



**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 In-Lieu Fee (ILF) program information provided separately as part of the Prospectus.

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. As coordinated previously with the St. Paul District (District), the CPF prepared for BSA 6 with the Prospectus submittal does not carry the analysis all the way through identification of sites in the prioritization process. BWSR intends to complete the remaining steps of this analysis after comments on the approach laid out in this version of the CPF have been provided by the District. In this way, BWSR avoids expending resources on time consuming analyses that may need to be revised or redone if District review comments are not supportive of the BWSR process proposed in this CPF. This primarily applies to the information provided in Section 7 of the CPF.

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 Survey¹

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 ILF instrument and any affected CPFs would be modified to adhere to these program changes.

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.

The focus of this CPF is BSA 6, which is the portion of the St. Croix River basin (HUC 0703) that lies within Minnesota. The vast majority of the St. Croix River watershed is located north and east of the Twin Cities metropolitan area except for a relatively narrow portion that surrounds the river as it approaches the confluence with the Mississippi 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.

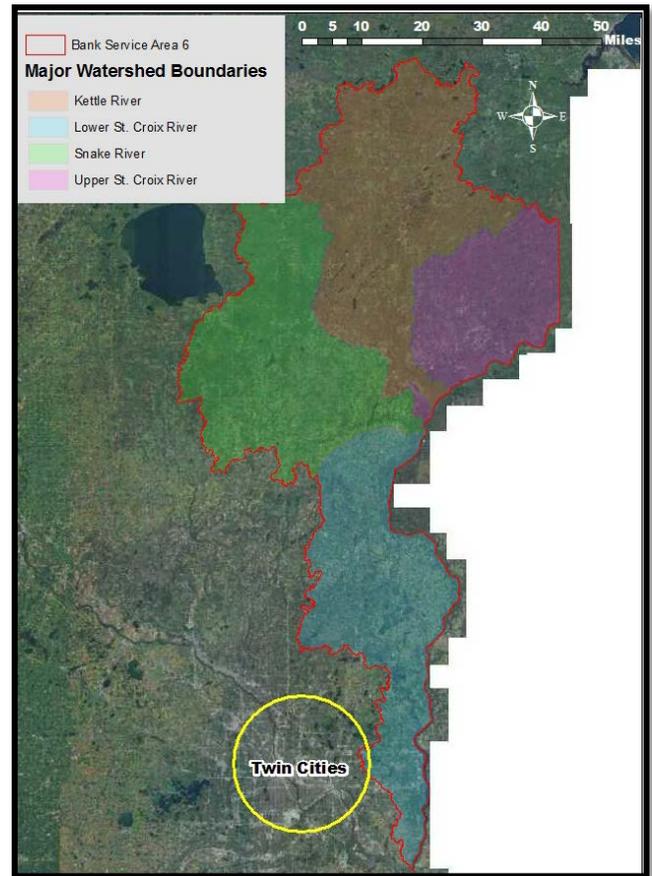
To provide a more manageable and meaningful analysis, the majority of the information in this CPF is provided at the 8-digit HUC scale (also referred to as a “major watershed” in Minnesota). This level of analysis takes into account the difference in land use from north to south as well as the quality 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 location and boundaries of the major watersheds in BSA 6 are shown in Figure 1.

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.

FIGURE 1
BSA 6 Major Watersheds



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 has been 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

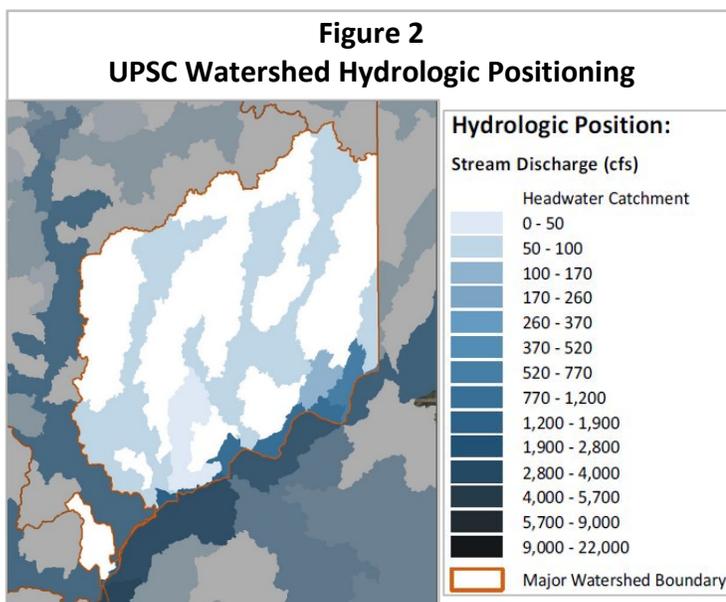
The entire UPSC watershed is classified as the Mille Lacs Upland Subsection, which covers the large area of Superior Lobe ground moraines and end moraine in east-central Minnesota. Gently rolling till plains and drumlin fields are the dominant landforms in this ecoregion with brown and red till forming 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 (Hole 1976, 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.



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 consist 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 (Hole 1976, 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.

Topography

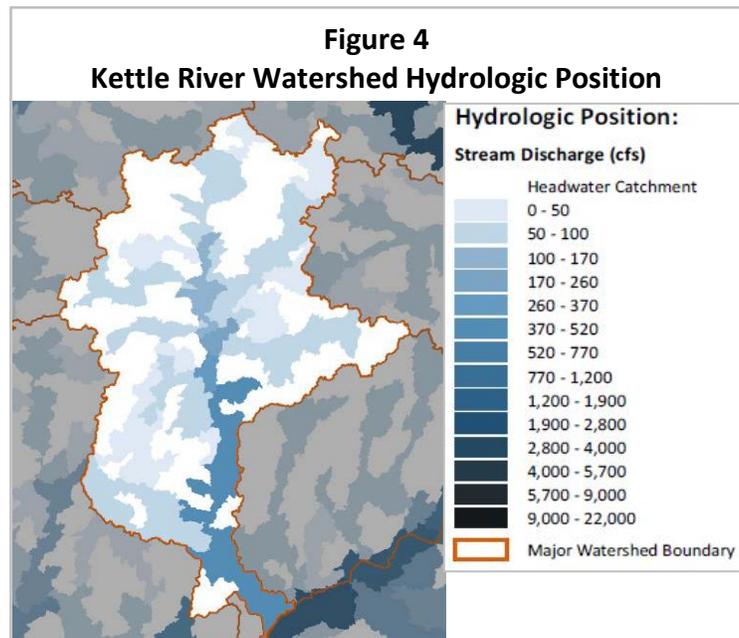
Like the UPSC watershed, the Kettle has a general north-south topographic gradient. Although elevations in the northern part of the Kettle watershed are slightly higher than the UPSC the distribution of watershed area over the range of hillslope is very similar to the UPSC watershed. Slopes range from 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 (Albert 1993).

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

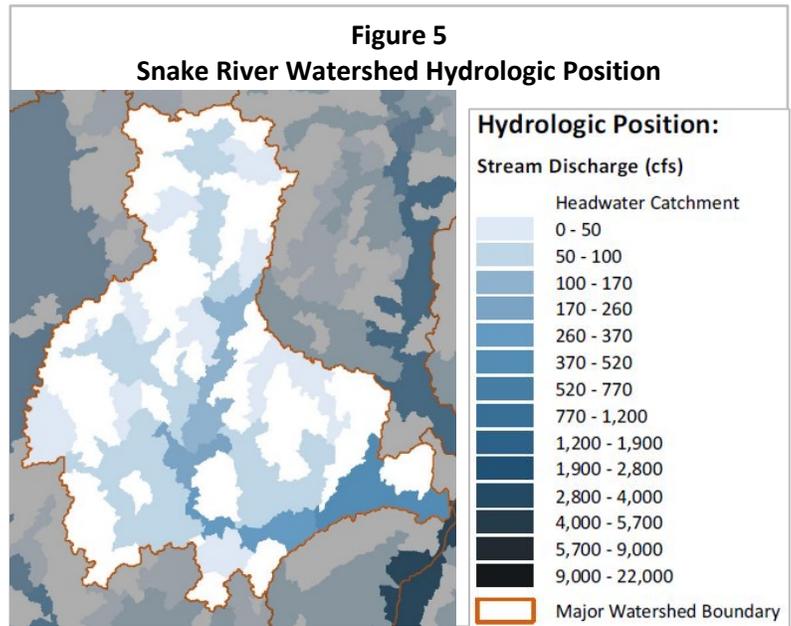
Typically, there is dense glacial till underlying most soils in this subsection. This dense till impedes water movement throughout the soil profile. The soils are described as acid, stony, reddish sandy loams, silt loams, and loamy sands (Hole 1976, Hobbs and Goebel 1982). The parent material in the 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 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

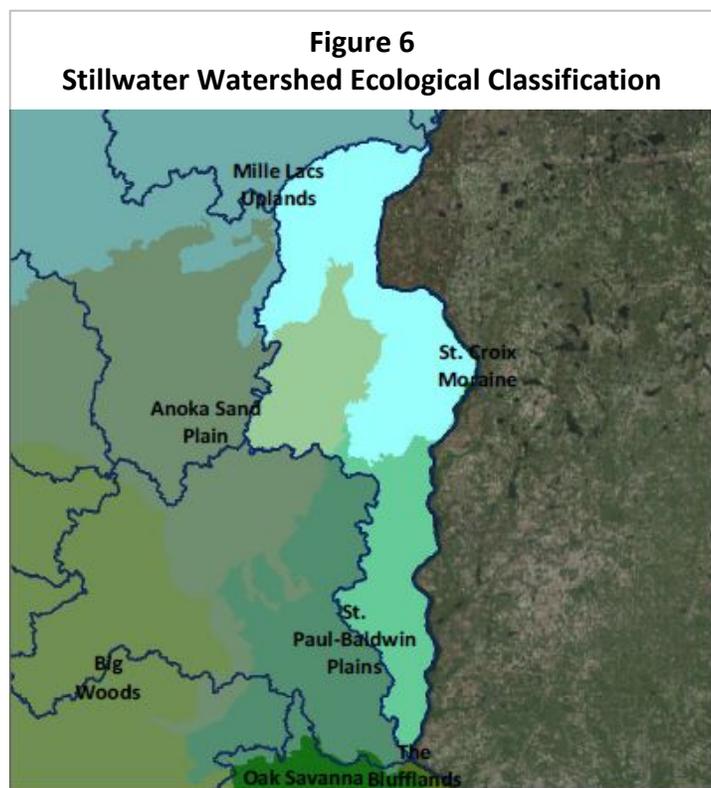
The Stillwater Watershed is classified into three ecological subsections: Mille Lacs Uplands 49%, St. Paul-Baldwin Plains 28% and the Anoka Sandplain 22%. The Mille Lacs Uplands was discussed previously and will not be addressed again in this section.

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 (Hole 1976, 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 (Psammets), 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.

Topography

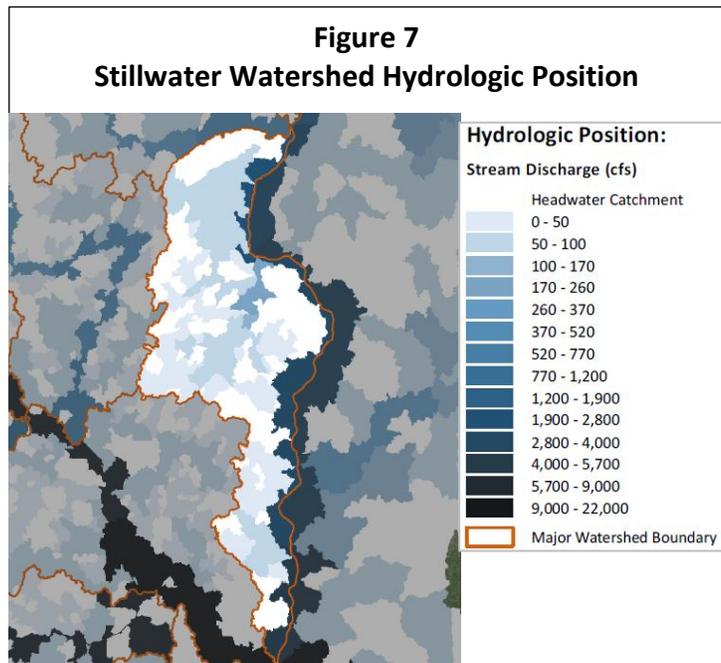
The watershed ranges in elevation from approximately 320 meters to 210 meters, with a general downward sloping gradient from west to east.

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 (Albert 1993).

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). This represents the most up to date wetland mapping for the watershed until completion of the Minnesota NWI update. 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 northernmost watershed also have more forested and scrub shrub wetlands than the Stillwater watershed.

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.

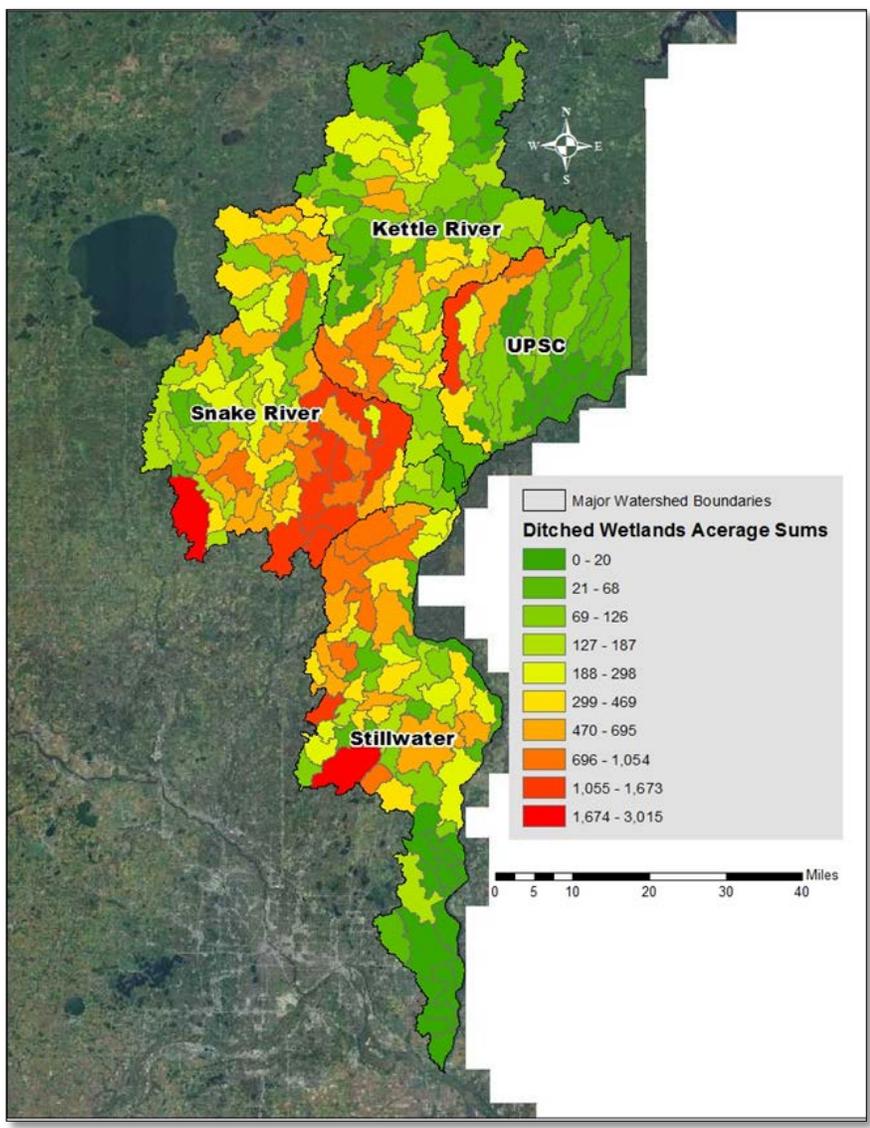
Several wetland functions assessed with the Minnesota Routine Assessment Method (MNRAM) and described in the Hydrogeomorphic Approach to wetland functional assessment (HGM) are adversely affected by drainage. These include water storage, downstream water quality, ground water recharge, wildlife habitat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

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

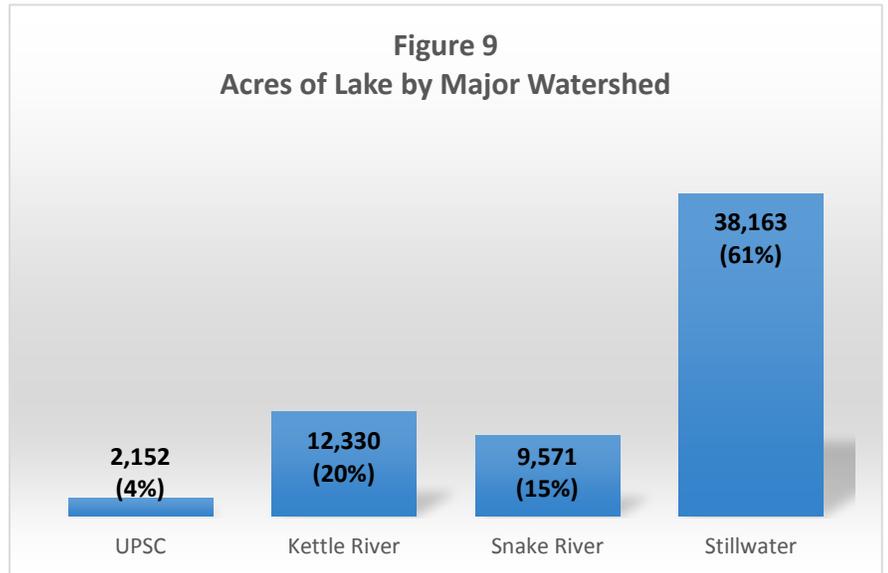
qualitative assessment does provide useful information for the assessment of baseline conditions. Table 6 shows that two of the major watersheds, the Snake River and Stillwater, have significantly higher percentages of ditched wetlands than the UPSC and Kettle River watersheds. The distribution of ditched 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

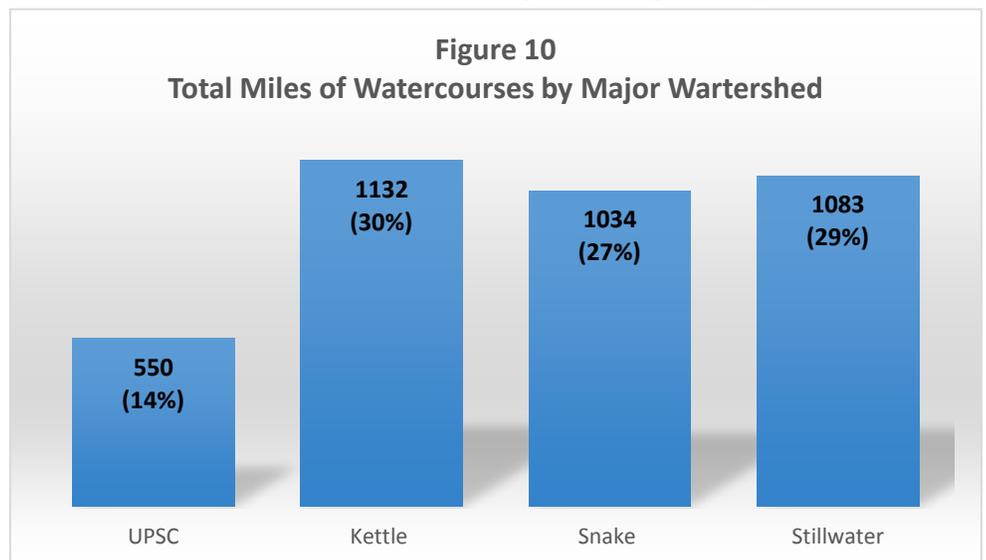
Based on the MN DNR's "Lakes and Open Water" data, BSA 6 contains over 62,000 acres of lakes with a disproportionate amount (approximately 60% of the total acreage) located within the Stillwater watershed (Figure 9) which is noteworthy considering that the Stillwater watershed has the fewest acres of 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

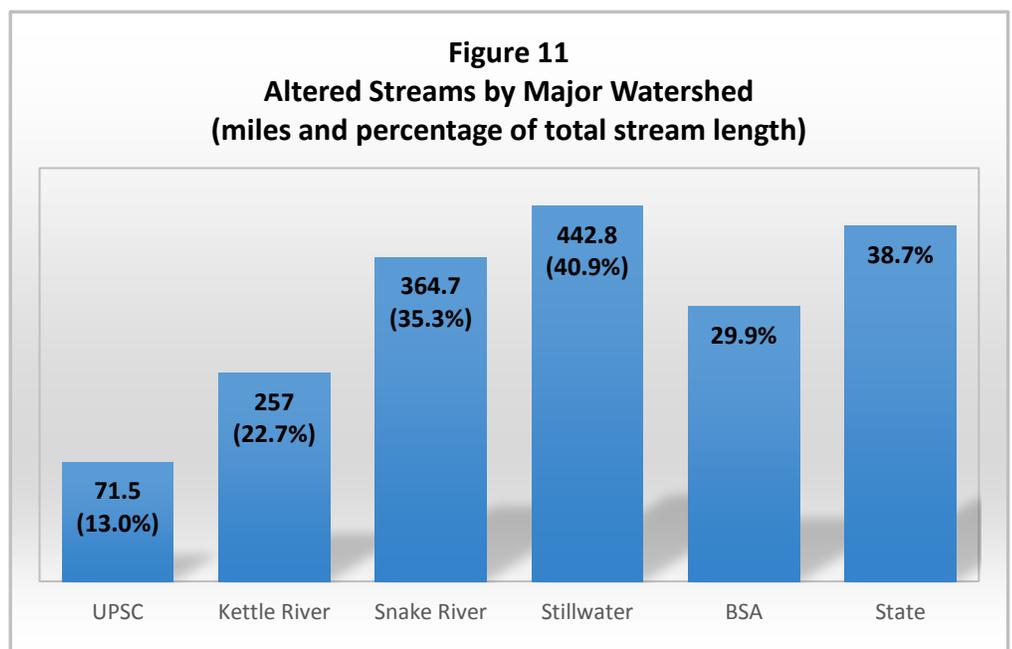
Altering the pattern, profile, or dimension of a watercourse reduces the ability of that aquatic resource to store water resulting in increased peak flows, lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes (Mitch and Gosselink, 2007). Water quality usually is degraded when storage is removed, and improved when storage is added (Zedler, 2003; Kovacic et al., 2006; Mitsch and Day, 2006).

As one means of assessing watercourse condition, we used the MPCA Altered Watercourse 2012 data set 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.

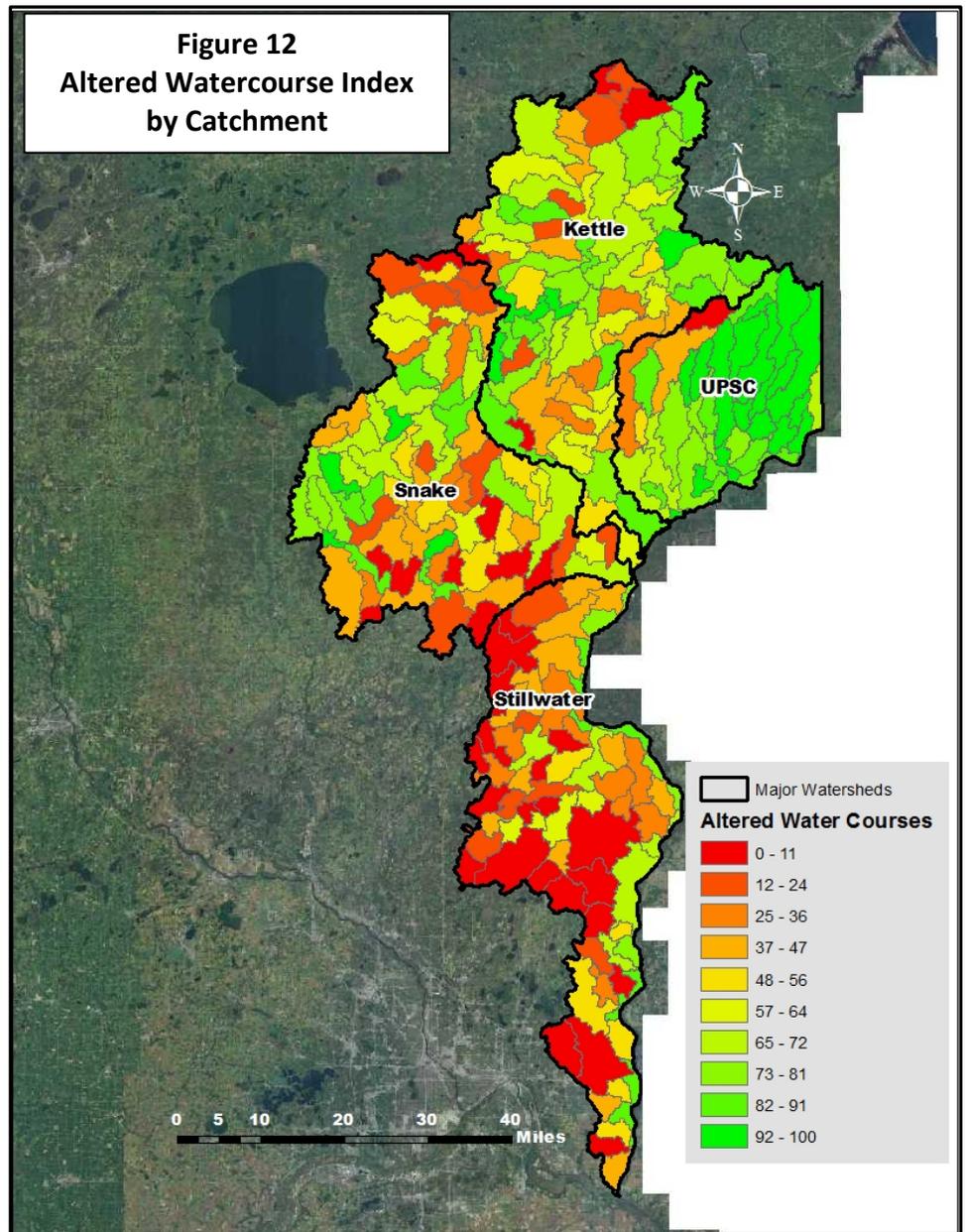
Comparing the percent of altered watercourses per total stream miles in each watershed and statewide, (Figure 11) shows that the UPSC and Kettle River major watersheds are below the state average at 13% and 23% respectively. The Snake major watershed (35%) is just below the 39% state average while the



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).

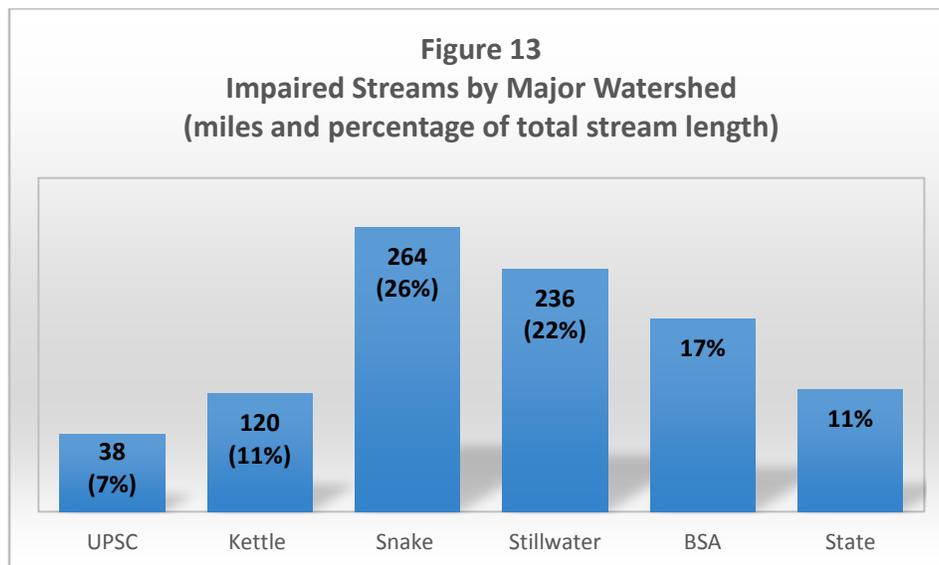
The WHAF altered stream outputs for the catchments in BSA 6 are presented in Figure 12. Consistent with the assessment at the major watershed scale, there is a high degree of watercourse alteration in the Stillwater and lower portions of the Snake watersheds, which are the most urbanized and farmed portions 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.



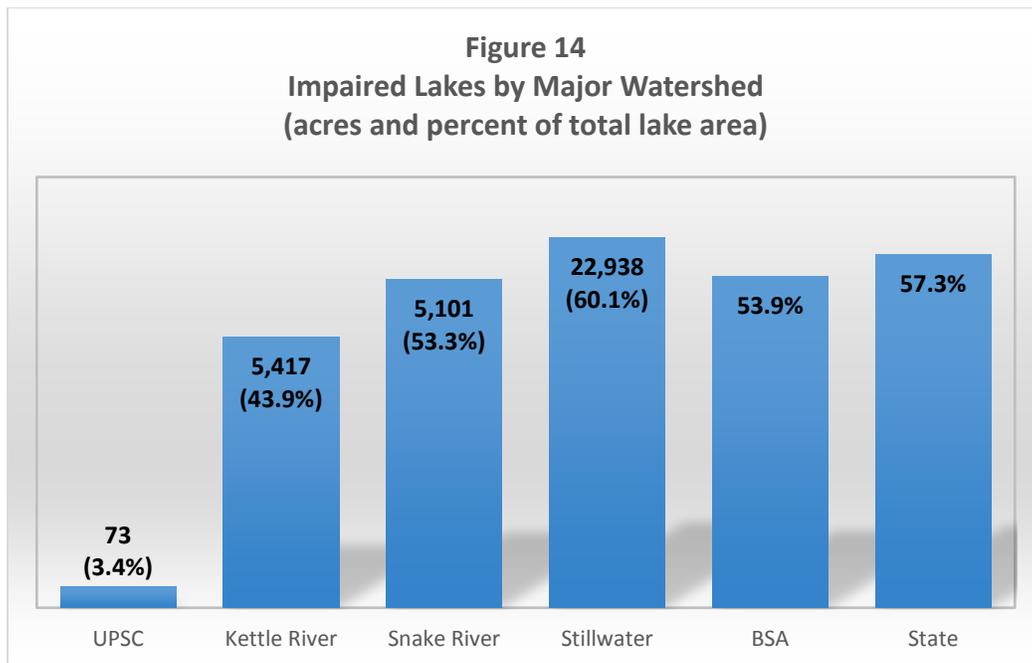
Water Quality

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.



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.

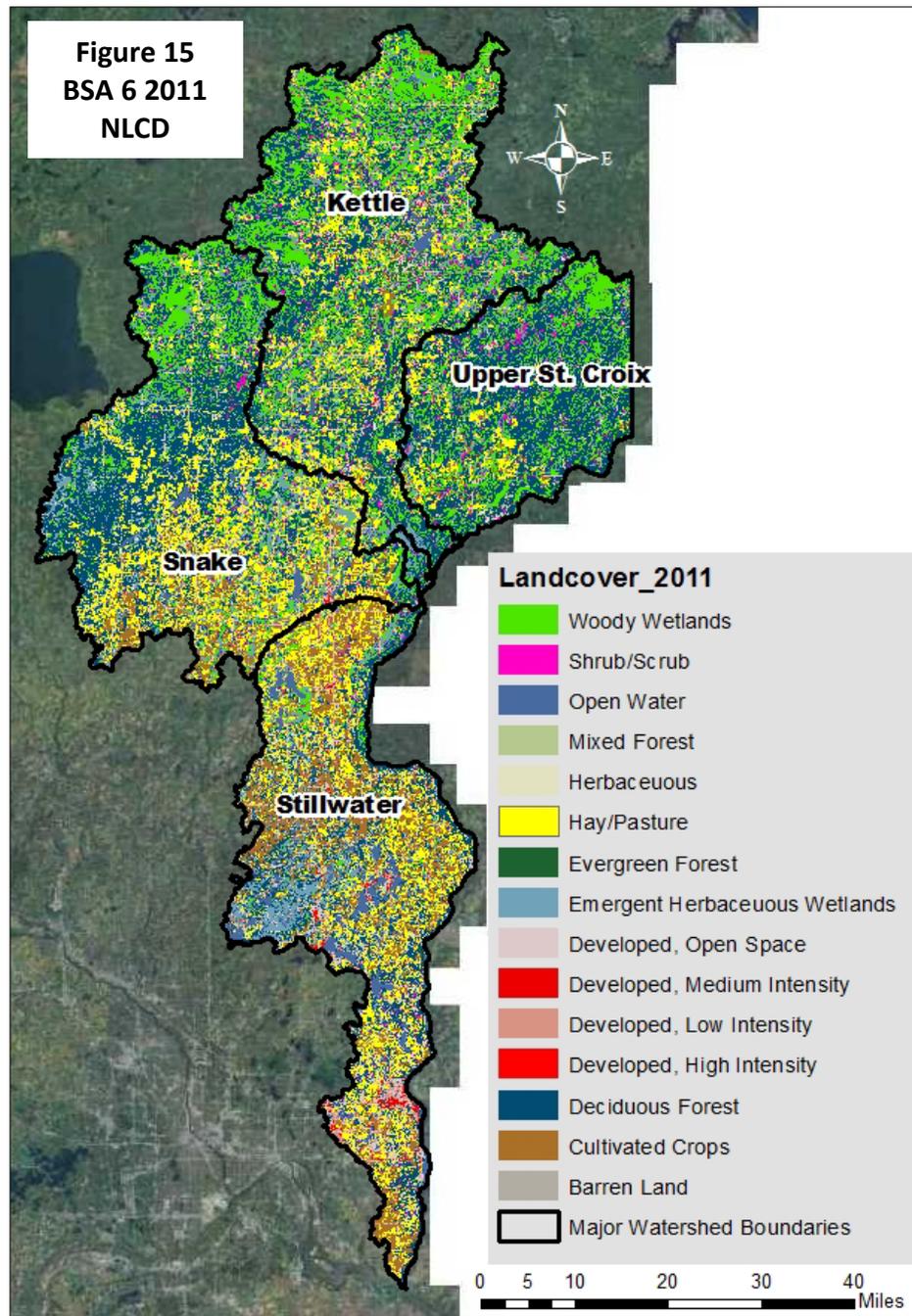
UPSC

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.

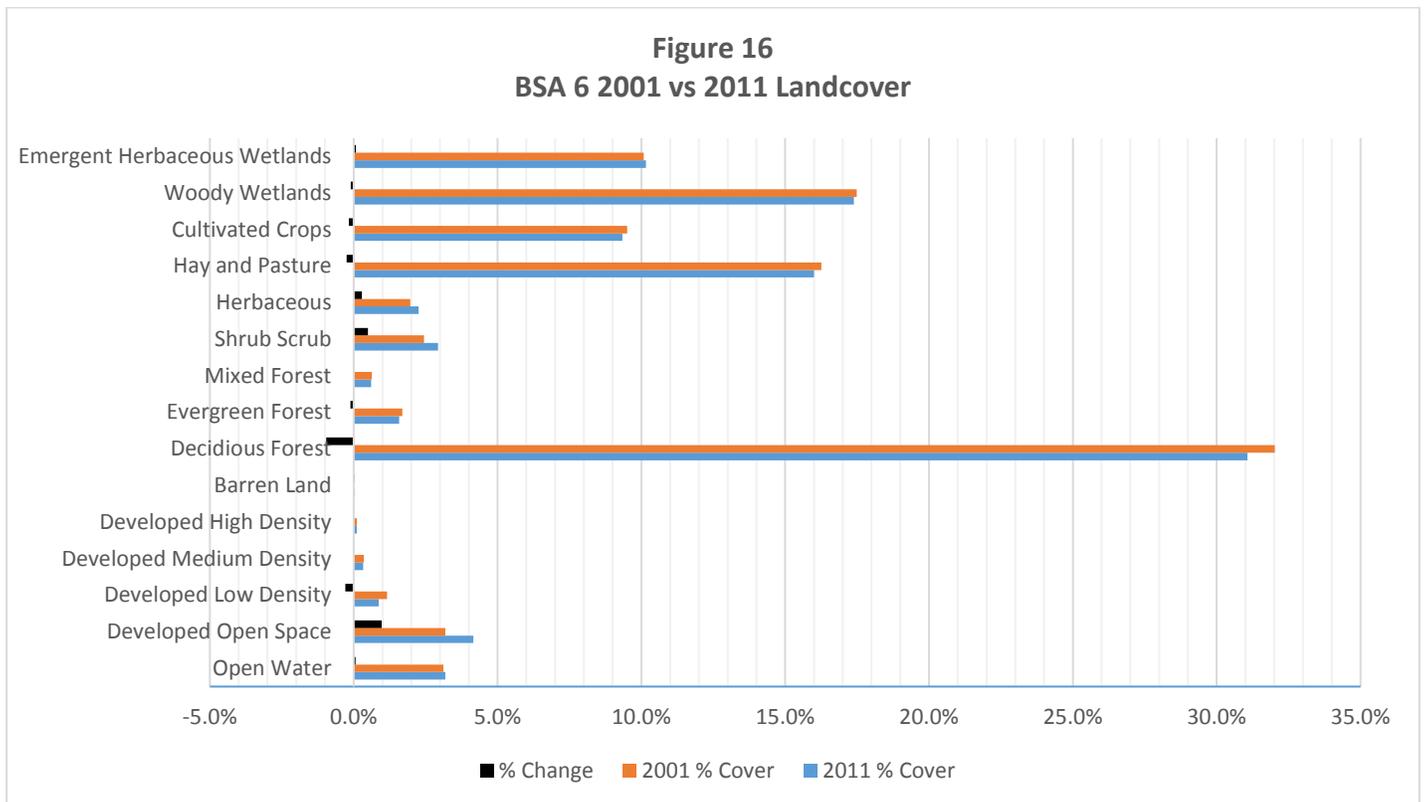
Figure 15 shows the 2011 land use classes for BSA 6. It is clear from the map that the northern third of the watershed contains more forested areas and significantly less agricultural and developed areas. Consistent with other baseline condition data evaluated for this CPF, the middle third of the watershed 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

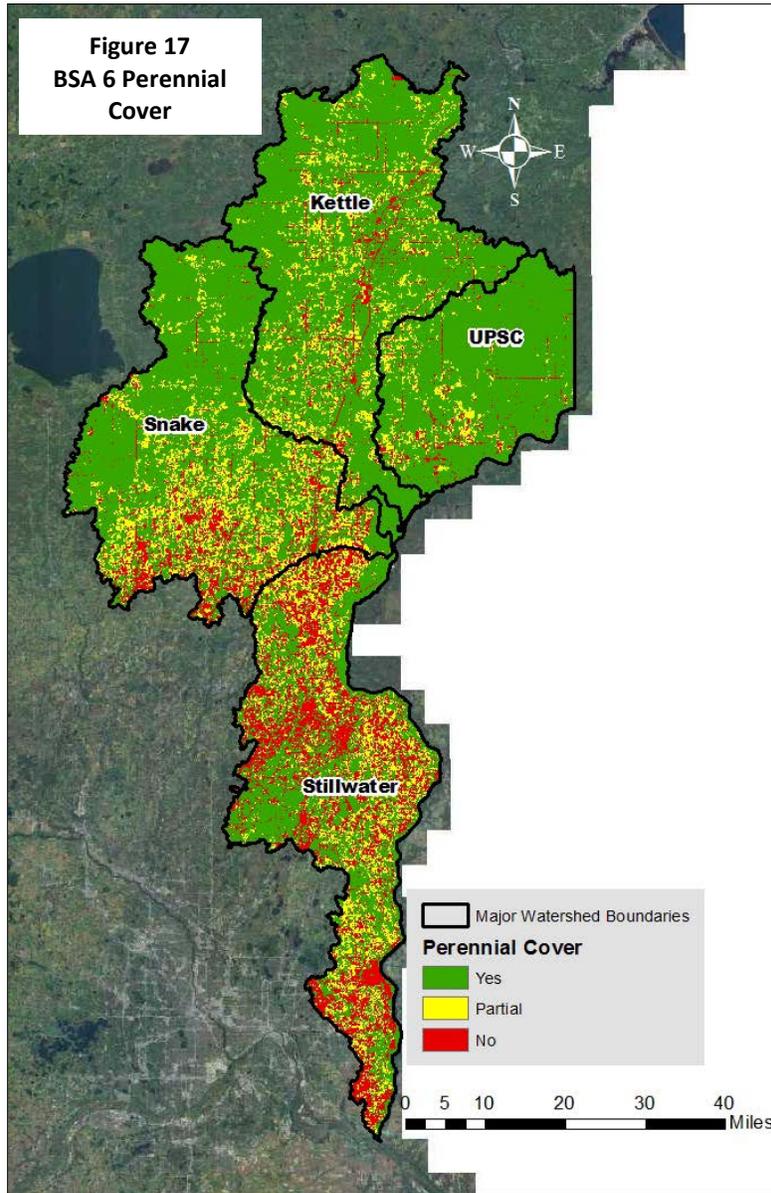
A comparison of the 2001 and 2011 land cover classes for BSA 6 is provided in Figure 16. The comparison of these two data sets shows that, for the most part, land cover did not change significantly during this ten year period except for a couple of situations. The most common land cover in BSA 6 in each 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.



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. The sensitive species that have been identified as potentially occurring within BSA6 are summarized in Table 7.

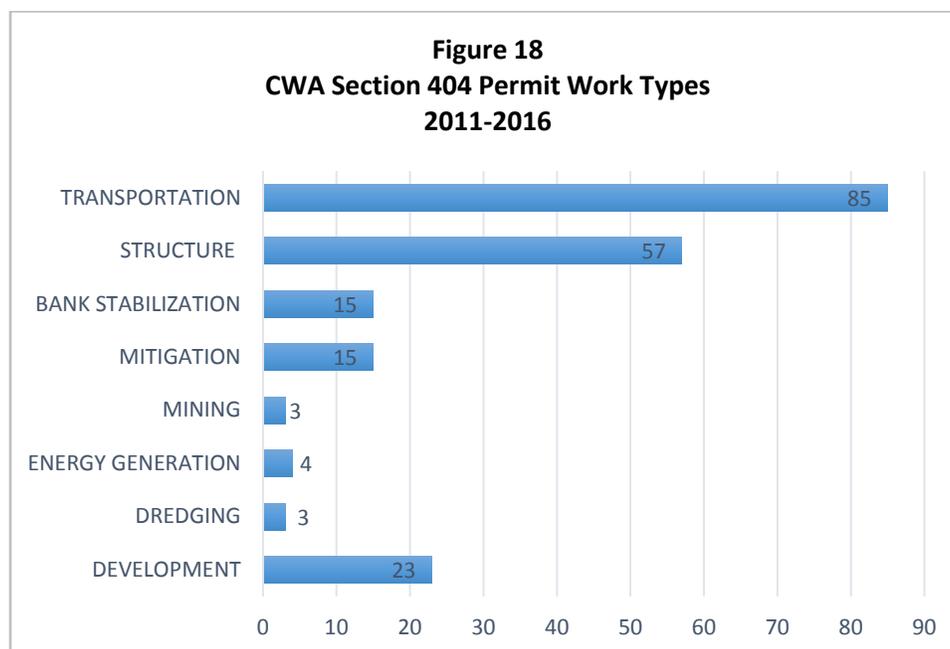
Table 7 Sensitive Species Identified in BSA 6			
Species	Status	Location in BSA 6	Habitat
Canada lynx (<i>Lynx canadensis</i>)	Threatened (fed)	Carlton, Pine	Northern forested areas
Gray wolf (<i>Canis lupus</i>)	Threatened (fed)	Carlton, Pine	Northern forested areas
Northern long-eared bat (<i>Myotis septentrionalis</i>)	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 (<i>Bombus affinis</i>)	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 (<i>Lampsilis higginsii</i>)	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers
Snuffbox (<i>Epioblasma triquetra</i>)	Endangered (fed)	Chisago, Washington	St. Croix River
Spectaclecase (<i>Cumberlandia monodonta</i>)	Endangered (fed)	Chisago, Pine, Washington	Mississippi and St. Croix Rivers
Winged mapleleaf (<i>Quadrula fragosa</i>)	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.

Permitting

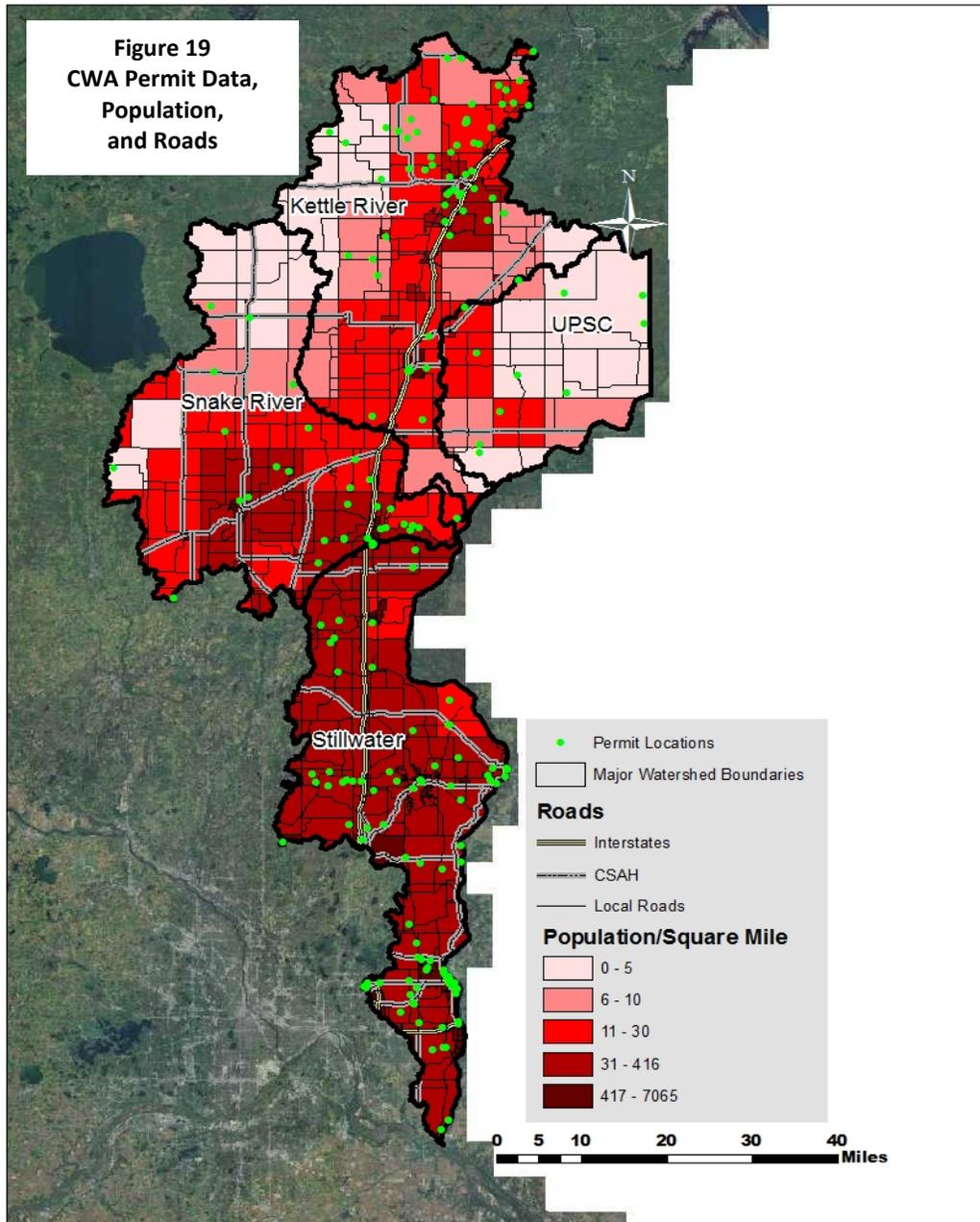
Permitting data from the U.S. Army Corps of Engineers, St. Paul District Clean Water Act Section 404 permitting program for fiscal years 2011-2016 was obtained and analyzed to: (1) determine the work types that most commonly result in regulated impacts to aquatic resources; (2) identify permit intensity 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.

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.



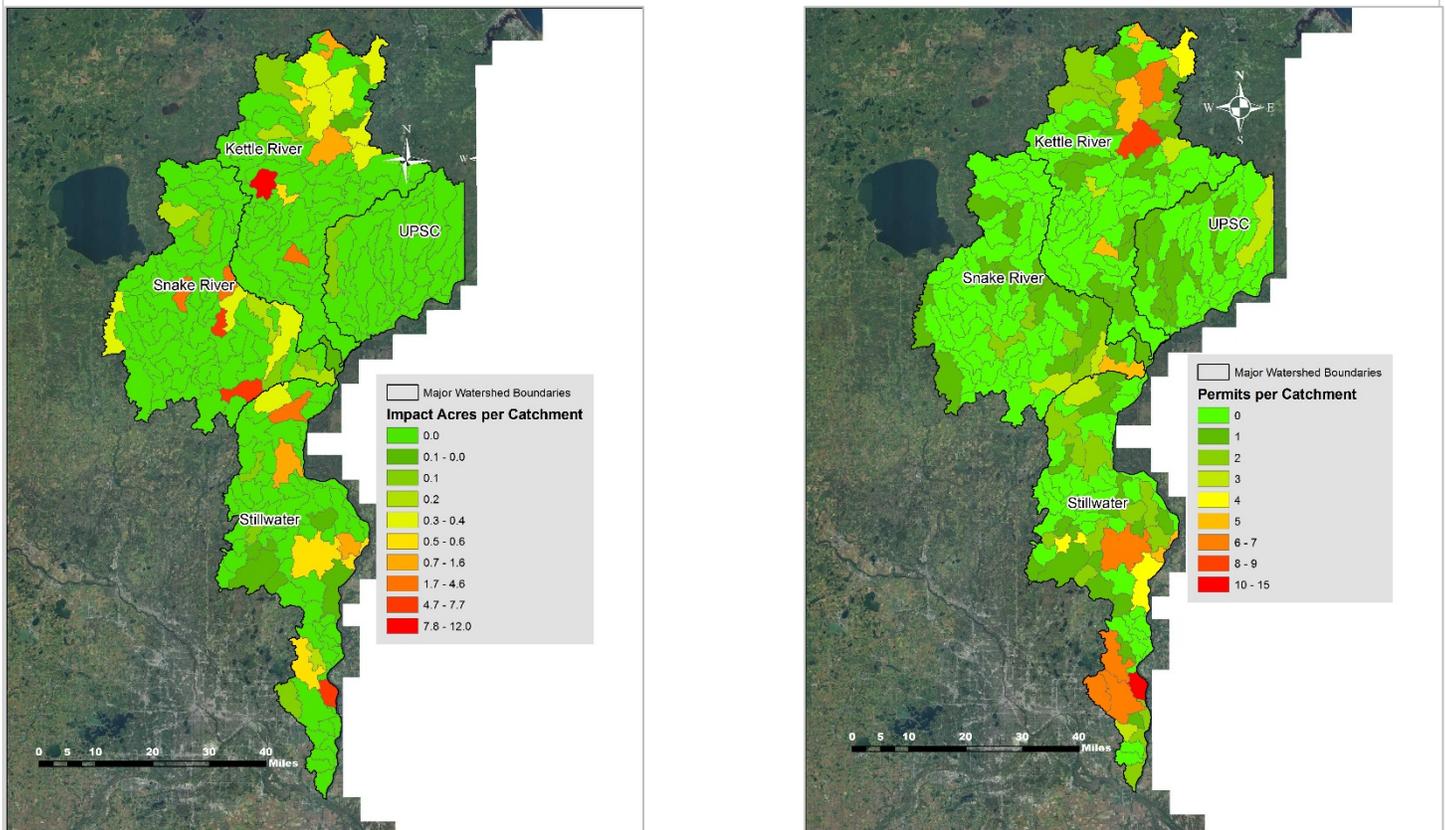
Since permit activity is often closely correlated with population density and transportation infrastructure, the permit data was plotted with these two data sets. Not surprisingly, the areas of highest population density in BSA 6 are home to the majority of the permitting actions. The Stillwater watershed, 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.

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.



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 quantity. 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. A more detailed comparative analysis of baseline conditions is provided in the Watershed Condition Assessment which can be found in Section 7 of this CPF.

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 8.

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 effect 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 measureable 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 county 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 9.

Table 9				
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
<i>BSA</i>	<i>2,249,920</i>	<i>636,436</i>	<i>79,792</i>	<i>13</i>

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 10 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.

watershed	Wetland Loss Method		Land Cover Classification				
	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 769.3 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 11.

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 11
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	Sold out	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.

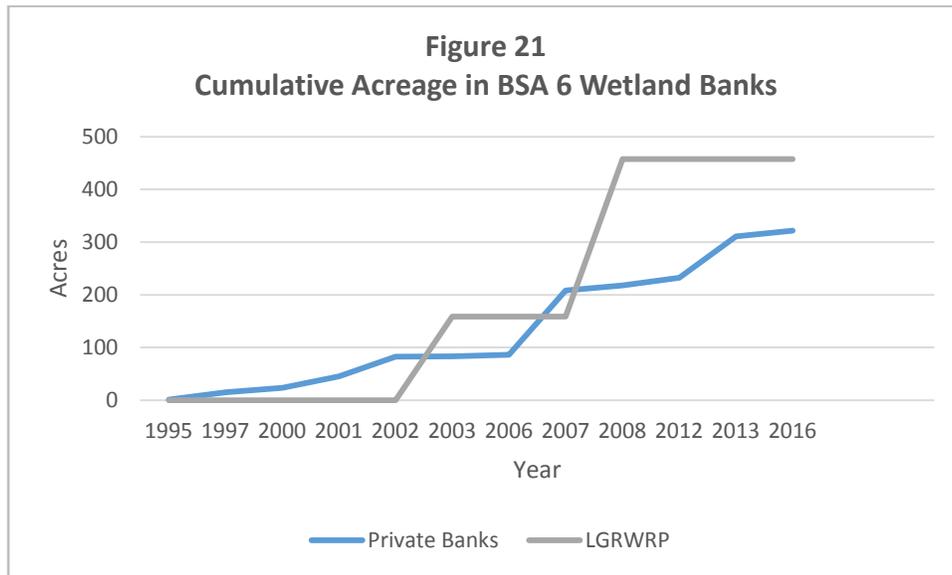
As of November 2017, the balance of wetland credits in BSA 6 was 73, which includes 29.9 federally approved credits and 43.1 state only approved credits. The total amount of federally approved credits includes 3.8 credits in LGRWRP accounts and 17.7 credits that have been purchased and placed in a transfer account but not yet applied towards a mitigation requirement. Removing these credits from the pool of federally approved credits leaves approximately 8.4 federally approved credits that are potentially available for sale on the private banking market. The 8.4 federally approved credits are spread amongst six different banks and include the following types and amounts: 3.17 shallow marsh, 2.6043 sedge meadow, 1.5091 deep marsh, 0.7381 fresh (wet) meadow, 0.18 open bog, 0.101 hardwood swamp, and 0.0891 upland buffer.

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.



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 12.

Activity Type	1	2	3	4	5	6	7	8	9	10	Unknown	Total	% In Place¹
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 12 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.

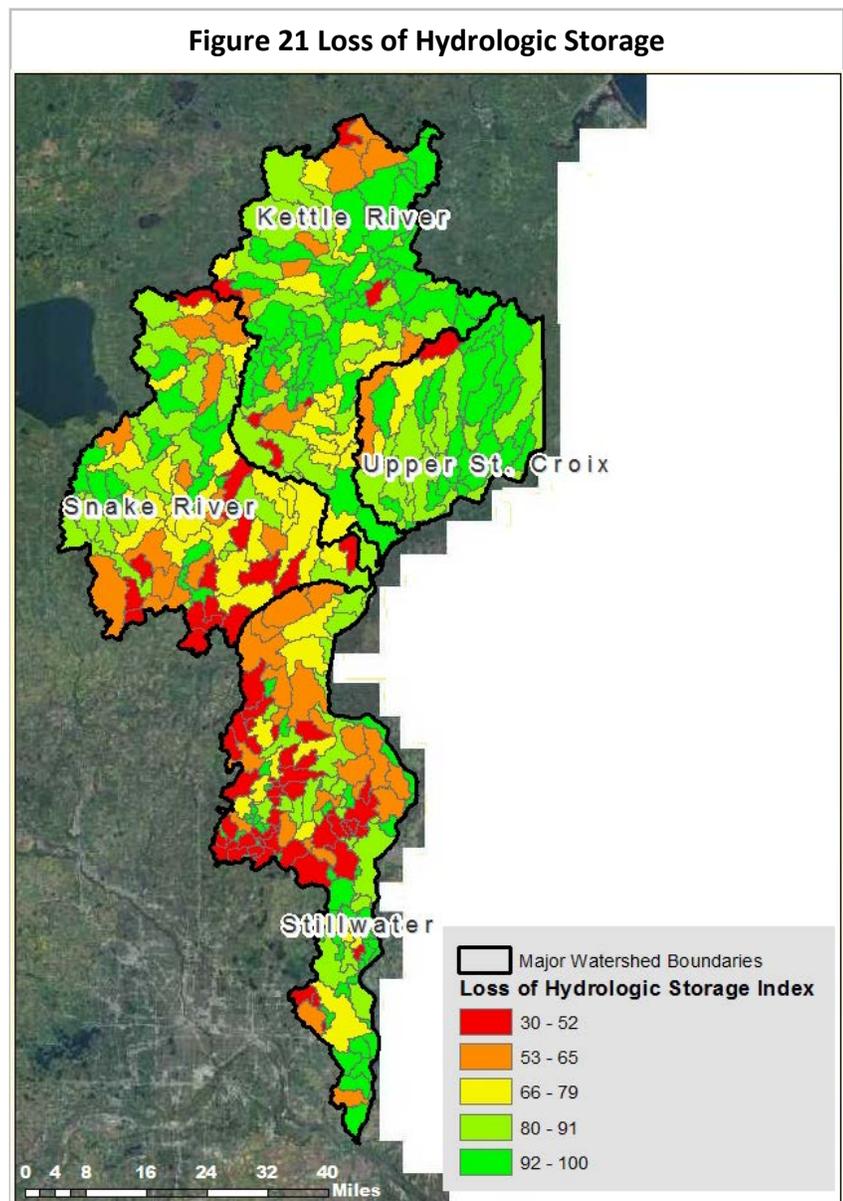
Description of Threats

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.



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

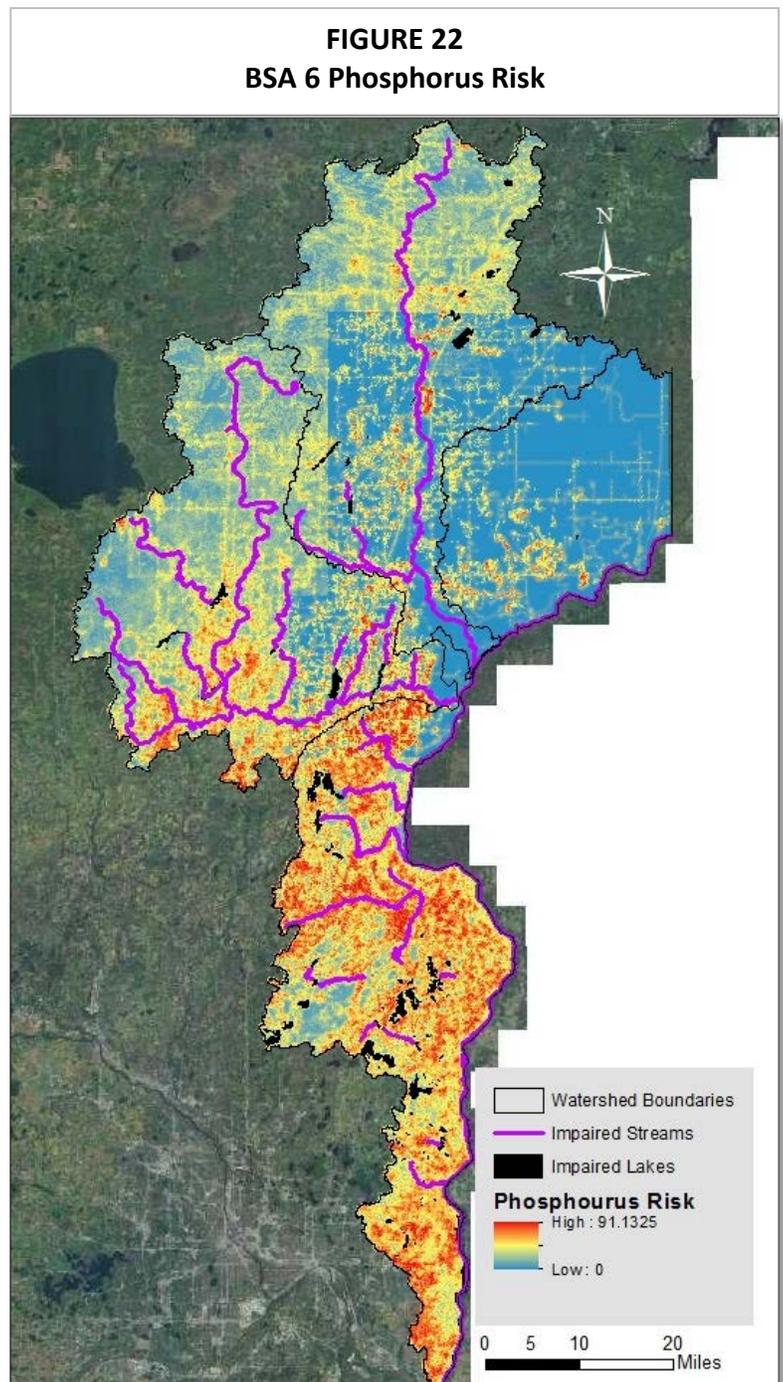
There is a significant increase level of phosphorus stress in the southern portion of the BSA, which correlates to the land cover illustrated in Figure 5. Results are similar to wetland loss and altered streams with the Stillwater and lower portion of the Snake having the most risk of contamination. 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 documented in Section x of 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 73 credits available for purchase of which 8.4 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 could be exhausted within a year's time and mitigation will need to be obtained from other BSAs in order to satisfy mitigation requirements unless project-specific mitigation is a viable options 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 49 acres. 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. An attendee list and copy of the material presented to the stakeholders is provided in Appendix C-1.

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 will be further evaluated by BWSR and factored into the identification and prioritization process that will be the focus of future stakeholder meetings. This process is described in greater detail in Section 7 of this document. An attendee list, copy of the material presented to the stakeholders, and a meeting summary is provided in Appendix C-2.

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. The ILF will provide high quality mitigation through strategic site selection using a watershed approach and criteria representative of conditions and limitations in the bank service area. Specific resource goals and objectives for BSA 6 will be established as the CPF is further developed between the prospectus and draft instrument phases of the federal review process. Until specific resource goals and objectives are established the following general principles are guiding CPF development:

- Reverse the trend of wetland mitigation export from BSA 6 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;
- Target mitigation sites that have the greatest potential functional lift for the watershed based on the mitigation site selection process;

Prioritization Strategy

Wetland mitigation site prioritization will be developed using a two-step process. The first step is a condition assessment of aquatic resources in each major watershed which assesses vulnerability. Vulnerability is the susceptibility of a watershed to harm primarily from human disturbance. Wetland communities sensitive to human-induced disturbance are vulnerable to land use changes and hydrologic alterations that are commonly the result of urban growth and development. The results of the condition assessment can be used as a factor when prioritizing mitigation opportunities within the BSA. The analysis conducted for BSA 6 utilized seven criteria to assess conditions in BSA 6. The criteria and rationale for each is provided in Table 13.

Table 13 Criteria Used in the Condition Assessment for BSA 6	
Assessment Criteria	Logic for Inclusion
Wetland Loss	Conversion of wetlands to non-wetland land use indicates a continued threat to ecosystem integrity through the loss of wetland function.
Altered Water Courses	Hydrologic alterations reduce ecosystem function in the watershed and the presence of these alterations serves as a proxy indicating existing watershed vulnerability.
Perennial Cover	Areas with exposed soils or impervious surfaces are an indicator of human disturbance and landscape alteration.
Population Density	Natural systems are sensitive to human disturbance. Population density is an indicator of the degree of urbanization in a watershed and the potential for human induced change.
Ditched Wetlands	Wetland function is affected by activities that degrade, but do not necessarily remove, wetlands from the landscape. Assessing the degree to which existing wetlands have been affected by one form hydrologic alteration helps characterize wetland degradation separate from a loss of acreage.
Wetland Impacts per Year	Section 404 permitted wetland impacts from 2011-2016 provide insight to where impacts are currently occurring in BSA 6.
Impaired Streams	Water quality impairments are an indicator of lost watershed function and vulnerability.
Impaired Lakes	Water quality impairments are an indicator of lost watershed function and vulnerability.

These criteria were assessed for each major watershed using publicly available GIS data obtained by BWSR with the exception of the wetland loss estimate which was obtained from extrapolating the Anderson and Craig report. The data was normalized based on a comparison of the worst-case scenario (wetland loss for each watershed was divided by the maximum loss documented for the major watersheds). The normalized result was then put into the appropriate “bin” using ten possible categories equally distributed across a scale from 1 to 100 and given the score assigned to that range of values. A score of 1 indicated a higher quality or more intact condition while a score of 10 represented a lower quality or more degraded condition. The score for each assessment criteria was then summed by watershed to produce an overall assessment score (maximum of 80). The results of the watershed condition assessment are provided in Table 14.

Table 14 BSA 6 Major Watershed Condition Assessment									
Major Watershed	Wetland Loss	Altered Watercourses	Perennial Cover	Population Density	Ditched Wetlands	Wetland Impacts/ Year	Impaired Streams	Impaired Lakes	Total
UPSC	3	4	3	1	3	1	3	1	19
Snake	4	10	6	2	10	10	10	9	61
Kettle	3	6	4	2	3	10	5	8	41
Stillwater	10	10	10	10	10	7	9	10	76

Consistent with the information obtained and evaluated in the baseline condition section of this CPF, there is a significant difference in condition between the major watersheds in BSA 6. The Stillwater watershed, with the highest population density and greatest degree of human disturbance, was identified as the most degraded in every category except impaired streams where it is second to the Snake River watershed. The Snake River watershed is also fairly degraded, scoring at or near the top for every criteria except wetland loss, population

density and perennial cover. This is most likely a reflection of the agricultural influence in this major watershed and the degree to which agricultural activities have affected watershed health since European settlement. The UPSC is in the best condition scoring no worse than a 4 in any one category and receiving a “1” population density, wetland impacts per year, and impaired lakes.

The second step of the prioritization process focuses on the identification of specific mitigation sites within the BSA. First, catchments within each major watershed will be ranked using a process similar to the baseline condition assessment. The purpose of the catchment assessment is to identify areas within a major watershed where mitigation opportunities may be prioritized based on their condition relative to other catchments. The catchment assessment will utilize the following data/information:

- MNDNR WHAF Soil Erosion Potential
- MNDNR WHAF Perennial Cover
- MNDNR WHAF Aquatic Habitat Connectivity
- Acreage of Restorable Wetland
- Ditched Wetlands
- Altered Watercourses
- Impaired Streams
- Impaired Lakes
- Recognition as a Priority Area for Wetland Restoration Projects in Local Water Management Plans
- Recognition as a Project Implementation Area in an Approved TMDL
- Other High Priority Areas Recognized under the Wetland Conservation Act

The list of criteria that will be used in the catchment assessment will be finalized after feedback from the stakeholder coordination meeting in January 2018 is compiled and comments on the Prospectus for the ILF program have been received and evaluated. Input from the watershed stakeholders will be used to verify the criteria proposed for the analysis and, if determined necessary, weight the criteria based on their importance to the prioritization of catchments.

The final step of the prioritization process is the identification of specific areas within the catchments identified in step 2. The identification of wetland mitigation opportunities is typically accomplished by identifying areas of mapped hydric soils that are no longer identified as wetlands on the NWI or similar types of wetland mapping efforts. As mentioned previously in this report, detailed hydric soil mapping is not available for a large portion of BSA 6 so this technique is not available as a method for identifying wetland restoration opportunities. Fortunately, the Minnesota Pollution Control Agency and the University of Minnesota Natural Resources Research Institute have created a statewide restorable wetland inventory (RWI) database that can be used in this analysis. The RWI was created with the purpose of identifying locations across the landscape that are suitable for wetland restoration. The RWI was developed using the compound topographic image (CTI) method outlined in the 2009 Minnesota Wetland restoration Strategy along with SSURGO polygon drainage classifications and NWI wetland classifications. Using this information as a baseline for identifying potential restoration opportunities, the CPF will prioritize wetland restoration opportunities by developing, through stakeholder input, specific criteria that can be used to select preferred sites. The criteria currently being considered for the prioritization process are identified in the following bullets. Those identified as part of the stakeholder input process are marked with an asterisk. Final decisions on the use of

selection criteria will be based on their suitability for the analysis including the degree to which the criterion can be represented with geospatial data.

- Land cost*
- Implementation Cost*
- Size*
- Flood Storage Potential*
- Potential to Benefit Water Quality*
- Proximity to Other Protected Lands*
- Distance from Urban Areas or Infrastructure
- Proximity to Water Bodies
- Location Relative to Priority Conservation Areas*
- Habitat Connectivity*
- Drained Forested Wetlands*
- Future Land Use*
- Ground Water Sensitivity Areas*
- Priority Areas Identified by local governmental units or other water resource agencies*
- Number of landowners*
- Proximity to Agricultural Land that Borders Other Aquatic Resources*

Once the stakeholder process has been completed, BWSR will prepare maps that identify priority areas (potentially at the catchment scale) within each major watershed and specific areas within those catchments that have been identified as high priority for wetland restoration projects. This information will then guide the site selection process when credits are needed based on the operation of the ILF.

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.