BOARD OF WATER AND SOIL RESOURCES

BANK SERVICE AREA 6 COMPENSATION PLANNING FRAMEWORK

Watershed Based Approach to Wetland Compensatory Mitigation

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Introduction

This Compensation Planning Framework (CPF) provides the initial documentation to evaluate and implement a watershed based approach to compensatory wetland mitigation in the St. Croix River Watershed in Minnesota. This watershed is also referred to as Bank Service Area (BSA) 6. The CPF is an attachment to the Minnesota In-Lieu Fee Program (ILFP) instrument provided separately.

This CPF contains the ten elements required by the Federal Mitigation Rule (33 CFR 332.8(c)(2)) in addition to other analyses completed by the Board of Water and Soil Resources (BWSR) to assist with prioritizing mitigation sites using a watershed approach. The majority of the information used in the documentation of baseline conditions and the subsequent analyses performed by BWSR was obtained from publicly available sources or by specific request to an agency that collects and archives a specific type of information. The data utilized during preparation of the CPF came from the following sources:

1. Minnesota Department of Natural Resources (DNR) Watershed Health Assessment Framework (WHAF)
2. Minnesota DNR GIS Geodatabase
3. Minnesota Pollution Control Agency (MPCA) Restorable Wetland Prioritization Tool
4. Minnesota Geo Spatial Commons
5. U.S. Army Corps of Engineers, St. Paul District Permit Data
6. BWSR Minnesota Wetland Bank Data
7. U.S. Department of Agriculture Natural Resources Conservation Service Soil Survey[1]

Geographic Service Area

State and Federal wetland regulatory agencies have divided Minnesota into ten BSAs for the purpose of locating compensatory mitigation. These BSAs are watershed-based areas generally consistent with the four-digit U.S. Geological Survey HUC codified in the District's mitigation policy and Minnesota Wetland Conservation Act (WCA) rules.[2] In the event that BWSR and the Corps agree to modify BSA boundaries in the future, the ILFP instrument and any affected CPFs would be modified to adhere to these program changes.

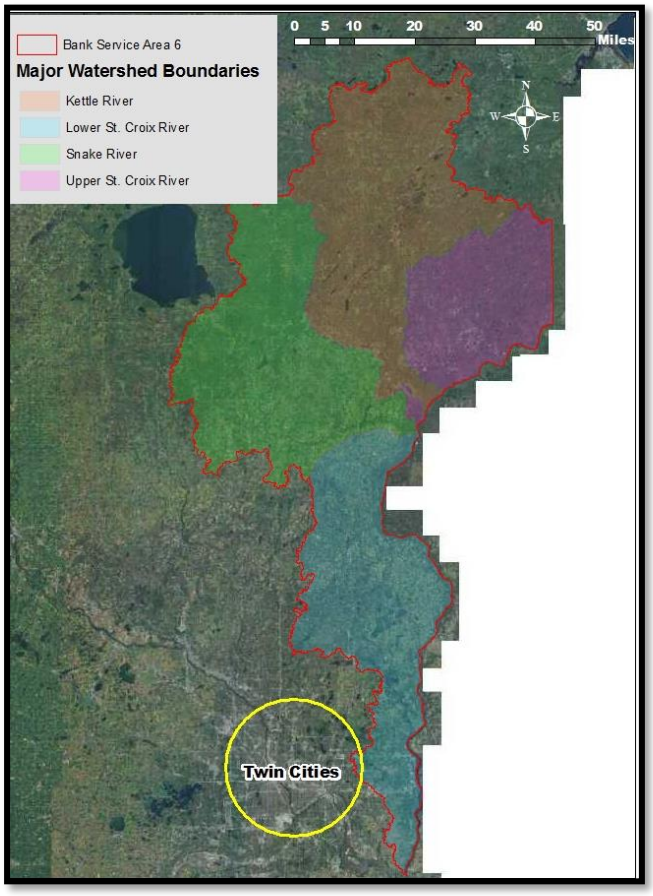
The focus of this CPF is BSA 6, which is the portion of the St. Croix River basin (HUC 0703) that lies within Minnesota. Most of the St. Croix River watershed is located north and east of the Twin Cities metropolitan area except for a relatively narrow portion as it approaches the confluence with the Mississippi River approximately 20-miles southeast of St. Paul, Minnesota at the border city of Prescott, Wisconsin. Although the St. Croix River watershed extends into the western portion of Wisconsin this CPF focuses exclusively on the areas within Minnesota.

[1] County level soil data was unavailable for Pine County, which covers approximately 40% of the BSA. The only soils data available for Pine County is the States Soil Geographic Database STATSGO, which is a general soil map at a scale with significant limitations for this study.

[2] The agencies have subdivided several of the 4-digit HUCs in Minnesota and made other adjustments to BSA boundaries in the southern half of the state to more effectively manage the siting of mitigation in Minnesota.

To provide a more manageable and meaningful analysis, the majority of the information in this CPF is provided at the 8-digit HUC scale (also referred to as a "major watershed" in Minnesota). This level of analysis takes into account the difference in land use from north to south as well as the quality and quantity of aquatic resources present. The major watersheds in BSA 6 include, from north to south, the Upper St. Croix (07030001), Kettle River (07030003), Snake River (07030004), and the Lower St. Croix (07030005). The Lower St. Croix is referred to as the Stillwater watershed in the remainder of this CPF. The location and boundaries of the major watersheds in BSA 6 are shown in Figure 1.

FIGURE 1
BSA 6 Major Watersheds



Major Watershed Descriptions

The following sections provide descriptions of population, land area, land-use, ecological classifications, precipitation, water discharge rates, topography and pre-settlement vegetation for each major watershed. This information is provided to identify the basic demographic and physiographic characteristics of each major watershed to provide a context for decisions involving mitigation site selection later in this CPF. This information was largely obtained from the Minnesota DNR's WHAF. A one page basic summary of each major watershed taken from the WHAF is provided in Appendix A.

Information on ecological classification was obtained from DNR's Ecological Classification System (ECS) which was developed jointly by the DNR and the U.S. Forest Service for ecological mapping and landscape classification in Minnesota. Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. The results of this mapping effort allows resource managers to consider ecological patterns and identify areas with similar management opportunities. The CPF includes ECS information at the subsection level, which are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief, and the distribution of plants, especially trees.

Upper St. Croix River

The Upper St. Croix Watershed (UPSC) encompasses approximately 347,720 acres (543 square miles) in the northeastern part of BSA 6 and includes many small tributaries that drain directly into the St. Croix River. It is a sparsely populated (5.37 people per square mile) and undeveloped region of Minnesota where there was little

change in population from 2000 to 2010. Development pressure is unlikely to increase as it is well removed from the metropolitan area. There is a modest amount of cropland, but the dominant land cover is forest and wetland.

Ecological Classification

The entire UPSC watershed is classified as the Mille Lacs Upland Subsection, which covers the large area of Superior Lobe ground moraines and end moraine in east-central Minnesota. Gently rolling till plains and drumlin fields are the dominant landforms in this ecoregion with brown and red till forming the parent material. In the southern portion, upland hardwood forests consisting of northern red oak, sugar maple, basswood, and aspen-birch were common before settlement.

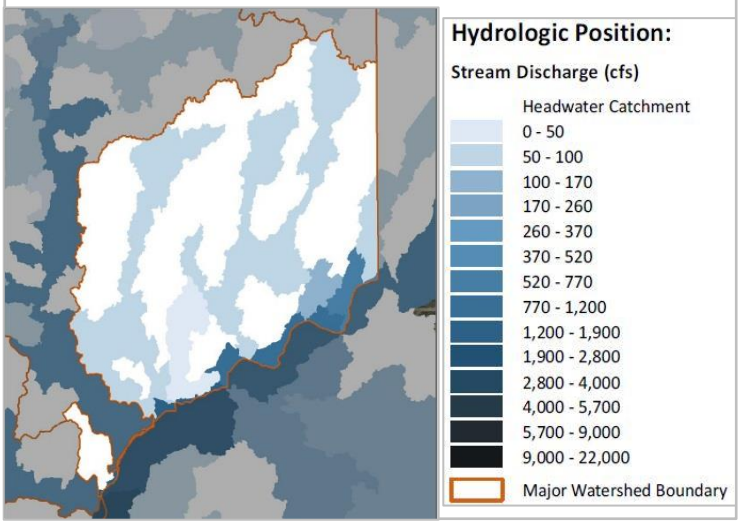
Soils

Typically, there is dense glacial till underlying most soils in this subsection. This dense till impedes water movement throughout the soil profile. The soils are described as acid, stony, reddish sandy loams, silt loams, and loamy sands (Hobbs and Goebel 1982). The parent material in the Grantsburg (Des Moines Lobe) portion of the subsection is more calcareous and finer textured than Superior Lobe sediments. It is underlain by Superior lobe drift which is locally exposed. The soils are classified as Boralfs (well-drained soils developed under forest vegetation) and Ochrepts (poorly developed soils formed under forest vegetation) on the moraines (Anderson and Grigal 1984).

Hydrologic Position

The hydrologic position data in the WHAF helps to illustrate where each watershed catchment resides on the landscape in relationship to neighboring catchments. The relationship is based on the location of the mouth of the catchment and the area that is upstream of it at that point. Headwater areas that do not receive overland flow from upstream but rather collect surface water and direct it downstream are shown in white. Areas shaded in blue receive flow from upstream catchments with darker shades representing higher discharge amounts from that mouth. In the UPSC, surface water is carried to the St. Croix River primarily through separate drainage basins as depicted in Figure 2.

Figure 2
UPSC Watershed Hydrologic Positioning



Topography

The watershed ranges in elevation from approximately 400 to 200 meters. The topographic gradient is generally north to south with the highest elevations observed in the northeastern portion of the watershed.

The UPSC watershed, and BSA 6 in general, have more relief than other areas in Minnesota with steeper slopes and bluffs present along the St. Croix River. Slopes in this watershed range from approximately 0% to 12% with three fourths of the land area having a slope of 3% or less.

Pre-settlement Vegetation

The WHAF contains an interpretation of Marschner's Early-European Settlement Vegetation Map based on Public land Survey notes from the 1890s. These maps provide an insight into the distribution of vegetation before European settlers began significantly altering the landscape. A summary of the vegetative cover by Marschner land class is provided in the following table.

Table 1 **UPSC Watershed Percent of Watershed by Marschner Land Class**
Conifer Bogs and Swamps: 41.0%
Aspen-Birch (trending to Conifers): 23.9%
Mixed White Pine and Red Pine: 16.8%
Aspen-Birch (trending to Hardwoods): 4.4%
River Bottom Forest: 3.5%
Big Woods – Hardwoods(oak, maple, basswood, hickory): 3.4%
Mixed Hardwood and Pine (maple, white pine, basswood, etc.): 2.6%
White Pine: 2.4%
Wet Prairie: 1.4%
Jack Pine Barrens and Openings: 0.3%

Kettle River

The Kettle River Watershed is the northern-most watershed in the BSA, with the Kettle River serving as the discharge point to the St. Croix River. It is the largest major watershed in BSA 6 covering 672,926 acres (1,051 square miles). The major land cover classes in the watershed are wetlands (38%) and forests (34%) collectively, which cover 72% of the watershed area. The population density in the watershed is 20.63 people per square mile and is concentrated along the I-35 corridor. Between 2000 and 2010 the population in the watershed increased by 2,359 people or 12%.

Ecological Classification

The Kettle River Watershed is mapped in the Mille Lacs Upland 83%, St. Louis Moraines 13% and North Shore Highlands 4%. The Mille Lacs Upland is mapped from the mouth of the Kettle River through the northern two-thirds of the watershed. The St. Louis Moraines area is mapped in the northeastern areas of the watershed and the North Shore Highlands in the extreme northern tip of the watershed. The Mille Lacs Upland Subsection is described in the UPSC watershed section and is not repeated here.

The St. Louis Moraine consists of distinct end moraines. A cap of calcareous gray sediment varies from 1 to 10-plus feet in depth. Coarse loamy Rainy Lobe sediments underlie the cap. Northwest portions of this watershed have very steep topography. These areas are ice disintegration features. Topography on the rest is gently rolling to rolling. Presently, forestry and tourism are the major land uses.

The Northshore Highlands landform is adjacent to Lake Superior with gently rolling to steep slopes. Bedrock outcroppings are common and soils are often shallow, forming from red and brown glacial till and are very rocky.

Soils

The Mille Lacs soils typically have dense glacial till underlying most soils in this subsection. This dense till impedes water movement throughout the soil profile. The soils are described as acid, stony, reddish sandy loams, silt loams, and loamy sands (Hobbs and Goebel 1982). The soils are classified as Boralfs (well-drained soils developed under forest vegetation) and Ochrepts (poorly developed soils formed under forest vegetation) on the moraines (Anderson and Grigal 1984).

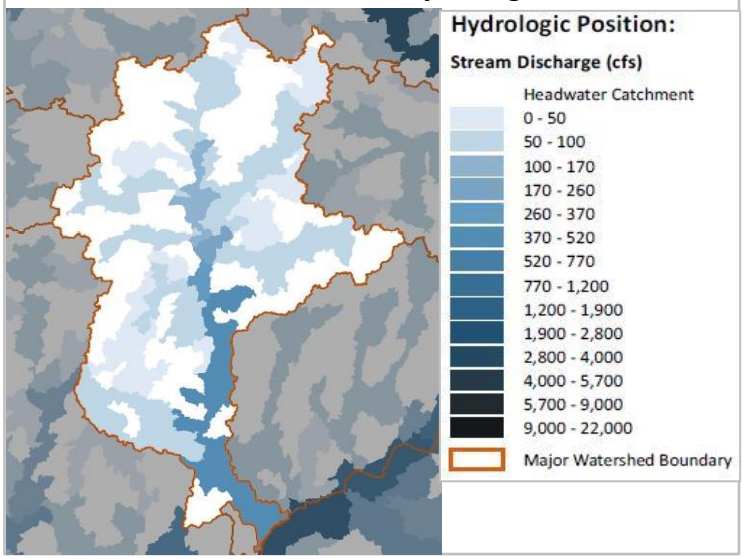
St. Louis loamy calcareous soils make up about 75% of the soils in this subsection (Dept. of Soil Science, Univ. of Minnesota 110-1971). Excessively well-drained outwash sands account for another 10 to 15% and poorly drained soils account for about 3%. The soils are classified as Boralfs (well drained soils developed under forest vegetation), Aqualfs (wet soils developed under forest vegetation), Hemists (moderately decomposed organic soils), and Psamments (sandy, poorly developed well-drained soils), with Boralfs most common (Cummins and Grigal 1981).

Northshore Highland soils are developed from rocky, red tills of the Superior lobe. Textures range from sand to clay (Hobbs and Goebel 1982). Loams and sandy loams are the most common soil textures on the moraines, which occupy most of the subsection. The Highland Flutes, along the eastern edge of the subsection, have a predominance of thin soils over bedrock and clayey soils (Dept. of Soil Science, Univ. of Minnesota 1981b). The Nemadji-Duluth Lacustrine Plain has about 95% clayey soils. The most common soils in the subsection are classified as Orthents, Ochrepts, and Boralfs (Anderson and Grigal 1984).

Hydrologic Position

The hydrologic position map shows that the Kettle River is the primary outflow from the watershed and, therefore, has the highest stream discharge. Major tributaries in the watershed that appear as lighter shades of blue in the map include the Grindstone River, Moose Horn River, Pine River, Split Rock River, and Willow River.

Figure 4
Kettle River Watershed Hydrologic Position



Topography

Like the UPSC watershed, the Kettle has a general north-south topographic gradient. Although elevations in the northern part of the Kettle watershed are slightly higher than the UPSC the distribution of watershed area over

the range of hillslope is very similar to the UPSC watershed. Slopes range from 0 to approximately 12% with over three quarters of the land area having a slope of less than 3%.

Pre-settlement vegetation

Historically, the vegetation in the Mille Lacs subsection consisted of a mosaic of forest types. Along the southern boundary, maple-basswood forests were prevalent. The rest of the subsection was a vast mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum, or white cedar-black ash communities.

The St. Louis Moraine had white pine-red pine forest covered large portions of the steep moraines and portions of the pitted outwash along the eastern edge of the subsection. South of Grand Rapids was an area of moraine dominated by northern hardwoods. Aspen-birch forests also grew on the moraines, but were more common on the outwash, which had excessively well drained sandy soils. Mixed hardwood-pine forest was locally present on the moraines, generally near large lakes. Conifer swamp and bogs were scattered throughout the subsection, occupying both kettles and linear depressions in the pitted outwash and moraines.

Northshore Highlands had aspen-birch forest, white pine-red pine forest, mixed hardwood-pine forest, and conifer bogs and swamps. White pine-red pine forest was most common on the clay lake plain and on thin soil over bedrock in the southern half of the subsection. Mixed hardwood-pine forest, with sugar maple, was concentrated on the ridges of the dissected clay lake plain and the Highland Flutes.

The Marschner land class summary for the Kettle River watershed is provided in the table below.

Table 2 **Kettle River Watershed Percent of Watershed by Marschner Land Class**
Conifer Bogs and Swamps: 32.8%
Aspen-Birch (trending to Conifers): 30.6%
Mixed White Pine and Red Pine: 19.6%
Mixed Hardwood and Pine (maple, white pine, basswood, etc.): 5.3%
Jack Pine Barrens and Openings: 2.9%
Wet Prairie: 2.0%
White Pine: 1.9%
Aspen-Birch (trending to Hardwoods): 1.7%
River Bottom Forest: 1.5%
Lakes (open water): 1.1

Snake River

The Snake River Watershed extends west and north from the St. Croix River towards Lake Mille Lacs. It is the second largest major watershed in BSA 6 covering 643,544 acres (1,006 square miles). The major land cover classes in the watershed are forest (35%), crops (28%) and wetlands (27%) collectively covering 90% of the watershed area. The population density in the watershed is 29.09 people per square mile and is most concentrated along the major north-south and east-west transportation corridors. Between 2000 and 2010 the population in the watershed increased by 2,931 people or 11%.

Ecological Classification

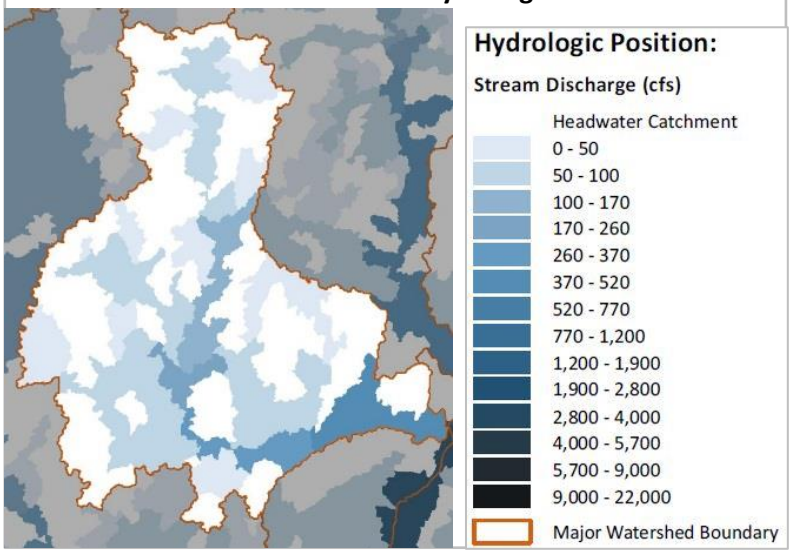
The Snake River Watershed is classified as the Mille Lacs Upland Subsection. This subsection is described in the UPSC watershed section and is not repeated for the Snake River watershed.

Soils

Typically, there is dense glacial till underlying most soils in this subsection. This dense till impedes water movement throughout the soil profile. The soils are described as acid, stony, reddish sandy loams, silt loams, and loamy sands (Hobbs and Goebel 1982). The parent material in the Grantsburg (Des Moines Lobe) portion of the subsection is more calcareous and finer textured than Superior Lobe sediments. It is underlain by Superior lobe drift which is locally exposed. The soils are classified as Boralfs (well-drained soils developed under forest vegetation) and Ochrepts (poorly developed soils formed under forest vegetation) on the moraines (Anderson and Grigal 1984).

Hydrologic Position

Figure 5
Snake River Watershed Hydrologic Position



The hydrologic position map shows that the Snake River is the primary outflow from the watershed and, therefore, has the highest stream discharge. Major tributaries in the watershed that appear as lighter shades of blue in the map include the Knife River, Ann River, Groundhouse River and Rice River.

Topography

The Snake River watershed generally drains in a northwest to southeast direction following the topographic gradient. The range of hillslope is very similar to the UPSC and Snake watersheds ranging from 0 to approximately 12% with just under three quarters of the land area having a slope of less than 3%.

Pre-settlement vegetation

The Mille Lacs Upland Subsection is described as consisting of a mosaic of forest types. Along the southern boundary, which is close to the southern limit of the watershed, maple-basswood forests were prevalent. The rest of the subsection was a vast mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum, or white cedar-black ash communities.

The Marschner land class summary for the Snake River watershed is provided in the table below.

Table 3 **Kettle River Watershed Percent of Watershed by Marschner Land Class**
Conifer Bogs and Swamps: 29.0%
Aspen-Birch (trending to Conifers): 28.8%

Big Woods – Hardwoods: 16.1%
Mixed Hardwood and Pine: 11.1%
Mixed White Pine and Red Pine: 4.9%
Wet Prairie: 3.0%
White Pine: 2.6%
Oak openings and barrens: 1.7%
Aspen-Birch (trending to Hardwoods): 1.5%
River Bottom Forest: 0.9%
Lakes (open water): 0.4%

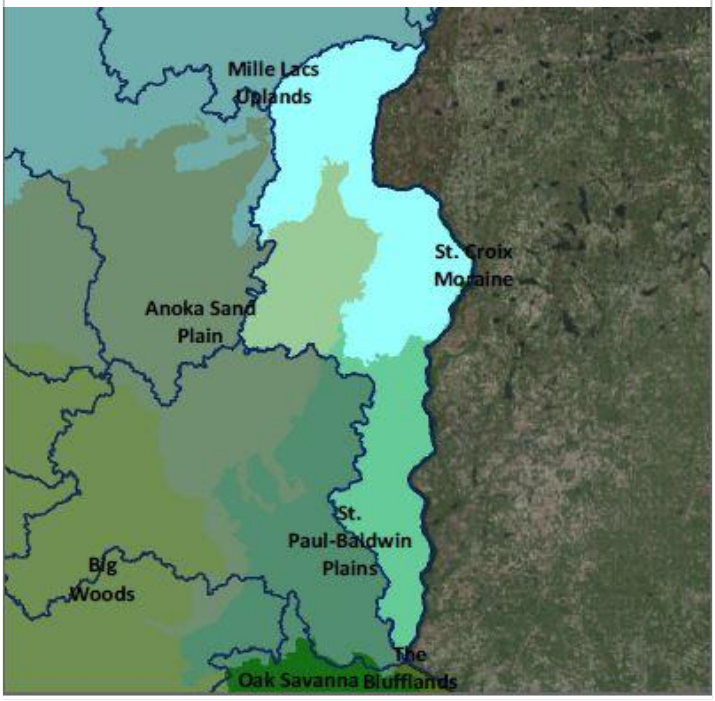
Lower St. Croix River-Stillwater

The Lower St. Croix River, or Stillwater, Watershed is at the bottom of BSA 6 respect to topography and receives inputs from the three other major watersheds in this BSA before discharging into the Mississippi River. It covers 585,737 acres (915 square miles) in a relatively narrow area that extends from just south of Pine City in the north to near Hastings in the south. The Stillwater watershed is different from the other watersheds in almost way mostly because of its proximity to the Twin Cities. The major land cover classes in the watershed are crops (44%), forest (21%) and wetlands (12%). The population density in the watershed is 173.35 people per square mile and is most concentrated in the areas in and around the city of Stillwater. Between 2000 and 2010 the population in the watershed increased by 21,679 people, the largest increase in the BSA.

Ecological Classification

The Stillwater Watershed is classified into three ecological subsections: Mille Lacs Uplands 49%, St. Paul-Baldwin Plains 28% and the Anoka Sandplain 22%. The Mille Lacs Uplands was discussed previously and will not be addressed again in this section.

Figure 6
Stillwater Watershed Ecological Classification



The St. Paul-Baldwin Plains are makes up the southern half of the Stillwater watershed and is topographically low in comparison to other areas of Minnesota and are dominated by a large moraine and areas of outwash plain that is rolling to hummocky on the moraine itself (steep, short complex slopes) and level to rolling on the outwash. The subsection encompasses part of the seven county metropolitan area and as a result is affected by urban development.

The easternmost extent of the Anoka Sandplain is found in the western portion of the Stillwater watershed and consists of a broad sandy lake plain and terraces along the Mississippi River. Low moraines are exposed above the outwash and there are small dune features (Wright 1972). There are also ice block depressions consisting of shallow lakes and wetlands. Sod and vegetable crops are extensively grown on drained peat and muck areas.

Soils

The Mille Lacs soils typically have dense glacial till underlying most soils in this subsection. This dense till impedes water movement throughout the soil profile. The soils are described as acid, stony, reddish sandy loams, silt loams, and loamy sands (Hobbs and Goebel 1982). The soils are classified as Boralfs (well-drained

soils developed under forest vegetation) and Ochrepts (poorly developed soils formed under forest vegetation) on the moraines (Anderson and Grigal 1984).

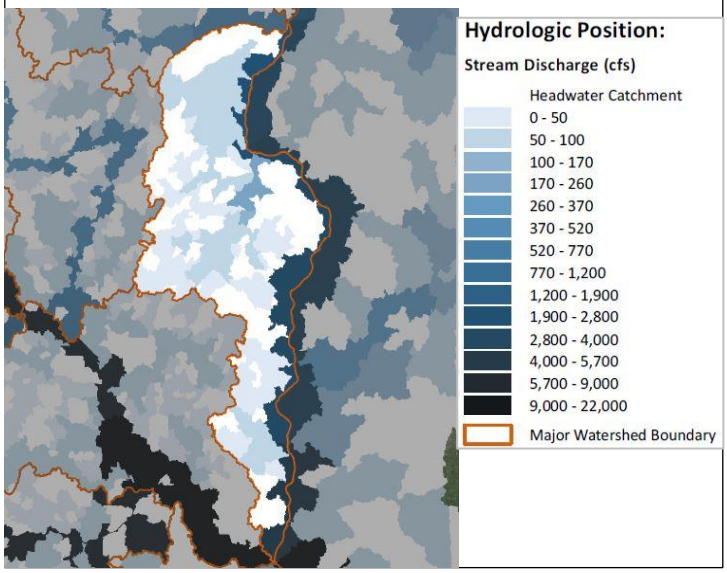
St. Paul-Baldwin soils are primarily Alfisols (soils formed under forested vegetation). Areas of Mollisols (soils formed under prairie vegetation) are present on the outwash plains. Parent materials are mixed on the moraines (mixtures of clay loams, loams, sandy loams, and loamy sands). The outwash plains have sandy parent materials (Cummins and Grigal 1981).

Anoka Sandplain soils are derived primarily from the fine sands. Most of these sandy soils are droughty, upland soils (Psamments), but there are organic soils (Hemists) in the ice block depressions and poorly drained prairie soils (Aquolls) along the Mississippi River (Cummins and Grigal 1981). Seventy to eighty% of the soils are excessively well drained sands and another 20% are very poorly drained.

Hydrologic Position

Similar to the Upper St. Croix watershed, water flows directly into the St. Croix River in a series of smaller west to east oriented drainages. The most notable of these include Rock Creek, Rush Creek, Goose Creek, Sunrise River, Lawrence Creek, Brown's Creek, Valley Branch, and Trout Brook.

Figure 7
Stillwater Watershed Hydrologic Position



Topography

The watershed ranges in elevation from approximately 320 meters to 210 meters, with a general downward sloping gradient from west to east.

Pre-settlement vegetation

The Mille Lacs Upland subsection is described under the Snake River description and is not repeated again here.

The St. Paul-Baldwin Plain was originally a mosaic of different vegetation types. Oak and aspen savanna were the primary communities, but areas of tallgrass prairie and maple-basswood forest were common. Tallgrass prairie was concentrated on level to gently rolling portions of the landscape. Bur oak savanna developed on rolling moraine ridges at the western edge of the subsection and in dissected ravines at the eastern edge. Maple-basswood forest was restricted to the portions of the landscape with the greatest fire protection, either in steep, dissected ravines or where stream orientation reduced fire frequency or severity.

Characteristic trees in the Anoka Sandplain included bur and northern pin oak (Kratz and Jensen 1983). Jack pine was present locally along the northern edge of the subsection. Brushland characterized large areas of the sandplain and upland prairie formed a narrow band along the Mississippi River along with areas of floodplain forest (Marschner 1974).

The Marschner land class summary for the Stillwater watershed is provided in Table 4.

Table 4 Stillwater Watershed Percent of Watershed by Marschner Land Class
Oak Openings and Barrens: 33.3%
Big Woods – Hardwoods: 28.2%
Aspen-Oak Land: 12.0%
Conifer Bogs and Swamps: 9.3%
Wet Prairie: 6.7%
Prairie: 3.7%
Lakes (open water): 2.8%
River Bottom Forest: 2.0%
Mixed Hardwood and Pine: 0.7%
White Pine: 0.7%
Aspen-Birch (trending to Conifers): 0.4%

Baseline Conditions

The baseline condition section of this CPF is intended to satisfy the requirement in 33 CFR 332. 8(c)(2)(iv) for an analysis of current aquatic resource conditions in the service area. The approach utilized in this document includes an analysis of wetlands, lakes, streams, and water quality using readily available information compiled by state and federal agencies. We have also included information on land use, vegetation cover, and permitting history that adds to an understanding of the current aquatic resource conditions and provides some insight on trends and potential future conditions throughout the watershed.

Wetlands

Information on the extent of wetlands in the St. Croix River watershed was obtained from the 1980 – 1986 National Wetland Inventory (NWI). The wetland acreage and the percentage of total land area as wetland by major watershed and the BSA are summarized in Table 5. Based on the NWI mapping, BSA 6 has a higher percentage of wetlands per total area than the rest of the state (27.6 % versus 19.1% statewide). Within the watershed, the UPSC, Snake and Kettle major watersheds are approximately one third wetlands while the Stillwater major watershed is 18% wetland. The three northern most watershed also have more forested and scrub shrub wetlands than the Stillwater watershed. The NWI mapped wetlands in each major watershed are provided in Appendix B.

Table 5 BSA 6 Summary of NWI Palustrine Class Wetlands							
Watershed Name	**Watershed Acres**	**Wetland Acres[1]**	**Percentage of Wetlands per Watershed**	**Emergent (%)**	**Forest (%)**	**Scrub Shrub (%)**	**Unconsolidated Bottom (%)**
UPSC	347,719	111,908	32.2	22.6	38	38.9	0.6
Snake River	643,542	186,050	28.9	42.5	26.1	30.2	1.2
Kettle River	672,924	220,582	32.8	18.8	42.7	37.7	0.8
Stillwater	585,735	102,844	17.6	52.6	23.5	19.4	4.4
BSA	*2,249,920*	*621,384*	*27.6*				
[1] – Wetland acreage identified as palustrine in the NWI.							

The condition of wetlands in BSA 6 was assessed by examining one factor that has a pronounced effect on wetland quality throughout Minnesota, hydrologic alteration via drainage. Since drainage tile maps are not publicly available the analysis was focused on the presence of drainage ditches. To determine the acreage of ditched wetlands within BSA 6, wetlands with the "d" (ditched) modifier in the NWI were identified and summed for each watershed. While this likely underestimates the amount of wetlands affected by drainage (because drainage tile is not represented and because of the age of the NWI data used for the analysis) it provides a baseline for understanding where wetland functions have been impacted through hydrologic alteration throughout the BSA.

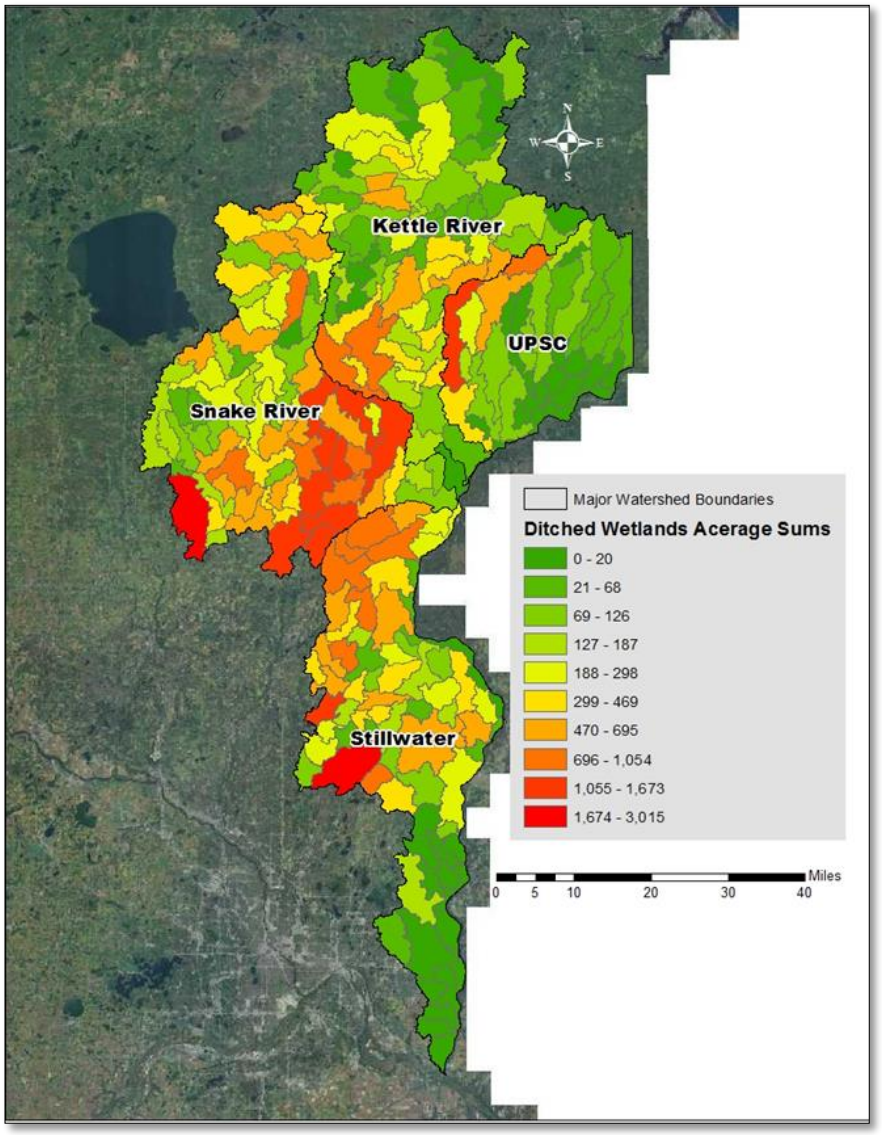
Several wetland functions assessed with the Minnesota Routine Assessment Method (MNRAM) and described in the Hydrogeomorphic Approach to wetland functional assessment (HGM) are adversely affected by drainage. These include water storage, downstream water quality, ground water recharge, wildlife habitat and vegetative bio-diversity.

Table 6 BSA 6 Summary of Ditched Wetlands by Watershed			
Watershed	**Wetland (acres)**	**Ditched Wetlands (acres)**	**Percent Ditched Wetlands**
UPSC	111,908	4,344	3.9
Snake	186,050	34,206	18.4
Kettle	220,582	11,909	5.4
Stillwater	102,844	31,696	30.8
BSA	**621,384**	**82,155**	**13.2**

The most significant effect of drainage, and the driver behind the decrease in function in MNRAM and HGM, is a reduction in the storage capacity of a wetland. This affects the ability of the wetland to control the rate at which surface water moves downslope/gradient into other aquatic resources, reduces the potential for groundwater recharge, and limits biogeochemical processing of nutrients and pollutants. Although the extent and effectiveness of ditching also influences the degree to which wetland functions are influenced, a

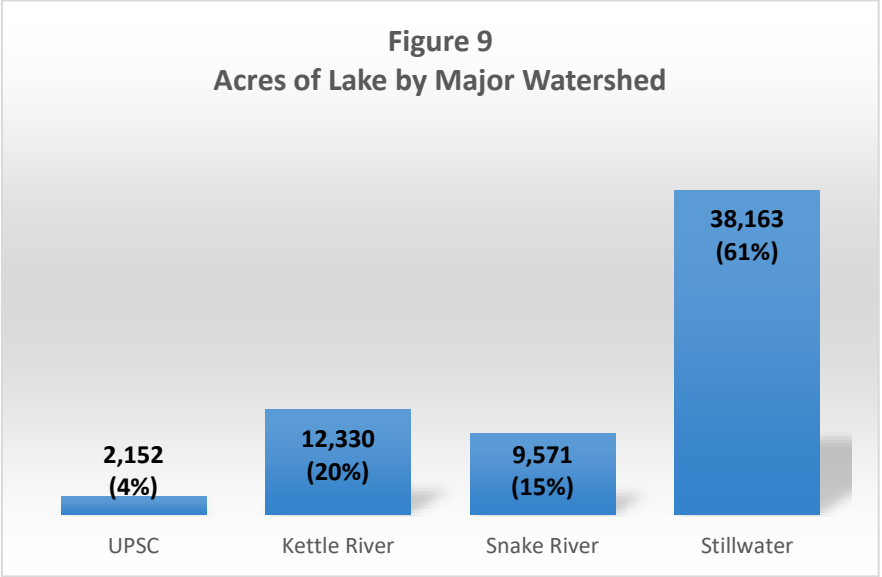
qualitative assessment does provide useful information for the assessment of baseline conditions. Table 6 shows that two of the major watersheds, the Snake River and Stillwater, have significantly higher percentages of ditched wetlands than the UPSC and Kettle River watersheds. The distribution of ditched wetlands are illustrated by catchment in Figure 8. The catchments that have the greatest area of wetlands affected by drainage, and potentially, the greatest functional loss as a result, are in the northern region of the Stillwater and southeastern region of the Snake River watersheds.

Figure 8
Distribution of Ditched Wetlands by Catchment



Lakes

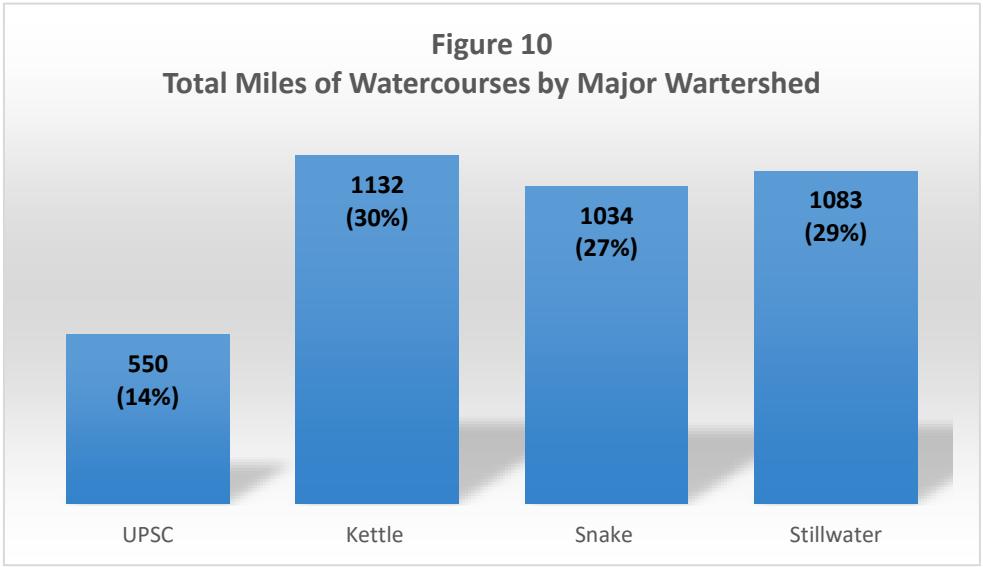
Based on the MN DNR's "Lakes and Open Water" data, BSA 6 contains over 62,000 acres of lakes with a disproportionate amount (approximately 60% of the total acreage) located within the Stillwater watershed (Figure 9) which is noteworthy considering that the Stillwater watershed has the fewest acres of wetlands and the lowest percentage of wetlands per land area. The most significant of the lakes in the Stillwater watershed include Forest, Sunrise Pools, Rush, Green, Big Marine, and Coon. The remaining acreage of lakes is split somewhat evenly between the Kettle (20%) and Snake (15%) River watersheds. Significant lake resources in these watersheds include Knife, Pokegama, Ann, Fish, Rice, Sand Grindstone, Sturgeon, and Island. The UPSC watershed has a small percentage of lakes relative to the other watersheds with just over 2,000 acres of mapped lakes.



Watercourses

The National Hydrography Dataset (NHD) was used to create a general inventory of all watercourses within each major watershed. Figure 10 shows the distribution of watercourses by total length and percent of the total in BSA 6 for each major watershed.

With exception of the UPSC, at only 14% or 550 miles, the data shows a relatively even distribution of stream miles between the major watersheds.



Altered Watercourses

The MPCA's Altered Water Course GIS data is based on the National Hydrography dataset and provides an inventory of all watercourses and their type of modification. This inventory is used to evaluate watercourses across each major watershed, and compare the degree of manipulation on a catchment scale

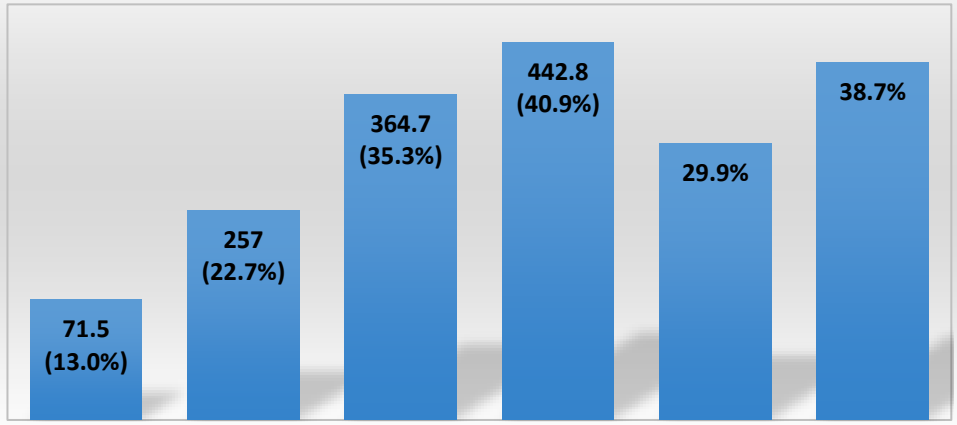
Altering the pattern, profile, or dimension of a watercourse reduces the ability of that aquatic resource to store water resulting in increased peak flows, lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes (Mitch and Gosselink, 2007).

As one means of assessing watercourse condition, the MPCA Altered Watercourse 2012 data set was used to assess the degree of channel alteration in BSA 6. State-wide photointerpretation was used to classify all streams in the state into four major classes: Altered, Impounded, No Definable Channel, or Natural.

- Altered watercourse: Any stream compromised through hydrological alteration.
- Impounded watercourses: Channels formed by the natural rise of the impounded water level.
- No definable channel: Flowlines that no longer appear in the aerial imagery or on LiDAR.
- Natural watercourses: Little to no human influence.

The altered watercourse data shows the UPSC and Kettle River watersheds have a higher ratio of natural to altered streams and a small amount affected by impoundments. The Snake River major watershed contains a higher amount of altered watercourses than the UPSC and Kettle as well as the most watercourse length affected by impoundments. Finally, the Stillwater major watershed has more mapped altered water courses than natural ones and also a dramatically higher amount of watercourses where there is no definable channel. There is a clear north-south trend in BSA 6 with respect to the extent of altered courses with a much greater occurrence of alteration in the southern major watersheds of BSA 6 relative to the northern ones.

Figure 11
Altered Streams by Major Watershed
(miles and percentage of total stream length)

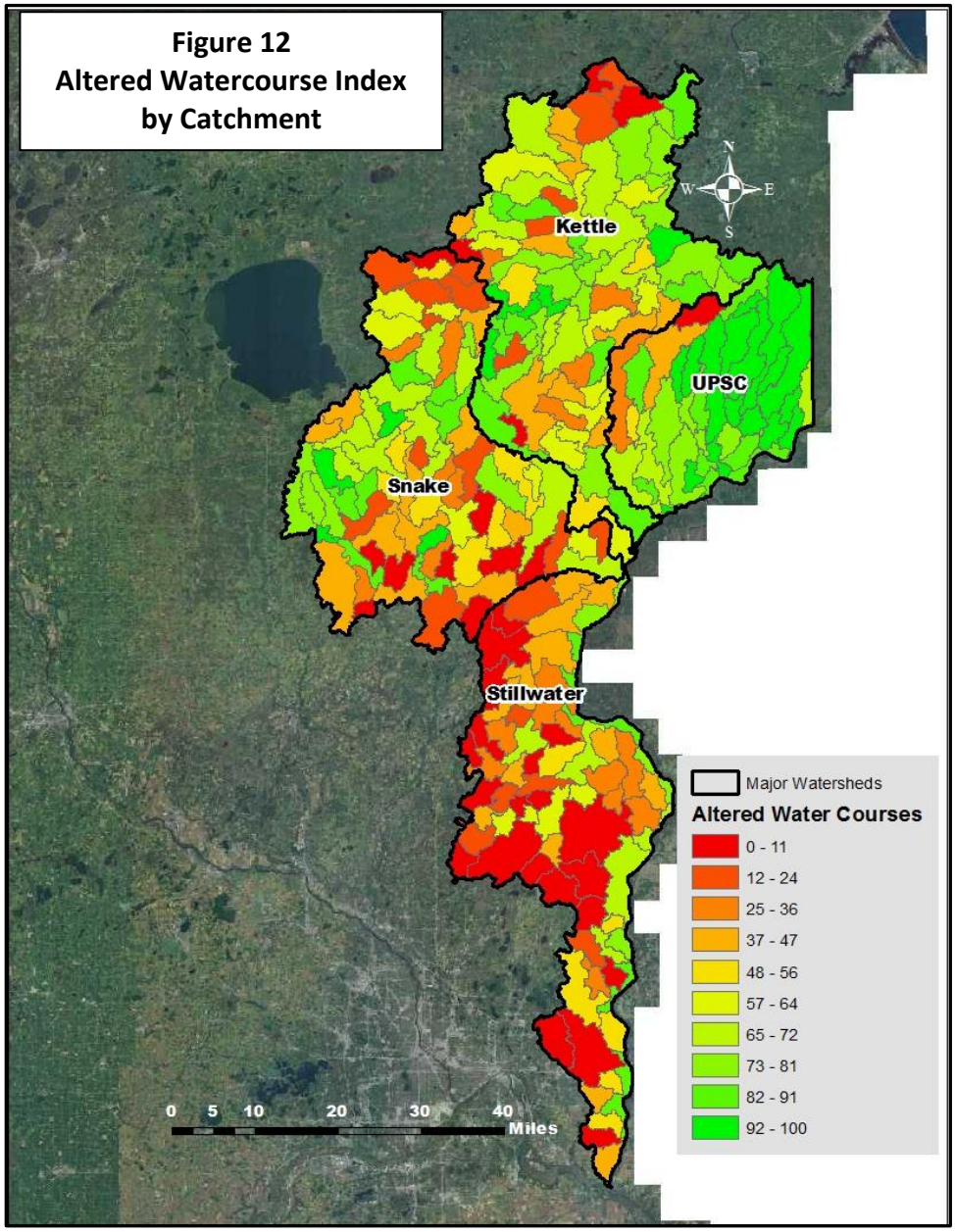


Comparing the percent of altered watercourses per total stream miles in each watershed and statewide, (Figure 11) shows that the UPSC and Kettle River major watersheds are below the state average at 13% and 23% respectively. The Snake major watershed (35%) is just below the 39% state average while the Stillwater is just above the state average at 41%. The average for the entire BSA is 30% which is also below the state average.

The assessment of altered watercourses can be further analyzed at the catchment level using the DNR's WHAF Altered Watercourse data set. The WHAF analysis of this condition derives an index score that represents the extent to which natural streams were straightened by human activity, thereby reducing the hydrologic storage of the land. The index is the ratio of the length of altered watercourses in the minor watershed to the total length of watercourses present. A score of zero represents the worst condition (all streams are altered), a score of 100 represent the best condition (all streams are natural).

The WHAF altered stream outputs for the catchments in BSA 6 are presented in Figure 12. Consistent with the assessment at the major watershed scale, there is a high degree of watercourse alteration in the Stillwater and lower portions of the Snake watersheds, which are the most urbanized and farmed portions of the watersheds. The Kettle River watershed has a few catchments in the northern portion of the watershed that have a high degree of alteration, but most catchments have minimal watercourse alteration. The UPSC, being the most undeveloped watershed shows only a few catchments with altered watercourses.

Figure 12
Altered Watercourse Index by Catchment

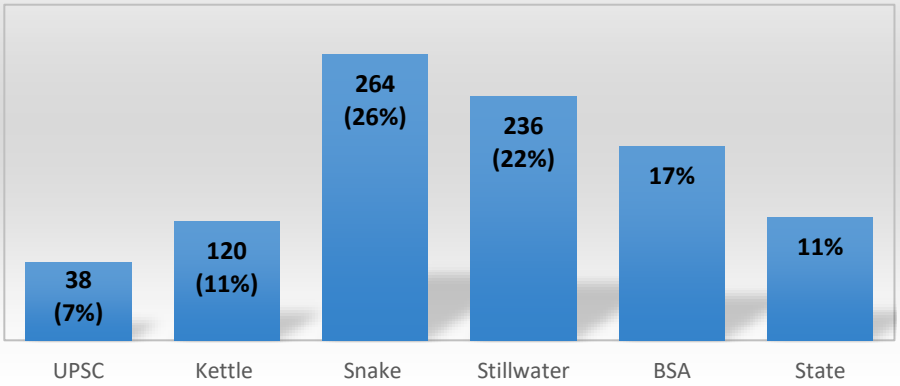


Water Quality

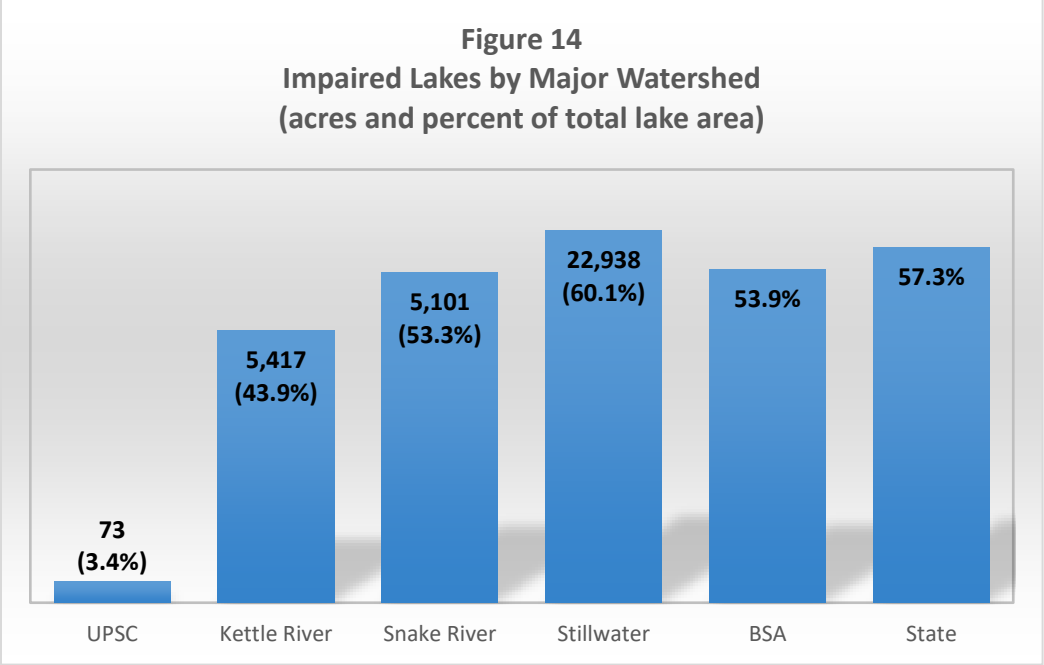
The MPCA's 2016 303(d) list of impaired waters was used to assess the quality of surface waters in BSA 6. States are required to submit their list for EPA approval every two years. For each water on the list, the state identifies the pollutant causing the impairment, when known. In addition, the state assigns a priority for development of Total Maximum Daily Loads (TMDL) based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors. The MPCA designates impairments by evaluating multiple physical, chemical, and biological parameters to assess surface water quality. The most common parameters causing impairments in Minnesota waters include turbidity, mercury, total phosphorus, polychlorinated biphenyls (PCBs) and other exotic chemicals, fecal coliform, impaired biota, and low dissolved oxygen (DO).

The MPCA data indicates that the UPSC and Kettle, the northern portions of the BSA, have the lowest amount of impaired stream miles, 38 and 120 miles respectively. The Snake and Stillwater, the southern portions of the BSA, have 264 and 236 impaired miles respectively which is at least double the amount of the other major watersheds by total length and percentage of impaired stream miles. This data shows significantly more stream impairment in the southern reaches of the BSA. The 2016 impaired stream data is summarized in Figure 13.

Figure 13
Impaired Streams by Major Watershed
(miles and percentage of total stream length)



A similar analysis of MPCA's 2016 impaired water data was conducted for lakes in BSA 6. The total acreage of impaired lakes was determined for each major watershed and then graphed as a total acreage and percentage of the total acres of lakes (Figure 14). The lake data shows that more than half of the lake acreage in BSA 6 is listed as impaired. The Stillwater watershed, with the majority of the total lake acreage, has five times the acres of impaired waters as any other major watershed. The Snake and Kettle River watersheds also have a sizeable amount of impaired lake acreage while the UPSC watershed has only a small amount designated. In general, the north-south gradient observed with other condition assessment factors is evident with impaired lake data which shows decreasing water quality from the north of BSA 6 to the south.



Water quality in each major watershed is discussed in more detail in the following sections.

Stillwater

As discussed previously, the Stillwater watershed is under development pressure from the development sprawl from the Twin Cities metropolitan area. The changes in land use from predominantly agricultural to more developed types raises concerns about surface water quality, groundwater quality and quantity, and storm water and wetland management. Currently, a handful of lakes and Lake St. Croix do not meet water quality standards for beneficial uses such as aquatic recreation and swimming. The main lake pollutant is phosphorus, causing algae blooms in summer months. Stream impairments range from biological fish and macroinvertebrate impairments and bacteria. The pollutants mainly reach the St. Croix River and lakes through urban and rural runoff.

Currently there are three Total Maximum Daily Loads (TMDLs) that have been completed in this watershed: Brown's Creek Biota and Turbidity TMDL, Comfort Lake Forest Lake Watershed District 6 Lake TMDL, and the North Branch of the Sunrise River Bacteria TMDL. There are also five others that were recently started: Lake St. Croix TMDL, Sunrise River Watershed TMDL, Typo and Martin lake TMDL, Carnelian-Marine St. Croix Watershed District 10 Lake TMDL, and the Chisago Chain of Lakes TMDL. The MPCA, along with the Watershed Districts and Watershed Management Organizations in this major watershed are active in monitoring and research to protect and enhance water quality and have plans to restore the waterbodies within their boundaries.

Snake

Monitoring and analysis of data show that water quality is good in the north half of this major watershed where lakes and streams need protective measures to maintain quality. Water quality become progressively worse in the southern half of the watershed as land use changes from undeveloped forest lands to pasture

and crop lands. In 2014, the MPCA and other watershed stakeholders completed a *Watershed Restoration and Protection Strategies Report* for the Snake River watershed highlighted the following with respect to water quality:

- Of the 128 streams in the watershed, 54 were assessed for biotic integrity and 19 were found to fully support aquatic life. Four were identified as impaired for aquatic life while 31 were intermittent and/or lacked data to make a determination;
- Seven river reaches in the watershed were identified as impaired for fecal coliform/*E. coli* bacteria;
- There are 87 lakes in the watershed. Of those that were assessed, six were found to be impaired for nutrients;
- There are six impaired lakes and seven impaired stream reaches that received TMDL allocations. These allocations refer to the maximum amount, or load, of pollutant that a water body can receive and still meet standards.

There is currently one sub-watershed TMDL completed, the Groundhouse River for bacteria and biota, and one underway for the Ann River subwatershed for biota, bacteria, and excess nutrients.

Kettle

Intensive water quality monitoring in the Kettle River watershed did not begin until 2015 so it lags behind the other major watersheds in BSA6 with respect to identifying impairments and formulating management strategies to protect and maintain water quality on a watershed scale. A considerable amount of monitoring has been completed on the Grindhouse River but development of a TMDL for this waterbody was delayed pending completion of the water quality assessment for the entire watershed. The Kettle River watershed has been identified as a contributing watershed to the impairments in downstream waters (Lake St. Croix) so addressing water quality issues in this watershed is viewed as important on both a local and regional scale.

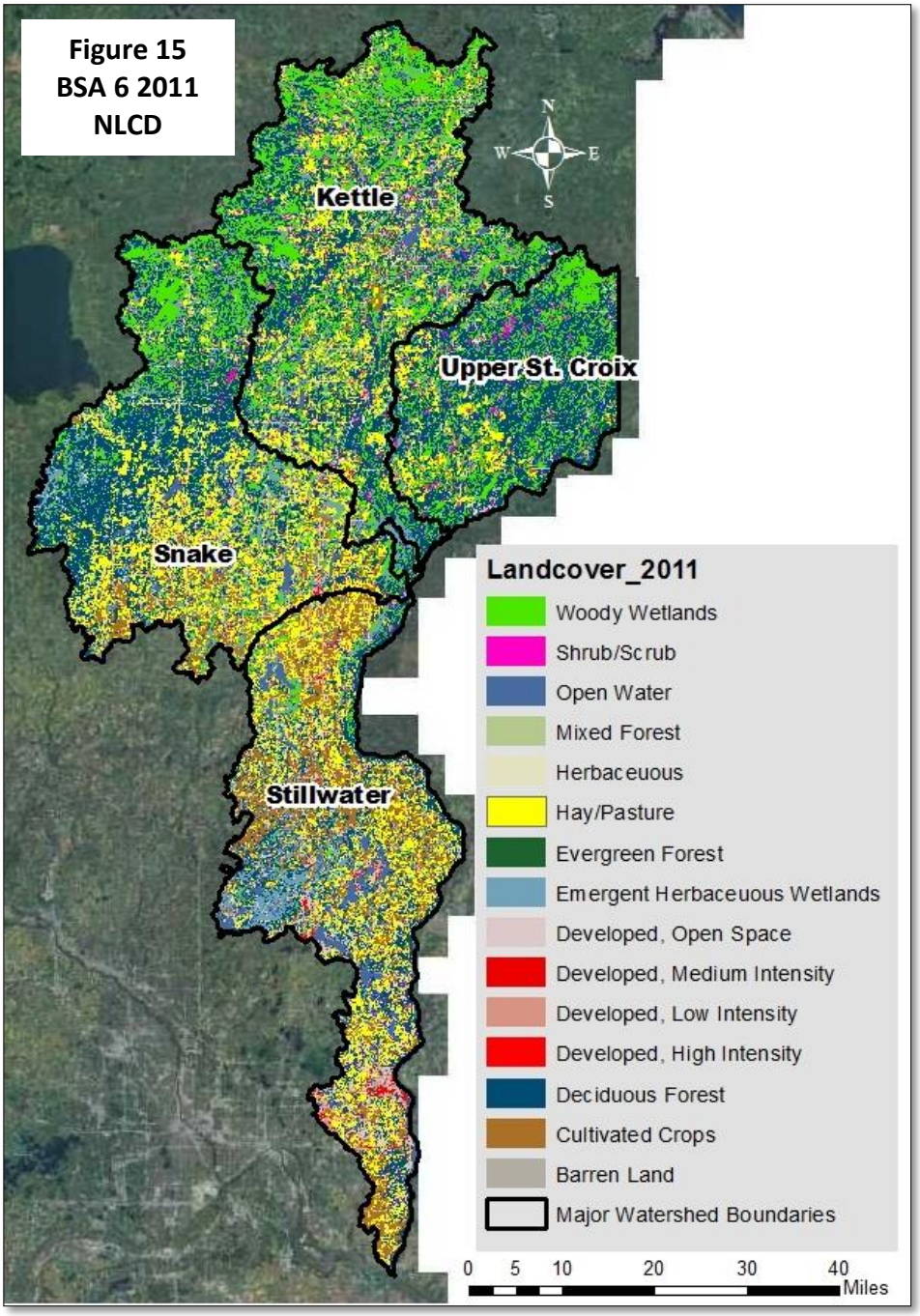
UPSC

Not surprisingly, the UPSC watershed has not been intensively monitored for water quality and a watershed scale assessment has not been completed. According to the MPCA, intensive monitoring was initiated in 2016 but the results of these efforts are not currently available. The MPCA has identified the major concerns in this watershed as water quality, streambank stabilization, stormwater management, and wetland management.

Land Cover

The National Land Cover Data (NLCD) data sets from 2001 and 2011 were used to assess current land cover (using the 2011 data) and changes in land use from 2001. The NLCD uses a nation-wide system of sixteen land cover classifications at a 30-square meter scale. This consistent classification system allowed a comparison of land cover over a ten year period to identify trends and other changes in land cover across the BSA 6 that may be relevant for wetland mitigation planning purposes.

Figure 15 shows the 2011 land use classes for BSA 6. It is clear from the map that the northern third of the watershed contains more forested areas and significantly less agricultural and developed areas. Consistent with other baseline condition data evaluated for this CPF, the middle third of the watershed is a transition area between the undeveloped north and the developed south. Based on visual observations of the 2011 data

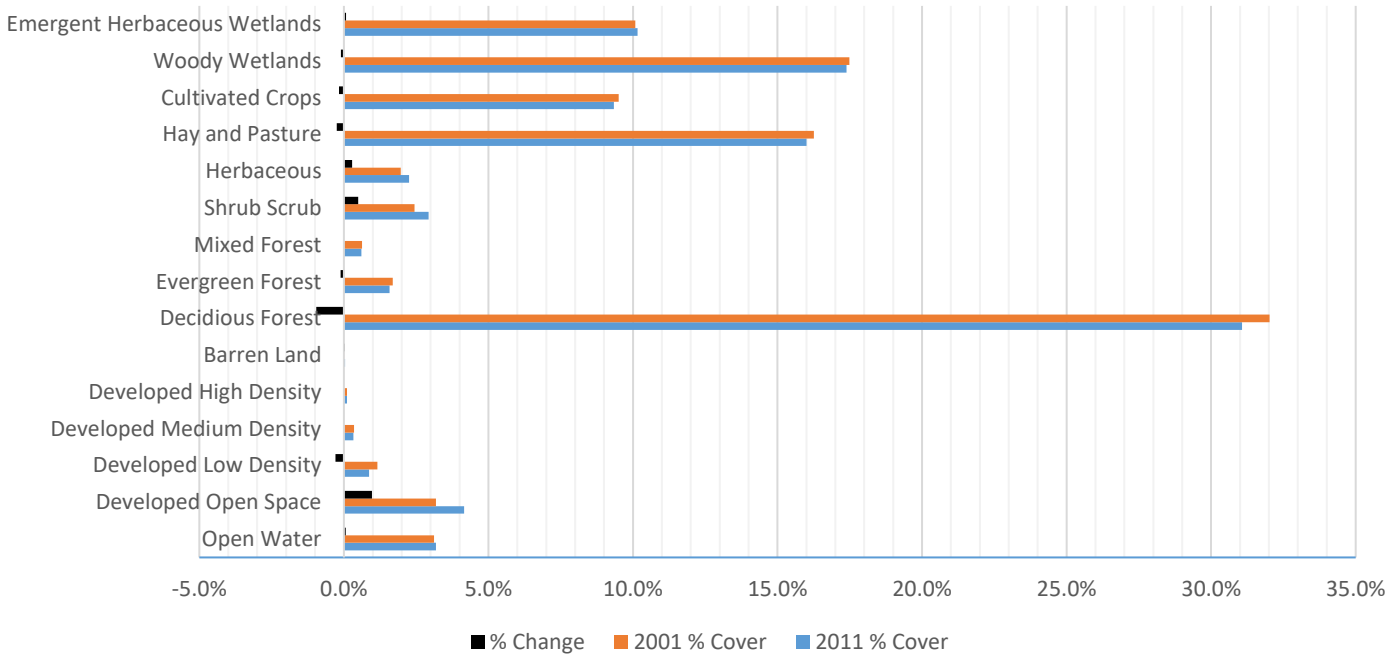


it contains a large amount of agricultural and cultivated crop areas along with various developed classes along the primary transportation corridors. In the southern third of BSA 6, the land cover classes are hay/pasture, cultivated crops, and developed areas. Forested land cover classes are much less prominent in the south. The Carlos Avery Wildlife Management Area located in the west central portion of the Stillwater watershed is clearly visible as a large area of emergent herbaceous wetlands. Outside of this area, the Stillwater watershed appears to be very fragmented from a natural community perspective.

Trends

A comparison of the 2001 and 2011 land cover classes for BSA 6 is provided in Figure 16. The comparison of these two data sets shows that, for the most part, land cover did not change significant during this ten year period except for a couple of situations. The most common land cover in BSA 6 in each dataset is deciduous forest followed by woody and herbaceous wetlands, hay and pasture, emergent and herbaceous wetlands, and cultivated crops. Developed open space shows the largest change of any land cover class, an increase of 0.97%, followed by a decrease in deciduous forest (0.95%), and an increase in land cover classified as shrub shrub (0.49%). Land cover classes that include wetlands (emergent herbaceous wetlands and woody wetlands) showed a net decrease of 0.02% (448 acres) throughout BSA 6.

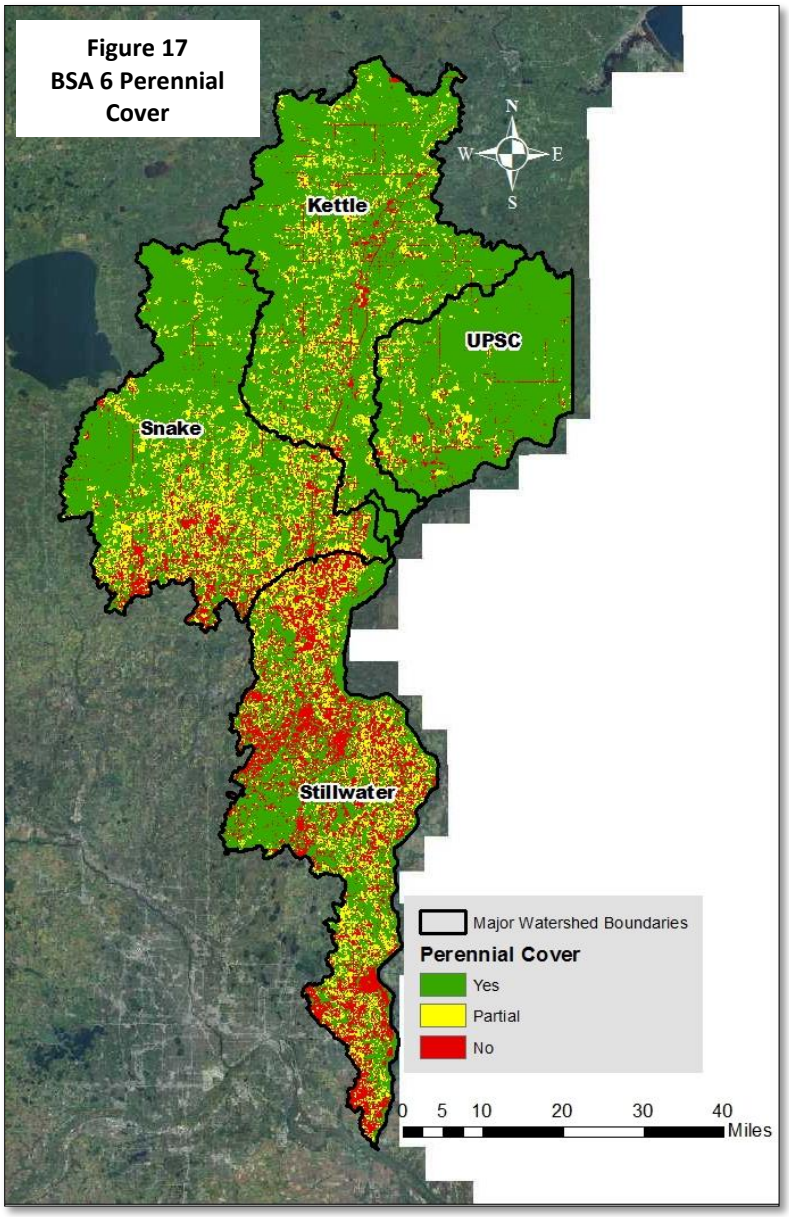
Figure 16
BSA 6 2001 vs 2011 Landcover



Perennial Cover

The 2011 NLCD data was also used to assess the degree to which development in the watershed has removed perennial vegetation. Vegetative cover is an important characteristic when assessing watershed health because as perennial vegetation is removed there is greater potential for erosion, soil loss, flooding, water quality degradation, and loss of habitat. For this analysis perennial cover is considered any land cover not labeled developed or in any form of agricultural use. Hay and pasture land cover was classified as a partial non-perennial designation because these areas could be in a fallow cycle of crop rotation but would otherwise be considered non-perennial with respect to vegetative cover. The results of the perennial cover analysis are shown on Figure 17.

The perennial cover analysis shows a decreasing trend of perennial cover from the northern areas of the BSA to the south. The UPSC and Kettle watersheds have 89% and 80.9% perennial cover. Further south and west, the Snake approximately 68.1% perennial cover while the Stillwater has the lowest amount at 45%. The southern portion of the Snake watershed and the northern proportion of the Stillwater form a large area where agricultural land use is dominant. The southern portion of the Stillwater watershed is also an area dominated by non-perennial cover but is a mix of agricultural and development land uses. The UPSC and Kettle have small isolated areas of non-perennial cover along travel routes and cities but otherwise have perennial vegetation throughout.



Sensitive Species and Plant Communities

Sensitive species and plant communities are those that have been recognized by natural resource management agencies as unique to a geographic area or have been determined to be in decline. These types of resources present both opportunities and constraints for CPF development because watershed scale planning can benefit these species/communities where the goals of the CPF line up with the needs of a particular species or habitat. Information on the presence of federally recognized sensitive species was obtained from the U.S. Fish and Wildlife Service's Environmental Conservation Online System reports for the counties in BSA 6 (Table 7). State listed sensitive species information (endangered, threatened, special concern, and those in greatest need of conservation) was obtained from the DNR's Native Plant Community (NPC) map and Conservation status rank information.

Table 7
Federally Listed Threatened and Endangered Species Identified in BSA 6

Species	Status	Location in BSA 6	Habitat
Canada lynx (*Lynx canadensis*)	Threatened (fed)	Carlton, Pine	Northern forested areas
Gray wolf *(Canis lupus)*	Threatened (fed)	Carlton, Pine	Northern forested areas
Northern long-eared bat *(Myotis septentrionalis)*	Threatened (fed)	Throughout BSA 6	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
Rusty patched bumble bee *(Bombus affinis)*	Endangered (fed)	Chisago, Washington	Grasslands with flowering plants from April through October, underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.
Higgins eye pearlymussel *(Lampsilis higginsii)*	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers
Snuffbox *(Epioblasma triquetra)*	Endangered (fed)	Chisago, Washington	St. Croix River
Spectaclecase *(Cumberlandia monodonta)*	Endangered (fed)	Chisago, Pine, Washington	Mississippi and St. Croix Rivers
Winged mapleleaf *(Quadrula fragosa)*	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers

Outside of the mussel species that are found in the St. Croix River, none of the federally identified species are associated primarily with aquatic resources and are not likely to be found in wetlands or in areas associated with wetland restoration projects. Canada lynx, gray wolf, and northern long-eared bat may utilize wetlands (particularly forested wetlands) at times during the year but these species are most typically found in upland habitats.

Identification of sensitive plant communities was based on Minnesota's Native Plant Community Classification (Version 2.0). The classification is hierarchical and based strongly on plant species composition developed through an analysis of extensive field data collected from forests, prairies, wetlands, and other habitats. The

NPC types and subtypes recognized in Minnesota have been assigned conservation status ranks (S-ranks) that reflect the risk of elimination of the community from Minnesota. There are five ranks:

S1 = critically imperiled
S2 = imperiled
S3 = vulnerable to extirpation
S4 = apparently secure; uncommon but not rare
S5 = secure, common, widespread, and abundant

A range in rank (for example, S1S2) indicates there is uncertainty in conservation status but it falls within a given range. Possible S-ranks (for example, S1 or S2) are listed for NPC subtypes based on the S-rank of the NPC type.

These ranks are determined using methodology developed by the conservation organization NatureServe and its member natural heritage programs in North America. S-ranks were assigned to Minnesota's NPC types and subtypes based on information compiled by DNR plant ecologists on: 1) geographic range or extent; 2) area of range occupied; 3) number of occurrences; 4) number of good occurrences, or percent area of occurrences with good viability and ecological integrity; 5) environmental specificity; 6) long-term trend; 7) short-term trend; 8) scope and severity of major threats; and 9) intrinsic vulnerability.

The analysis of NPC types for the CPF focused on the subtypes assigned a ranking of S3, S2, or S1. There are 37,853.1 acres of native plant communities that have been assigned one of these conservation status ranks in BSA 6. The Stillwater watershed has the most total acres designated (14,971.2) followed by the Upper St. Croix (10,735.1 acres), Snake River (6,778.7 acres), and the Kettle River (5,368 acres). The Stillwater watershed also had the largest amount of wetland NPCs designated S1, S2, or S3 with 8,796.7 acres attributable primarily to the *Black Ash - Yellow Birch - Red Maple - Basswood Swamp* (WFn55b), *Black Ash - (Red Maple) Seepage Swamp* (WFs57a), and *Southern Tamarack Swamp* (FPs63a). As observed with other BSA characteristics there is a north/south gradient with respect to the types of NPCs identified in BSA 6 and their distribution. Several of the NPCs identified in the Stillwater major watershed are at the northern edge of their range and are not found in the more northern major watersheds in BSA 6.

Of the eighteen NPCs identified as either S1, S2, or S3 only one has a designation containing S1, the *Black Ash - (Red Maple) Seepage Swamp* (WFs57a) with a designation of S1S2. This plant community is found throughout the BSA but is most common in the Stillwater major watershed. It occurs on strongly rolling to steeply dissected terrain where there is sufficient relief for groundwater to upwell or discharge laterally in springs or broad zones. Most often these seepage areas are present on level alluvial terraces below steep slopes with exposed bedrock aquifers; less often, they develop in regions of deep glacial drift where groundwater flows through highly permeable aquifers and emerges at the ground surface. In all settings, springheads and rivulets with continuously flowing cold groundwater are evident. A summary of the wetland NPCs with S1, S2, or S3 rankings is provided in Table 8. Maps showing the location of these areas are provided in Appendix C.

Table 8 Native Plant Community Summary for Wetland Subtypes					
Native Plant Community	**S-rank**	**UPSC**	**Kettle**	**Snake**	**Stillwater**
APn91b - Graminoid Poor Fen (Basin)	S3		180.0	17.1	
FFn57a - Black Ash - Silver Maple Terrace Forest	S3	373.1	426.7	802.0	
FFn67a - Silver Maple - (Sensitive Fern) Floodplain Forest	S3	382.7	65.8	149.1	233.3
FPn72a - Rich Tamarack Swamp (Eastcentral)	S3	164.3	282.1	1,111.0	
MRn83a - Cattail - Sedge Marsh (Northern)	S2			54.8	
WFn55b - Black Ash - Yellow Birch - Red Maple - Basswood Swamp (Eastcentral)	S3	1,554.0	221.0	2,431.2	4,057.5
WFs57a - Black Ash - (Red Maple) Seepage Swamp	S1S2	122.6	20.3	35.6	1,358.0
OPn91b - Graminoid Rich Fen (Water Track)	S2 or S3		82.2		
WFn74a - Alder - (Red Currant - Meadow-Rue) Swamp	S3	265.8	167.8		
WMs83a - Seepage Meadow/Carr	S3		4.2		5.7
WFn53b - Lowland White Cedar Forest (Northern)	S3	30.6			
APn90b - Graminoid Bog	S2 or S3 or S4				4.7
FFs59c - Elm - Ash - Basswood Terrace Forest	S2				77.1
FFs68a - Silver Maple - (Virginia Creeper) Floodplain Forest	S3				882.6
FPs63a - Tamarack Swamp (Southern)	S3				2,037.4
MRn93b - Spikerush - Bur Reed Marsh (Northern)	S2				126.9
WMs83a1 - Seepage Meadow/Carr, Tussock Sedge Subtype	S3				11.2
WPs54b - Wet Prairie (Southern)	S2				2.2
TOTAL ACRES WITH S1, S2, or S3 RANKING (WETLAND and UPLAND)		**10,735.1**	**5,368.0**	**6,778.7**	**14,971.2**
TOTAL WETLAND ACRES WITH S1, S2, or S3 RANKING		**2,893.0**	**1,450.1**	**4,600.8**	**8,796.7**
WETLAND ACRES AS S1		0	0	0	0
WETLAND ACRES AS S1S2		122.6	20.3	35.6	1,358.0
WETLAND ACRES AS S2		0	0	54.8	206.2
WETLAND ACRES AS S2 OR S3		0	82.2	0	0
WETLAND ACRES AS S3		2,770.4	1,347.6	4,510.4	7,227.8
WETLAND ACRES AS S2 OR S3 or S4		0	0	0	4.7

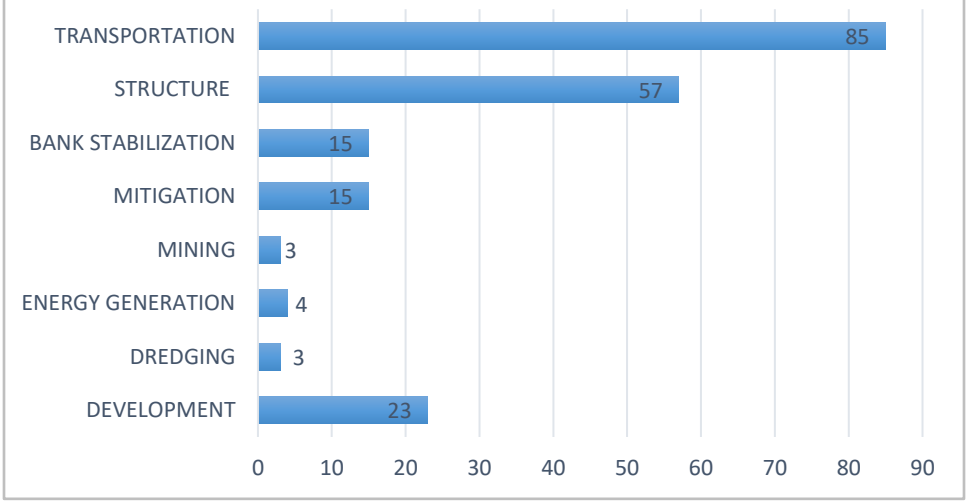
Permitting

Permitting data from the U.S. Army Corps of Engineers, St. Paul District Clean Water Act Section 404 permitting program for fiscal years 2011-2016 was obtained and analyzed to: (1) determine the work types that most commonly result in regulated impacts to aquatic resources; (2) identify permit intensity per major watershed; and (3) assess the amount of impacts authorized by Corps' permits during this period.[3] The results of the permitting analysis are discussed in the following paragraphs.

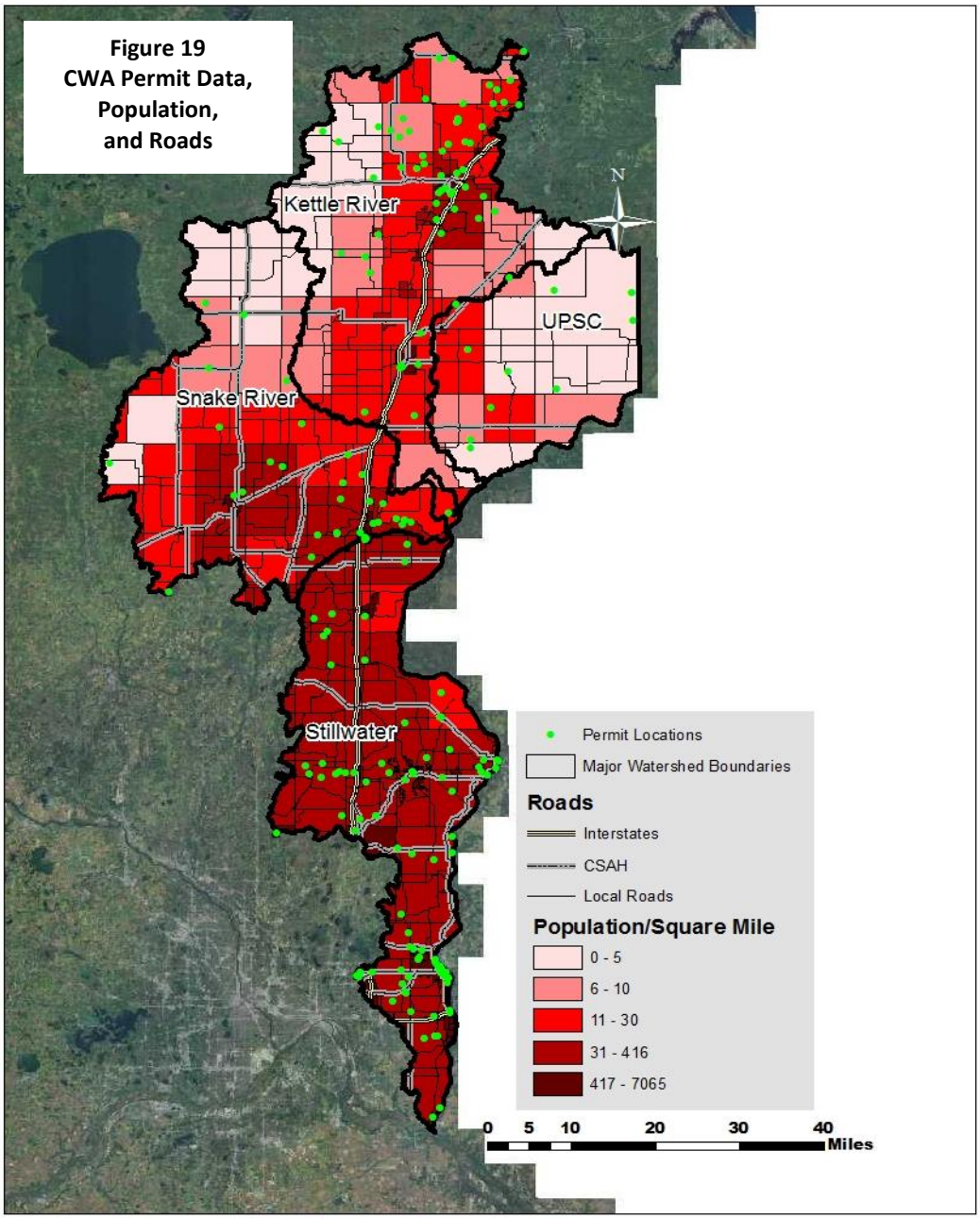
[3] All data is from permits finalized from October 1, 2012 through September 30, 2016. This data does not include non-reporting/no pre-construction notification activities where a permittee was not required to submit an application or preconstruction notification to the Corps.

The work type categories in the Corps' permitting data were variable and contained a high number of classes that represented similar types of work. For ease of analysis and illustration, the types were consolidated into eight major types. These include the following: transportation, structures, bank stabilization, mitigation, mining, energy generation, dredging, and development. From 2011-2016, 205 permit actions were processed within BSA 6 (Figure 18). The highest number of permits issued were for transportation projects, followed by projects involving structures, which, for the most part, were also transportation related projects.

Figure 18
CWA Section 404 Permit Work Types
2011-2016

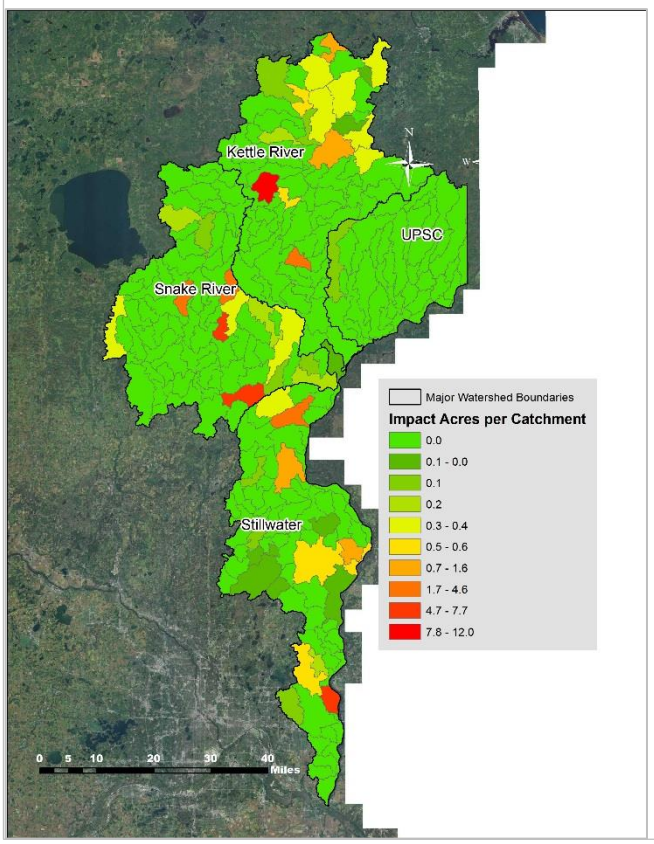


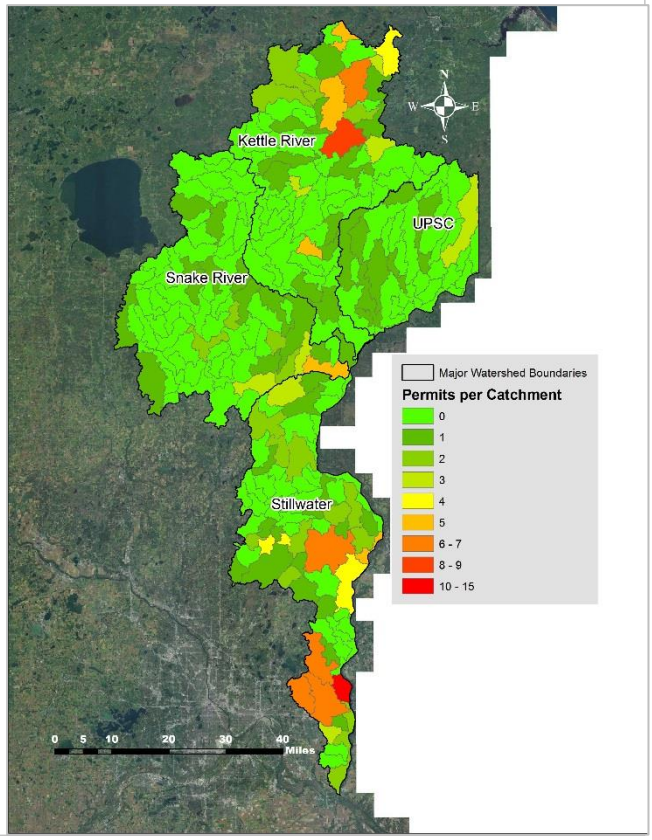
Since permit activity is often closely correlated with population density and transportation infrastructure, the permit data was plotted with these two data sets. Not surprisingly, the areas of highest population density in BSA 6 are home to the majority of the permitting actions. The Stillwater watershed, with the highest population density and the most miles of major roadways, has the highest number of permit actions (96) which amounts to 47% of the total number of permits issued during this time period. The Kettle River had the second most permit actions (64), or 31% of the total. Permit actions were clustered primarily around the cities of Moose Lake and Sandstone where Interstate 35 intersects with major county arterial roads. The Snake and UPSC River watersheds show lesser amounts of permit activity concentrated near major roadways and cities.



Permit location and impact data for BSA 6 was also analyzed at the catchment scale to provide more detailed information regarding the location and degree of regulated impacts. The figure below shows the number of permits and the amount of impact for each catchment in BSA 6. The Stillwater watershed's southern region has the highest number of permits and impact. Since this area has the highest population and more intense development pressure and associated infrastructure, these results are not unexpected. The Snake River watershed does not have any catchments with a high concentration of permit actions, however, there are several where impact amounts are at the higher end of the scale for BSA 6, an indication of higher amounts of impacts associated with the few documented permit actions. In the north portion of BSA 6, the concentration of permits in the Moose Lake area discussed previously also translated into higher amounts of impact relative to other catchments. Very few impacts were authorized by Section 404 permits in the UPSC watershed resulting almost exclusively in the green tones in Figure 20.

Figure 20
BSA 6 Section 404 Impacts and Permit Density by Catchment





Summary of Baseline Conditions

The baseline condition assessment for BSA 6 considered seven characteristics that together provide a general overview of the condition of aquatic resources in the BSA and factors that may be affecting their quality and quality. These characteristics include wetlands, lakes, watercourses, water quality, land use, sensitive species, and permitting. The baseline condition assessment revealed a significant difference in the quantity and quality of aquatic resources generally following a north to south gradient. In the north, both upland and aquatic resources are more intact, there is less anthropogenic disturbance, less fragmentation and higher quality resources (assuming that resource quality can be inferred from watershed landscape scale assessments of water quality, amount of ditched wetlands, and land use patterns). In the central portion of the watershed, forested lands give way to cropped land and pasture along with more concentrated developed areas around transportation corridors. The degree of disturbance evidenced by ditched wetlands and altered courses is significantly greater in the southern Kettle River major watershed and the Snake River major watershed. The southernmost major watershed in BSA 6, the Stillwater, is the most degraded of the four and shows the adverse effects of being located on the northeastern edge of the Twin Cities metropolitan area. The Stillwater major watershed showed more evidence of impacts than the other major watersheds in every factor evaluated in the baseline condition assessment. However, it still contains a significant amount of aquatic resources with respect to lakes, watercourses, and the extent of wetlands remaining.

Aquatic Resource Loss

The Federal Mitigation Rule requires an analysis of historic resource loss in the geographic service area that the CPF addresses. A discussion of wetland condition based on one form of hydrologic alteration (ditching) was provided in the baseline condition section of this CPF. That information will not be repeated in this section. Instead, this section will focus on wetland loss with respect to acres of loss using the pre-settlement condition as the baseline for the loss evaluation. This section also includes an evaluation of how wetland banking has factored into managing the loss of wetlands over the past twenty years from a regulatory program perspective (through compensatory mitigation requirements).

Wetland Loss

One of the most frequently utilized metrics for assessing watershed health is the amount of loss or degradation of aquatic resources over a specified period of time. Most often these analyses are conducted with the baseline condition established as the time of European settlement or slightly thereafter depending on the availability of information to document a baseline condition. With respect to wetlands, this type of analysis is frequently accomplished by comparing the extent of hydric soils in the watershed to the most current wetland mapping available. Unfortunately, this method is not accurate for the St. Croix watershed because the county level soils data for Pine County, which is 40% of the BSA, is not complete. Without the county level data, a less refined state level data set must be used which increases the uncertainty associated with this analysis, particularly for major watersheds that include large portions of Pine County (UPSC, Kettle, and Snake). The analysis was completed by first estimating the pre-settlement extent of wetlands by selecting soil map unit polygons that had an 80% or greater hydric soil rating if using the county level data or if identified as hydric for the state level data. Next, the current extent of wetlands in the BSA was estimated using the palustrine class from the 1980-1986 NWI. The two datasets were then combined using GIS and the overlap between the NWI and the mapped soil polygons was identified and eliminated. The remaining soil polygons were then identified as areas of wetland loss and saved as a unique file. The results of this analysis are provided in Table 9.

Table 9
Calculated Wetland Loss Using NWI and Hydric Soil Data

Watershed	Watershed Size (acres)	Hydric Soils (acres)	Wetland Loss (acres)	Wetland Loss (%)
UPSC	347,719	108,384	60,945	56.2
Snake River	643,542	215,118	77,081	35.8
Kettle River	672,924	171,643	45,496	26.5
Stillwater	585,735	145,966	68,771	47.1
BSA	2,249,920	641,111	252,293	39.4

The effects of the state level soil data are clearly evident in Table 8. The UPSC watershed, which has been shown to be the least disturbed and generally most intact watershed based on the factors examined in this CPF, shows the highest amount of wetland loss at 56.2%. Based on agency experience and familiarity with this area, we are confident this number greatly overestimates the amount of loss in this watershed. Since the UPSC watershed is located entirely within Pine County these results are not unexpected. The results for the Kettle River watershed are also likely skewed towards more loss than actually has occurred since 53% of this

watershed is located in Pine County. The estimates for the Snake and Stillwater watersheds are more in line with what was expected based on agency experience although there is most likely a measurable influence from the soils data on the result for the Snake River watershed.

In light of the obvious shortcomings of the wetland loss estimate, other sources of information were reviewed to further assess the degree to which wetlands have been removed from the landscape in BSA 6. In 1984, the University of Minnesota Center for Urban and Regional Affairs published a document that estimated the pre-settlement and, at the time, current extent of wetlands in each country of the state (referred to as the Anderson and Craig report). This report was used to establish the pre-settlement areas that are incorporated into certain operational aspects of the Minnesota Wetland Conservation Act. Although the report is nearly thirty-five years old, it does provide meaningful information about the extent of wetlands in this BSA at the time the report was authored. The wetland loss data in the report was provided on a county basis which then required some manipulation to present on a watershed basis. To accomplish this, the area within each major watershed was broken down by county and the amount of pre-settlement and current wetland acres in these areas was derived based on the information in Anderson and Craig report. This required an assumption that the pre-settlement and current wetlands reported in Anderson and Craig were uniformly distributed across each county which is likely not the case. The results of this analysis are provided in Table 10.

Table 10
BSA 6 Calculated Wetland Loss Using Anderson and Craig 1985

Watershed	Watershed Size (acres)	Pre-settlement Wetlands (acres)	Wetland Loss (acres)	Wetland Loss (%)
UPSC	347,719	116,668	9,241	8
Snake River	643,542	196,017	20,026	10
Kettle River	672,924	215,835	16,998	8
Stillwater	585,735	107,916	33,527	31
BSA	*2,249,920*	*636,436*	*79,792*	*13*

The loss analysis based on the Anderson and Craig report suggests that overall the BSA has experienced an approximate 13% loss of wetland acreage from the pre-settlement period through approximately 1980. The highest losses within a major watershed were in the Stillwater watershed which is what is expected based on the population density and degree of landscape alteration in that area. This assessment also suggests that the watersheds that are located the furthest north, the UPSC and Kettle River watersheds, have the least amount of loss which is also what is expected based on the other data evaluated in this CPF.

The loss calculations in Table 8 are very different from those in Table 9. Each has limitations based on the source(s) of the data and assumptions that were made in order to produce an estimate. Since cumulative loss is an important consideration in assessing watershed health and for strategic siting of mitigation sites additional analyses were conducted to attempt to substantiate, to some degree, one of the wetland loss estimates.

Wetland loss generally correlates well with the amount of landscape disturbance from urban development and conversion to agricultural use, in particular row cropping. Table 11 presents the results of the wetland loss assessments in the context of land cover. The fifteen cover classes in the 2011 NLCD were consolidated into the five categories shown in the table to differentiate between land uses that could result in wetland loss

and those typically do not. The categories generally associated with activities that result in wetland loss are shaded gray for illustration purposes. Assuming the correlation between land use type and wetland loss is valid, the data in the table supports the loss estimates based on Anderson and Craig over those obtained from the estimate relying on soil mapping and the NWI. The increase in wetland loss between watersheds in Anderson and Craig moves in the same direction as the increase in the amount of land classified as developed or in agricultural use. Therefore, these estimates appear to be a more reliable although it has to be understood that the data from which it was obtained is dated and would not be an accurate assessment of actual wetland loss based on watershed conditions in 2018. However, the land use cover data does support a conclusion that wetland loss in BSA 6 is highest in the Stillwater watershed, decreases to some degree in the Snake watershed, and is even less in the Kettle and UPSC watersheds.

Table 11
BSA 6 Wetland Loss Determinations and Land Cover Classifications

	Wetland Loss Method		Land Cover Classification				
watershed	Hydric Soils/NWI	Anderson and Craig	Water	Development	Forest	Wetland	Agriculture
UPSC	56.2	8	1.2	2.1	48.5	39.3	8.9
Kettle	26.5	8	2.7	4.1	33.9	44.3	15
Snake	35.8	10	1.8	4.2	35.3	31.1	27.7
Stillwater	47.1	31	6.5	10.6	21.2	17.3	44.4

Wetland Banking Analysis

As part of the CPF development, BWSR conducted an analysis of wetland banking in BSA 6 to assess how this form of wetland replacement was being used to offset wetland impacts authorized under WCA and Section 404. The analysis relied on data obtained from the State of Minnesota Wetland Bank from 1996 through 2017 primarily through the processing of wetland bank transactions. The analysis is conducted at a fairly coarse scale because of limitations associated with data collected during the approximate 20 year period of record.[4] However, even at a coarse scale, the analysis is useful in understanding how wetland banking has been operating in BSA 6 as a means of informing decisions about how and where to locate wetland mitigation sites in the future.

Status

From the date the wetland banking program was created in 1996 to the present day, seventeen wetland banks have been established in BSA 6. Together, these banks have resulted in the deposit of 796.4 wetland credits. They are generally concentrated near the metro area with 15 of the 17 located in the Stillwater Watershed and the remaining two located in the southern portion of the Snake River Watershed. The wetland banks located in BSA 6 are summarized in Table 12.

[4] A comparison by type of impacted wetlands and replacement wetlands could not be completed because of limitations associated with the data collected by the regulatory agencies.

Table 12 Approved Wetland Banks in BSA 6								
Name	Type	Major	County	Year Established[1]	Size	Status	CWA[2]	WCA
Sandager 1	Private	Stillwater	Chisago	1995	1.5	Sold out	N	Y
Sandager 2	Private	Stillwater	Chisago	1997	13.6	Active	Y	Y
Swenson	Private	Stillwater	Washington	2000	8.8	Sold out	N	Y
Palme	Private	Stillwater	Isanti	2001	21.2	Sold out	N	Y
Goertz	Private	Stillwater	Chisago	2002	37.5	Sold out	N	Y
White	Private	Stillwater	Washington	2003	1.01	Active	N	Y
Brown's Creek	LGRWRP	Stillwater	Washington	2004	10.26	Sold out	N	Y
Nelson	LGRWRP	Snake	Kanabec	2004	148.4	Sold out	Y	Y
Bald Eagle	Private	Stillwater	Washington	2006	2.76	Active	Y	Y
Strandlund 1	Private	Stillwater	Anoka	2007	16.08	Sold out	Y	Y
Mold Family Trust	Private	Stillwater	Chisago	2007	50	Active	Y	Y
Pryor	Private	Stillwater	Chisago	2007	56.1	Active	Y	Y
Holmstrom	Private	Stillwater	Chisago	2008	9.11	Active	Y	Y
Janet Johnson	LGRWRP	Stillwater	Chisago	2008	298.6	Active	Y	Y
Strandlund 2	Private	Stillwater	Anoka	2012	15	Active	Y	Y
South Fork	Private	Snake	Kanabec	2013	78.28	Active	Y	Y
Wildflower Shores	Private	Stillwater	Washington	2016	11.034	Active	N	Y
[1] – Based on first deposit of credits into the MWB. [2] – "Y" indicates that at least some of the credits from the bank were federally approved.								

As of April 2020, the balance of wetland credits in BSA 6 was 79.4, which includes 36.3 federally approved credits and 43.1 state only approved credits. The total amount of federally approved credits includes 3.8 credits in LGRWRP accounts and 17.7 credits that have been purchased and placed in a transfer account but not yet applied towards a mitigation requirement. Removing these credits from the pool of federally approved credits leaves approximately 14.8 federally approved credits that are potentially available for sale on the private banking market. The majority of these credits are associated with the South Fork Bank in Kanabec County (14.2 credits). The 14.8 federally approved credits are spread amongst five different banks and include the following types shallow marsh, sedge meadow, deep marsh, open bog, hardwood swamp, fresh (wet) meadow, shrub-carr, wet to wet mesic prairie, and upland buffer. The most abundant wetland credit type is fresh (wet) meadow which accounts for approximately 92% of the available federally approved credits.

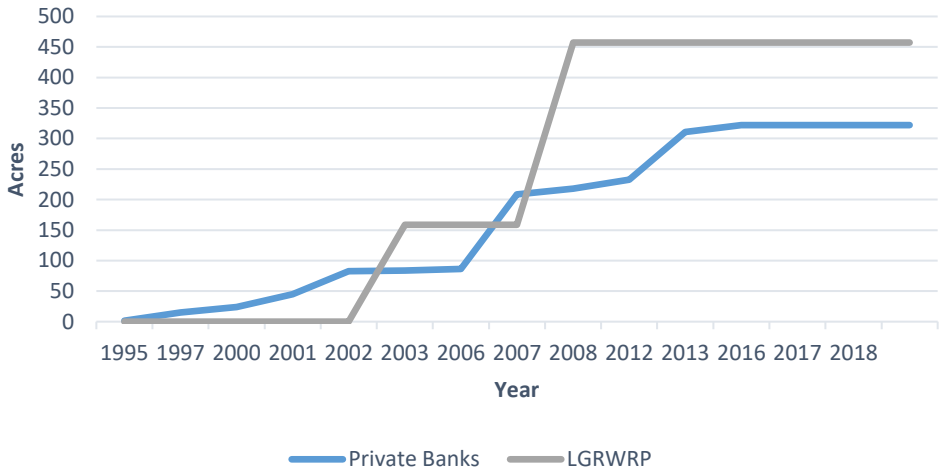
The 3.8 federally approved credits in LGRWRP accounts in BSA 6 are associated with the Janet Johnson bank in Chisago County. This total includes 1.34 fresh (wet) meadow credits and 2.42 deep marsh credits. There are currently no LGRWRP wetland bank sites in BSA 6 that are anticipated to have additional credit deposits nor are there any potential LGRWRP wetland bank sites in development that would to the credit totals within the next two years.

Credit Generation and Use

Credit generation in BSA 6 was assessed by examining the cumulative acreage in wetland banks for both private banking and the LGRWRP. Acreage was used in lieu of credits because of the differences between state and federal crediting and the difficulty with obtaining information on credits from the early years of the wetland banking program. However, information on credit amounts is provided in this assessment whenever

possible. The assessment focuses primarily on the preceding ten year period since activities within this timeframe will have the greatest effect on wetland banking today. The preceding ten years is also the standard BWSR uses for determining average annual demand for the LGRWRP and is thus consistent with analyses currently in place. As shown by the gray line in Figure 21, wetland bank acres have not been added to the LGRWRP since 2007 when the Janet Johnson bank was approved. With respect to credit generation, the most recent deposit of credits for the LGRWRP was made in late 2014 with the final deposit for the Janet Johnson bank. The number of credits generated for the LGRWRP program in BSA 6 has not changed since that time. For private banking, approximately 113.4 acres have been added to the total for private banks in BSA 6 since 2008. The additional acreage comes from four banks. Assuming each of these banks achieves their full performance level and the maximum number of projected credits are approved for deposit this would generate approximately 62.9 credits consisting of 54.1 credits approved under both the CWA and WCA and 8.8 credits approved only under WCA (some of these credits have already been released). Thus, over this ten year period approximately 5.4 federally approved credits have been generated each year. This figure is expected to decline in future years because no private banks have been established since 2013 and the number of credits released from existing banks is not expected to be enough to sustain this average.

Figure 21
Cumulative Acreage in BSA 6 Wetland Banks



Data from the MWB also were used to assess the degree to which impacts that occurred in BSA 6 were offset with wetland credits from banks located within the BSA. This analysis relied on data from the MWB database that was submitted on transaction forms as part of the WCA replacement approval process. The data represents the number of credits withdrawn from bank accounts located in BSA 6 in order to satisfy a mitigation requirement and does not take into consideration project specific mitigation. This data should not be considered an estimate of the total acreage of wetland impacts since it represents credits that were derived using replacement ratios (the acreage will almost always be less than or equal to the credits withdrawn because ratios are applied to impact acreages to determine the mitigation requirement). In cases where the impact location was not specified in the database the impact acreage was identified as “unknown” but was represented in the summary. Information that would allow a comparison between impacted wetland type and credit type are not available in the MWB database and is therefore not addressed in this analysis. The data was broken down into LGRWRP activities and non-LGRWRP activities to identify any significant

differences between the BWSR administered program and private banking. The results of this analysis are summarized in Table 13.

Table 13
Source of Wetland Bank Credit Used as Mitigation for Impacts in BSA 6

Activity Type	1	2	3	4	5	6	7	8	9	10	Unknown	Total	% In Place[1]
LGRWRP	39.7	0.8	39.8	0.5	38.9	129.6	21.6	6.1	2.5	0	23.4	302.9	42.7
Non-LGRWRP	0	0	5.3	0.2	10.5	63.8	21.3	0.7	16.5	0	7.6	125.9	50.7
Combined	39.7	0.8	45.1	0.7	49.4	193.4	42.9	6.8	19	0	31	428.8	45.1

[1] – In place refers to impacts in BSA 6 that were mitigated in BSA 6.

Table 13 shows that, with respect to wetland bank activity, the in-place requirement is being met in BSA 6 less than half the time for LGRWRP activities and approximately half the time for non-LGRWRP activities. Because of the higher number of credits used for LGRWRP impacts the combined rate on in-place replacement from wetland banking is only 45.1% which indicates that there is a fairly significant number of wetland impacts that are being mitigated outside of BSA 6. This is not unexpected given the low or non-existent credit balances for both private banking and the LGRWRP. For those impacts where credits were obtained from outside of BSA 6, adjacent BSAs that are part of the Mississippi River basin (BSAs 5, 7, and 8) were used 38.4% of the time (66.6 credits) for LGRWRP credits and 52.3% of the time (32.5 credits) for non-LGRWRP impacts. The LGRWRP utilized credits from outside the Mississippi River basin for roughly a quarter (26.7%) of the total credits used and 46.6% of the credits obtained from outside of BSA 6. Non-LGRWRP projects utilized credits from outside the Mississippi River basin much less frequently: 4.4% of the total credits used and 8.9% of the total from outside BSA 6.

Summary

The analysis of wetland banking data identified several important facts that will be factored into development of the CPF for BSA 6. First, both the LGRWRP and private banking are experiencing a shortage of available wetland bank credits that will carry into the future based on the current balances and lack of proposed banks. Second, the banks that have been constructed to date are concentrated in the southern, more populated/developed areas of the St. Croix River watershed (Snake and Stillwater major watersheds) which is where aquatic resources are more degraded and where most of the permitting activity is taking place. Third, approximately half of the wetland bank credits used for mitigation for impacts occurring within the watershed have come from outside of the BSA.

Aquatic Resource Loss Summary

The information contained in the baseline condition section of this CPF combined with the wetland loss and mitigation banking assessment indicates that aquatic resource loss from a functional and acreage basis is concentrated in the southern portions of BSA 6, particularly the Stillwater and southern Snake River major watershed. The loss estimates appear to correlate strongly with the amount of agricultural and developed land in these areas. Wetland banks have been located primarily in the areas where the loss has occurred but, from a quantity standpoint, there has been an export of mitigation from the BSA either because the supply of credits has not been sufficient to meet the demand or because regulatory requirements have not prevented the use of credits from outside of the BSA to mitigate impacts occurring within the BSA.

Description of Threats

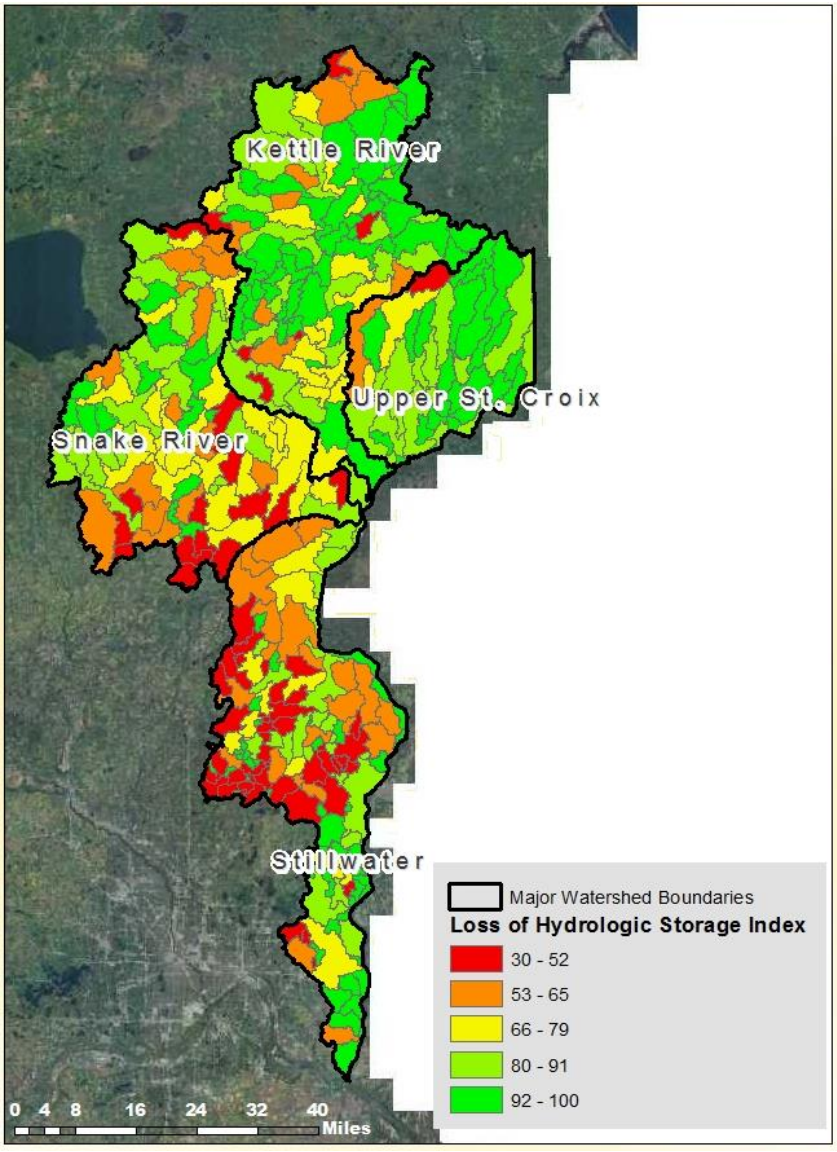
BWSR completed an initial threat assessment for BSA 6 relying on our familiarity with implementing WCA in this watershed in conjunction with published reports and other information. A total of four threats were identified during the assessment. They include loss of hydrologic storage, population growth and urbanization, declining water quality, and shortage of wetland mitigation bank credits. Each of these threats is discussed in the following paragraphs.

Loss of Hydrologic Storage

The ability of wetlands and streams to store water on the landscape has been significantly altered by wetland loss, ditch construction and stream alterations in many areas of the BSA. Changing the capacity of these natural systems results in increased peak flows, lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes (Mitch and Gosselink, 2007) which, in turn, degrades water quality.

The loss of hydrologic storage metric in the WHAF Health Scores was used to assess the degree to which hydrologic storage has been impacted in each catchment in BSA 6. The WHAF loss of hydrologic storage index combines two underlying metrics that represent two ways in which hydrologic storage has changed: the current extent of wetlands relative to the historic extent and the length of altered or straightened streams relative to the total length of stream. Each of these metrics is calculated as a ratio that is then multiplied by 100 to calculate an index score that ranges from 0 to 100. A score of 0 represents the worst condition, a score of 100 represent the best condition. The two metrics were averaged to create a combined index score for hydrologic storage at the catchment scale. The scores range from 0 (all historic storage converted and/or all streams altered) to 100 (all historic storage present and/or all streams are natural). The Loss of Hydrologic Storage Index scores for BSA 6 are provided in Figure 21.

Figure 21 Loss of Hydrologic Storage



From this WHAF health score, it is evident that the most impacted catchments are located in the northern Stillwater and southern Snake watersheds. Many of these catchments have index scores in the 30 – 50 range which indicates that the hydrologic storage capability in these areas has been significantly reduced.

The results of this analysis are consistent with other measures of watershed health including the amount of impaired aquatic resources within the watershed. The two most degraded watersheds are the Snake and Stillwater with more than 500-miles of impaired streams. Conversely, the Upper St. Croix and Kettle have less than 160 impaired miles combined. The data for impaired lakes shows a similar pattern in BSA 6 with more than half the lakes in the Snake and Stillwater listed as impaired. The Kettle River watershed also has a high degree of impairment but it does not appear to track with the lost hydrologic storage metric in the WHAF. The loss of hydrological storage remains a stressor in the Upper St. Croix and Kettle, but just to a lesser degree.

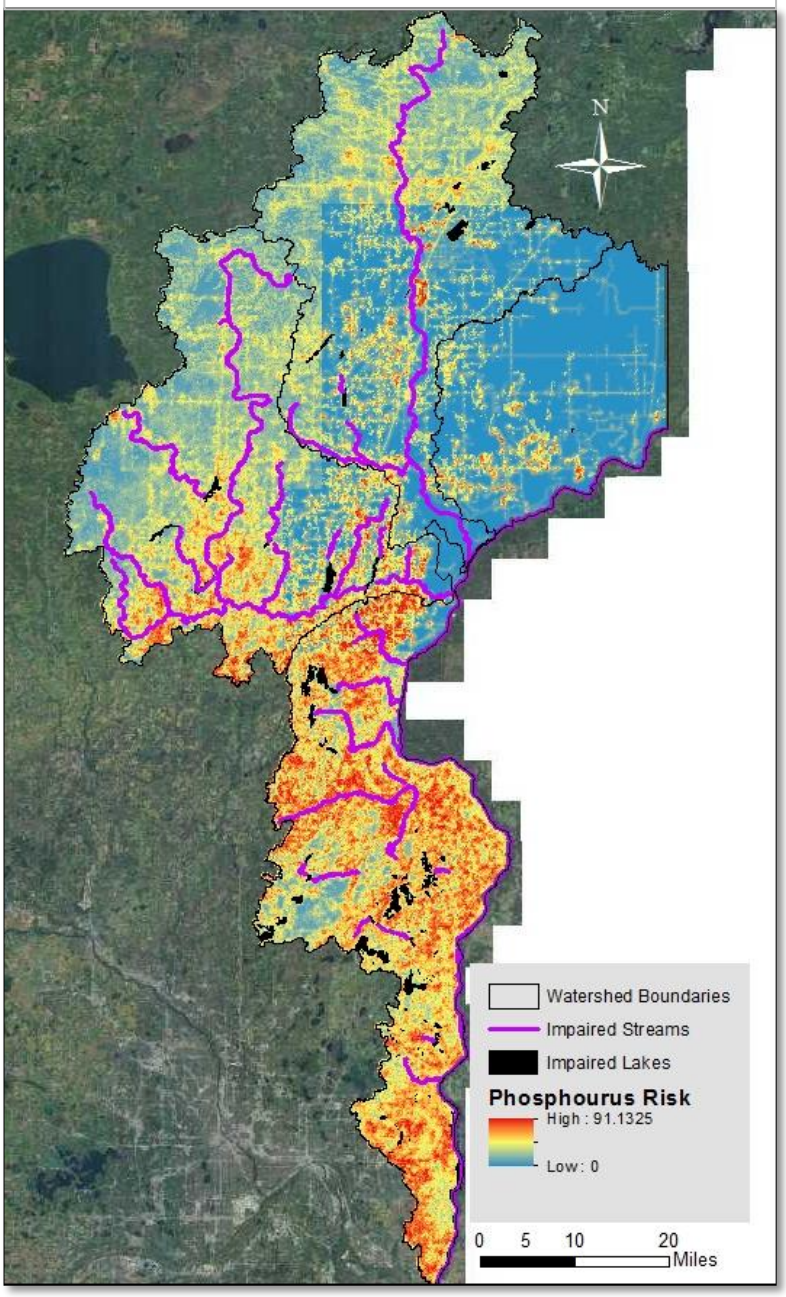
Population Growth and Urbanization

Each major watershed in BSA 6 experienced an increase in population during the period 2000 – 2010 based on United States census data. The increase in population ranged from 6% in the UPSC to 16% in the Stillwater with the Kettle and Snake River seeing 12% and 11% growth respectively. Continued population growth is expected in this part of Minnesota particularly in areas that are closest to the Twin Cities metropolitan area (the Stillwater and Snake River watersheds). On the landscape, population growth results in loss of perennial cover, artificial drainage, fragmentation of habitats, and an increase in impervious surfaces. As formally natural areas are converted to agriculture or urban land uses the landscape's ability to filter and store water is reduced which correlates to increased storm water runoff and loading of pollutants into receiving waters.

As an indicator of urbanization and potential high threat areas, the phosphorus stress layer developed by the MPCA was used to predict anthropogenic stress on water quality in the form of phosphorus inputs across the landscape. The phosphorus stress tool combines the GIS data inputs for land cover (open development, low

density development, medium density development, high density development, pasture, crops, and barren land), distance to roads, distance to feedlots, and population block density into a single stress score. High levels of stress could suggest an increased need for functioning wetlands, whereas low levels of stress could predict areas to maintain wetlands. The phosphorus stress analysis for BSA 6 is provided in Figure 22

FIGURE 22
BSA 6 Phosphorus Risk



There is a significant increase level of phosphorus stress in the southern portion of the BSA, which correlates to the land cover illustrated in Figure 5. Results are similar to wetland loss and altered streams with the Stillwater and lower portion of the Snake having the most risk of contamination. This risk manifests itself in terms of the increased impaired stream miles, and acres of impaired lakes. The northern watersheds show some localized phosphorus stress, but overall is significantly lower than the southern watersheds.

Water Quality Impairments

As discussed in the Baseline Condition section of this CPF, BSA 6 has numerous documented water quality impairments that affect use of the aquatic resources in the watershed and the flora and fauna that depend on them. Restoring the affected waters to a higher quality condition and reversing the trends that led to the impairments is a challenging task. The recognition of this in the form of completed and ongoing TMDLs is positive for the watershed but in the face of increasing population and the resulting land use changes, water quality impairments remain a threat not only in this watershed but in the downstream receiving waters.

Shortage of Wetland Bank Credits

At its core, the watershed approach to wetland mitigation seeks to maintain and improve the quality and quantity of wetlands in a watershed through strategic selection of mitigation sites. One method used to achieve this goal is wetland banking where credits are generated in advance of impacts at locations approved

by regulatory agencies. The credits stem from activities that have met rigorous performance standards established for the bank site. Using these credits to offset impacts that occur within the watershed addresses the quality component of the watershed approach. The quantity aspect is addressed through ratios used to determine the amount required to offset the impact as well as through a robust supply of credits in the watershed. As discussed previously in this CPF, BSA 6 has a shortage of wetland credits that hinders progress toward full implementation of the watershed approach. Currently, there are a total of 79.4 credits available for purchase of which 14.8 are federally approved and available to the public for purchase. Similarly, the LGRWRP has a balance of 3.8 federally approved credits that could be used to offset authorized impacts. Using an average annual demand of 13 credits for the LGRWRP in BSA 6 and 7.4 for non-LGRWRP impacts we estimate that the current supply for the LGRWRP would be exhausted within a year's time while credits available to the public would be exhausted within two years. When these supplies are gone, credits will need to be obtained from other BSAs in order to satisfy mitigation requirements unless project-specific mitigation is a viable option for applicants. Assuming bank credits would be used, over a three-year period the amount of wetland impact that would be replaced with credits from outside BSA 6 would be 42.6 acres assuming a 1:1 replacement ratio. Compounding the credit shortage issue is the fact that there are no wetland banks currently in development in BSA 6 which makes it more of a long-term issue easily extending beyond the three year timeframe used in this estimate.

Stakeholder Involvement Plan

BWSR initiated a stakeholder involvement process as part of the BSA 6 CPF development in February of 2017. A meeting was held with stakeholders in the watershed to familiarize them with the ILF concept, review and approval process, and, specifically the development of the CPF. Attendees at the meeting included staff from the soil and water conservation districts, counties, watershed districts, and the St. Croix River Association. The importance of stakeholder input to CPF development and the prioritization of watershed needs was emphasized during that initial meeting.

A second stakeholder meeting was held on January 22, 2018 to update the stakeholders on development of the CPF and to solicit their input on the watershed condition assessment and the site selection process. BWSR staff provided an overview of the baseline condition summary prepared in support of the BSA 6 CPF and presented the condition assessment that provides a relative comparison of the state of aquatic resources in each major watershed in the BSA. The stakeholders had no specific concerns or comments on the condition assessment. Following the presentation on exiting conditions, BWSR staff solicited input from the stakeholders on criteria that would be useful when identifying and prioritizing potential wetland restoration sites. The stakeholders provided fifteen criteria that could be used in the process. The input from the stakeholders was evaluated by BWSR staff and factored into the catchment identification and prioritization process addressed in the next section of this CPF.

Prioritization Strategy for Selecting and Implementing Mitigation Activities

Statement of Aquatic Resource Goals and Objectives

The primary objective of Minnesota's ILF program is to provide high quality and sustainable mitigation to offset the loss of aquatic resource functions resulting from authorized impacts. This will be accomplished through strategic site selection based on a watershed approach that incorporates stakeholder input. The specific resource goals and objectives for this bank service area are provided below:

- Reverse the trend of wetland mitigation export and improve watershed health by targeting and pursuing high quality wetland mitigation opportunities;
- Provide public value by replacing impacts from smaller individual projects with larger mitigation sites that have greater ecological value;
- Identify and design sites that, to the greatest extent practicable, represent pre-settlement conditions with respect to hydrology and vegetation;
- Establish priorities between the major watersheds based on the condition assessment and input from watershed stakeholders;
- Identify priority areas for mitigation projects within each major watershed based on the condition assessment and input from watershed stakeholders;

Prioritization Strategy

The geographic scale used to identify priority areas for wetland mitigation in this CPF is the catchment. In Minnesota, the DNR has defined catchment to be "the smallest delineated and digitized drainage area mapped by the Minnesota DNR Watershed Delineation Project that contains all land area(s), as well as noncontributing inclusions and water features, upstream from, or between Hydrologic Points of Interest (HPOI) defining other DNR Catchments." The catchment scale was selected for the CPF for two primary reasons. First, the prioritization process can be conducted at a finer scale which allows for more specific identification of areas where wetland mitigation may benefit watershed health. At the same time, the number of catchments in BSA 6 is not excessive and the process can be completed in a reasonable amount of time with meaningful results. Second, the MNDNR has developed large amounts of watershed data at the catchment level that can be easily accessed to support the prioritization process which reduces the time associated with the GIS-based analyses.

BSA 6 is made up of 368 unique catchments distributed across the four major watersheds as follows: Kettle River 100 catchments, Snake River 89 catchments, Upper St. Croix 39 catchments, and Stillwater 140 catchments. The process followed to prioritize catchments where wetland mitigation would have the greatest watershed benefit is described step-by-step in the remainder of this section.

Catchment prioritization criteria were identified through information obtained from stakeholders at two workshops in 2017 and from BWSR staff with experience in watershed planning and wetland mitigation siting. Each criterion was evaluated to assess the availability and suitability of spatially-explicit GIS data to characterize the criterion. Input was also obtained from the Corps of Engineers and other members of the Interagency Review Team during their review of the ILFP prospectus. Ultimately, a larger list of potential criteria was reduced to twelve that could be used to evaluate catchments throughout the BSA. As a general rule, a potential criterion must have had the following qualities to be selected.

- The criterion represents a watershed health characteristic that affects or can be affected by the presence/absence of wetlands.

- The criterion represents a watershed characteristic that is generally present throughout the BSA which allows for comparison between and amongst catchments. There must also be sufficient variation in the criterion throughout the BSA such that comparisons are meaningful.

- GIS data at the catchment level was publicly available for the criterion.

The source of the data for each criterion and the rationales behind their selection are provided in Table 14.

Table 14
Summary of Catchment Prioritization Criteria

Catchment Prioritization Criteria	Rationale for Inclusion
Criterion #1: Areas With High Soil Erosion Potential	Soil erodibility is directly related to water quality because sediment is a common water pollutant. Increased soil erosion and sediment transport to wetlands and water bodies increases turbidity and fine sediment delivery, which impairs aquatic resource function. This criterion was represented using the areas with high soil erosion potential from the Minnesota Department of Natural Resources Watershed Health Assessment Framework (WHAF). The index score combines the inherent erodibility of a soil type (known as K-factor); with the position of the soil on the landscape (slope) to rank each catchment by its erosion potential.
Criterion #2: Areas With Low Amounts of Perennial Cover	Vegetative cover is an important characteristic when assessing watershed health because as perennial vegetation is removed there is a greater potential for erosion, soil loss, and flooding, water quality degradation, and loss of habitat. Perennial cover was considered to be any land cover not identified as developed or in any form of agricultural use based on the 2011 National Land Cover Data. Hay and pasture was considered to be perennial cover. The amount of land with perennial cover was divided by the total catchment area and then multiplied by 100 to create the final ratio.
Criterion #3: Areas With Poor Habitat Connectivity	Riparian refers to the land immediately adjacent to water features such as lakes and rivers. Access to this area is important to aquatic and terrestrial species particularly during seasonal high flow or flood events. Riparian lands are also important year round as travel corridors and habitat connectors, often providing the only remaining natural land cover in developed landscapes. The Riparian Connectivity Index in the WHAF compares the amount of cropped or developed land cover to the amount of open land in the riparian area. The percent agricultural and developed land relative to the total riparian area was

	calculated and scored. Scores range from 0 (all lands within 200 meters of streams or in floodplains are in annual cropland or urban cover) to 100 (all lands are neither urban nor annual agriculture).
Criterion #4: Areas With More Degraded Wetlands (Ditched Wetlands)	Wetland functions are affected by activities that degrade, but do not necessarily remove, wetlands from the landscape. Assessing the degree to which existing wetlands have been altered by ditching provides insight into the quality of the wetlands remaining in the catchment. The acreage of ditched wetlands in each catchment was determined using the "d" modifier in the NWI. The ditched wetland score was determined by dividing the area of ditched wetlands by the total area of wetlands in the catchment and multiplying the result by 100.
Criterion #5: Areas With More Altered Watercourses	Activities that hydrologically alter watercourses (e.g. channelized, ditched or impounded) affect the way that the landscape stores and releases water and results in increased peak flows, lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes. The altered watercourse score measures the proportion of streams and rivers that have been altered within each catchment watershed (Minnesota Pollution Control's Altered Watercourses Project). This score is the ratio of the length of altered watercourses in the catchment to the total length of watercourses present. The score is the inverse of the percentage.
Criterion #6: Areas With Higher Amounts of Impaired Streams	Water quality impairments are an indicator of lost watershed function and the degree of landscape alteration. Using the MPCA's Water Quality Assessment Database (2016) a ratio of impaired stream length to total stream length was calculated and multiplied by 100 for each catchment.
Criterion #7: Areas With Higher Amounts of Impaired Lakes	Water quality impairments are an indicator of lost watershed function and the degree of landscape alteration. Using the MPCA's Water Quality Assessment Database (2016) a ratio of impaired lake area to total lake area was calculated and multiplied by 100.
Criterion #8: Areas With Approved TMDL Implementation Plans	All of BSA 6 is covered by a TMDL developed to reduce phosphorus inputs to the St. Croix River. The phosphorus risk metric from the WHAF quantifies the risk of phosphorus mobilization from upland non-point sources. In Minnesota, the majority of non-point source phosphorus that reaches surface waters in years of average rainfall comes from overland flow. This metric combines a land-use based phosphorus export value with soil erodibility and slope to assess the relative risk of mobilizing phosphorus from the landscape. Risk values were calculated as a three meter grid that covers the entire state. For each cell, an individual score represents the risk of phosphorus mobilization from that location. The average of the grid cell values intersecting each catchment watershed were used to create a score for that catchment.
Criterion #9: Areas Identified As Priorities For Wetland Restoration In Other Watershed/Regional Plans	Identification of wetland restoration opportunities in other local/regional plans recognizes the value of planning being done by resource professionals who have more familiarity with the resources in their areas of jurisdiction. Reviewing these plans and, where determined appropriate, including these efforts in the prioritization process acknowledges other planning efforts and increases the potential for wetland mitigation siting to provide greater watershed benefits.
Criterion #10: Areas With High Permitting Frequency Based On Previous 5 Years Data	Areas with higher amounts of permitted wetland impacts may have a greater need for mitigation projects to offset losses. The analysis was the number of permits per catchment divided by the area of wetlands in the catchment using data was provided by the U.S. Army Corps of Engineers Section 404 permit database from 2011 to 2016.
Criterion #11: Areas Where There Are High Value Habitats and/or Threatened or	Wetland mitigation projects completed in areas with high concentrations of high quality habitats have greater potential to benefit Species of Greatest Conservation Need (SGCN). Using information from the MNDNR 2015-2025

Endangered Species Associated With Wetland or Aquatic Flora and Fauna	Wildlife Action Plan a ratio of the high and medium high scored areas to total area was calculated for each catchment.
Criterion #12: Catchments Containing Groundwater Recharge Areas As Designated in State and Local Plans	This criterion identifies areas with high potential for groundwater recharge. Wetlands play an important role in storing water and allowing surface water to slowly infiltrate which benefits recharge efforts. The pollution sensitivity of near-surface materials index from the WHAF was used to represent this criterion. The index score is an area weighted average for each catchment's rate of infiltration based on properties of the soil and surficial geology.

Development of Criterion Maps

GIS transformation of spatially-explicit data characterizing each criterion were normalized through a reclassification process to generate maps that captured the potential for a catchment to improve watershed health through wetland restoration. The geoprocessing process for each criterion followed a straightforward and repeatable process (Figure 23).

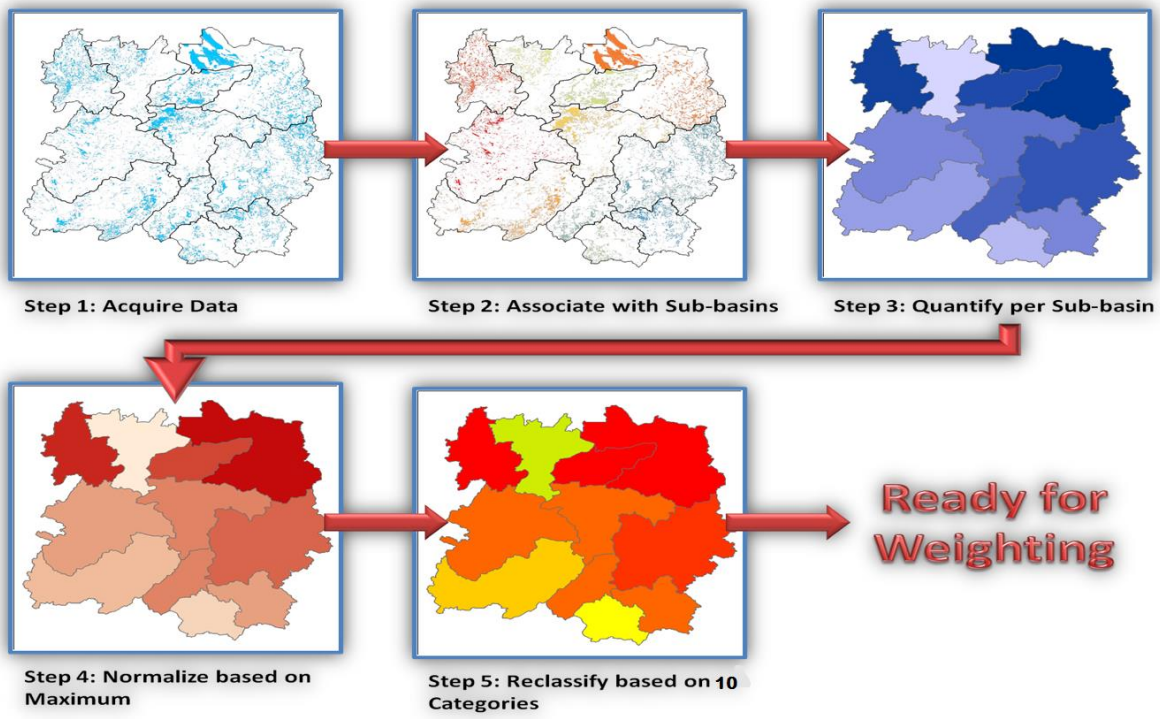


Figure 23. Illustration of the geoprocessing procedures used in the BSA 6 catchment prioritization. In the BSA 6 CPF the procedures were applied at the catchment scale as opposed to the sub-basin scale referenced in the figure.

First, GIS data representing each criterion was obtained and associated with each catchment in the BSA. If a catchment value had not been assigned (GIS data obtained from the WHAF typically had predetermined criterion scores for each catchment), a value was calculated for each catchment using raw data. For example,

the amount of ditched wetlands was determined by dividing the area of NWI wetlands with a "d" modifier by the total area of wetlands in the catchment and multiplying the result by 100. The resulting criterion scores were then normalized from 0 to 100 for each major watershed by dividing each catchment criteria value by the highest value in that major watershed. The normalized results were binned into ten classes using the natural breaks tool in ArcGIS in an ascending order of priority (Step 5 in Figure 23). In other words, low scores are catchments with lower potential for wetland mitigation to improve watershed health and high scores represent areas that would have a higher potential to improve watershed health.

The process above was used for all but three of the catchment prioritization criteria: Areas with Higher Amounts of Impaired Streams (C6), Areas with Higher Amounts of Impaired Lakes (C7), and Areas Identified as Priorities for Wetland Restoration in Other Watershed/Regional Plans (C9). The impaired streams and lakes data lacked enough assessed locations, so this data was binned to the extent allowable based on the number and range of values. For the criterion Areas Identified as Priorities for Wetland Restoration in Other Watershed/Regional Plans (C9) existing watershed and wetland management plans were reviewed to determine if there was specific reference to restoration of wetlands or, more generally aquatic resources. If the document did identify restoration as a goal, recommendation, or opportunity for the geographic area covered by the plan then the geographic area was identified as satisfying this criterion. To represent this criterion in the prioritization process, a GIS data layer was created showing the geographic areas where plans with restoration identified as a goal, recommendation, or opportunity within the St. Croix River watershed exist. These catchments were given a score of 10 while those catchments without specific recognition for wetland restoration in a completed plan were given a score of 1.

Weighting Derived from Stakeholder Input

Although the criteria in used in the catchment prioritization could be equally weighted, the stakeholders were offered the opportunity to "weight" the individual criteria differently based on "value" preferences – i.e., performing tradeoffs amongst criteria using an approach referred to as Multi-Criteria Decision Analysis (MCDA). MCDA is a set of systematic and tractable procedures that offers a means of combining disparate (non-commensurable) criteria through the use of weighting and straightforward mathematical algorithms (Chee 2004; Malczeski, 1999).

To elicit preferences, an internet-based querying tool (SurveyMonkey) was used to gauge stakeholder perceptions of value of each criterion in relation to one another. The results of these elicitations were used as weighting factors in the catchment prioritization. The preferences were polled in two separate fashions: a straight ranking of the criteria and a pair-wise comparison of the criteria. Twenty two separate stakeholders were invited to participate in the elicitation process. Of these, twelve responded to the internet tool's inquiries (55% response rate). The results of the stakeholder elicitation is summarized in Table 15.

As the table indicates, using the MCDA pairwise weighting method the stakeholders placed a higher value on siting mitigation in areas with degraded wetlands (>12% of the score) and impaired water bodies (11% each) and less value on areas with poor habitat connectivity (3.7% of the score) and high permitting frequency (5.7% of the score). The results were nearly identical for the straight average method except that areas containing groundwater recharge areas was valued the same as areas with high permitting frequency and represented the least valued of the criteria.

Table 15 Summary of Stakeholder Weighting of Catchment Prioritization Criteria				
Criteria	**MCDA Pairwise Weighting[1]**	**Rank**	**Straight Average[2]**	**Rank**
Areas with high soil erosion potential (C1)	0.070	9	6.11	5
Areas with low amounts of perennial cover (C2)	0.076	6	7.00	8
Areas with poor habitat connectivity (C3)	0.037	12	8.67	12
Areas with more degraded wetlands (ditched wetlands) (C4)	0.124	1	4.67	1
Areas with more altered watercourses (C5)	0.072	8	6.22	6
Areas with higher amounts of impaired streams (C6)	0.111	3	4.89	3
Areas with higher amounts of impaired lakes (C7)	0.113	2	4.67	1
Areas with approved TMDL implementation plans (C8)	0.070	9	7.33	9
Areas identified as priorities for wetland restoration in other watershed/regional plans (C9)	0.109	4	5.89	4
Areas with high permitting frequency based on previous 5 years data (C10)	0.057	11	8.00	10
Areas where there are high value habitats and/or threatened or endangered species associated with wetland or aquatic flora and fauna (C11)	0.087	5	6.56	7
Areas containing groundwater recharge areas as designated in state and local plans (C12)	0.074	7	8.00	10
Notes: Green shading denotes the two most valued criteria based on rank. Red represents the two least valued criteria based on rank. [1] – Results of the MCDA pairwise comparisons using responses from seven stakeholders. [2] – Average priority ranking based on responses from nine stakeholders.				

The normalized criteria values calculated for each catchment were weighted using the MCDA pairwise comparison weights from Table 15 based on a straightforward algorithm:

$$V_i = \sum_j w_j c_{ij}$$

Where V_i is the prioritization score for the ith catchment which is equal to the sum of the values of the ith catchment criteria ($c_{ij,}$ where j = 1, 2, 3 ….12) multiplied by their normalized weights (w_j). The summed prioritization score was used to generate a map displaying the comparative preference for siting wetland mitigation within each catchment based on these inputs. Maps of the weighted outputs for each major watershed are provided in Appendix D.

Designation of Priority Catchments

The catchment prioritization process resulted in a relative ranking of catchments for wetland mitigation within each major watershed in BSA 6. The next step in the process was to use the catchment prioritization scores to identify the catchments that will be targeted for wetland mitigation projects when there is a need to generate credits for the ILFP (repayment of advanced credits). This involved finding a breakpoint in the ranking that balanced the need for sufficient wetland mitigation opportunities while maximizing benefits to the watershed. For example, designating only a small number of catchments as high priority areas may not result in any projects when a request for proposal is advertised. Similarly, identifying a large number of catchments as high priority areas may decrease the potential benefits to the watershed because ILFP sites could be selected in catchments that scored lower in the prioritization exercise.

To find a reasonable and defensible breakpoint for identifying high priority catchments we applied the following rules:

- All catchments with weighted prioritization scores in the top third of the distribution for their respective major watershed were identified as a high priority area;
- If the total acreage of restorable wetlands for the top third of the catchments within a major watershed was less than 33% of the total acreage of restorable wetlands for that major watershed then additional catchments were added as high priority areas, based on their weighted prioritization scores, until the total acreage of restorable wetlands reached 33% of the total restorable wetlands for that major watershed.

The acreage of restorable wetlands was obtained from the RWI and was used as an estimate of the amount of restorable wetlands in each catchment. It was not treated as an absolute and catchments were not removed as high priority areas if the RWI identified few or no restorable wetlands.

A total of 130 catchments were identified as high priority areas in BSA 6: 41 in the Kettle River watershed, 29 in the Snake River watershed, 13 in the Upper St. Croix watershed, and 47 in the Stillwater watershed. Eight additional catchments were included in the Kettle River watershed in order to meet the requirement that 33% of the total acreage of restorable wetlands be included in high priority areas. This resulted in 41% of the catchments in the Kettle River watershed being designated as high priority areas. The three other major watersheds each had greater than 33% of the restorable wetlands covered within the highest third of the weighted scores. Overall the process designated a total of 892,028 acres (1,394 square miles) of lands including 27,264 acres of restorable wetlands as high priority in BSA 6. A summary of the prioritized catchments is provided in Table 16. The prioritized catchments in each major watershed are shown in Figures 24.1 through 24.4.

Table 16
Summary of BSA 6 Prioritized Catchments

Major Watershed	Catchments			Restorable Wetlands		Weighted Scores		
	Number Prioritized	Prioritized Area[1] (acres)	Prioritized Acres (% of total)	Prioritized[2] (acres)	Major Watershed (% of total)	range	avg	median

UPSC	13/39	135,057	39	1,997	42	77.9 -100	86.8	85.2
Snake	29/89	239,410	37	12,599	49	77.6 - 100	84.4	83.4
Kettle	41/100	230,238	34	3,242	36	77.2 - 100	86.1	84.6
Stillwater	47/140	287,323	49	9,426	55	55.2 - 100	74.7	72.8

Notes:
[1] – Prioritized area is the total land area within each major watershed.
[2] – Prioritized acres based on the RWI.

Figure 24.1 Prioritized Catchments UPSC Watershed

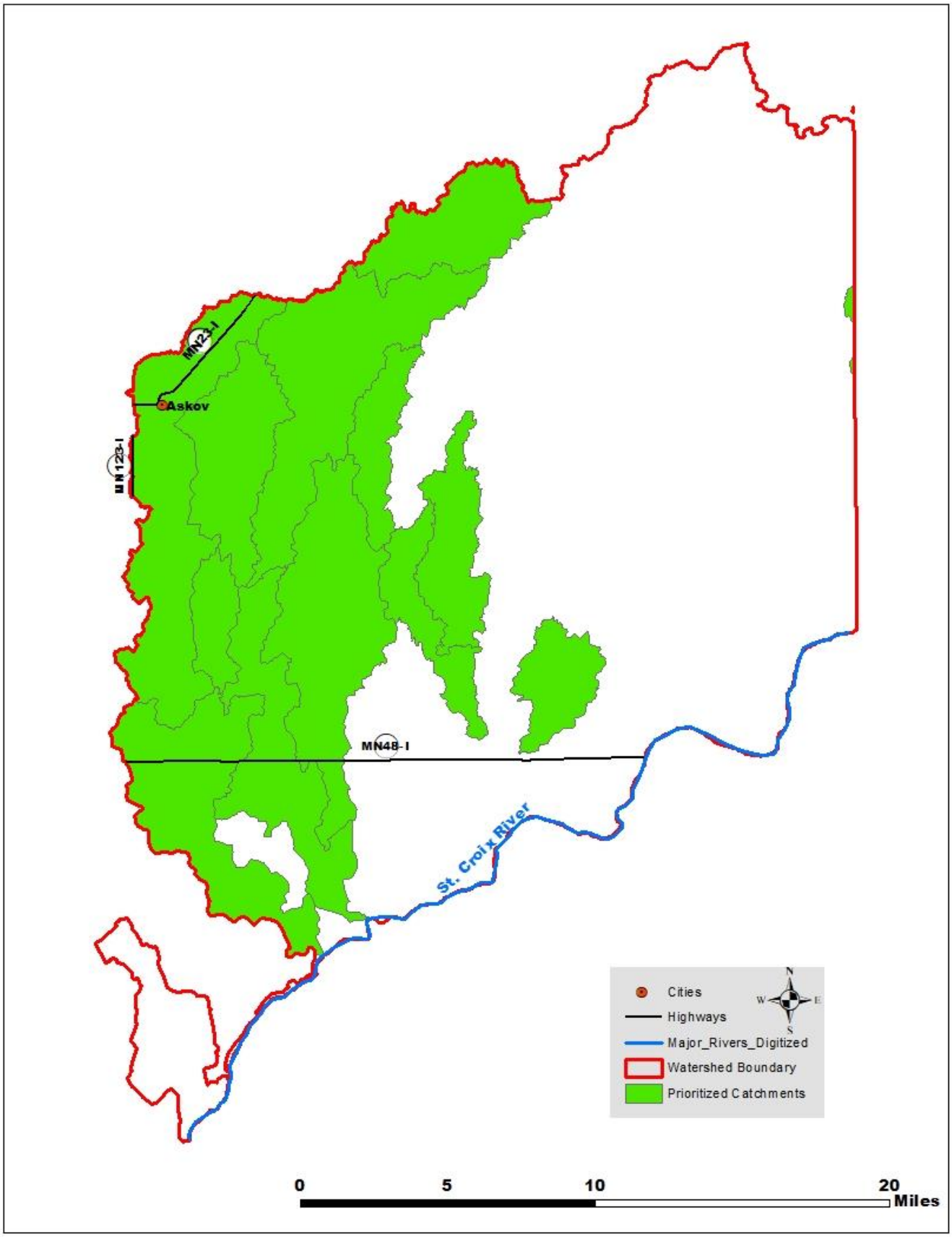


Figure 24.2 Prioritized Catchments Snake Watershed

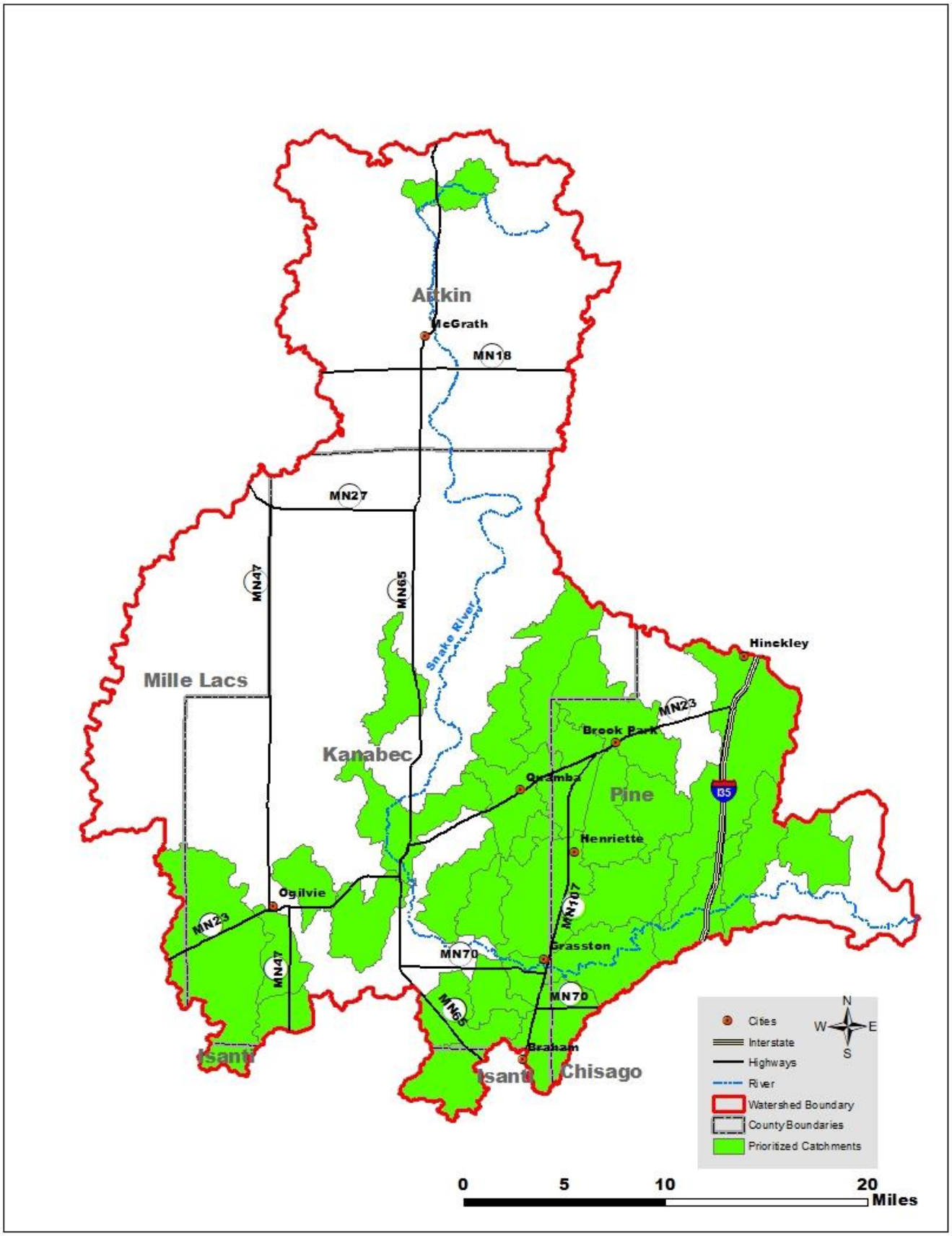


Figure 24.1 Prioritized Catchments Kettle Watershed

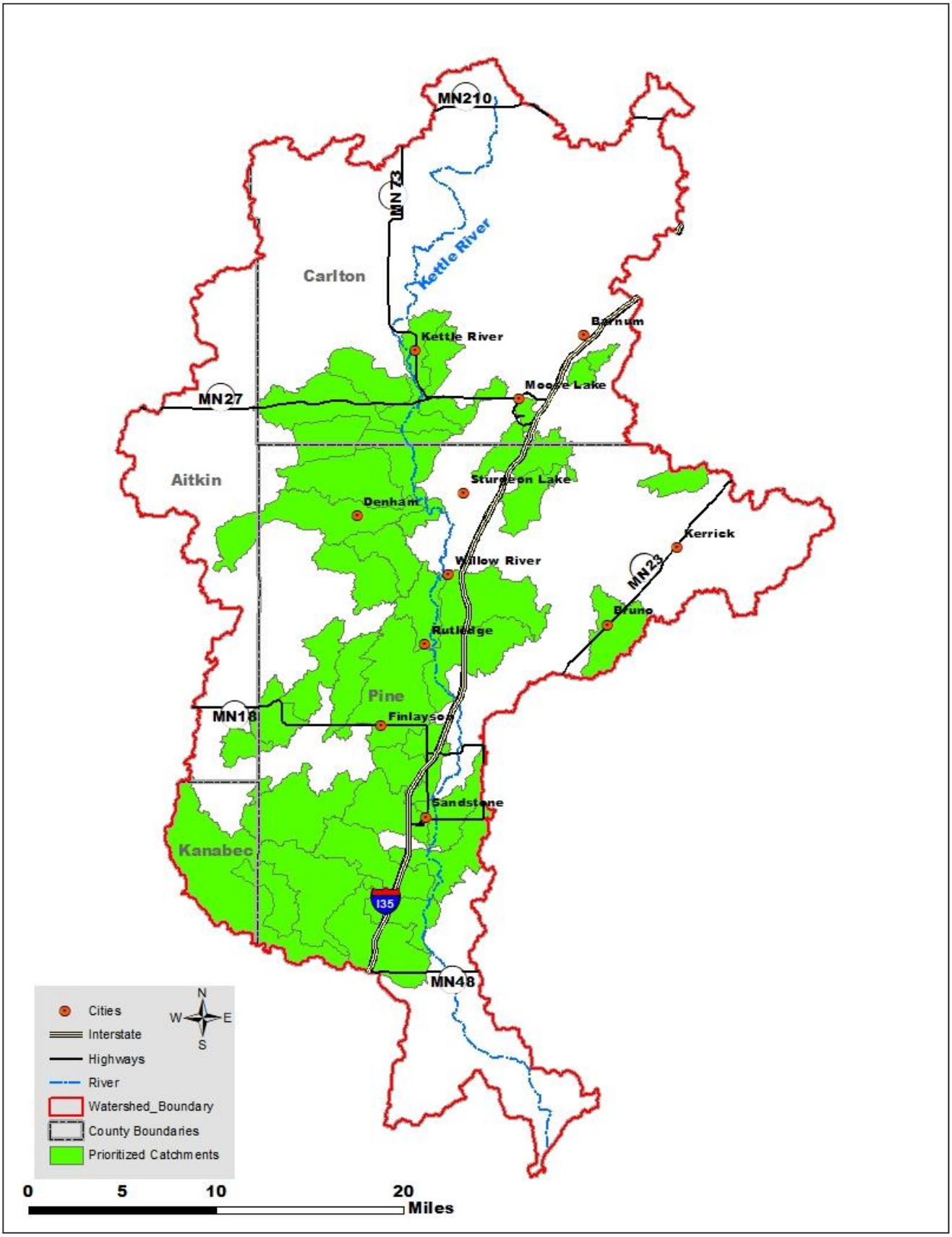
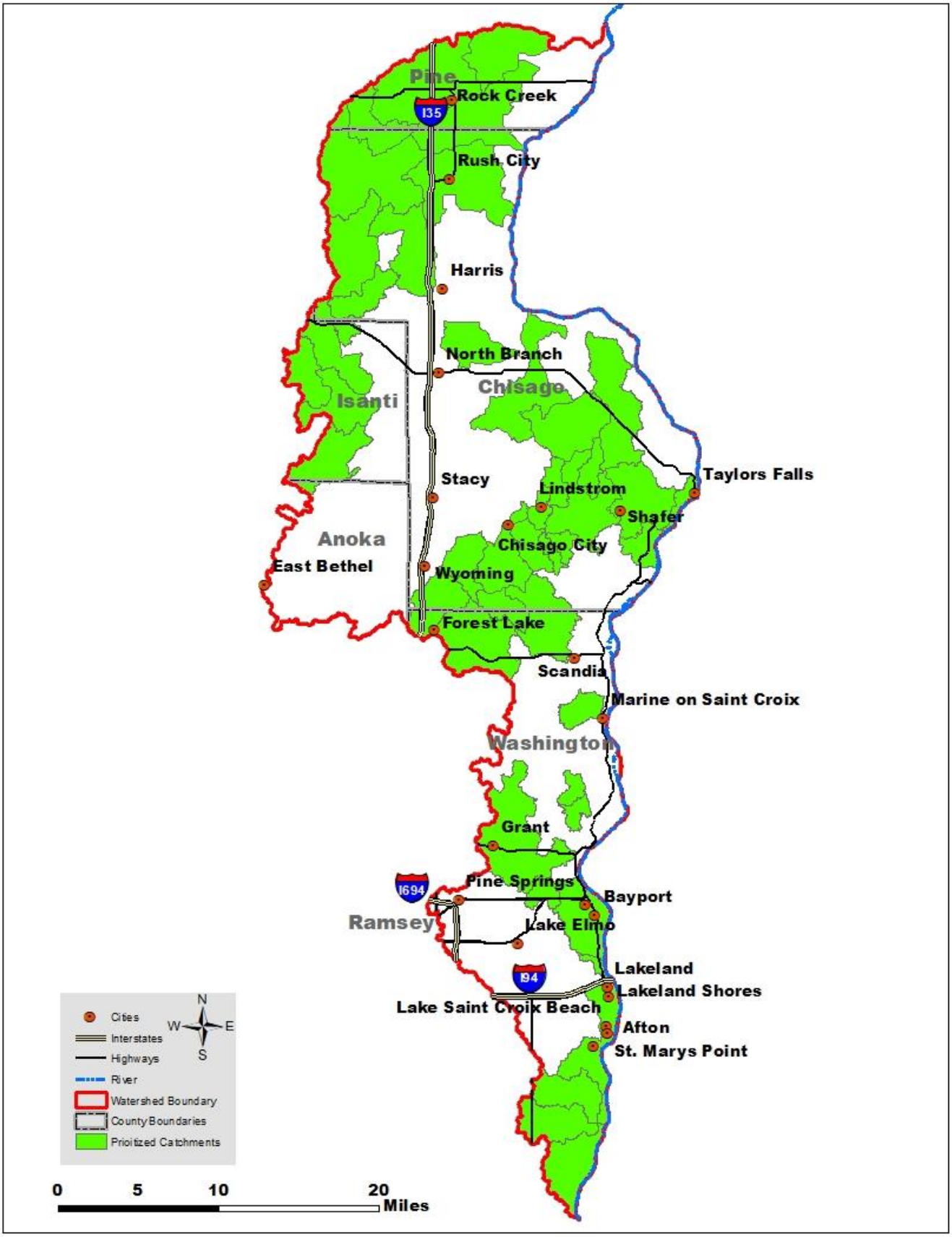


Figure 24.1 Prioritized Catchments Stillwater Watershed



The prioritization process resulted in consistent results for the UPSC, Snake, and Kettle major watersheds with respect to range, average, and median weighted scores for the prioritized catchments. In addition, for each of these major watersheds the selected catchments all had weighted scores greater than 77 with an average between 84 and 86 which supports the decision to designate the top 33% of the catchments as high priority for wetland mitigation since there was not a significant drop off in weighted scores within the top third of the catchments. The Stillwater major watershed is an outlier with respect to the range, average, and median weighted scores. It also had the largest percentage of prioritized acres and restorable wetlands (based on the RWI). This is likely attributable to the higher number of catchments in this major watershed combined with a smaller average size relative to the other major watersheds and the decision in this CPF to base prioritization on a percentage of the catchments evaluated.

Assessment of Restorable Wetlands Within Prioritized Catchments

As a follow-up to the catchment prioritization process BWSR staff conducted an analysis of the potentially restorable wetlands in each major watershed. Although performed for all of BSA 6, the discussion and results of this exercise are focused on the prioritized catchments. This additional step was taken to assess the degree to which the RWI data identifies potentially restorable wetlands that would meet a basic set of preferred site characteristics. The preferred characteristics represent site attributes that, in BWSR's experience, make a potential restoration more viable from an economic and technical perspective and potentially result in greater benefits to the watershed. This analysis was completed for informational purposes only and did not lead to any refinement of the catchment prioritization process. However, it may be used in the future to evaluate the effectiveness of the CPF and the quality of the RWI data with respect to identifying wetland restoration opportunities. The preferred characteristics included the following:

- A minimum size of 20 acres of restorable wetlands for a viable project site
- Located within 175 feet of a lake, 50 feet of a first and second order stream, or 175 feet of a third order or higher stream
- Located further than 66 feet from a mapped roadway
- Located further than 50 feet from a medium or highly developed land use using the 2011 NLCD

As shown in Table 17, the total amount of restorable acres that satisfied the preferred characteristics was xxxxx which is x% less than the total identified in the prioritized catchments.

Table 17
BSA 6 Wetland Loss Determinations and Land Cover Classifications

Major Watershed	Restorable Wetlands (acres)	Restorable Wetlands Meeting Preferred Characteristics (acres)	Percent of restorable Wetland Acres Meeting Preferred Characteristics
UPSC	1,997	449	22
Kettle	12,599	242	2
Snake	3,242		
Stillwater	9,426	1,019	11
Total	**27,264**		

Long-term Protection and Management

Each wetland bank site that becomes part of the ILF Program will be required to have an establishment, maintenance, and management plan to achieve the identified goals of the project. The management strategies will be specific to the project and will include standard, recognized strategies such as those identified in the Minnesota Wetland Restoration Guide (BWSR online guide, 2012). All project sites will have long-term protection through the recording and enforcement of a perpetual conservation easement. After an initial establishment and maintenance period (typically 5 years), the easement will be periodically monitored by BWSR staff to ensure compliance. BWSR began collecting a stewardship fee in 2017 to fund these long-term easement compliance and monitoring activities which ensures that the inspection program will be funded into the future. As stipulated in the easement, the landowner is ultimately responsible for maintenance of the project site in concert with the approved mitigation plan and conservation easement. However, in the past BWSR has also played a role in making sure that long-term management issues are satisfactorily addressed on LGRWRP wetland bank sites.

Evaluation Strategy

BWSR has considerable experience managing the LGRWRP which includes monitoring budgets, site development activities, and credit balances. Evaluation of the CPF will be integrated into the annual program review activities that are currently part of the overall program management. Because we intend for the CPFs to be used to influence wetland banking site selection as well as ILF site selection we fully expect that these documents will be reviewed on a regular basis and periodically updated. Potential reasons for revisiting the goals and objectives of the CPF could include completion of local watershed plans that address management of aquatic resources, identification of wetland mitigation priority areas by a WCA local government unit, and feedback on the prioritization strategy from implementation activities. We anticipate that an initial review of the goals and objectives of the BSA 6 CPF will be conducted three years after the first advanced credits are sold which provides enough time for the prioritization strategy to be implemented and evaluated.

Anderson, J.L., and D.F. Grigal. 1984. Soils and Landscapes of Minnesota. Agricultural Extension Service, University of Minnesota.

Chee, Y.E. 2004. An ecological perspective on the valuation of ecosystem services. Biological Conservation 120: 549-565.

Cummins, J.F. and D.F. Grigal. 1981. Soils and Land Surfaces of Minnesota. Department of Soil Science, Univ. of Minn. Agricultural Experiment Station, St. Paul, Minnesota. Soil Series No. 110, Miscellaneous Publication 11. 59 pp. + map (1:1,000,000).

Dept. of Soil Science, University of Minnesota; Soil Conservation Service, U.S. Dept. of Agriculture; and Minnesota Geological Survey. 1971. Minnesota Soil Atlas: Hibbing Sheet. Miscellaneous Report 110. Agricultural Experiment Station. University of Minnesota. St. Paul, MN. 1 map (1:250,000) + booklet.

Dept. of Soil Science, University of Minnesota; Soil Conservation Service, U.S. Dept. of Agriculture; and Minnesota Geological Survey. 1981b. Minnesota Soil Atlas: International Falls-Two Harbors Sheets. Miscellaneous Report 177. Agricultural Experiment Station. University of Minnesota. St. Paul, MN. 2 maps (1:250,000) + booklet.

Hobbs, H. C., and J. E. Goebel. 1982. Geologic Map of Minnesota; Quaternary Geology. 1:500,000. Minnesota Geological Survey, Univ. of Minnesota.

Kratz, T.K., and G.L. Jensen. 1983. Minnesota's Landscape Regions. Natural Areas Journal 3(2): 33-44.

Malczewski, J. 1999. GIS and Multicriteria Decision Analysis. John Wiley and Sons, Inc., New York.

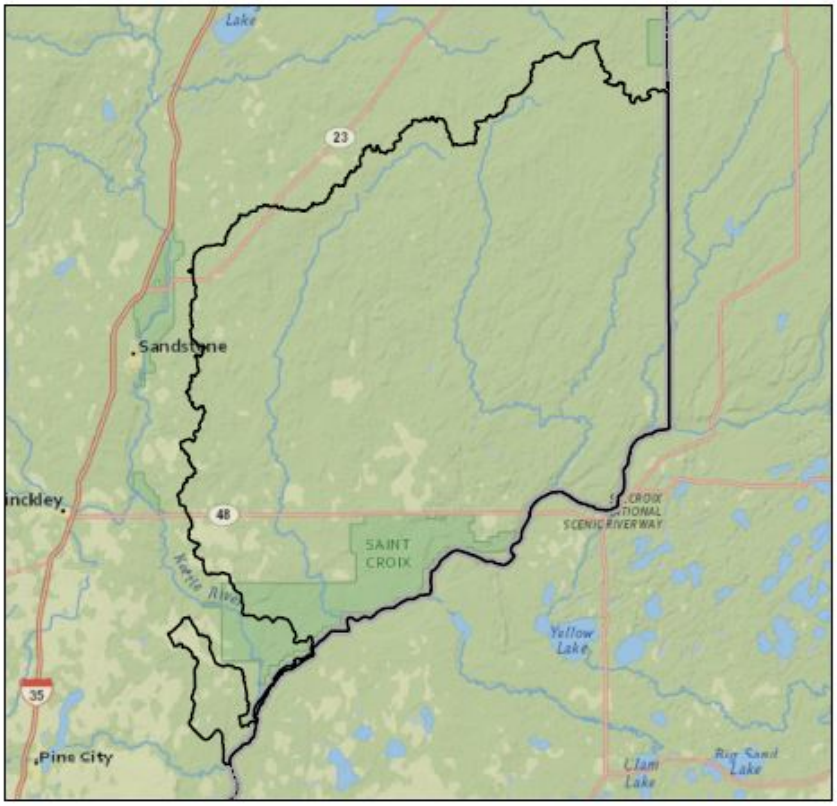
Marschner, F.J. 1974. The Original Vegetation of Minnesota, a map compiled in 1930 by F.J. Marshner from U.S. General Land Office Survey Notes and published in 1974 under the direction of M.L. Heinselman of the U. S. Forest Service. Cartography Laboratory of the Department of Geography, University of Minnesota, St. Paul. 1 map (1:500,000).

Mitsch, W.J. and Gosselink J.G. 2007. Wetlands. 4th Edition, John Wiley & Sons, Inc., Hoboken, New Jersey.

Wright, H. E., Jr. 1972. Physiography of Minnesota. In Geology of Minnesota. P.K. Sims and G.B. Morey (eds.). Minnesota Geological Survey. St. Paul, Minnesota. 632 pp.

Appendix A
Minnesota DNR WHAF Major Watershed Summaries

Appendix A-1
UPSC Watershed Summary Sheet



People and Places:

Watershed Population:
2000 census - 2,761
2010 census - 2,920

Largest Cities - Population:
Askov - 364
Saint Johns Landing Camp - None
Cloverdale - None
Markville - None
Duxbury - None

Counties - % of watershed:
Pine - 100 %

Watershed Area:

Watershed size:
347,720 acres
543 square miles

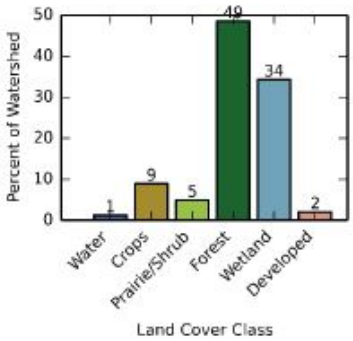
Watershed Surface Area:
Percent Land - 99 %
Percent Water - 1 %

HUC8 ID:
07030001

Basin Name:
St. Croix (0703)

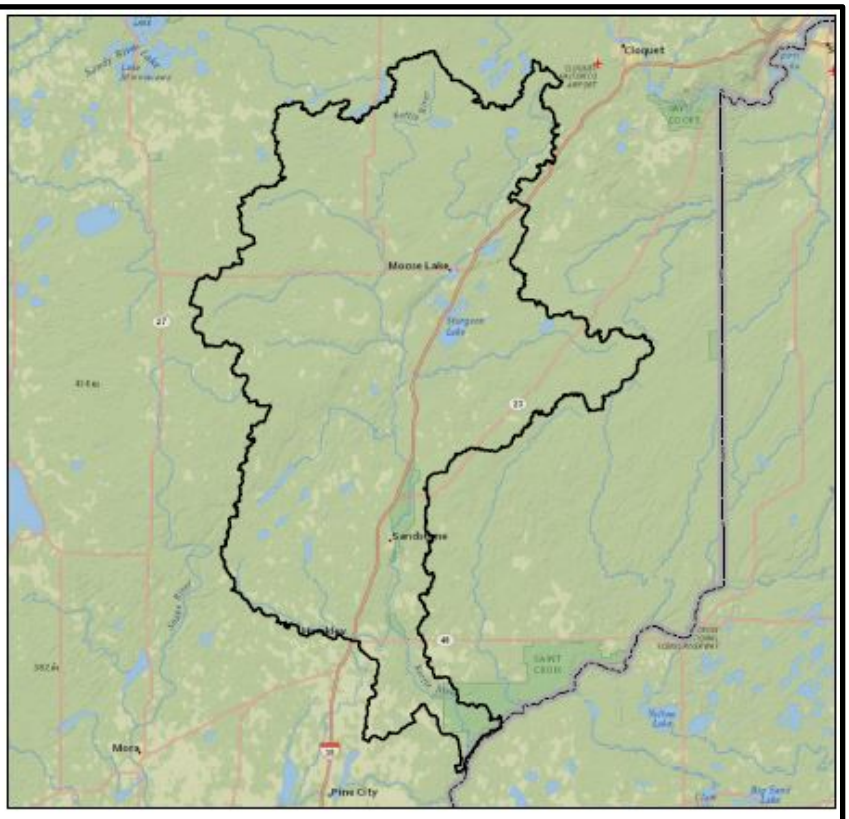
Land Use:

Percent of watershed area by land cover type:



BOARD OF WATER AND SOIL RESOURCES

Appendix A-2
Kettle River Watershed Summary Sheet



People and Places:

Watershed Population:
2000 census - 19,335
2010 census - 21,694

Largest Cities - Population:
Sandstone - 2,849
Moose Lake - 2,751
Barnum - 613
Mahtowa - 613
Sturgeon Lake - 439

Counties - % of watershed:
Pine - 53 %
Carlton - 34 %
Aitkin - 10 %
Kanabec - 3 %

Watershed Area:

Watershed size:
672,926 acres
1,051 square miles

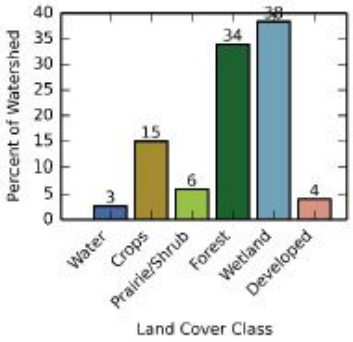
Watershed Surface Area:
Percent Land - 97 %
Percent Water - 3 %

HUC8 ID:
07030003

Basin Name:
St. Croix (0703)

Land Use:

Percent of watershed area by land cover type:



BOARD OF WATER AND SOIL RESOURCES

Appendix A-3
Snake River Watershed Summary Sheet

People and Places:

Watershed Population:
2000 census - 26,322
2010 census - 29,253

Largest Cities - Population:
Mora - 3,571
Pine City - 3,123
Hinckley - 1,800
Brunswick - 1,333
Grass Lake - 1,038

Counties - % of watershed:
Kanabec - 48 %
Pine - 21 %
Aitkin - 20 %
Mille Lacs - 10 %
Isanti - 1 %
Chisago - 0 %

Watershed Area:

Watershed size:
643,544 acres
1,006 square miles

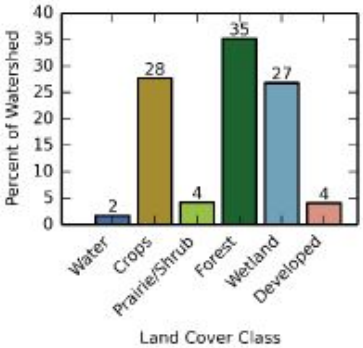
Watershed Surface Area:
Percent Land - 98 %
Percent Water - 2 %

HUC8 ID:
07030004

Basin Name:
St. Croix (0703)

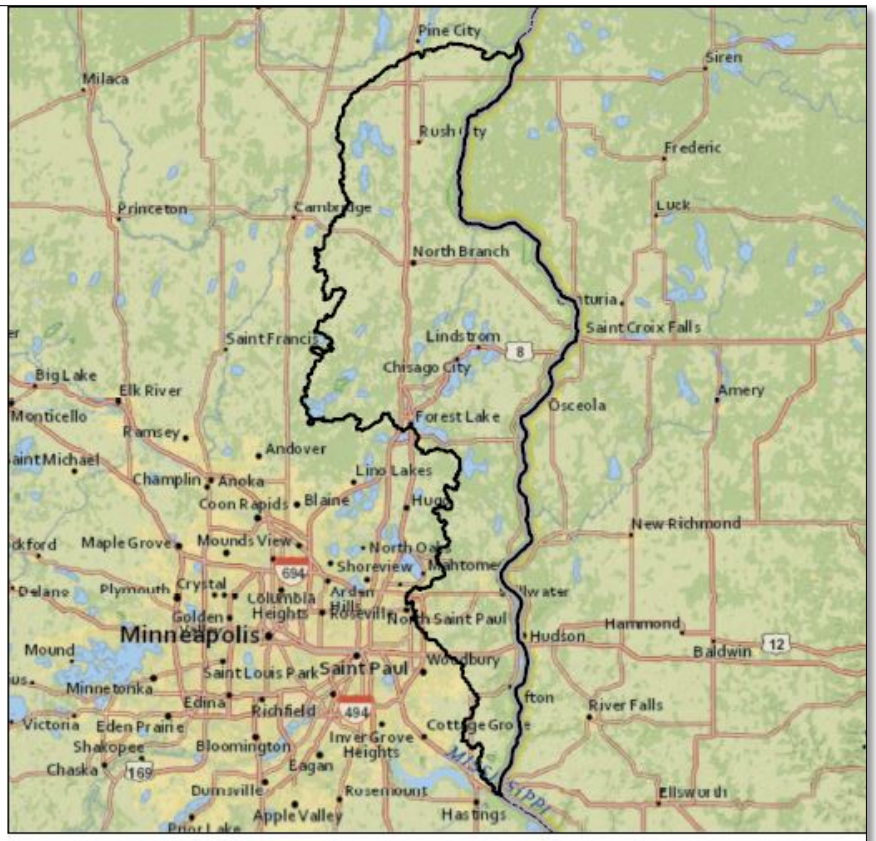
Land Use:

Percent of watershed area by land cover type:



BOARD OF WATER AND SOIL RESOURCES

Appendix A-4
Stillwater Watershed Summary Sheet



People and Places:

Watershed Population:
2000 census - 137,033
2010 census - 158,712

Largest Cities - Population:
Forest Lake - 18,375
Stillwater - 18,225
East Bethel - 11,626
North Branch - 10,125
Lake Elmo - 8,069

Counties - % of watershed:
Chisago - 47 %
Washington - 29 %
Pine - 9 %
Anoka - 8 %
Isanti - 7 %
Ramsey - 0 %

Watershed Area:

Watershed size:
585,737 acres
915 square miles

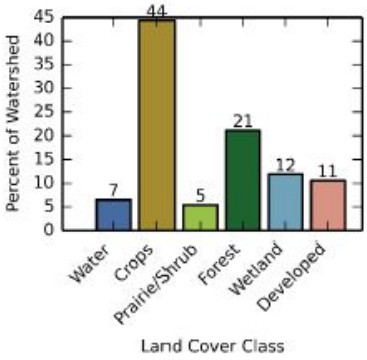
Watershed Surface Area:
Percent Land - 93 %
Percent Water - 7 %

HUC8 ID:
07030005

Basin Name:
St. Croix (0703)

Land Use:

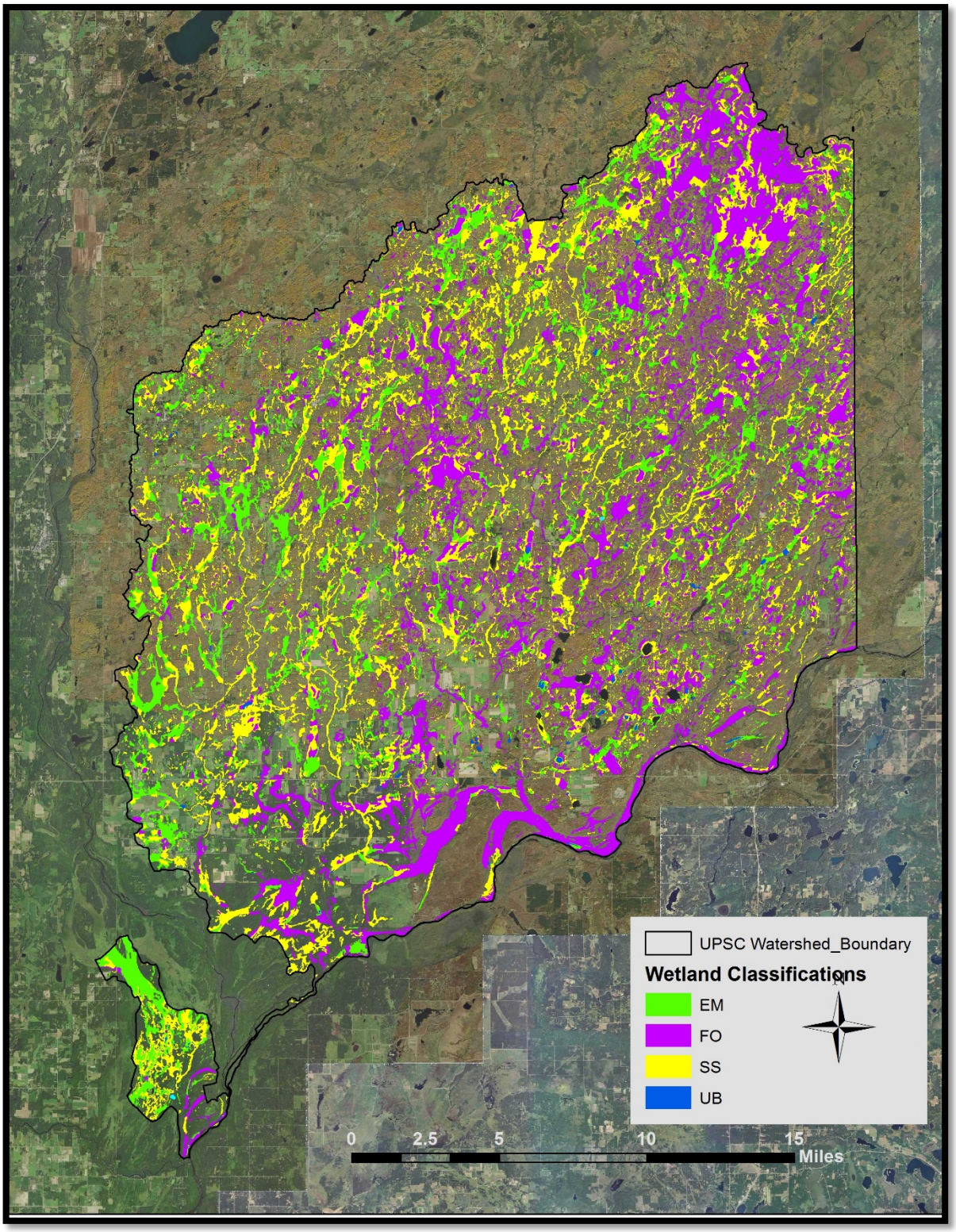
Percent of watershed area by land cover type:



BOARD OF WATER AND SOIL RESOURCES

Appendix B
BSA 6 Major Watershed National Wetland Inventory Summaries

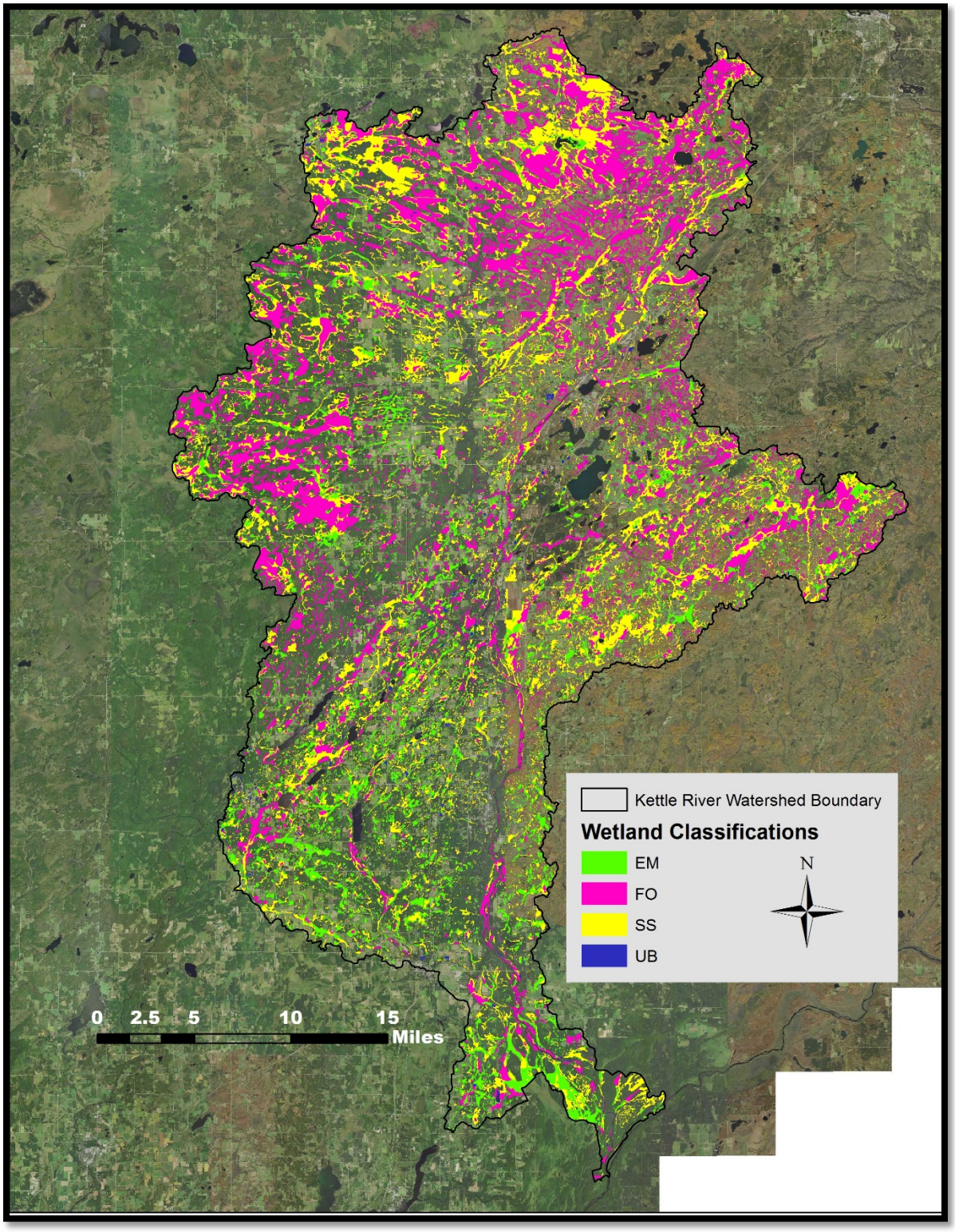
Appendix B-1
UPSC National Wetland Inventory Summary Sheet



Watershed Size (Ac)	Wetland Acres	% Wetlands per Watershed	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
347,719	111,908	32%	23%	38%	39%	1%

BOARD OF WATER AND SOIL RESOURCES

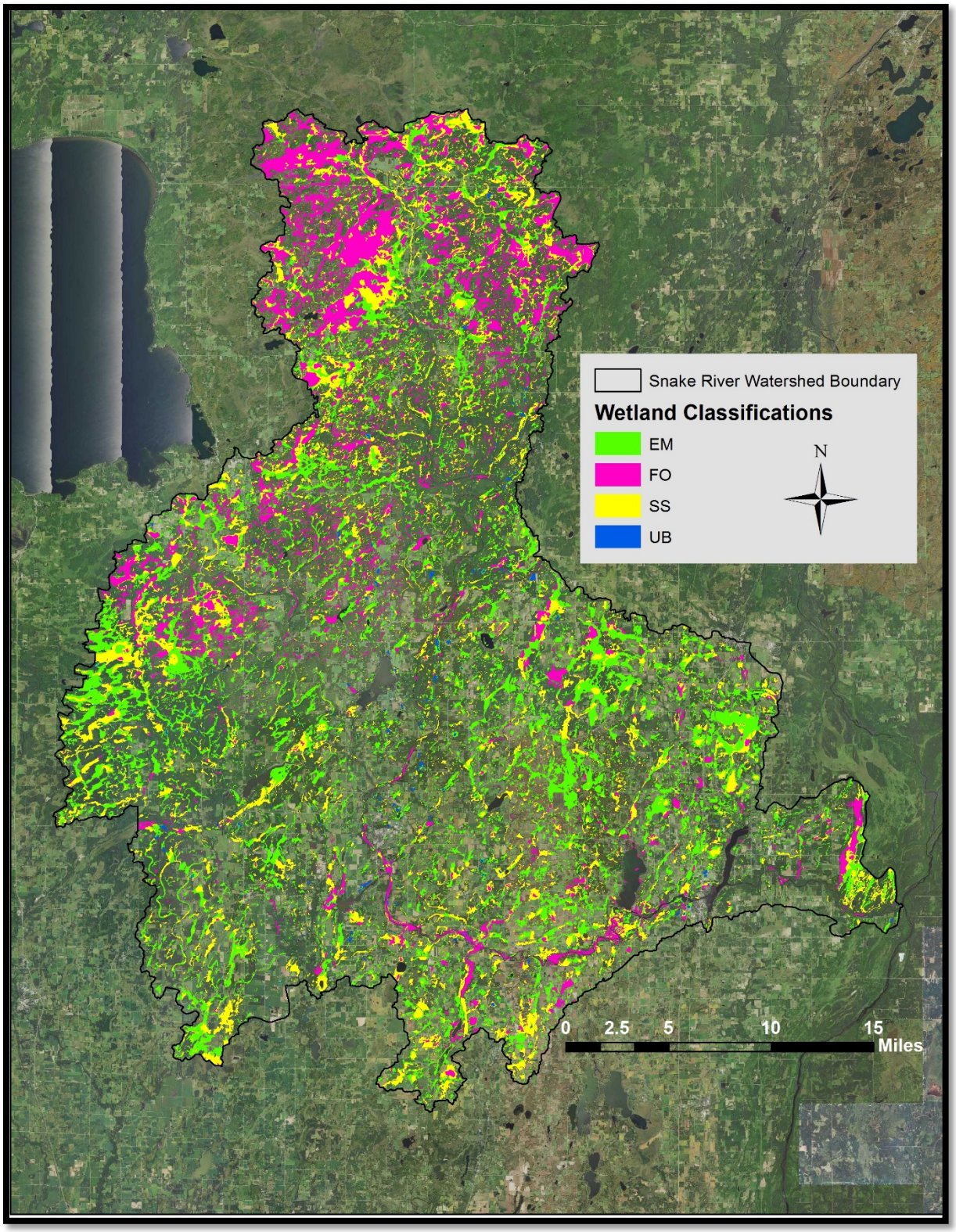
Appendix B-2
Kettle River National Wetland Inventory Summary Sheet



Watershed Size (Ac)	Wetland Acres	% Wetlands per Watershed	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
672,924	220,581	33%	19%	43%	38%	1%

BOARD OF WATER AND SOIL RESOURCES

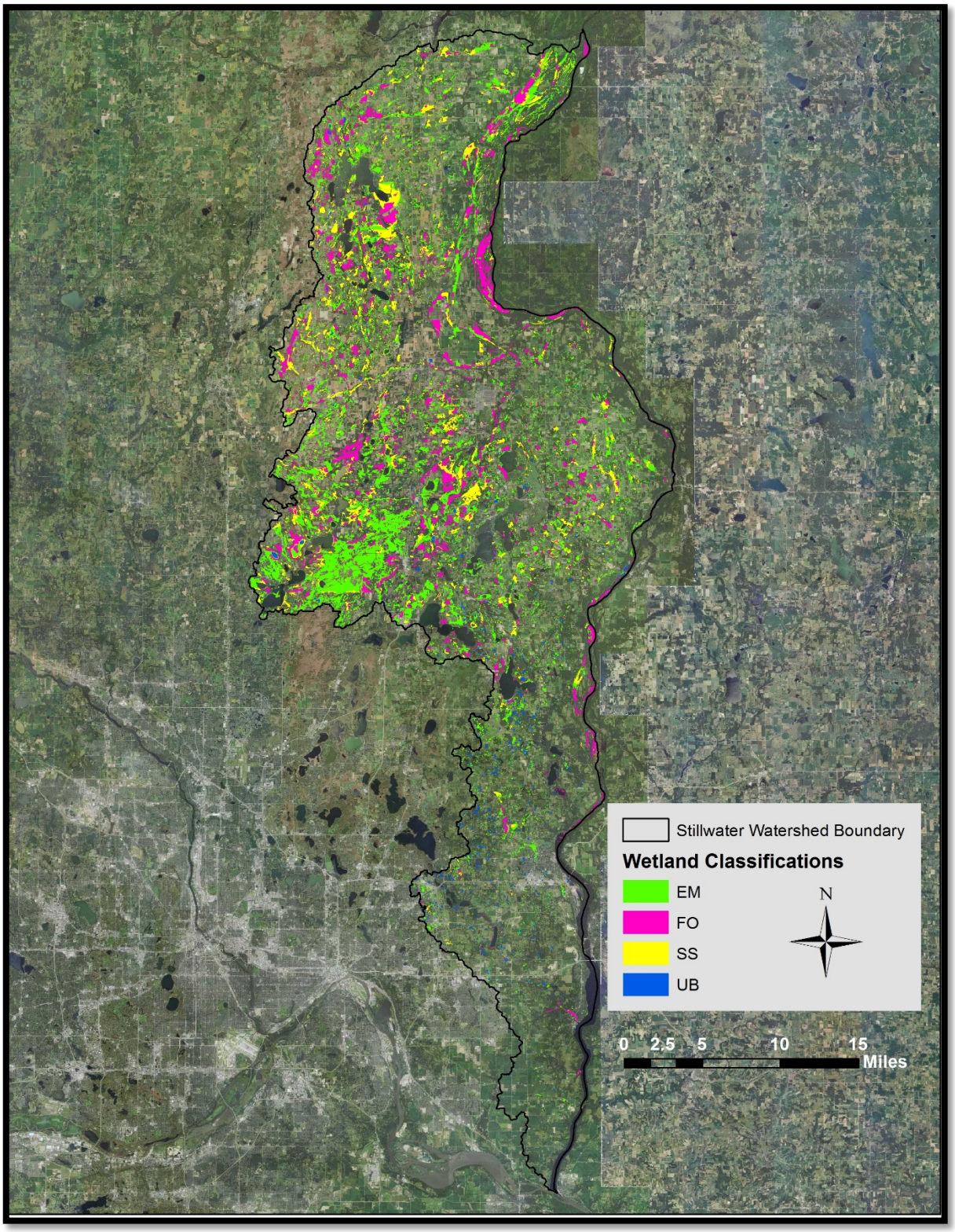
Appendix B-3
Snake River National Wetland Inventory Summary Sheet



Watershed Size (Ac)	Wetland Acres	% Wetlands per Watershed	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
643,542	186,050	29%	43%	26%	30%	1%

BOARD OF WATER AND SOIL RESOURCES

Appendix B-4
Stillwater National Wetland Inventory Summary Sheet



Watershed Size (Ac)	Wetland Acres	% Wetlands per Watershed	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
585,735	102,844	18%	53%	23%	19%	4%

BOARD OF WATER AND SOIL RESOURCES

Appendix C
Stakeholder Involvement

Appendix C-1
February 2017 Stakeholder Meeting

St. Croix Drainage Basin (Bank Service Area 6) Stakeholder Meeting Agenda

February 28th 12 PM

6355 379th St, North Branch, MN 55056

12:00 PM

- Introductions
- What is an In-Lieu Fee Program?
  - Compensatory Planning Framework (CPF)
  - Importance of local stakeholder input
- How will we develop the CPF?
  - BWSR will analyze current vs historic watershed conditions, sources of impairment and threats using publically available data sets.
  - We will ask for your input on appropriate data sources and local plans.
  - BWSR will identify specific watershed goals that will guide the prioritization of wetland restorations.
  - What you think are the most important watershed goals that should guide the prioritization of wetland restorations.
- How final product will be used, and who will use it.
  - How used by the road program.
  - How used by the private sector as they seek to develop commercial banks.
- Proposed timeline for completion.
- Next Meeting

1:30 Adjourn

GOAL OF MEETING: Define the process for Development of a CPF

1. **What is an In-Lieu Fee Program?**

   A fee based wetland mitigation program based on a watershed approach. A fee given to a federally approved sponsor to fulfill the wetland regulatory replacement requirement

   An in-lieu-fee program is based in federal rule, and is an agreement between the Corps and the state as single sponsor. So federal approval is necessary, there is no state approval process other than approving a particular site and its plan

   The sponsor uses the funds pooled from multiple permittees to create one or more sites to compensate for lost aquatic resources.

   - Difference between ILF and current Bank System
     - Advanced vs released credits; Feds will allow sale of AC if they have a pre-approved plan stating where replacement will go.
     - Non-profits or governmental agencies only. Takes the profit driving force out of the equation
     - No control on type and location of mitigation
     - Does not take into account watershed needs

   - State of Mitigation in BSA 6 (figure showing bank sites)
     - PSA Map and constraints
     - Closure of Road Program

   - ILF and CPF relationship

2. **Compensatory Planning Framework (CPF)**

   Prioritizes wetland restoration to meet watershed goals

   Within the CPF BWSR will analyze:
   - Current vs historic watershed conditions,
   - Sources of impairment and threats

   We will then add local plans and stakeholder input. Once we have the data we will determine:
   - Goals and objectives of mitigation
   - Prioritization strategy for selecting and implementing mitigation projects

3. **How your input will be solicited and used**

   Federal Rule requires stakeholder input, but there are no specifics, we could just send you a letter stating were doing an ILF. But that would be foolish, you are the people with the intimate knowledge of you watershed and counties.

   For example- should we just focus on restoration in the south and preservation in the North- should we just focus on TMDLs, or loss of habitat. So we need you to ensure we are not missing the mark

   We will ask for your input on appropriate data sources (State and Local data).

We will ask you to help identify the most important watershed goals that should guide the prioritization of wetland restorations in the watershed. You have great knowledge of your areas, so your input is vital in determining watershed needs.

You have to the local plans and can lead me through them to see what is applicable

4. CPF Development

- GIS Analysis to determine (use existing data sets)
  - Current vs. historic watershed conditions (Some initial Ideas)
    - Wetland Loss
    - Changes in perennial cover
    - Development and agricultural conversion of lands
    - Hydrologic Storage
  - Sources and threats and to aquatic resources
- Data Sources available (So Far)
  I. Watershed Health Assessment Framework Reports (Handouts to group)
    - http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#

  II. Restorable Wetland Prioritization Tool (Need Detail on data in PPT)
    - http://www.mnwetlandrestore.org/
- Presentation of GIS analysis data to Stakeholders
  - We will come to you with maps, and data to discuss results
  - We will ask for your most important watershed goals that should guide the prioritization of wetland restorations.
- BWSR will identify specific watershed goals based on data and stakeholder input that will guide the prioritization of wetland restorations.

5. Use and users of final product.

a) How used by the road program.
   - No final decision, but LRWRP will have access to advance credits to avoid BSA shutdowns.
   - Will guide the generation of Road banks
   - Can act as an economic engine for larger project with supplemental funding from private use

b) How used by the private sector as they seek to develop commercial banks.
   - New bankers can use CPF to locate potential bank sites
   - CPF credits will have more value than banks developed without the CPF
   - Will grandfather existing banks

c) Conservation groups

d) WSD on water plans

e) SWCD on County Projects

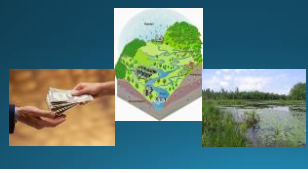
6. **Proposed timeline for completion.**
    - March 2017 Prospectus to Corp

7. **Goal of Next Meeting will solicit information from you.**
    - TBD

St. Croix Basin ILF Program Stakeholder Meeting

What is an ILF Program

- Fee based wetland mitigation program based on a watershed approach



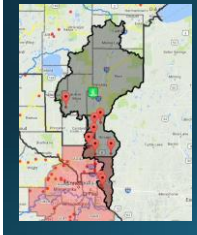
ILF Approval Process

- Based in Federal Rule
  - Federal approval necessary no State approval process
- Agreement between Corps and Sponsor to allow Sale of Advance Credits
  - Pre-Approved plan on how mitigation will occur

ILF and Banks

- Advanced vs Released Credits
  - Advanced are like Loan
  - Released or on the landscape
- Non-Profits or Government Agencies Only
  - Removed the drive for profit
  - Outcome driven= better mitigation
- Watershed approach selection of projects
  - Banks are oppportunity based

Current State of Mitigation



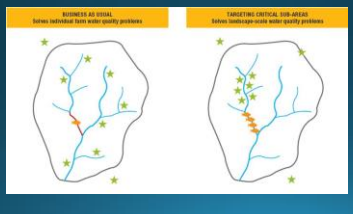
6.6 Credits Remaining

Two Components of ILF Program

- Instrument
  - Program Establishment and Operation
    - Costs and Fees of Credits
    - Accounting Procedures
    - Long Term Management
    - Land Protection
    - Reporting
- Compensatory Planning Frame Work (CPF)
  - How and Where Mitigation Will Occur

Compensatory Planning Framework (CPF)

- Prioritizes Wetland Restoration to Meet Watershed Goals



CPF Development Process

Stakeholder Input

- Federal Rule Requires Stakeholder Input
  - Nothing replaces local knowledge
- Input on Appropriate Data Sources (State and Local)
- Lead Us Through Your Local Plans
- ID Your Most Important Watershed Goals

CPF Development

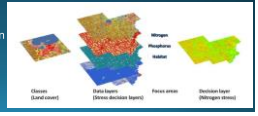
- Initial Analysis using GIS to Determine
  - Wetland Loss
  - Changes in Perennial Cover
  - Changes in Land-use
  - Changes in Hydrologic Storage
  - ???
- Identify Sources of Impairment and Threats
  - Wide ranging in St. Croix Basin
    - Ag vs Development
    - TMDLS's Vs Loss of Habitat

CPF Development Initial Data Sources

- Watershed Health Assessment Framework
  - http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#
    - Web-site that provides a comprehensive overview of the ecological health of Minnesota's watersheds
  - Provides:
    - Watershed Report Card
    - Ecological Context Report
    - Downloadable GIS Data on Watersheds and Catchments

CPF Development Initial Data Sources

- Restorable Wetland Prioritization Tool
  - http://www.mnwetlandrestore.org/
  - MNRWI
    - Predicts likely locations for restorable wetlands using 30-Meter DEM resolution
    - Locates stressed areas in need of water quality and habitat improvement
    - Prioritizing areas that are most likely to result in high functioning sustainable wetlands
    - Refines output based on your priorities
  - Provides
    - Downloadable GIS data at the 30 meter pixel resolution
    - Focus on Nitrogen, Phosphorus, Habitat



CPF Development
Share and Present Data

1. Present Analysis of Data
   - Maps
   - Tabular data
   - Our thoughts on threats
   - Our Thoughts on Goals
2. Solicit Information from you
   - What local data you may have
   - What you perceive as threats
   - Your watershed goals

Final Step in CPF Development

&

Use of CPF

- Road Program Access to Advance Credits
  - Prevent closure of program in service areas
  - Guide for future road banks
  - Can act as an economic catalyst to share credits with private sector needs
- Private Commercial Banks
  - Bankers and use CPF to locate potential bank sites
  - CPF credits will have more value than non-CPF credits (New WCA Rules)
  - Will grandfather existing banks

Use of CPF

- Non-Regulatory Conservation Groups
  - BWSR RIM
  - CREP
- Watershed District Plans and Projects
  - Direct project location for regulatory and non-regulatory uses
- SWCD Projects
  - Work with county or landowners is developing more effective projects

Time Line

• Prospectus	March 2017
• Second Stakeholder meeting	?
• Draft Instrument	?
• Final Instrument	?

Goal of Next Meeting

1. Present Analysis of Data
   - Maps
   - Tabular data
   - Our thoughts on threats
   - Our Thoughts on Goals
2. Solicit Information from you
   - What local data you may have
   - What you perceive as threats
   - Your watershed goals

Appendix C-2
January 2018 Stakeholder Meeting

BOARD OF WATER AND SOIL RESOURCES

Memorandum for File

Date: 2/23/2018

From: Dennis Rodacker

RE: BSA 6 ILF Stakeholder Meeting Summary

This memo summarizes the In-Lieu Fee (ILF) Compensation Planning Framework (CPF) stakeholder meeting held on 1/22/18. The goal of this meeting was to cover the completed components of the CPF and to elicit site selection criteria from the stakeholders.

Presented to the group was a description of the individual components of the CPF with the focus on baseline information and the condition assessment. After the stakeholder group had obtained a good understanding of the CPF, the focus moved to mitigation site selection criteria. The last step remaining is to have the stakeholders rank these criteria for use in the prioritization process. The following criteria were identified as important for site selection in BSA 6 by the stakeholders present at the meeting.

- Number of Landowners per restoration site, the fewer the better
- Connectivity of parcels along with their riparian corridors, examples include
    - Natural or wildlife corridors identified in local or state plans
    - Parks and open space
    - County Biological Survey areas
    - Areas with both state and federal sensitive/T&E species
- Variable size requirements depending on where you are in the BSA. The closer to the metro the smaller the size requirement should become
    - Stillwater 5-Acres
    - Kettle 40-Acres
- Sites that act as buffers between agricultural lands and other aquatic resources, or that have direct discharge to other aquatic resources
- Cost of procuring the rights to perform restoration activities
- Sites located within priority wetland restoration areas identified by LGUs, SWCDs, watershed districts or other aquatic resource agencies
- Proximity to other conservation projects
    - CREP
    - RIM
    - Stream restoration projects
- Sites located in areas where additional flood storage has been identified as a local watershed need
- Restorable wetlands fully or partially drained by ditches

    - Prioritize private systems over public systems, as private systems can be altered much easier than public systems
- Restorable wetlands which are fully or partially drained by tile
    - Lack of tile maps makes this difficult
- Costs related to implementing a restoration plan, such as earth moving, ditch plugs, or tile removal
- Water quality functional lift
    - Restorable wetlands directly adjacent to impaired waters with direct discharge
    - Restorable wetlands not directly adjacent to impaired water, but have inferred indirect discharge to those waters
- Drained forested wetlands identified in local water plans or LGUs
- Avoid areas where future land use is designated for urbanization
- Ground water sensitive and recharge areas designated by local or state plans

St. Croix Drainage Basin (Bank Service Area 6)
Stakeholder Meeting Agenda
January 22nd 12 PM
6355 379th St, North Branch, MN 55056

12:00 PM

- Compensatory Planning Framework (CPF) Overview
  - Baseline Conditions
    - Description of Data Used
  - Cumulative Impact Analysis
    - What we found
  - Description of Threats to the BSA
- Vulnerability Assessment
  - Purpose of Assessment and what it does for the CPF
- Site Selection Criteria
  - Solicit input from Stakeholders
- Next Steps

2:00 Adjourn

BSA 6 Stakeholder List

Organization	Name	Email	Present at 1/22/18 Meeting
Washington SWCD	Jay Riggs	jay.riggs@mnwcd.org	No
Chisago SWCD	Craig Mell & Cassey	craig.mell@mn.nacdnet.net	Yes
Knabec SWCD	Deanna Pomije	deanna.pomije@mn.nacdnet.net	No
Pine SWCD	Robin Poppe	robin.poppe@co.pine.mn.us	No
Carlton SWCD	Laura Christianson	lchristensen@carltonswcd.org	Yes
Isanti SWCD	Todd Kulaf	todd.kulaf@mn.nacdnet.net	Yes
Mille Lacs SWCD	Suasan Shaw	susan.shaw@co.mille-lacs.mn.us	No
Aikin SWCD	Steve Hughs	hughes.aitkinswcd@gmail.com	No
Anoka SWCD	Becky Wozney	becky.wozney@anokaswcd.org	Yes
Comfort Lake Forest Lake WD	Mike Kinnny	michael.kinney@clflwd.org	No
Sunrise WMO	Jamie Shurbon	jamie.schurbon@anokaswcd.org	No
Chisago Lake LID	Susanna Wilson	susanna.wilson@chisagocounty.us	No
Carnelian Marine St. Croix WD	Jim Shaver	NA	No
Browns Creek WD	Karen Kill	karen.kill@mnwcd.org	No
Valley Branch WD	John Hanson	jhanson@barr.com	Yes
South Washington WD	Matt Moore	mmoore@ci.woodbury.mn.us	No
Middle St. Croix WMO	Mike Isensee	misensee@mnwcd.org	No
St. Croix River Association	Deb Ryun	debryun@scramail.com	No
St. Croix River Association	Monica Zachay	monicaz@scramail.com	No
St. Croix River Association	Natalie Warren	nataliew@scramail.com	No
Chisago County Environmental	Jeff Fertig	jafertig@co.chisago.mn.us	No

BSA 6 Stakeholder Meeting

Today's Goals

1. Describe CPF components
2. Review data used in CPF
3. Discuss and select site selection criteria

CPF Components

1. Geographic Service Area
2. Baseline Data
3. Cumulative Impact Analysis
4. Description of Threats
5. Prioritization Strategy

Geographic Service Areas

- Defines the scale of area involved and provides General descriptions
  - Population
  - Land area
  - Land-use
  - Ecological classifications
  - Precipitation
  - Water discharge rates
  - Pre-settlement vegetation
  - Topography

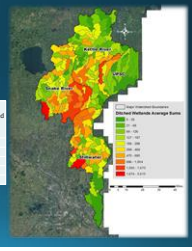
Baseline Data

- Analysis of Current Conditions
  1. Wetlands
  2. Lakes and water courses
  3. Altered Water courses
  4. Water quality
  5. Land cover and perennial cover
  6. Sensitive species
  7. Section 404 permitting

Baseline Data

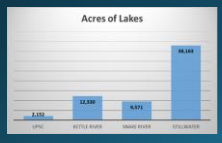
1. Wetlands
   a. Acres and Types per Major Watershed
   b. Acres ditched per major and minor watershed

Watershed	Acres in Watershed	Wetland Acres	% Wetlands per Watershed	Ditched Wetlands	Percent Ditched	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
Stillwater	582,775	201,849.8	37.6%	31,695.5	30.8%	32.6%	23.5%	19.4%	4.4%
Kettle River	672,924	220,581.5	32.8%	11,909.3	5.4%	18.8%	42.7%	37.7%	0.8%
Snake River	643,542	186,092.2	28.9%	34,206.4	18.4%	42.5%	26.1%	30.2%	1.2%
LPSC	347,779	111,508.1	32.1%	4,352.7	3.9%	22.6%	56.0%	18.9%	0.6%
BSA	2,249,300	620,383.9	27.6%	82,314.8	13.2%	32.1%	33.7%	32.6%	1.5%



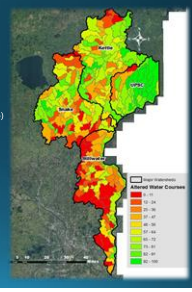
Baseline Data

2. Lakes and Water Courses
   a. Acres of lakes
   b. Miles of stream per watershed



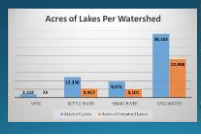
Baseline Data

3. Altered Water Courses
   a. Miles of: altered, natural, impounded, no definable channel
   b. Index Scores at Minor watershed scale
   (ratio of length of altered watercourse to the total length of water course scaled 1-100)



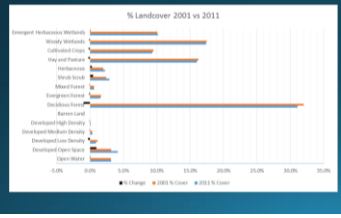
Baseline Data

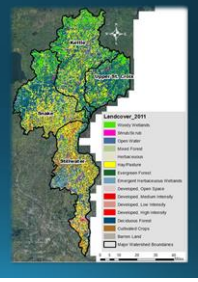
4. Water Quality
   a. Miles of Impaired Streams per major watershed
   b. Acres of impaired lakes per major watershed
   c. Degree and results of TMDL Studies



Baseline Data

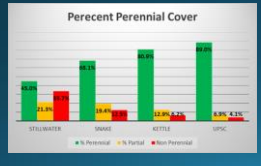
5. Land Cover
   a. Trends of Loss and Gains per major watershed

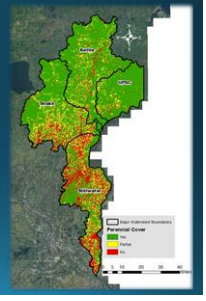




Baseline Data

5. Perennial Cover
   1. Per major Watershed
   2. Subset of land cover data





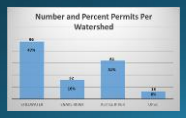
Baseline Data

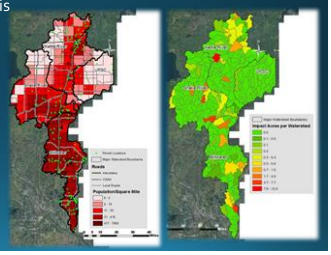
6. Sensitive Species

Species	Status	Location in BSA6	Habitat
Canada lynx (Lynx canadensis)	Threatened (fed)	Carlton, Pine	Northern forested areas
Grey wolf (Canis lupus)	Threatened (fed)	Carlton, Pine	Northern forested areas
Northern long-eared bat (Myotis septentrionalis)	Threatened (fed)	Throughout BSA6	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
Rusty patched bumble bee (Bombus affinis)	Endangered (fed)	Chisago, Washington	Grasslands with flowering plants from April through October, underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.
Higgins eye pearlymussel (Lampsilis higginsii)	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers
Snuffbox (Epioblasma triquetra)	Endangered (fed)	Chisago, Washington	St. Croix River
Spectaclecase (Cumberlandia monodonta)	Endangered (fed)	Chisago, Pine, Washington	Mississippi and St. Croix Rivers
Winged mapleleaf (Quadrula fragosa)	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers

Baseline Data

7. Section 404 Permitting Analysis





Summary of Baseline Conditions

- Consistent and significant degradation from north to south
  - Northern Watersheds *(Northern Kettle & UPSC)*
    - Upland and aquatic resources are more intact
  - Central Portion *(Southern Kettle and Snake)*
    - Changes from forested to agricultural with higher degree of disturbance
  - Southern Portion *(Stillwater)*
    - Most degraded and urbanized

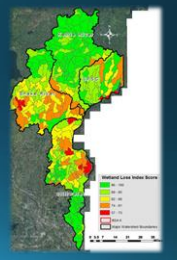
Cumulative Impact Analysis

- Summary of the loss of aquatic resources
  1. Wetland Loss
  2. Ditched Wetlands
  3. Wetland Banking Analysis

Cumulative Impact Analysis

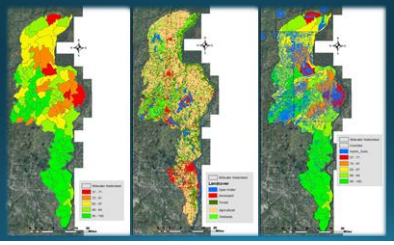
Wetland Loss
- (WHAF Data Using SSURGO and STATSGO)

Watershed	Acres in Watershed	NWI Wetlands	Hydric Soil Acres	Acres Lost	% Lost	% Lost per Watershed Area
Stillwater	585,735	146,317	207,046	60,730	41.5%	10.4%
Kettle River	672,924	232,397	242,138	9,741	4.2%	1.4%
Snake River	643,542	196,134	277,920	81,786	41.7%	12.7%
UPSC	347,719	123,619	142,752	29,133	25.6%	8.4%
BSA	2,249,920	688,467	869,856	181,389	26.3%	8.1%



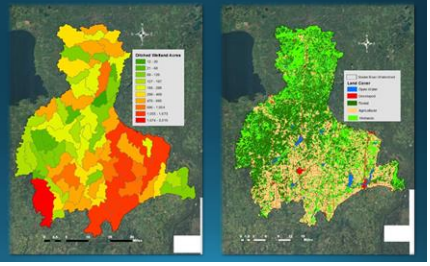
Cumulative Impact Analysis

- Wetland Loss *(Wetland Loss WHAF Data-Land Use-Hydric Soils)*



Cumulative Impact Analysis

- Ditched Wetlands
  - Correlate land-use to wetland alteration



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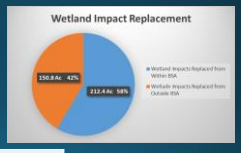

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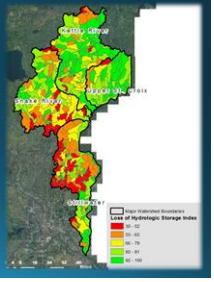

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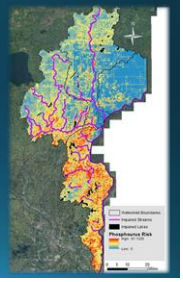

Description of Threats

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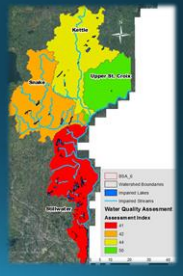

Prioritization Strategy

- Strategic site selection using a watershed approach

1. Watershed vulnerability/condition analysis
   - Assesses the condition of each major watershed
2. Identification of priority minors within each major
   - Purpose is to identify areas within a major watershed where mitigation opportunities should be prioritized
3. Site selection criteria
   - Develop a list of specific site selection criteria to select and rank individual projects

Prioritization Strategy

1. Watershed vulnerability analysis
   - Select data to asses vulnerability of each major watershed
   - Normalize data *(Adjust values of different scales to a common scale)*
   - Reclassify to derive an index *(e.g. scale 1-10)*
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BSA 6 Major Watershed Vulnerability Analysis									
Major Watershed	Wetland Loss	Altered Watercourses	Perennial Cover	Population Density	Ditched Wetlands	Wetland Impacts/Year	Impaired Streams	Impaired Lakes	Total
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Prioritization Strategy

2. Identification of priority minors within each major
   - Minor watersheds proposed to be ranked using a process similar to the vulnerability assessment based the following data sets

Used to weight ranking:
- MNDNR WHAF Soil Erosion Potential
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Prioritization Strategy

3. Site Selection Criteria
   - Prioritize wetland restoration opportunities by developing specific criteria to select preferred sites
   - Restorable Wetland Inventory
     - Baseline for identifying potential restoration opportunities

Site Selection Criteria

BSA 6 Stakeholder Meeting

Today's Goals

1. Describe CPF components
2. Review data used in CPF
3. Discuss and select site selection criteria

CPF Components

1. Geographic Service Area
2. Baseline Data
3. Cumulative Impact Analysis
4. Description of Threats
5. Prioritization Strategy

Geographic Service Areas

- Defines the scale of area involved and provides General descriptions
  - Population
  - Land area
  - Land-use
  - Ecological classifications
  - Precipitation
  - Water discharge rates
  - Pre-settlement vegetation
  - Topography

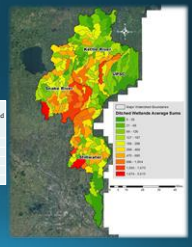
Baseline Data

- Analysis of Current Conditions
  1. Wetlands
  2. Lakes and water courses
  3. Altered Water courses
  4. Water quality
  5. Land cover and perennial cover
  6. Sensitive species
  7. Section 404 permitting

Baseline Data

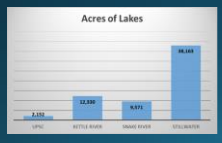
1. Wetlands
   a. Acres and Types per Major Watershed
   b. Acres ditched per major and minor watershed

Watershed	Acres in Watershed	Wetland Acres	% Wetlands per Watershed	Ditched Wetlands	Percent Ditched	Emergent	Forested	Scrub Shrub	Unconsolidated Bottom
Stillwater	582,775	201,849.8	37.6%	31,695.5	30.8%	32.6%	23.5%	19.4%	4.4%
Kettle River	672,924	220,581.5	32.8%	11,909.3	5.4%	18.8%	42.7%	37.7%	0.8%
Snake River	643,542	186,092.2	28.9%	34,206.4	18.4%	42.5%	26.1%	30.2%	1.2%
LPSC	347,779	111,508.1	32.1%	4,352.7	3.9%	22.6%	56.0%	18.9%	0.6%
BSA	2,249,300	620,383.9	27.6%	82,314.8	13.2%	32.1%	33.7%	32.6%	1.5%



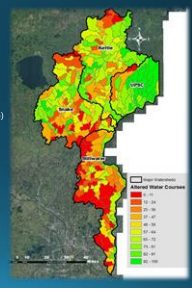
Baseline Data

2. Lakes and Water Courses
   a. Acres of lakes
   b. Miles of stream per watershed



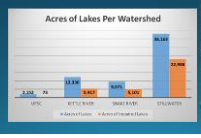
Baseline Data

3. Altered Water Courses
   a. Miles of: altered, natural, impounded, no definable channel
   b. Index Scores at Minor watershed scale
   (ratio of length of altered watercourse to the total length of water course scaled 1-100)



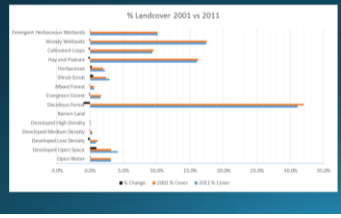
Baseline Data

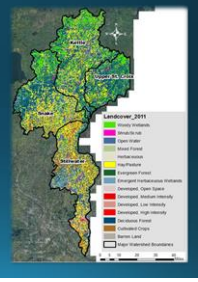
4. Water Quality
   a. Miles of Impaired Streams per major watershed
   b. Acres of impaired lakes per major watershed
   c. Degree and results of TMDL Studies



Baseline Data

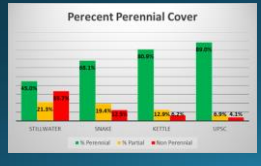
5. Land Cover
   a. Trends of Loss and Gains per major watershed

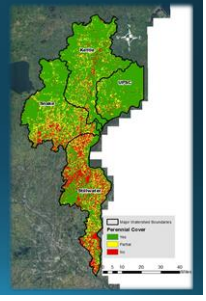




Baseline Data

5. Perennial Cover
   1. Per major Watershed
   2. Subset of land cover data





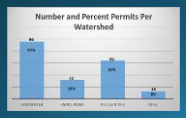
Baseline Data

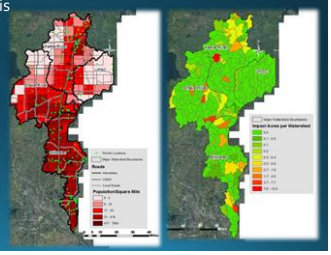
6. Sensitive Species

Species	Status	Location in BSA6	Habitat
Canada lynx (Lynx canadensis)	Threatened (fed)	Carlton, Pine	Northern forested areas
Grey wolf (Canis lupus)	Threatened (fed)	Carlton, Pine	Northern forested areas
Northern long-eared bat (Myotis septentrionalis)	Threatened (fed)	Throughout BSA6	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
Rusty patched bumble bee (Bombus affinis)	Endangered (fed)	Chisago, Washington	Grasslands with flowering plants from April through October, underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.
Higgins eye pearlymussel (Lampsilis higginsii)	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers
Snuffbox (Epioblasma triquetra)	Endangered (fed)	Chisago, Washington	St. Croix River
Spectaclecase (Cumberlandia monodonta)	Endangered (fed)	Chisago, Pine, Washington	Mississippi and St. Croix Rivers
Winged mapleleaf (Quadrula fragosa)	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers

Baseline Data

7. Section 404 Permitting Analysis





Summary of Baseline Conditions

- Consistent and significant degradation from north to south
  - Northern Watersheds *(Northern Kettle & UPSC)*
    - Upland and aquatic resources are more intact
  - Central Portion *(Southern Kettle and Snake)*
    - Changes from forested to agricultural with higher degree of disturbance
  - Southern Portion *(Stillwater)*
    - Most degraded and urbanized

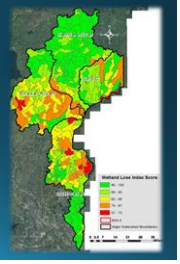
Cumulative Impact Analysis

- Summary of the loss of aquatic resources
  1. Wetland Loss
  2. Ditched Wetlands
  3. Wetland Banking Analysis

Cumulative Impact Analysis

Wetland Loss
- (WHAF Data Using SSURGO and STATSGO)

Watershed	Acres in Watershed	NWI Wetlands	Hydric Soil Acres	Acres Lost	% Lost	% Lost per Watershed Area
Stillwater	585,735	146,317	207,046	60,730	41.5%	10.4%
Kettle River	672,924	232,397	242,138	9,741	4.2%	1.4%
Snake River	643,542	196,134	277,920	81,786	41.7%	12.7%
UPSC	347,719	123,619	142,752	29,133	25.6%	8.4%
BSA	2,249,920	688,467	869,856	181,389	26.3%	8.1%



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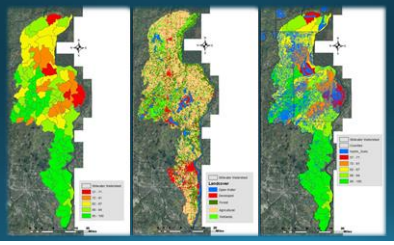

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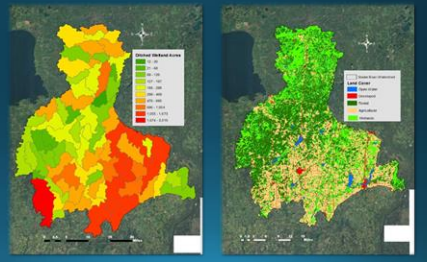

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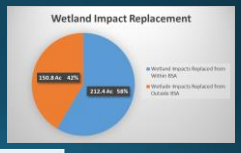

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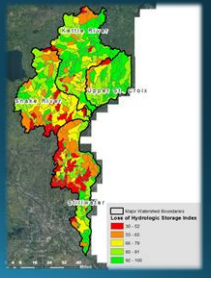

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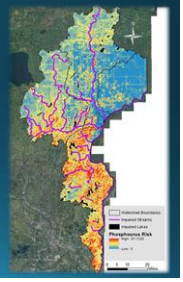

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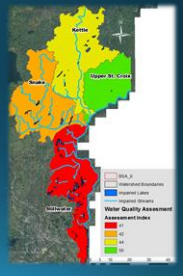

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