOTS

Livestock populations were estimated for cattle, chickens, goats, horses, sheep, and turkeys for each subwatershed area contributing to the listed impairments and are provided in ***Table 13***. Although the MPCA's geographic feedlot database developed for registered and NPDES permitting provide location and allowable populations of animals, these populations are the maximum allowable populations under the permits and are not the actual populations at these sites. Therefore the USDA census data was used to estimate livestock populations.

**Table 13: Livestock Population Estimates within Whiskey Creek**

| Animal | Type | Number of animals |
|---|---|---|
| Cattle | All | 2,340 |
| | Beef | 2,209 |
| | Cattle on Feed | 131 |
| Other | Pigs | 575 |
| | Sheep and Goats | 45 |
| | Horses | 74 |

| Animal | Type | Number of animals |
|---|---|---|
| Poultry | Layers | 234 |
| | Broilers | 203 |
| | Turkey | 56,438 |
| | Ducks and other | 324 |

#### 6.2.4.1 GRAZING

Grazing occurs on pastured areas where concentrations of animals allow grasses or other vegetative cover to be maintained during the growing season. Grazing pasture neither requires a permit nor registration in the State of Minnesota. According to Minnesota Shoreland Management Rules, agricultural areas adjacent to lakes, rivers, and streams require a buffer strip of permanent vegetation that is 50 feet wide unless the areas are part of a resource management system plan (Minn. R. 6120.330, subp. 7). Grazing cattle were assumed to be the total cattle population from the Census of Agriculture (see Livestock Populations) minus the cattle on feed.

#### 6.2.4.2 ANIMAL FEEDLOTS

Animal feedlots that do not meet requirements for an NPDES Permit (less than 1,000 animal units) may be required to be registered with the MPCA. Animal feedlots outside of shoreland areas with more than 50, but less than 1,000 animal units are regulated by the MPCA under a feedlot registration program. Animal feedlots inside shoreland areas with more than 10 but fewer than 50 animal units are also regulated under the same feedlot registration program. A permit is required for feedlots with 1,000 animal units or more. Shoreland is defined in Minn. Stat. § 103F.205 to include: land within 1,000 feet of the normal high-watermark of lakes, ponds, or flowages; land within 300 feet of a river or stream; and designated floodplains (MPCA 2009). These smaller facilities are subject to state feedlot rules, which include provisions for registration, inspection, permitting, and upgrading.

#### 6.2.4.3 LAND APPLICATION OF MANURE

Manure is often surface applied or incorporated into fields as a fertilizer and soil amendment. The land application of manure has the potential to be a substantial source of fecal bacteria, transported to waterbodies from surface runoff and drain tile intakes. Minn. R. ch. 7020 contains manure application setbacks based on research related to nutrient transport, but the effectiveness of these setbacks on bacteria transport to surface waters are unknown. A portion of the livestock population was assumed to supply manure for land application.

#### 6.2.4.4 SMALL OPERATIONS

Small-scale animal operations are operations that do not require feedlot registration with the MPCA, and therefore contain less than 50 animal units outside of a shoreland area and less than 10 animal units within a shoreland area. Small-scale operations are also not included in the MPCA's geographic feedlots database but should be included in the Census of Agriculture (see Livestock Populations). All cattle, goats, horses, sheep, and poultry were treated as partially housed or open lot operations, and literature estimates were used to identify the number of animal operations without runoff controls. The geographic areas for stockpiling or spreading of manure from these small, partially housed or open lot operations is based on NLCD 2011 Pasture/Hay and Grassland/Herbaceous land covers.

### 6.2.5 CURRENT MANAGEMENT PRACTICES/PROJECTS

The Buffalo-Red River Watershed District (BRRWD), Wilkin County, Wilkin Soil and Water Conservation District (Wilkin SWCD), and West Otter Tail Soil and Water Conservation District (West Otter Tail SWCD) have partnered to complete best management practice (BMP) studies and implementation projects. Projects include locating priority BMP locations through GIS terrain analysis (using LiDAR data) and implementation of BMPs by the BRRWD and the SWCD's. Additional projects recently completed by the BRRWD and Wilkin SWCD includes:

- Wilkin County Ditch Retrofits (Wilkin County Ditches 6A, 23, 1A, 1B, 1C, and 34)
    - Projects included reshaping county ditch systems and installing approximately 85 miles of expanded buffers and approximately 160 side inlet structures along the ditch systems.
- A Prioritize, Target and Measure Application (PTMApp) analysis of the Whiskey Creek Watershed was completed in 2019 and serves as the basis of this implementation plan by prioritizing and targeting critical areas for practice implementation.
- The watershed has served as a pilot area for the MN Agricultural Water Quality Certification Program (Wilkin and West Otter Tail SWCDs). The project resulted in 11 certified producers with 15,000 certified acres.
- The BRRWD has identified two regional retention sites within the watershed as a result of a Red River Basin Commission study in 2013 to reduce downstream flooding. Preliminary hydrologic design work has been completed. The sites have been located to provide flood damage reduction benefits, which would address the altered hydrology identified in the Stressor ID Report for the Upper Red River watershed.
- Whiskey Creek Enhancement Project
    - Study included the use of SPI analysis to identify areas with high gully erosion potential.
    - Identified a stream restoration with expanded buffers and sediment controls to improve water quality in the watershed.
- Whiskey Creek 1-mile Channel Restoration Demonstration Project
    - Project completed in 2015 as an example to show area landowners what a channel restoration project might look like.

A list of practices that have been implemented is included in the goals, milestones, and assessment tables in Sections 7. ***Table 14*** describes a list of practices will be targeted for implementation in the watershed. These practices as modeled by PTMApp are expected to obtain water quality standards in Whiskey Creek. PTMApp was used to determine the potential quantity, average reduction, and costs. Based on this data, the reduction values were determined based on the best estimation from the PTMApp data for each practice.

**Table 14: Suite of BMPs modeled to obtain water quality standards**

| Practice Code | Practice Name | Quantity | Unit | Cost |
|---|---|---|---|---|
| 104 | Nutrient Management Plan | 40 | EA | $119,747.20 |
| 114 | Integrated Pest Management Plan | 40 | EA | $119,747.20 |
| 329 | Residue & Tillage Management, No-Till | 3,600 | AC | $39,708.00 |
| 332 | Buffer Strips | 70 | AC | $100,000.00 |

| Practice Code | Practice Name | Quantity | Unit | Cost |
|---|---|---|---|---|
| 340 | Cover Crop | 9,000 | AC | $342,630.00 |
| 342 | Critical Planting Area | 500 | AC | $146,885.00 |
| 362 | Diversion | 12,000 | LF | $18,840.00 |
| 386 | Field Border | 500 | AC | $150,000.00 |
| 390 | Riparian Cover | 60 | AC | $24,204.00 |
| 393 | Filter Strip | 500 | AC | $150,000.00 |
| 395 | Stream Habitat Improvement and Management | 106,656 | LF | $1,000,000.00 |
| 410 | Grade Stabilization Structure | 200 | EA | $600,000.00 |
| 412 | Grassed Waterway | | | |
| 466 | Land Smoothing | 500 | AC | $27,840.00 |
| 554 | Drainage Water Management | 100 | EA | $350,000.00 |
| 580 | Streambank and Shoreline Protection | 32,000 | LF | $385,920.00 |
| 582 | Open Channel | 106,656 | LF | $7,000,000.00 |
| 590 | Nutrient Management | 62,500 | AC | $271,875.00 |
| 595 | Integrated Pest Management | 62,500 | AC | $529,375.00 |
| 601 | Vegetative Barrier | | | |
| 638 | Water and Sediment Control Basin | 20 | EA | $240,000.00 |
| 656 | Constructed Wetland | 5 | EA | $675,000.00 |

### 6.2.6 COSTS

Costs are estimated through both capital projects and PTMApp modeling. The primary capital project cost is about $15 million for the Whiskey Creek Channel Restoration project. Education, project design, outreach, staff costs, technical assistance, and implementation is estimated to be approximately $25 million. The total costs for restoration of Whiskey Creek to achieve water quality standards is projected to be $40 million.

### 6.2.7 CRITICAL SOURCE AREAS

Based on the analysis completed through PTMApp, stream power index, and riparian buffer locations, along with communication with the Buffalo Red-River Watershed District and local SWCDs, critical source areas have been identified within the watershed as shown in ***Figure 22***. Critical source areas within the map were identified by the areas along Whiskey Creek that require riparian buffers in combination with the Erosion Vulnerability data obtained from PTMApp for sediment yields ranging from 1.0-4.5 tons/acre/year. The critical source areas are locations identified as providing the greatest contaminant loads and, therefore, are the highest priority for conservation practice implementation. Implementation of practices within these areas will provide sediment load and nutrient reduction at the lowest cost for the provided benefit. The critical source areas can be addressed through on-field practices, such as side inlet structures or riparian buffers, or in-stream practices, such as stream restoration through the construction of two-stage ditches. Additional information regarding specific conservation practices to complete within the critical source areas can be found in Section 7 Summary and Recommendations.

Near channel critical areas are identified using the SPI and field surveys. The SPI was used primarily for concentrated flow areas to identify where to place side inlets. The majority of the streambank instability and erosion was identified through field survey, determining where there is erosion and sediment build up. Whiskey Creek Enhancement Project is planned to start at the upstream end of Whiskey Creek on the downstream of Minnesota Highway 9, based on the high sediment build up in the stream. Sediment build up was a key factor in identifying the critical area in the Whiskey Creek. This project will continue the work from the headwaters to the mouth.

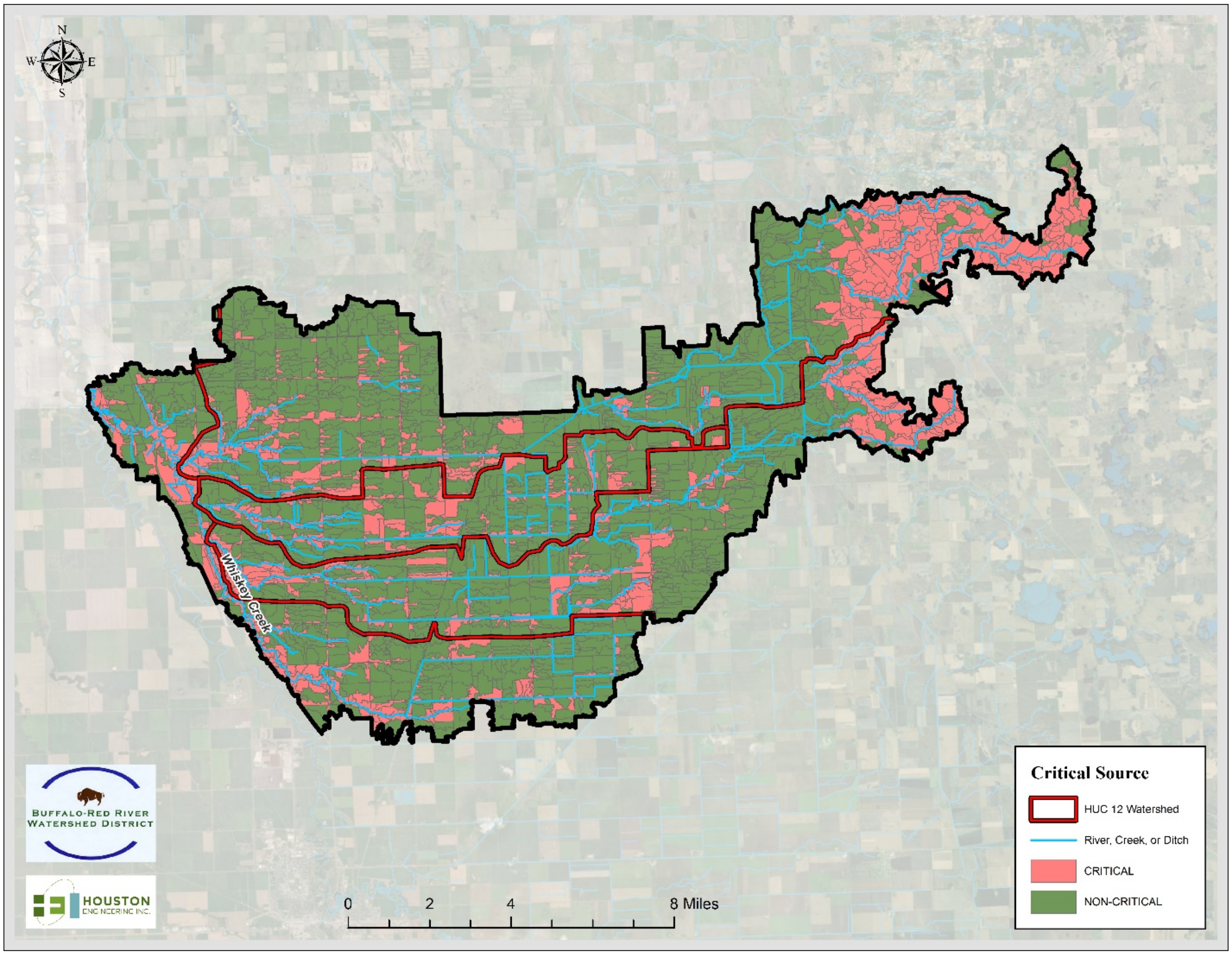


**Figure 22: Critical Source Areas**

## 6.2.8 BMP SUITABILITY ANALYSIS

In addition to targeting fields based on the delivery of water quality constituents, fields also can be targeted for opportunities to place BMPs. For instance, a field may produce a moderate to high amount of sediment but have limited opportunities to implement BMPs to reduce sediment delivery because of the physical setting (i.e. ability of the landowner and productivity of land). As such, field scale opportunities to implement BMPs were targeted across the Upper Red River Watershed.

The BMP suitability analysis for the Upper Red River Watershed was purposefully focused on those BMPs and Control Practices (CPs) used most often within the watershed area. PTMApp was used to complete the BMP suitability analysis within the Whiskey Creek watershed. The analysis focused on identifying potential locations believed suitable for BMPs and CPs based on various design criteria and landscape conditions. The implementation of BMPs and CPs are largely dependent upon a site's suitability for a given practice based on NRCS guidelines and topographic characteristics, soils, and land use. Many other factors such as landowner willingness and the proximity to priority water resources are also important criteria. The high spatial resolution hydro conditioned DEM makes it possible to identify potential locations to place BMPs based on topography and other design factors. The locations can then be reviewed and screened to assist in targeting the implementation of practices. The approach identifies preliminary locations to target BMP placement. As such, field verification is required to confirm the opportunities. The analysis excludes whether a practice is already constructed at the location.

In addition, the BRRWD has identified three regional retention sites within the URRW. These sites have been identified and preliminary hydrologic design work has been completed. The sites have been located to provide flood damage reduction benefits, which would address the altered hydrology identified in the SID Report for the URRW. Significant effort and funding would be required to implement these sites. Each site would have an approximate cost of $10 to $15 million dollars. One of these sites is proposed to be within the Whiskey Creek watershed, generally located within Meadows or Nilsen Townships along the Lake Agassiz Beach Ridge.

# 7 SUMMARY AND RECOMMENDATIONS

## 7.1 WATERSHED ASSESSMENT SUMMARY

Whiskey Creek generally has poor water quality conditions within its watershed, as a result of the altered landscape throughout the area. The hydrology of the Whiskey Creek watershed has been extensively altered through the construction of numerous legal public drainage systems along with an extensive system of private field drains (ditches and swales). This anthropogenic alteration has made most areas of the watershed well-drained, resulting in a more flashy rainfall to runoff response than what would have occurred historically. Since much of the land use is in agricultural production, watercourses have been channelized or straightened, hydrology has been modified, and riparian cover adjacent to ditches, streams, and wetlands has historically been inadequate. However, due to efforts by the BRRWD, Wilkin SWCD, and West Otter Tail SWCD (local government units – LGUs) to enforce the Minnesota Buffer Law and implement other watershed management practices, conditions are improving. Through continued partnerships between LGUs, state and federal agencies, and landowners, the watershed can continue to improve its water quality conditions to meet the limits established by the Upper Red River of the North Watershed TMDL.

## 7.2 PRACTICE IMPLEMENTATION RECOMMENDATIONS

As shown in ***Table 15***, there are multiple management practices that can be used within the watershed to improve water quality conditions. The best management practice to use at specific locations will be based on existing terrain, land use, landowner preference, and constructability. A main objective to achieve improved water quality within the watershed is to educate landowners on the current issues within the watershed and provide practical and cost-effective alternatives to fix those issues. Without landowner cooperation, the implementation of management practices to improve water quality will be difficult. Ideas to educate landowners and implement management practices will be addressed within the Outreach Plan. After discussion with the LUGs, a four-year implementation plan was developed. ***Table 15*** shows a summary of the practices that are proposed to be implemented between 2020 and 2023 and the requested funds for each practice.

**Table 15: Four-Year NWQI Implementation Plan**

| Practice Code | Practice Name | Quantity | Unit | Estimated cost |
|---|---|---|---|---|
| 410 | Grade Stabilization Structure | 160 | EA | $ 285,326.40 |
| 362 | Diversion | 12,000 | LF | $ 18,840.00 |
| 340 | Cover Crop | 9,000 | AC | $ 342,630.00 |
| 104 | Nutrient Management Plan | 40 | EA | $ 119,747.20 |
| 114 | Integrated Pest Management Plan | 40 | EA | $ 119,747.20 |
| 590 | Nutrient Management | 62,500 | AC | $ 271,875.00 |
| 595 | Integrated Pest Management (formal name: Pest Management Conservation System) | 62,500 | AC | $ 529,375.00 |
| 329 | Residue & Tillage Management, No-Till | 3,600 | AC | $ 39,708.00 |
| 582 | Open Channel | 106,656 | LF | $ 593,007.36 |
| 466 | Land Smoothing | 500 | AC | $ 27,840.00 |
| 342 | Critical Area Planting | 500 | AC | $ 146,885.00 |
| 390 | Riparian Herbaceous Cover | 60 | AC | $ 24,204.00 |
| 580 | Streambank & Shoreline Protection | 32,000 | LF | $ 385,920.00 |
| | | | **Total** | **$2,905,105.16** |

In addition to the four-year NWQI implementation plan, it is recommended that the following plan of action (***Table 16***) be executed within the next 10 years in order to achieve desired water quality goals and reduce nutrients levels within the watershed. It is also recommended that all storage and protection practices located within the critical source locations shown in ***Figure 22*** be addressed within the next 5-10 years. The *Cost Estimate* column shown in ***Table 16*** is an approximate cost to complete the projects within the proposed timeframe. The current NWQI proposal is for a portion of the project funds needed for total implementation. See the *Funding Sources* column in ***Table 16*** for additional avenues of funding that will be sought.

**Table 16: 10 Year Action Plan (for milestones, goals, and assessment see Table 17)**

| Recommendations | Indicators | Timeline | Cost Estimate | Funding Source | Implementation |
|---|---|---|---|---|---|
| Complete Whiskey Creek Enhancement Project | Completion of 20.2 miles of stream restoration | 2-10 Years | $6-$7 Million | 319 Grant, CWF, LSOHC, RIM, CREP, NWQI | BRRWD, Wilkin SWCD, NRCS |

| Recommendations | Indicators | Timeline | Cost Estimate | Funding Source | Implementation |
|---|---|---|---|---|---|
| Continue Gully and Concentrated Flow Stabilization Projects | Continued construction of side inlets, WASCOB, storage areas, etc. | 5-10 Years | $300K-$400K | 319 Grant, CWF, NWQI | BRRWD, Wilkin SWCD, West Otter Tail SWCD, NRCS |
| Complete In-Field Conservation Practices | Cover Crop, Nutrient Management, Integrated Pest Management, Residue & Tillage Management, Land Smoothing, Critical Area Planting, Riparian Cover, etc. | 5-10 Years | $1.6-$1.8 Million | 319 Grant, CWF, NWQI | BRRWD, Wilkin SWCD, West Otter Tail SWCD, NRCS |

PTMApp data products are suitable for targeting fields for restoration and protection strategies based on the delivery of water quality constituents (e.g. TN, TP, sediment) to downstream resources and identification of opportunities to implement BMPs. As such, it is our intention to use the data products delivered with this TM to develop the implementation table and source assessment that will be established as part of the URRW WRAPS. In addition, these data products can be used by local practitioners on an ongoing basis to target opportunities to implement BMPs that will be most beneficial to restoration and protection strategies aimed at improving water quality.

The results of the field validation work confirmed that the EGWQP and target opportunities for BMPs and CPs show probable locations of high sediment, TN, and TP loading and potential locations from BMPs and CPs. However, field site visits are needed to confirm the results.

The above-mentioned NWQI documentation was completed for the NRCS NWQI funding request, which created the foundation for the Section 319 funding request. The NWQI assessment has been completed and EQIP dollars have been designated for the Whiskey Creek watershed, although the exact funding amount is not yet known. These funds can be combined with future Section 319 funds to assist with the cost share required for completion of future projects.

## 7.3 NEPA CONCERNS

The National Environmental Policy Act (NEPA) was signed into law on January 1, 1970. NEPA requires federal agencies to evaluate the environmental effects of their proposed actions prior to making decisions. Included in this law is governance of area wide or watershed planning activities. As part of these plans the responsible federal agency is required to evaluate the individual and cumulative effects of the actions being proposed. Any project that has significant environmental impacts must be evaluated with an Environmental Assessment (EA) or Environmental Impact Statement (EIS) unless the activities are eligible under a categorical exclusion or are covered by an existing EA or EIS.

The NRCS uses an Environmental Evaluation worksheet which incorporates an evaluation of potential environmental impacts for the planning process. There are several NRCS conservation practices and activities that fall under a categorical exclusion. A categorical exclusion is a category of actions that do not normally create a significant individual or cumulative effect on the human environment. The NRCS lists 21 approved conservation or restoration categorical exclusions in GM190 §410.6. These categorical exemptions include practices that reduce soil erosion, involve planting vegetation, and restore areas to natural ecological systems.

The plan for the Whiskey Creek watershed recommends conservation practices that control soil erosion and runoff from agricultural fields, which will be covered by categorical exclusions listed by the NRCS. A list of practices that have previously been completed within the watershed and will continue to be implemented going forward are shown in ***Table 14***. Each planned practice will be evaluated to ensure the project meets the criteria of the categorical exclusions established by the NRCS. If the project is deemed to have adverse environmental impacts, those impacts will try to be avoided. If avoidance is not feasible then said impacts will be minimized or mitigated as required by the NEPA. It is not expected that any of the planned practices within the watershed will required an EA or EIS.

# 8 MILESTONES

## 8.1 MILESTONES

Interim 10-year milestones are identified in ***Table 10*** for each pollutant so incremental progress is measured and achieved. On-going water quality monitoring data will be used in future components of the WRAP process to judge the effectiveness of the proposed strategies and inform adaptive implementation toward meeting the identified long-term goals. The timeline for the identified protection strategies is on-going.

**Table 17. Whiskey Creek assessments, milestones, and goals**

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| TSS | Complete Whiskey Creek Enhancement Project | One mile completed Following the NWQI, devise plan to identify easement sites along the stream corridor/finalize design plans | 5 miles completed | 10 miles completed | 15 miles completed | Whiskey Creek Enhancement Project 20.2 miles | 84% reduction of TSS for this project | Project completed |
| | Reduce TSS for high and very high flow conditions within Whiskey Creek | | Monitor TSS for possible decreases in concentration | Assess and analyze effectiveness of implemented BMPs for future of plan | 10% reduction in TSS at high flow conditions/7% reduction in TSS at VHF | Assess and analyze effectiveness of implemented BMPs for future of plan | 29% reduction in TSS at high flow conditions/24% reduction in TSS at VHF | Water quality monitoring at outlet of Whiskey Creek completed by BRRWD |
| | Install 50' vegetated buffer along all waterways | 30% complete | | 40% complete | | 50% complete | 100% adoption | Determine number of waterways that have implemented 50' buffers |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | Outreach to promote 50' vegetated buffer installation along all waterways | Have been meeting on site with landowners to discuss possible buffer locations | Meet with 10 additional landowners | Meet with 20 additional landowners | Meet with 30 additional landowners | Meet with 40 additional landowners | Meet with all landowners adjacent to waterways | Number of landowners met with in the field |
| | Compliance with MN Buffer Rule | 90% complete | 100% complete | Maintain 100% compliance | Maintain 100% compliance | Maintain 100% compliance | Maintain 100% compliance | Monitoring by BRRWD and partners |
| | Increase conservation cover in/near water bodies, to create corridors | 9% adopted | Continue outreach and conversations with landowners | Continue outreach and conversations with landowners | Continue outreach and conversations with landowners | 10% adoption in 10 years | 15% adoption long term | Monitoring by BRRWD and partners |
| | Improve/increase natural habitat in riparian, control invasive species | 0% currently | | 1% of watershed addressed | | | 2% of watershed area addressed | Monitoring by BRRWD and partners |
| | Implement Streambank and shoreline protection/stabilization | 0 feet | 1,000 feet | 2,000 feet | 3,500 feet | 5000 feet | 10,000 feet | Determine length of streams that have implemented practice |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | Restore wetlands throughout the watershed | 0 acres | 10 acres | 40 acres | 75 acres | 100 acres | 200 acres | Number of practices completed/ area affected |
| | Accurately size bridges and culverts to improve stream stability | 80% complete | | Continue to identify opportunities to improve bridges and culvert sizes for connectivity | | 90% complete | 100% complete | Accurate bridge and culvert size to be determined by BRRWD. BRRWD will monitor the progress. |
| | Construct Floodwater Impoundments | 0 acre-ft | | Work with landowners to identify potential location and begin design work | Finalize design work | 10,000 acre-ft | 25,000 acre-ft | Number of acre-ft constructed |
| | Install water and sediment control basins | 100 acres | 100 acres | 250 acres | 350 acres | 500 acres | 1,500 acres | Number of practices completed/ area affected |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | Outreach to promote installation of WASCOB's and side inlets | Have been meeting with landowners on site to discuss storage and protection practice options | Meet with 10 additional landowners | Meet with 20 additional landowners | Meet with 30 additional landowners | Meet with 40 additional landowners | Meet with 50 additional landowners | Number of landowners met with in the field |
| | 3,600 acres utilizing NRCS #329 -residue & tillage management | 10% complete | Promote residue and tillage management practices | 30% complete | Promote residue and tillage management practices | 50% complete | 100% complete | Monitoring by BRRWD and partners |
| | Install side inlet control structures or similar grade and rate control structures | 15% of critical areas (CAs) have side inlets (NWQI) 80% in watershed | Continue to promote side inlets in critical areas (30% in CAs) | Continue to promote side inlets in critical areas (30% in CAs; 80% in watershed) | Continue to promote side inlets in watershed (85% in watershed) | 95% in watershed | 75% of CAs have side inlets (NWQI) 100% in watershed | Number of practices completed |
| | Install field wind breaks | 1.5% of area implemented | | | | 3% of area implemented | 5% of area implemented | Monitoring by BRRWD and partners |
| | Install two-stage ditches on drainage ditches | 0 ft | Promote two-stage ditches with landowners and producers | 5,000 ft completed | 10,000 ft completed | 20,000 ft complete | 100,000 ft complete | Monitoring by BRRWD and partners |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | Large-scale restoration – channel dimensions match current hydrology & sediment loads, connect the floodplain, have a stable pattern, and follow natural channel design principals | 0 miles | 5 miles completed | 10 miles completed | 15 miles completed | 25 miles completed | 30 miles completed (WRAPS) | Determine length of streams that have been converted from unstable streams to stable streams |
| | Install conservation cover (easements/buffers of native grass & trees, pollinator habitat) | 9% complete | Promote conservation cover/pollinator habitat with landowners | Identify willing landowner to conduct a demonstration/field day event | | 12% complete | 15% complete | Monitoring by BRRWD and partners |
| | Perennials grown on marginal lands and riparian lands | 1% complete | Promote perennials on marginal and riparian lands | Promote perennials on marginal and riparian lands | Promote perennials on marginal and riparian lands | 2% complete | 2% complete | Monitoring by BRRWD and partners |
| | 9,000 acres of cover crops | 10% complete | Promote cover crops with landowners | 50% complete | Promote cover crops with landowners | 75% complete | 100% complete | Determine number of acres of cover crops installed |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | Replace 10% of current crops with low nutrient-demanding crops (e.g. hay) | | 5% increase in low nutrient-demanding crops | | | | 10% increase in low nutrient-demanding crops | Determine increase in low nutrient-demanding crops installed |
| | Install 160 grade stabilization structures | | 50% complete | 100% complete | | | 100% complete | Determine number of grade stabilization structures installed |
| | Install 12,000 LF of diversions | | 50% complete | 100% complete | | | 100% complete | Determine length of diversion practice installed |
| **Bacteria** | To increase adoption of inject or immediately incorporate manure where currently surface applied in CAs | | | | Increase 5% adoption of inject or immediately incorporate manure where currently surface applied in CAs | | 64% reduction in E. coli at very high flow conditions | 100% inject or immediately incorporate manure where currently surface applied in CAs |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| Dissolved Oxygen (TP) | Maintain 100% SSTS compliance | | Maintain 100% SSTS compliance, 25% to be verified by field inspection every 2 years | Maintain 100% SSTS compliance, 25% to be verified by field inspection every 2 years | Maintain 100% SSTS compliance, 25% to be verified by field inspection every 2 years | Maintain 100% SSTS compliance, 25% to be verified by field inspection every 2 years | | No failing SSTS |
| | Increase 25% rotational grazing /livestock exclusion on pastured stream miles | | | 10% rotational grazing / Livestock exclusion on pastured stream miles | | 25% rotational grazing / Livestock exclusion on pastured stream miles | Adequately manage the pasture locations within the watershed | Verify if TSS practices improve stream habitat |
| | Install 200 acres of saturated buffers | | | 50 acres of saturated buffers | 100 acres of saturated buffers | | 200 acres of saturated buffers | Determine number of saturated buffer acres installed |
| | 40 Nutrient management plans developed | | 5 nutrient management plans developed | 15 nutrient management plans developed | 20 nutrient management plans developed | | 20 nutrient management plans developed | Determine number of nutrient management plans developed |

| Impairment | Goal | Current/ underway | Milestones | | | | Long-Term Goals | Assessment |
|---|---|---|---|---|---|---|---|---|
| | | | 2-year (2023) | 4-year (2025) | 6-year (2027) | 8-year (2029) | | |
| | 62,500 acres following nutrient management plans | | 15,000 acres implemented | | 30,000 acres implemented | | 62,500 acres implemented | Determine number of acres following nutrient management plan |
| **MIBI and FIBI** | Implement 200 acres of grassed waterways | | 50 acres implemented | | 100 acres implemented | 200 acres implemented | Meet standards | Verify if TSS practices improve stream habitat |

## 8.2 BMP EFFICIENCIES AND LOAD REDUCTION ESTIMATES

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to estimate sediment and E. coli loads and reductions for the watershed. The BMPs identified in the ten-year milestone table were summed and entered as individual practices in STEPL. The default sediment reduction efficiencies were used. Reduction efficiencies for E. coli were assumed from MPCA (2011) and Wright Water Engineers, Inc. (2010) and added to the BMP List worksheet. The removal efficiencies for the treatment types and resulting watershed load reduction estimates for sediment and E. coli are shown in ***Table 18***.

**Table 18. STEPL removal efficiencies and load reduction estimates for milestone BMPs**

| Treatment | # | Unit | STEPL BMP | Sediment efficiency | E. coli efficiency | Sediment Reduction | Sediment reduction per unit | E. coli Reduction | E. coli reduction per unit | % Sediment Reduction | % E. coli Reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | t/yr | t/unit/yr | Billion MPN/yr | Billion MPN /unit/yr | % | % |
| Buffers - streams and public ditches | 230 | mi. | Buffer - Grass (35ft wide) | 0.533 | 0.65 | 694 | 3.02 | 9,306 | 40.46 | 12 | 16 |
| 15% conservation cover | 12,000 | | Cover Crop 3 | 0.2 | 0.5 | 115 | 0.01 | 3,150 | 0.26 | 2 | 5 |
| Wetland restoration * | | | | | | | | | | | |
| Culvert and bridge improvements * | | | | | | | | | | | |
| Impoundment | 25,000 | ac-ft | Land Retirement | 0.95 | 0.9 | 445 | 0.02 | 4,639 | 0.19 | 8 | 8 |
| WASCOBs | 1,500 | ac. | Terrace | 0.4 | 0.3 | 584 | 0.39 | 4,811 | 3.21 | 10 | 8 |
| Residue and tillage management | 3,600 | ac. | Conservation tillage 1 | 0.403 | 0.3 | 63 | 0.02 | 515 | 0.14 | 1 | 1 |
| Side inlet controls | 200 | # | Terrace | 0.4 | 0.3 | 188 | 0.94 | 1,546 | 7.73 | 3 | 3 |
| Two-stage ditches | 100,000 | ft. | Two-stage ditch | 0.75 | 0.3 | 55 | 0.001 | 241 | 0.00 | 1 | 0.4 |
| Cover crops | 9,000 | ac. | Cover Crop 2 | 0.1 | 0.3 | 42 | 0.005 | 1,374 | 0.15 | 0.7 | 2.4 |
| Addition of perennial crop (hay) | 8,000 | ac. | Cover Crop 3 | 0.2 | 0.5 | 83 | 0.01 | 2,291 | 0.29 | 2 | 4 |

| Treatment | # | Unit | STEPL BMP | Sediment efficiency | E. coli efficiency | Sediment Reduction | Sediment reduction per unit | E. coli Reduction | E. coli reduction per unit | % Sediment Reduction | % E. coli Reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grade stabilization structures | 160 | # | Terrace | 0.4 | 0.3 | 167 | 1.04 | 1,374 | 8.59 | 3 | 2 |
| Manure incorporation | 4,000 | ac. | Nutrient management 1 | 0.2 | 0.5 | 42 | 0.01 | 1,145 | 0.29 | 0.7 | 2 |
| SSTS * | | | | | | | | 103 | | | 0.002 |
| Rotational grazing | 160 | ac. | Prescribed grazing | 0.333 | 0.3 | 0.005 | 0.00 | 0.41 | 0.00 | 0.0 | 0.0 |
| Saturated buffers - 200 acres | 200 | ac. | Buffer - Grass (35 ft wide) | 0.533 | 0.65 | 528 | 2.64 | 7,073 | 35.36 | 9 | 12 |
| Nutrient management | 62,500 | ac. | Nutrient management 1 | 0.2 | 0.5 | 615 | 0.01 | 16,895 | 0.27 | 11 | 29 |
| Grassed waterways | 20 | ac. | Terrace | 0.4 | 0.3 | 19 | 0.94 | 155 | 7.73 | 0.3 | 0.3 |
| Streambank & Shoreline Protection * | 6 | mi. | | | | 1,095 | 183 | | | 9 | |
| Diversion | 2,000 | linear ft | Land Retirement | 0.95 | 0.9 | 35 | 0.02 | 361 | 0.18 | 0.6 | 0.6 |
| Whiskey Creek Enhancement Project in STEPL * | 20.2 | mi. | | | | 2,912 | 144 | | | 30 | |
| | | | | | | | | | | | |
| * | | | | | | | | | | | |

* Wetland restoration - reduces flows, reducing streambank erosion, no sediment reduction estimated
Culvert and bridge improvements - increase connectivity, no sediment reduction estimated
SSTS - based on STEPL Septic worksheet
Streambank and WCEP - based on STEPL streambank worksheet

The overall reductions in sediment and *E. coli* loads with the BMP implementation described in this plan is shown in ***Table 19***. The estimated loads using STEPL are different than those using PTMApp for upland loading and methods described in Section 6.2.1 for streambank and channel erosion given that the tools and methods have different assumptions, data inputs, and computations. However, the loads are within the same magnitude such that the percent reductions estimated by STEPL indicate that the TSS and E. coli water quality standards for Whiskey Creek will be met with the implementation of this plan.

**Table 19. Estimated existing and post-BMP implementation watershed loads based on STEPL.**

| | Existing load | Load reduction | Post-BMP load | Percent reduction |
|---|---|---|---|---|
| **Sediment (t/yr)** | 9,817 | 7,680 | 2,137 | 78% |
| **E. coli (Billion MPN/yr)** | 58,056 | 54,980 | 3,076 | 95% |

# 9 OUTREACH PLAN

## 9.1 LANDOWNER AND COMMUNITY ENGAGEMENT

Landowner and community engagement are a critical component in implementing practices to reduce pollutant loading to Whiskey Creek and, eventually, attain its water quality goals. The Wilkin SWCD has been in constant contact with Landowners to determine who is interested in implementation of conservation practices. The Wilkin SWCD has held large group meetings, one-on-one meetings, and in field meetings with landowners to gauge interest and identify existing problems. Approximately 40 landowners have expressed interested in implementation of conservation practices. Of the Landowners who have expressed interested in future implementation of conservation practices, all of them have desired practices be implemented in the past. However, due to funding restrictions, most Landowners were unable to complete any projects. The Wilkin and West Otter Tail SWCDs, BRWD, and NRCS all play important roles in implementing the outreach plan. The roles for each are described below.

## 9.2 ROLE OF THE WILKIN AND WEST OTTER TAIL SWCD

The Wilkin and West Otter Tail SWCDs will focus on community engagement as part of this outreach plan. Below are outreach steps the SWCDs will focus on.

- Market Critical Source BMPs to Landowners
    - The SWCDs will focus their marketing efforts on educating landowners on BMPs that could be implemented to address the critical source locations identified. This will be accomplished through individual and group meetings with landowners.
    - There are approximately 40 Landowners within the Whiskey Creek watershed who have expressed interest in implementation of conservation practices. All of these Landowners have historically expressed interest in implementation of conservation practices; however, projects were unable to be completed due to lack of funding.
- Market the Conservation Reserve Enhancement Program (CREP)
    - The CREP is part of the Conservation Reserve Program (CRP), the country's largest private-land conservation program administered by the Farm Service Agency. The SWCDs will work with landowners to encourage use of this program to aid in treating sediment carrying runoff from agricultural fields.
- Assist Landowners with Establishment and Maintenance
    - Assist in farm conservation plan development and coordination with NRCS on NWQI applications.
    - The SWCDs will assist landowners with the establishment and maintenance of the critical source BMPs installed throughout the watershed.

## 9.3 ROLE OF THE BUFFALO-RED RIVER WATERSHED DISTRICT

The Buffalo-Red River Watershed District (BRRWD) will follow Minnesota Statues 103D, also known as "Watershed Law", to implement critical source projects within the watershed. Below are steps that will be completed by the BRRWD to facilitate the establishment of projects.

- Hold Preliminary Resolution Hearing
    - The BRRWD will hold Preliminary Resolution Hearings to provide evidence on the need for the proposed projects.

- Complete Project Environmental Review
  - The BRRWD will complete an environmental review, if necessary, to assess any impacts the proposed projects will have on the environment. This will mainly focus on the stream restoration aspects of the overall project.
- Complete Project Permitting
  - The BRRWD will determine what permits need to be completed and will apply for permits required on the local, state, and federal level.
- Develop Easement Maps for Landowners
  - When necessary, the BRRWD will develop easement maps for Landowners to show where permanent or temporary easements will be acquired for the proposed project.
- Establish Local Funding Methodology
  - Based on Landowner feedback, a Water Management District could be established to secure a local funding source to maintain installed practices and implement additional practices in the future.
- Hold Final Project Hearing
  - The BRRWD will hold a final project hearing, allowing work to commence.

## 9.4 ROLE OF THE NATURAL RESOURCES CONSERVATION SERVICE

The NRCS will assist the Local Government Units with project planning and technical assistance, while also assisting Landowners with NWQI applications. In addition, NRCS staff may assist with conservation practice design if their availability allows. Below are steps that will be taken by the NRCS.

- Provide Conservation Planning
  - The NRCS will assist with the planning and implementation of conservation practices.
- Provide Technical Expertise and Design
  - The NRCS will provide technical assistance with the conservation practices. Depending on staff availability, the NRCS will also perform project design.
- Assist Landowners with NWQI Applications
  - The NRCS will work with landowners to complete and submit NWQI applications for critical source practices within the watershed.

# 10 MONITORING AND EVALUATION

Monitoring and evaluation will be completed by the BRRWD and the Wilkin and West Otter Tail SWCDs. The BRRWD has a regional assessment location at the outlet of Whiskey Creek and completes monthly monitoring during the open water season (April – October) for all the sediment, turbidity, phosphorus, and nitrogen. This assessment location has been monitoring data within Whiskey Creek for over 5 years. In total, there are 33 locations (13 with flow monitoring abilities) throughout the greater watershed. Staff members of the BRRWD and SWCDs also complete both formal and informal field analysis throughout the year. Formal field analysis and monitoring on past projects are completed on an annual basis and maintenance reports are put together based on the findings. In addition, staff members are always observing the conditions around them as they drive through the watershed. This would fall under the informal field analysis, resulting in field conditions and issues being observed by general observation. A formal field review will be completed by members of the BRRWD and the SWCDs for all milestones listed in Section 8. The reviews will be tabulated and compared to the milestone goals to see what progress is

being made toward achieving the overall reduction goals for the watershed. Once data has been analyzed, a determination will be made whether the current process is making sufficient progress toward the reduction goals or if implementation practices need to be altered to better achieve said goals.
The MPCA will continue to conduct its 10-year Intensive Watershed Monitoring program.

# 11 REFERENCES


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