Bank Service Area 5
Compensation Planning Framework

Watershed Based Approach to Wetland Compensatory Mitigation

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1. INTRODUCTION

This Compensation Planning Framework (CPF) provides documentation for a watershed-based approach to compensatory wetland mitigation in the Mississippi Headwaters Wetland Bank Service Area, also referred to as Bank Service Area (BSA) 5, as part of the Minnesota In-Lieu Fee Program (ILF). The CPF documents baseline conditions and prioritizes compensatory wetland mitigation on a major watershed scale by using statewide data sources, as well as local and regional planning efforts which are readily available to the public.

The CPF is a report which analyzes baseline conditions and develops a prioritization methodology for the implementation of the ILF Program. As required by both the Federal Mitigation Rule and the Minnesota Wetland Conservation Act (WCA), the CPF must designate areas of high priority for wetland replacement. These are areas of the state where preservation, enhancement, restoration, or creation of wetlands have high public value (Rodacker & Smith, 2018). The CPF informs wetland mitigation opportunities on the major watershed scale by using local and regional planning efforts and reports which are readily available to the public. Initially, the ILF and CPF will be focused on credit generation and wetland restoration or preservation opportunities for the Local Government Road Wetland Replacement Program (LGRWRP) which is administered by the Minnesota Board of Water and Soil Resources (BWSR). This CPF focuses on the Mississippi Headwaters BSA in north central Minnesota. A list of acronyms and their meanings can be referenced in Appendix A.

2. GEOGRAPHIC SERVICE AREA

Bank Service Area Overview

This CPF focuses on the Mississippi Headwaters Wetland Bank Service Area (BSA 5), which is part of the Upper Mississippi River Basin. The Upper Mississippi River Basin has a unique Hydrologic Unit Code (HUC) of 0701, and was split into two Bank Service Areas, BSAs 5 and 7, by regulatory authorities for the purposes of wetland mitigation. BSA 5 is located in the northern portion of the Upper Mississippi River Basin. BSA 5 spans approximately 7.4 million acres and 15 counties in north central Minnesota. The boundary of BSA 5 ranges from the cities of Bemidji in the north to Alexandria in the south. Cromwell and Hibbing are on the eastern border and to the west is Ottertail (Figure B-1). According to the National Land Cover Database (NLCD), in 2016 land cover in BSA 5 was primarily natural, undeveloped space. Deciduous forest covers approximately 26% of BSA 5, along with woody wetlands covering 20%, and emergent herbaceous wetlands covering 11% (Table 2 1). Only about 4% of BSA 5 is developed. The land use across the remaining area includes open water, cultivated crops, and hay/pasture. BSA 5 contains 8 major watersheds (HUC 8) including the Mississippi River- Headwaters (Major Watershed number 7; HUC8 ID 07010101), Leech Lake River (8; 07010102), Mississippi River- Grand Rapids (9; 07010103), Mississippi River- Brainerd (10; 07010104), Pine River (11; 07010105), Crow Wing River (12; 07010106), Redeye River (13; 07010107), and Long Prairie River (14; 07010108). The major watersheds are show in Figure B-1 and described in the following paragraphs.

Table 2-1. Current Land Cover from the National Land Cover Database	
Landcover (NLCD 2016)	**Percent Area**
Deciduous Forest	26%
Woody Wetlands	20%
Emergent Herbaceous Wetlands	11%
Open Water	9%
Cultivated Crops	9%
Pasture/Hay	8%
Mixed Forest	7%
Developed	4%
Evergreen Forest	3%
Shrub/Scrub	2%
Grassland/Herbaceous	1%
Barren Land	0.19%
Land cover data from the National Land Cover Database (NLCD) for BSA 5	

Ecological Classification

The ecological classification system used in this study was developed jointly by the Minnesota Department of Natural Resources (MnDNR) and the United States Forest Service (USFS). This system is used to classify areas with similar ecological characteristics. It is set up in tiers which become successively smaller and more unique. Provinces are the broadest tier and are defined by major climate zones, native vegetation, and biomes. There are four provinces present in Minnesota but only three of those provinces intersect with BSA 5: Eastern Broadleaf Forest, Laurentian Mixed Forest, and Prairie Parkland. Within the provinces are sections, which are defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. In Minnesota there are 10 sections but only five are present in BSA 5. Each section is then broken down further into subsections. Subsections are defined by the glacial deposition processes, surface bedrock formations, local climate, topographic relief, and the distribution of plants (Cleland et al., 1997). There are 26 total subsections in Minnesota, 10 of the subsections are represented within BSA 5. Maps of the provinces, and subsections can be found in Figure B-2. Each province and subsection is described in more detail below. The acreage of each province, section and subsection within each major watershed can be found in Table 2-2. This will be helpful for decision makers because it allows them to consider ecological patterns and identify areas with similar management opportunities.

EASTERN BROADLEAF FOREST PROVINCE

The Eastern Broadleaf Forest province extends over 14% (approximately 1 million acres) of BSA 5. Outside of BSA 5 and Minnesota, this province spans most states in the Midwest. It is a transition zone between the semi-arid prairies in southwest United States and the semi-humid mixed conifer-hardwood forests to the north and into Canada. During the last glaciation, glaciers covered the northern section of the Eastern Broadleaf Forest Province in Minnesota. After receding, the glaciers left a thick layer of glacial drift which can be the cause of poor drainage and is highly erodible (MnDNR, n.d.-c). There are two subsections within BSA 5.

Anoka Sand Plain Subsection

This subsection has unique characteristics that date back to the last glaciation. There is evidence that it was once covered in glacial meltwater which formed lakes and laid down numerous layers of sand. Broad sandy plains are distinctive of this subsection. At one point there were active dunes which have now become stabilized by vegetation and an increase of surface water. The southern portion of the Anoka Sand Plain subsection is part of the Mississippi River valley and flood plain. Wetlands in this subsection are found on the poorly drained soils along the Mississippi River, as well as in the depressions on the sand plain where drainage is limited and organic matter has accumulated. There is only a very small fragment of the Anoka Sand Plain subsection within BSA 5. This subsection is in the Mississippi River- Brainerd major watershed and covers only approximately 39,000 acres of BSA 5 (MnDNR, n.d.-a).

Hardwood Hills Subsection

The Hardwood Hills subsection is characterized by steep slopes, high hills, and lakes which formed in glacial end moraines and outwash plains. It is was once dominated by conifers and aspen-birch forests. The northern portion of this subsection covers the southwestern tip of BSA 5. The 972,000 acres of the subsection within BSA 5 extends across four major watersheds, the Crow Wing River, Long Prairie River, Mississippi River- Brainerd, and the Redeye River watersheds. In the northern portion of the Hardwood Hills subsection the land cover is a mix of wetlands, lakes, forests, and cultivated crops. Wetlands in this subsection formed in the poorly drained potholes and remnant features of glaciation (MnDNR, n.d.-d).

LAURENTIAN MIXED FOREST PROVINCE

The Laurentian Mixed Forest province spans the largest area within BSA 5, covering 86% (approximately 6.3 million acres). This province has broad areas of conifer forest, mixed hardwoods and conifer forest, and conifer bogs and swamps. A unique characteristic of this landscape is the thin layer of glacial deposit which overlays bedrock. This leads to a landscape that is rugged, rocky, and has many lakes. Wetlands in this province appear in poorly drained depressions which accumulate organic matter (MnDNR, n.d.-e). There are seven subsections within BSA 5.

Chippewa Plains Subsection

The Chippewa Plains subsection covers about 1.4 million acres of the northern portion of BSA 5. It spans two major watersheds, Leech Lake River and Mississippi River- Headwaters. This subsection is characterized by vast forest cover and popular lakes. The landscape in the Chippewa Plains subsection is mostly gently rolling hills. Areas of thick glacial drift cover most of the subsection. Soils range from fine sands to clays. The wetlands in this subsection are mostly forested wetlands with some emergent wetlands present. The drainage network throughout the subsection is poorly developed which leads to more lakes and wetlands on the land surface (MnDNR, n.d.-b).

Pine Moraines and Outwash Plains Subsection

Located just south of the Chippewa Plains subsection is the Pine Moraines and Outwash Plains subsection. This subsection is the largest subsection in BSA 5, covering approximately 2.7 million acres and extending over the 8 major watersheds. As the name implies, the Pine Moraines and Outwash Plains is mostly made up of end moraines and outwash plains. There is extensive glacial drift which is very thick and mostly sandy. The subsection is mostly forested with some kettle lakes. Wetlands in this subsection are found in the outwash channels and are both forested as well as emergent (MnDNR, n.d.-j).

St. Louis Moraines Subsection

The St. Louis Moraines subsection is heavily forested and has many lakes and wetlands. The Mississippi River cuts through the middle of the subsection. This subsection is on the eastern side of BSA 5 and spans about 1.2 million acres across five of the major watersheds: Leech Lake River, Mississippi River- Brainerd, Mississippi River- Grand Rapids, Mississippi River- Headwaters, and Pine River. There is substantial glacial drift which is very thick. The majority of the soils in this subsection are loamy. The remaining soils are excessively well-drained sand with minor amounts of poorly drained soil. Although the soils are mostly well-drained, there are a large number of lakes, rivers, and wetlands because the drainage network is poorly developed. Wetlands are scattered throughout the subsection and include both forested and emergent wetlands (MnDNR, n.d.-l).

Tamarack Lowlands Subsection

Also on the eastern side of BSA 5 is the Tamarack Lowlands subsection. This subsection is approximately 500,000 acres of BSA 5, spanning across three of the major watersheds, Mississippi River -Brainerd, Mississippi River- Grand Rapids, and Mississippi River- Headwaters. The St. Louis Moraines subsection almost entirely surrounds the Tamarack Lowlands. This subsection has extensive wetlands as it was once covered by Glacial Lake Upham. There are extensive areas of wetlands with peat soils, making the land marginal for agriculture (MnDNR, n.d.-m).

Nashwauk Uplands Subsection

The Nashwauk Uplands subsection covers the northeastern tip of BSA 5. It comprises a relatively small area of BSA 5, approximately 209,000 acres, all within the Mississippi River- Grand Rapids major watershed. This subsection is covered in conifer forests and mining is prevalent, as it includes the iron ore rich Iron Range. Soils in this area are well-drained. Most wetlands in this area are conifer bogs and swamps. Giants Ridge and the Continental Divide make up the southern border of the subsection. Water from this subsection either flows north to the Hudson Bay or west to the Mississippi River (MnDNR, n.d.-h).

North Shore Highlands Subsection

Covering the smallest area within BSA 5, about 12,000 acres, is the North Shore Highlands subsection. This subsection is on the very eastern border of BSA 5. It extends from BSA 5 to the north shore of Lake Superior. There is a very thin layer of glacial drift over the entire subsection. Bedrock is exposed across most of the area. Soils are clayey with some sandy loams and loams. Wetlands are not as extensive in this subsection but are still present. There tend to be numerous streams and small lakes (MnDNR, n.d.-i).

Mille Lacs Uplands Subsection

The Mille Lacs Uplands subsection covers approximately 319,000 acres in the south eastern portion of BSA 5. The major landforms in this subsection are ground moraines and drumlin fields. Soils are mostly loamy but are underlain by dense glacial till. This glacial till only allows for a small amount of water movement throughout the soil profile. The drainage pathways are extremely young and undeveloped, resulting in many rivers and wetlands. Wetlands in this subsection occur as peatlands in the depressions between drumlin ridges (MnDNR, n.d.-f).

PRAIRIE PARKLAND PROVINCE

The Prairie Parkland Province covers the western side of Minnesota and extends northwest into Canada, west into North and South Dakota, and south into Iowa, Nebraska, Kansas, Oklahoma, and Missouri. This province has less precipitation and higher

temperatures than the other provinces in Minnesota. Prairies and grasslands were the dominate vegetation before European settlement. The thick layer of glacial drift left by the Des Moines lobe as well as the natural development of prairie soils rich in organic matter, provide incredibly fertile soil for agriculture. One of the most distinct characteristics of this province is the Minnesota River, which formed from extreme erosion and downcutting when Glacial Lake Agassiz was dramatically drained. This province is home to prairie pothole wetlands. These wetlands formed in the uneven landscape left by the receding Des Moines Lobe. They are not well connected via surface water, leading to wetlands with variable hydrology and groundwater connections. They are extremely important for both the flora and fauna of the area (MnDNR, n.d.-k). There is one subsection within BSA 5.

Minnesota River Prairie Subsection

Taking up the second smallest amount of area in BSA 5 is the Minnesota River Prairie Subsection. This subsection covers about 21,000 acres on the southwestern tip of BSA 5. The Minnesota River Prairie subsection generally has gently rolling hills, except for the area around the Minnesota River which has steep bluffs. It is flanked on the western side by the Prairie Coteau. The subsection is covered in a very thick layer of glacial drift which leads to soils that are well to moderately well drained loams. Wetlands in this area are generally prairie pothole wetlands. As far as surface water is concerned, these wetlands would be considered disconnected. The drainage network is poorly developed due to the relatively young age of the landscape. Agriculture is the dominate land use in this subsection (MnDNR, n.d.-g).

Table 2-2. Area (Acres) of Ecological Subsections Broken Down by Each Major Watershed within BSA 5											
Province:	**Eastern Broadleaf Forest Province**		**Laurentian Mixed Forest Province**							**Prairie Parkland Province**	
Section:	**Minnesota + NE Iowa Morainal**		**N. Minnesota Drift + Lake Plains**				**Northern Superior Uplands**		**Western Superior Uplands**	**North Central Glaciated Plains**	
Subsection:	**Anoka Sand Plain**	**Hardwood Hills**	**Chippewa Plains**	**Pine Moraines + Outwash Plains**	**St. Louis Moraines**	**Tamarack Lowlands**	**Nashwauk Uplands**	**North Shore Highlands**	**Mille Lacs Uplands**	**Minnesota River Prairie**	**Total**
Crow Wing River	12	59,288	-	1,209,660	-	-	-	-	-	-	**1,268,959**
Leech Lake River	-	-	371,138	458,164	28,670	-	-	-	-	-	**857,971**
Long Prairie River	-	459,146	-	84,810	-	-	-	-	-	21,122	**565,078**
Mississippi River- Brainerd	38,965	214,900	-	91,704	284,945	126,734	-	-	319,052	-	**1,076,300**
Mississippi River- Grand Rapids	-	-	-	30,058	696,514	384,068	209,719	12,440	-	-	**1,332,798**
Mississippi River- Headwaters	-	-	1,043,568	59,002	125,607	712	-	-	-	-	**1,228,889**
Pine River	-	-	-	422,252	78,635	-	-	-	-	-	**500,887**
Redeye River	-	239,455	-	332,614	-	-	-	-	-	-	**572,069**
BSA 5 Total	**38,977**	**972,789**	**1,414,706**	**2,688,263**	**1,214,371**	**511,514**	**209,719**	**12,440**	**319,052**	**21,122**	**7,402,952**

Major Watershed Descriptions

The purpose of each watershed description is to provide context for future decisions about mitigation site selection. Data used to fill out the watershed descriptions is plentiful and publicly available. Reports that were used include: Watershed Restoration and Protection Strategy Reports (WRAPS) from the Minnesota Pollution Control Agency (MPCA), Watershed Health Assessment Framework (WHAF) from the MnDNR, county local water management plans, and One Watershed One Plan documents, when available. Mapping resources used were provided from various state agencies through the Minnesota Geospatial Commons. Other resources used in the descriptions are watershed specific and listed when appropriate. For descriptions of the ecological classifications see section 2-B.

MISSISSIPPI RIVER- HEADWATERS

The Mississippi River- Headwaters watershed (HUC 07010101) is located along the northern most border of BSA 5. It includes six counties: Becker, Beltrami, Cass, Clearwater, Hubbard, and Itasca. The population within the watershed, based on the 2010 U.S. Census, was 51,846 (MnDNR, 2015f). The primary industries are forestry and tourism (Votruba et al., 2018). About 44% of the land is privately owned with the remaining land held by the state, county, federal government or tribal land owners (MPCA, n.d.). Land use does not vary much across the watershed. Most of the land is forested with less than 10% of the watershed in agriculture and 3% in urban development (Votruba et al., 2018). It is an incredibly surface water rich watershed with many lakes and rivers, including Lake Itasca which is the headwaters of the Mississippi River.

The watershed spans four different ecological subsections, including the Chippewa Plains, Pine Moraines and Outwash Plains, St. Louis Moraines, and Tamarack Lowlands. About one-quarter of the watershed is considered wetland. Emergent wetlands comprise about 27% of the wetland area, forested wetlands about 41%, and scrub shrub about 30%. Soils in the Mississippi River- Headwaters watershed are low-nutrient glacial soils which support coniferous and hardwood forests (Gutknecht et al., 2019). The watershed receives an average of 25.6 inches of precipitation every year. Most of the precipitation (10.9 inches) falls during the summer (June through August) (MnDNR, 2019d).

LEECH LAKE RIVER

The Leech Lake River watershed (HUC 07010102) is located in the center of BSA 5. It has a very low population of 13,157 according to the 2010 U.S. Census and covers three counties: Cass, Hubbard, and Beltrami. It is home to many surface water resources such as Leech Lake. The watershed is primarily forested (50%) but also has a high number of wetlands, lakes, and streams (MnDNR, 2015b). Development is low across the watershed at less than 3% and focused in and around Walker, Minnesota along the southern shore of Leech Lake. Cultivated crops and agriculture are also extremely low at less than 2% of the watershed (MnDNR, 2017b).

Leech Lake River covers three different ecological subsections including Chippewa Plains, Pine Moraines and Outwash Plains, and the St. Louis Moraines. The majority of the wetlands are forested (38%) with emergent being the next predominate wetland type (33%), with Scrub Shrub following close behind (27%). The dominate

soil types across the watershed are sandy and coarse loams (Blackburn & Tracy, 2019). Annually, Leech Lake River watershed receives on average 26.2 inches of precipitation. The majority of the precipitation occurs during the summer months (11.2 inches) and the least occurs during the winter months (2.2 inches) (MnDNR, 2019b).

MISSISSIPPI RIVER- GRAND RAPIDS (PRAIRIE-WILLOW)

The Mississippi River- Grand Rapids watershed (HUC 07010103) is on the eastern side of BSA 5. It covers five different counties including Itasca, Aitkin, Cass, Carlton, and St. Louis. Based on the 2010 U.S. Census the population in the watershed was 35,882. It has about equal areas of forest and wetland, 39% and 37% of the watershed respectively (MnDNR, 2015e). Development in this watershed is less than 4% and is primarily focused around the Mesabi Iron Range in the north. The largest cities and towns include Grand Rapids and Hibbing. Agriculture covers about 5% of the watershed and is primarily pasture and hay. It has a rich and extensive history of iron ore, taconite, and aggregate mining, as well as timber harvesting, and peat mining (Funke et al., 2019).

The ecological subsections included in this watershed include the Pine Moraines and Outwash Plaines, St. Louis Moraines, Tamarack Lowlands, Nashwauk Uplands, and the North Shore Highlands. The Mississippi River- Grand Rapids watershed has the highest acreage of wetlands in BSA 5. Of the wetlands within this watershed, 46% of them are forested, 15% are emergent, and 37% of them scrub-shrub. There are nominal amounts of unconsolidated bottom and aquatic bed wetlands. Soils in the Mississippi River- Grand Rapids watershed are loamy with some areas of high sand and other areas of high organic matter. The average annual precipitation is 27.5 inches. Summer receives the most precipitation at 11.7 inches and winter receives the least, 2.4 inches (MnDNR, 2015e).

MISSISSIPPI RIVER- BRAINERD (ELK-NOKASIPPI)

The Mississippi River- Brainerd watershed (HUC 07010104) is located along the southeastern border of BSA 5. This watershed has the highest population in BSA 5. The 2010 U.S. Census listed the population as 64,632 (MnDNR, 2015d). It spans four counties, including Aitkin, Crow Wing, Morrison, and Todd. The largest cities in the watershed are Brainerd, Little Falls, and Aitkin. About 77% of the land in the watershed is privately owned. The remaining land is owned by the State of Minnesota, counties, and tribal landowners (Marston et al., 2020). Agriculture and cultivated crop land use is present but comprises less than 22% of the watershed area. The watershed has almost equal amounts of forest and wetlands, approximately 30% each. Only about 5% of the watershed is developed. The developments are centered around the cities of Aitkin in the north of the watershed, Brainerd in the north, and Little Falls in the south (Marston et al., 2020; MnDNR, 2017c).

The ecological subsections in the Mississippi River- Brainerd watershed includes the Anoka Sand Plain, Hardwood Hills, Pine Moraines and Outwash Plains, St. Louis Moraines, Tamarack Lowlands, and the Mille Lacs Uplands. There are about 313,000 acres of wetland across the watershed with approximately equal amounts of emergent (35%), forested (30%), and scrub shrub (33%) wetlands. Aquatic bed and unconsolidated bottom wetlands make up only about 2% of the wetlands. Soils across the watershed range from sand and

loams to organic. The watershed receives about 28.5 inches of precipitation per year. The summer average precipitation is 12.1 inches and in the winter it is 2.3 inches (MnDNR, 2019c).

PINE RIVER

The Pine River watershed (HUC 07010105) is located in the center of BSA 5. According to the 2010 U.S. Census the population in this watershed was just over 15,000 (MnDNR, 2015g). It spans four counties, including Aitkin, Cass, Crow Wing, and Hubbard. The largest cities in the watershed are Breezy Point and Pine River. The watershed's landscape is dominated by forest (49%) with the next most abundant landscape being wetlands (21%) and open water (12%) (MnDNR, 2015g).

The ecological subsections in the Pine River watershed include the Pine Moraines and Outwash Plains, and the St. Louis Moraines. There are about 109,797 acres of wetland across the watershed which are fairly evenly distributed between emergent wetlands (33%), forested wetlands (29%), and scrub shrub wetlands (35%). Soils range across the watershed from sand and loams to organic (MnDNR, 2015g). The watershed receives about 27.1 inches of precipitation per year. In the summer the average is 11.7 inches and in the winter it is 2.1 inches (MnDNR, 2015g).

CROW WING RIVER

The Crow Wing River watershed (HUC 07010106) is located on the western side but still central in BSA 5. In the 2010 U.S. Census, there were slightly less than 50,000 people. Being central in the BSA, it covers nine different counties: Cass, Hubbard, Becker, Wadena, Crow Wing, Todd, Morrison, Clearwater, and Otter Tail. The largest city is Park Rapids with a population of 3,700. The watershed is mostly forested (46%) with some agriculture (21%), wetlands (15%), and development (5%) (MnDNR, 2015a).

The majority of the watershed covers two different ecological subsections, Pine Moraines and Outwash Plains, and Hardwood Hills. There is a very small portion, about 12 acres, of the watershed in the Anoka Sand Plain subsection. Wetlands in the Crow Wing watershed are mostly emergent wetlands (44% of the wetlands). There is also a high percentage of scrub-shrub wetlands (35%) and less forested wetlands (17%). Soils are mostly sandy with organic soils in the glacial outwash channels (MnDNR, 2017a). The Crow Wing River watershed receives on average 26.2 inches of precipitation annually. The summer receives the most precipitation, 11.2 inches, and the winter receives the least, 2.0 inches (MnDNR, 2019a).

REDEYE RIVER

The Redeye River watershed (HUC 07010107) is located on the western border of BSA 5. It covers five counties: Otter Tail, Wadena, Todd, Becker, and Douglas. The 2010 U.S. Census listed the population in the watershed at 18,752. The landscape of the watershed is mostly made up of cropland (46%), forest (22%), and wetland (17%) with development covering only 5% of the watershed area. The largest cities and towns include Wadena, New York Mills, and Parkers Prairie (MnDNR, 2015h).

The Redeye River watershed is split between two different ecological subsections, the Pine Moraines and Outwash Plains, and the Hardwood Hills. There are roughly 141,320 acres of wetlands in the watershed with

the dominant type being emergent wetlands (46%), followed by scrub shrub wetlands (34%), and forested wetlands (18%). Soils vary across the watershed but are predominantly sandy loam with areas of silt loam that has higher organic material. The watershed receives about 26.6 inches of precipitation a year. In the summer the average is 11.4 inches and in the winter it is 2.0 inches (MnDNR, 2015h).

LONG PRAIRIE RIVER

The Long Prairie River watershed (HUC 07010108) is located on the southern border of BSA 5. It covers five counties: Todd, Douglas, Morrison, Otter Tail, and Wadena. The 2010 U.S. Census listed the population in the watershed as 41,867. The landscape of the watershed is mostly cropland (47%), followed by forest (20%), and wetland (10%) with development comprising 7% of the watershed area. The largest cities include Alexandria and Long Prairie (MnDNR, 2015c).

The Long Prairie River watershed spans across three different ecological subsections, the Hardwood Hills, Pine Moraines and Outwash Plains, and Minnesota River Prairie. There are roughly 112,957 acres of wetlands in the watershed of which a majority are emergent wetlands (60%) followed by scrub shrub wetlands (23%), and forested wetlands (13%). Soils throughout the watershed are predominantly sandy loam with areas of silt loam that has higher organic material. The watershed receives about 27.5 inches of precipitation a year. In the summer the average is 11.9 inches and in the winter it is 2.0 inches (MnDNR, 2015c).

3. BASELINE CONDITIONS

The baseline conditions section analyzes and describes the current conditions of water resources across BSA 5. All of the data analyzed is readily available to the public. Additional information about the land use, vegetation cover, and permitting history is included to add a greater understanding of current conditions and to further inform the prioritization process. Maps for the geographic service area and the baseline conditions are located in Appendix B.

Pre-settlement vegetation

The Historic Vegetation Model (VEGMOD) developed by the Minnesota Department of Transportation (MnDOT) was summarized to gain insight into the distribution of vegetation prior to the significant changes resulting from European settlement (pre-settlement). VEGMOD was developed to represent the vegetation present at the time of the Public Land Survey (1848-1907) across Minnesota. The model is based on statistical analysis of interpreted data which includes surveyor's observations and modern terrain and soils data (MnDOT, 2019). A summary of the vegetative cover grouped by vegetative class is provided in Table 3-1.

Results from the VEGMOD data (Figure B-3) reflect the ecological classification subsections for each of the major watersheds. This includes conifer and mixed forested areas, wetland, and bog areas in the northern region of BSA 5 that transitions to a hardwood dominant forested area, wetland, and prairie landscape in the southern region of BSA 5. These are still present today but exist in a greatly altered state, particularly in the

southern region of BSA 5 where the wetland and bog landscape has been drained, and prairie and forested area reduced to support agriculture.

Table 3-1. Summary of Pre-Settlement Vegetation for BSA 5

Category	Water	Wetland		Forest					Prairie			
Major Watershed	Surface Water	Seasonally Wet	Permanently Wet	Coniferous Forest	Coniferous Woodland	Mixed Coniferous-Deciduous Forest	Deciduous Forest	Deciduous Woodland	Brush-Prairie	Prairie	Coniferous Savanna	Deciduous Savanna
Crow Wing River	7%	1%	23%	43%	-	5%	14%	2%	-	-	-	4%
Leech Lake River	20%	1%	28%	25%	-	11%	13%	1%	-	-	-	1%
Long Prairie River	8%	3%	22%	4%	-	1%	36%	5%	-	17%	-	3%
Mississippi River- Brainerd	6%	2%	40%	8%	-	7%	21%	2%	-	2%	-	10%
Mississippi River- Grand Rapids	6%	2%	51%	8%	-	23%	10%	-	-	-	-	0%
Mississippi River- Headwaters	14%	1%	32%	30%	-	10%	11%	1%	-	-	-	1%
Pine River	13%	2%	25%	38%	-	9%	10%	-	-	-	-	3%
Redeye River	2%	1%	32%	6%	-	1%	29%	6%	-	11%	-	12%
BSA 5 Total	**10%**	**1%**	**33%**	**21%**	**-**	**10%**	**16%**	**2%**	**-**	**3%**	**-**	**4%**
Category Total	**10%**	**34%**		**49%**					**7%**			

Wetlands

The current extent of wetlands in BSA 5 is based on the 2019 update of the Minnesota National Wetland Inventory (NWI) provided by the MnDNR (Kloiber et al., 2019). BSA 5 has approximately two million acres of palustrine wetlands (Figure B-4). Riverine and Lacustrine wetlands were not included in this analysis because they are under the regulatory jurisdiction of the MnDNR rather than WCA. Approximately 27% of the entire BSA 5 is palustrine wetlands, which is higher than the statewide percentage of 20%. The two most prevalent classes or types of wetlands in BSA 5 include forested wetlands (667,082 acres; 33% of the wetlands in BSA 5) and scrub shrub wetlands (650,505 acres; 33% of the wetlands in BSA 5). Emergent wetlands account for about 31% of the wetlands in BSA 5 (625,509 acres) and unconsolidated bottom and aquatic bed wetlands account for only about 2% (48,688 acres). On the watershed level, the Mississippi River- Grand Rapids watershed has the greatest area of wetlands with 527,648 acres. Both of the other watersheds that include

the Mississippi River, the Mississippi River- Brainerd and Mississippi River- Headwaters watersheds, have high amounts of wetlands with more than 300,000 acres each. The remaining watersheds still have high amounts of wetlands, but the acreage ranges from 114,000 acres to 250,000 acres. Table 3-2 includes the exact numbers and a comparison with the whole BSA 5 and statewide numbers.

Table 3-2. Acres of Wetland

Major Watershed	Watershed Acres	Palustrine				Total Wetland Acres	Percent Watershed Wetland
		Emergent	Forested	Scrub-Shrub	AB+UB*		
Crow Wing River	1,268,959	110,242	42,438	87,540	9,997	250,217	20%
Leech Lake River	857,971	67,061	79,434	55,039	4,356	205,890	24%
Long Prairie River	565,078	68,399	14,706	26,013	4,978	114,096	20%
Mississippi River- Brainerd	1,076,300	112,103	96,554	105,610	7,213	321,479	30%
Mississippi River- Grand Rapids	1,332,798	82,084	242,067	195,402	8,095	527,648	40%
Mississippi River- Headwaters	1,228,889	83,852	134,502	92,876	6,389	317,618	26%
Pine River	500,887	36,939	31,904	38,908	4,487	112,238	22%
Redeye River	572,069	64,831	25,478	49,116	3,173	142,598	25%
BSA 5 Total	**7,402,952**	**625,509**	**667,082**	**650,505**	**48,688**	**1,991,784**	**27%**
Statewide	**55,643,000**	**3,497,216**	**4,017,768**	**3,272,709**	**291,406**	**11,079,099**	**20%**

Data from the Minnesota NWI (2019 update)
*Aquatic Bed and Unconsolidated Bottom

Lakes

According to the MnDNR Hydrography data, BSA 5 has approximately 5.3 million acres of lakes (Figure B-5). About 10% of BSA 5 is lakes. The Mississippi River- Headwaters has the largest acreage of lakes with 180,717 acres. The second highest acreage of lakes is in the Leech Lake River watershed. Both of these watersheds have extremely low amounts of development and high quantities of surface water resources. The area of lakes in all watersheds can be found in Table 3-3. The five largest lakes in BSA 5 include Leech Lake (102,945 acres), Lake Winnibigoshish (56,427 acres), Cass Lake (15,958 acres), Gull Lake (9,947 acres), and Pelican Lake (8,367 acres). Leech lake is located in the Leech Lake River watershed and both Lake Winnibigoshish and Cass Lake are located within the Mississippi River- Headwaters watershed. Gull Lake is in the Crow Wing River watershed and Pelican Lake is in the Pine River watershed.

Table 3-3. Summary of Lake Area (Acres) for BSA 5			
Major Watershed	**Watershed Acres**	**Lake Acres[1]**	**Lake Area %**
Crow Wing River	1,268,959	91,385	7%
Leech Lake River	857,971	170,685	20%
Long Prairie River	565,078	42,634	8%
Mississippi River- Brainerd	1,076,300	66,528	6%
Mississippi River- Grand Rapids	1,332,798	81,521	6%
Mississippi River- Headwaters	1,228,889	180,717	15%
Pine River	500,887	63,090	13%
Redeye River	572,069	8,564	1%
BSA 5 Total	**7,402,952**	**705,124**	**10%**
Statewide Total	**55,643,000**	**5,389,925**	**10%**
[1]Data from MnDNR Hydrography- Lakes and Open Water			

Watercourses

The MnDNR Rivers and Streams dataset was used to conduct an inventory of all watercourses within each major watershed. This dataset is part of the National Hydrography Dataset (NHD) provided by the United States Geological Survey (USGS). The length of mapped watercourses, categorized by channel type (ditched or natural) and flow regime (intermittent or perennial), is provided in Table 3-4. A measure of watercourse density (watercourse length in miles divided by area of watershed in square miles) for each major watershed was calculated to assess variability of the tributary network throughout BSA 5. The Mississippi River- Grand Rapids watershed has the highest number of miles of watercourses, with the majority in the natural- perennial category. The Long Prairie River, Mississippi River- Brainerd, and the Redeye River watersheds share the highest density, at 1.1. BSA wide, the majority of the watercourses are categorized as natural or natural-perennial (Figure B-5).

Table 3-4. Summary of Watercourses (Miles) for BSA 5						
Major Watershed	**Drainage Ditch**	**Natural**	**Natural-Intermittent**	**Natural-Perennial**	**Total**	***Watercourse Density**
Crow Wing River	318.30	568.73	315.37	685.00	**1,887.40**	**1.0**
Leech Lake River	37.10	519.66	147.69	266.68	**971.13**	**0.7**
Long Prairie River	227.30	220.55	317.23	204.19	**969.26**	**1.1**
Mississippi River-Brainerd	333.46	480.33	393.23	598.31	**1,805.33**	**1.1**
Mississippi River-Grand Rapids	337.31	527.75	301.22	799.10	**1,965.39**	**0.9**
Mississippi River-Headwaters	81.25	658.30	256.15	579.61	**1,575.31**	**0.8**
Pine River	22.11	244.84	29.60	295.27	**591.82**	**0.8**
Redeye River	340.11	91.22	270.39	319.58	**1,021.31**	**1.1**
BSA 5 Total	**1,696.93**	**3,311.40**	**2,030.87**	**3,747.75**	**10,786.95**	**0.9**
*Watercourse Density equals total stream miles divided by square miles of watershed						

Altered Watercourses

An inventory of altered watercourses statewide was completed via a joint project with MPCA and the Minnesota Geospatial Information Office (MnGEO). The inventory analyzed historic aerial photos as well as LiDAR and up to date aerial photography to determine watercourses that have been altered. Watercourses were sectioned into four categories: altered, impounded, natural, and no definable channel. An altered watercourse is a naturally occurring stream or river or an artificially constructed canal or ditch whose habitat has been compromised through hydrologic alteration. Streams whose flow has been dammed are categorized as impounded. Natural watercourses are those that have little to no human influence. The no definable channel category includes flowlines from the NHD that no longer appear on the aerial imagery or LiDAR hillshade (MnGEO, 2013). BSA wide, most of the watercourses are categorized as natural, which means they have not been altered (Figure B-6). Of the impounded watercourses, the Mississippi River- Headwaters watershed has the most with 141 miles. The Mississippi River- Brainerd watershed has the highest amount of altered watercourses at 569 miles. The Long Prairie River, Redeye River, Crow Wing River, and Mississippi River- Grand Rapids, have a high number of altered streams due to urbanization and ditching. Exact length of altered watercourses for each watershed can be found in Table 3-5.

Table 3-5. Summary of Altered Watercourses (Miles) in BSA 5

Major Watershed	Altered	Impoundment	Natural	No Definable Channel
Crow Wing River	514	99	778	496
Leech Lake River	103	17	276	576
Long Prairie River	408	35	318	208
Mississippi River- Brainerd	569	118	825	300
Mississippi River- Grand Rapids	494	130	964	380
Mississippi River- Headwaters	162	141	756	547
Pine River	57	29	337	173
Redeye River	352	6	332	333
BSA 5 Total	**2,659**	**576**	**4,587**	**3,014**
Data from the MPCA Altered Watercourses Project updated in 2019				

Water Quality

Water quality in BSA 5 was assessed using the MPCA list of impaired waters which satisfies the requirement of section 303(d) of the Clean Water Act. Data for lakes, streams, and wetlands was collected in 2018, and the GIS layer was updated in 2019. There were 10 different impairments listed for BSA 5. Not all the impairments are pertinent to wetland restoration and protection, therefore a subset of the impairments were chosen. The impairments included in this report are dissolved oxygen, fishes bioassessments, aquatic macroinvertebrate bioassessments, nitrate, nutrients and eutrophication biological indicators, turbidity, and total suspended solids. Lakes and streams that were assessed and located partially or wholly within tribal lands are included in this analysis.

Across BSA 5, 1,245 lakes were assessed and 60 lakes were found to be impaired (Figure B-7). Of the impaired lakes, one (1) lake was located partially on tribal land and 7 lakes were wholly on tribal land. The Long Prairie River watershed had the highest percentage (15%) of its lakes impaired. Leech Lake River, Redeye River, and Pine River watersheds had the lowest percentage of their lakes impaired. Table 3-6 includes assessed and impaired lake area and percentage for each watershed.

With regard to streams, there were 393 individual stream reaches assessed across BSA 5 and 100 of those reaches were found to be impaired. Only one (1) of the impaired stream reaches was wholly on tribal land and two (2) of the reaches were partially on tribal land. The Redeye River watershed had the highest percentage of its stream reaches impaired at 48%. The Mississippi River- Headwaters was by far the lowest with only one (1) of 57 stream reaches assessed being impaired. See Table 3-7 for assessed and impaired stream miles and percentages in each watershed.

Table 3-6. Assessed and Impaired Lakes

Major Watershed	Assessed		Impaired		% Impaired
	Acres	Count	Acres	Count	
Crow Wing River	67,972	168	3,061	9	5%
Leech Lake River	153,356	101	208	1	1%
Long Prairie River	36,150	67	2,044	10	15%
Mississippi River- Brainerd	33,350	108	4,738	9	8%
Mississippi River- Grand Rapids	63,994	378	11,766	11	3%
Mississippi River- Headwaters	164,483	269	4,419	15	6%
Pine River	49,676	137	1,581	5	4%
Redeye River	5,805	17	-	-	0%
BSA 5 Total	**574,786**	**1,245**	**27,819**	**60**	**5%**
Data includes lakes wholly and partially on tribal lands					

Table 3-7. Assessed and Impaired Streams

Major Watershed	Assessed		Impaired		% Impaired
	Miles	Count*	Miles	Count*	
Crow Wing River	539	74	175	22	30%
Leech Lake River	130	28	24	6	21%
Long Prairie River	231	35	155	16	46%
Mississippi River- Brainerd	373	47	143	7	15%
Mississippi River- Grand Rapids	660	87	245	29	33%
Mississippi River- Headwaters	462	57	7	1	2%
Pine River	142	38	16	6	16%
Redeye River	267	27	187	13	48%
BSA 5 Total	**2,803**	**393**	**951**	**100**	**25%**
*Count is the number of stream reaches not individual streams Data includes streams wholly and partially on tribal lands					

Land Cover

The National Land Cover Dataset (NLCD) was used to analyze the current land cover across BSA 5. There are 20 land cover classifications in the NLCD but a simplified list of classes was used for this study. The simplified classifications include *Agriculture, Barren, Developed, Forest, Grassland, Water*, and *Wetlands*. The 2016 NLCD was used to analyze BSA 5. Table 3-8 includes the landcover classification breakdown within each individual watershed.

The majority of land cover in BSA 5 is classified as *Forest* (38%) with the second highest category being *Wetlands* at 31% (Figure B-8). Although the wetland area as mapped in the NWI and the NLCD are similar (27% and 31% of BSA 5 respectively), the difference is a result of different mapping methods, scales, and accuracy. On the watershed level, *Forest* is the highest land cover in the Crow Wing River, Leech Lake River, Mississippi River- Headwaters, and Pine River watersheds. *Agriculture* is the highest in the southern watersheds, Long Prairie River and Redeye River. In the two remaining watersheds, the Mississippi River- Brainerd and Mississippi River- Grand Rapids, *Wetlands* is the dominant land cover.

Table 3-8. Land Cover Percentage of Each Watershed in 2016

Major Watershed	Agriculture	Barren	Developed	Forest	Grassland	Water	Wetlands
Crow Wing River	21%	0.11%	4%	43%	2%	7%	23%
Mississippi River- Brainerd	22%	0.09%	5%	32%	1%	6%	34%
Leech Lake River	3%	0.09%	3%	47%	1%	19%	26%
Long Prairie River	46%	0.06%	6%	20%	2%	8%	19%
Mississippi River- Headwaters	7%	0.11%	4%	44%	2%	14%	30%
Pine River	6%	0.06%	3%	50%	1%	12%	28%
Mississippi River- Grand Rapids	4%	0.65%	3%	41%	1%	6%	45%
Redeye River	47%	0.04%	4%	18%	1%	2%	29%
BSA 5 Total	**17%**	**0.19%**	**4%**	**38%**	**1%**	**9%**	**31%**

Data from the National Land Cover Database. Categories simplified based on 2016 NLCD categories

Perennial Cover

In addition to analyzing land cover, perennial cover was evaluated using the 2016 NLCD. Of the seven classes, *Forest*, *Grassland*, and *Wetlands* were categorized as *Perennial*. The rest of the classes were categorized as *Non-perennial*. As can be seen in Figure B-9 and Table 3-9, *Perennial* cover is greatest in the Mississippi River-Grand Rapids and Mississippi River- Headwaters watersheds. *Non-perennial* cover dominates the Long Prairie River and Redeye River watersheds. BSA 5-wide, 70% of the area is in *Perennial* cover and 30% is in *Non-perennial*.

Table 3-9. Acres of Perennial and Non-Perennial Cover in 2016			
Major Watershed	**Perennial**	**Non-Perennial**	**Total**
Crow Wing	871,158	397,721	**1,268,879**
Leech Lake River	641,830	216,141	**857,971**
Long Prairie River	229,532	335,349	**564,881**
Mississippi River- Brainerd	721,299	354,752	**1,076,051**
Mississippi River- Grand Rapids	1,154,679	177,782	**1,332,461**
Mississippi River- Headwaters	925,198	303,411	**1,228,609**
Pine River	396,997	103,890	**500,887**
Redeye River	271,871	300,048	**571,919**
BSA 5 Total	**5,212,563**	**2,189,095**	**7,401,657**
Based on the 2016 NLCD.			

Areas of Biodiversity Significance

To assess sensitive plant communities and rare species, the Biodiversity Significance Rank provided by the Minnesota Biological Survey was used. Within the survey, ranks were given to each site based on the presence of rare species populations, the size and condition of native plant communities, and the proximity of the site to different land uses (MnDNR, 2022). One of four ranks was assigned to each site: *Outstanding*, *High*, *Moderate*, and *Below*. Sites ranked as *Outstanding* typically have the most numerous occurrences and best examples of the rarest species and contain the most intact rare native plant communities. Sites ranked as *High* have medium occurrences of rare species and are good examples of high quality rare native plant communities. Sites ranked as *Moderate* contain some rare species and have moderately disturbed native plant communities. These sites have very good potential for recovery of native plant communities. Sites ranked as *Below* lack rare species and native plant communities. However, these sites may still be important for local conservation efforts and may benefit native plants and animals. They have high potential for restoration of native habitat (MnDNR, 2022).

Within BSA 5, approximately 2.1 million acres (37% of the total area of BSA 5) was surveyed for biodiversity significance (Figure B-10). The majority of sites (20%) were ranked as *Moderate*. Within each watershed, the majority of the sites were ranked as *Moderate*. The watershed with the most acres ranked as *Outstanding* was the Leech Lake River watershed, with 15% of the sites within the watershed. Redeye river watershed had no sites ranked as *Outstanding*. Mississippi River- Grand Rapids and Pine River watersheds each had about 15% of their area ranked as *High*. The watersheds with the most sites ranked as *Below* were Leech Lake River and Mississippi River- Grand Rapids, with 3% each. Acres and percentages for each watershed and BSA wide can be found in Table 3-10.

Table 3-10. Acres of Areas of Biodiversity Significance and Rank										
Major Watershed	**Below**		**High**		**Moderate**		**Outstanding**		**Grand Total**	
Crow Wing River	13,733	1%	87,165	7%	231,698	18%	8,780	1%	**341,375**	**27%**
Leech Lake River	27,479	3%	82,413	10%	176,426	21%	130,586	15%	**416,904**	**49%**
Long Prairie River	6,559	1%	16,514	3%	63,281	11%	2,810	0.5%	**89,164**	**16%**
Mississippi River- Brainerd	25,354	2%	142,956	13%	158,822	15%	1,665	0.2%	**328,796**	**31%**
Mississippi River- Grand Rapids	42,408	3%	205,414	15%	387,474	29%	23,339	2%	**658,635**	**49%**
Mississippi River- Headwaters	22,823	2%	213,262	17%	290,935	24%	64,365	5%	**591,386**	**48%**
Pine River	8,957	2%	79,160	16%	114,736	23%	55	0.01%	**202,909**	**41%**
Redeye River	10,268	2%	13,111	2%	64,513	11%	-	-	**87,892**	**15%**
BSA 5 Total	**157,581**	**2%**	**839,995**	**11%**	**1,487,886**	**20%**	**231,599**	**3%**	**2,717,060**	**37%**
Data updated 2021										

Hydrologic Connectivity

Hydrologic connectivity was characterized by the MnDNR in the WHAF by calculating the density of aquatic disruptions per mile of stream length within each watershed. Aquatic disruptions included culverts, bridges, and dams. The MnDOT culvert and bridge database was used to gather the number of culverts and bridges. The number of dams was calculated from the National Dam Inventory (MnDNR, n.d.-n). Higher scores reflect fewer aquatic disruptions and more hydrologic connectivity. BSA 5 has an average score of 69, which is higher than the average for Minnesota as a whole (53). The Mississippi River- Grand Rapids watershed received the highest score in BSA 5 at 79. The lowest score, 58, was in the Redeye River watershed (Table 3-11; Figure B-11). This is reflective of the land use in the Redeye River watershed which has the highest amount of agriculture and development, relative to the other watersheds.

Table 3-11. WHAF Aquatic Connectivity Score	
Major Watershed	**Aquatic Connectivity Score**
Crow Wing River	73
Leech Lake River	76
Long Prairie River	53
Mississippi River- Brainerd	69
Mississippi River- Grand Rapids	79
Mississippi River- Headwaters	73
Pine River	72
Redeye River	58
BSA 5 Average	**69**
Data provided by the MnDNR	

Important Habitats

WHITE CEDAR

White Cedar (*Thuja occidentalis*) wetlands are important natural resources for the northern portion of BSA 5. These trees normally dominate rich swamps and are sensitive to groundwater flow. White Cedar are an important species as they support both fauna and the lumber industry. Deer prefer the tree for both browse and shelter. It also supports many other animals by providing a food source, especially in the winter. Commercially, it is used in many products ranging from fence posts to cabin logs. It is highly valued because of the wood's rot-resistance (Johnston, n.d.).

In BSA 5 there are approximately 96,000 acres of white cedar forests on public lands. The MnDNR has mapped forests located on state administered lands through the Minnesota Forest Stand Inventory. Figure B-12 and Table 3-12 show the area of White Cedar on public lands across BSA 5. White Cedar in BSA 5 is mostly located within the northern and northeastern watersheds: Leech Lake River, Mississippi River- Brainerd, and Mississippi River- Grand Rapids. White Cedar wetlands are of particular focus in the Leech Lake River watershed for management and preservation. Although the data is limited to state-administered lands; it is representative of the relative abundance of White Cedar across BSA 5.

Table 3-12. Acres of White Cedar Forest

Major Watershed	White Cedar Forest (acres)
Crow Wing River	90
Leech Lake River	24,233
Long Prairie River	-
Mississippi River- Brainerd	3,572
Mississippi River- Grand Rapids	35,171
Mississippi River- Headwaters	32,525
Pine River	762
Redeye River	12
BSA 5 Total	**96,365**

Data based on the MnDNR Forest Stand Inventory. Only includes forests on state-administered lands.

RIPARIAN AND LITTORAL WETLANDS

Wetlands surrounding both lakes and rivers (littoral and riparian wetlands, respectively) are important habitats that were highlighted by stakeholders in BSA 5. These wetlands provide important habitat for both flora and fauna of the region. They are also essential corridors for fauna movement. Anecdotally, stakeholders have seen impacts to these wetlands that degrade or remove them from the landscape.

The NWI was used to estimate the extent of wetlands in riparian and littoral habitats. Wetlands within 20 feet of lakes and rivers (as mapped in the Public Watercourses and Water Basins GIS layer from the MnDNR) were

clipped from the NWI. All palustrine class wetlands were included. Within the Lacustrine class, only littoral wetlands were included. Limnetic and all riverine wetlands were not included in this analysis. Littoral wetlands were included even though, as stated in the wetlands baseline condition, they are not typically under WCA jurisdiction, because these wetlands are unique to lake shores and still an important habitat type under duress. There is a total of 772,774 acres of wetlands within riparian and littoral habitats across BSA 5 (Table 3-13). The Mississippi River- Headwaters watershed has the highest area of these wetlands with 137,372 acres. As stated previously, the Mississippi River- Headwaters watershed has the highest lake area in the BSA and has one of the highest densities of rivers. The Redeye River Watershed has the least extent of riparian and littoral wetlands. Although the Redeye River has a high density of watercourses; they are mostly drainage ditches or have been altered in some way. This would lead to the assumption that a lot of the riparian and littoral wetlands have been historically impacted or degraded in some way.

An important aspect of both littoral and riparian wetlands is the quality of the wetlands. To quantify quality for riverine wetlands, the Riparian connectivity metric from the WHAF was used. This metric represents the amount and connectivity of non-developed land cover in riparian areas. It was quantified by first mapping the riparian area along perennial ditches and streams and then calculating the percent of agriculture and developed land in the riparian area. Lands with a high amount of agriculture or developed lands within the riparian zone have lower scores (MnDNR, n.d.-o). Overall, BSA 5 has a very high score for riparian connectivity, 92 out of 100 (Table 3-14). The lowest score is in the Long Prairie River watershed (79). Both the Leech Lake River and the Pine River watersheds have the highest score of 97.

Quality of littoral habitat was analyzed by using the relative development of the shoreline which was assessed through the MnDNR's Score the Shore survey. In this survey lakes were ranked based on the amount of shoreland, shoreline, and aquatic zones remaining in natural condition. Numerical scores were then put in ranges of high, medium, low, and very low (MnGEO, 2020). Of the 305 lakes that were scored across the BSA, the majority fell into the moderate category (209 lakes). The Crow Wing River watershed had the most highly ranked lakes with the Mississippi River- Brainerd watershed coming in second place. Only the Long Prairie River watershed had lakes categorized as very low. A summary of all three parameters can be found in Figure B-13 as well as the data in Tables 3-13, 3-14, and 3-15.

Table 3-13. Acres of Wetland Within 20ft of Lake and River Shore			
Major Watershed	**Palustrine Wetlands**	**Littoral Wetlands**	**Total**
Crow Wing River	76,975	38,759	115,734
Leech Lake River	76,105	54,756	130,861
Long Prairie River	33,104	15,516	48,620
Mississippi River- Brainerd	81,465	21,228	102,693
Mississippi River- Grand Rapids	100,860	29,188	130,048
Mississippi River- Headwaters	87,222	50,149	137,372
Pine River	36,359	22,591	58,951
Redeye River	43,072	5,417	48,489
BSA 5 Total	**535,165**	**237,608**	**772,774**
Wetlands are within 20ft of a lake or river			

Table 3-14. WHAF Riparian Connectivity Score	
Major Watershed	**Riparian Connectivity Score**
Crow Wing River	94
Leech Lake River	97
Long Prairie River	79
Mississippi River- Brainerd	91
Mississippi River- Grand Rapids	96
Mississippi River- Headwaters	96
Pine River	97
Redeye River	87
BSA 5 Average	**92**
Data provided by the MnDNR	

Table 3-15. Number of Lakes Ranked by Score the Shore					
Major Watershed	**High**	**Moderate**	**Low**	**Very Low**	**Total**
Crow Wing River	16	55	14	-	**85**
Leech Lake River	8	26	-	-	**34**
Long Prairie River	5	18	8	3	**34**
Mississippi River- Brainerd	10	52	6	-	**68**
Mississippi River- Grand Rapids	6	16	1	-	**23**
Mississippi River- Headwaters	7	23	2	-	**32**
Pine River	1	16	8	-	**25**
Redeye River	1	3	-	-	**4**
BSA 5 Total	**54**	**209**	**39**	**3**	**305**
Data from the MnDNR Score the Shore program					

Permitting Analysis

Permits issued under the U.S. Army Corps of Engineers (USACE) Regulatory Program were reviewed for the four-year period between January 2012 and March 2016. This review focused on authorized impacts to wetlands (e.g., filling or draining) that resulted in a permanent loss of the resource.

Table 3-16 provides a summary of authorized wetland impacts between 2012 and 2016. It is important to note that this information provides only a subset of wetland impacts over this period. For example, the placement of fill material into a wetland for residential development would be included in this summary. However, the placement of fill material into a wetland for a temporary road, which would be restored to its preexisting condition at a later time, would not be included in this summary. Lastly, the USACE does not regulate impacts to all wetlands. Certain wetlands that are considered isolated are not regulated by the USACE and would not be included in this summary.

Considering these caveats, the Mississippi River– Grand Rapids watershed experienced the greatest amount of wetland impacts over this period. This appears reasonable as this portion of BSA 5 has several mining projects. The remaining watersheds have significantly less impacts as impacts are generally correlated with the level of development.

Table 3-16. Acres of Wetland Impact

Major Watershed	Acres of Impact
Crow Wing River	32.4
Leech Lake River	-
Long Prairie River	14.6
Mississippi River- Brainerd	16.1
Mississippi River- Grand Rapids	131.4
Mississippi River- Headwaters	48.2
Pine River	8.6
Redeye River	8.2
BSA 5 Total	**259.5**

Data from 2012 to 2016 provided by the U.S. Army Corps of Engineers

BSA 5 Baseline Conditions Summary

*Percent of assessed lakes and rivers not total area or miles **Wetlands within 20ft of lake or river. Also includes littoral wetlands which are not included in the total wetland area	Crow Wing River	Leech Lake River	Long Prairie River	Mississippi River Brainerd	Mississippi River Grand Rapids	Mississippi River Headwaters	Pine River	Redeye River	BSA 5 Total
Total Area (Acres)	1,268,959	857,971	565,078	1,076,300	1,332,798	1,228,889	500,887	572,069	7,402,952
Total Acres of Wetland	250,217	205,890	114,096	321,479	527,648	317,618	112,238	142,598	1,991,784
Wetland Impacts (Acres)	32		15	16	131	48	9	8	260
River and Lakeshore Wetlands (Acres)**	115,734	130,861	48,620	102,693	130,048	137,372	58,951	48,489	772,774
Total Acres of Lakes	91,385	170,685	42,634	66,528	81,521	180,717	63,090	8,564	705,124
Impaired Lakes*	5%	1%	15%	8%	3%	6%	4%	0%	5%
Total Miles of Watercourses	1,887	971	969	1,805	1,965	1,575	592	1,021	10,787
Altered and Impounded Watercourses (Miles)	613	120	443	687	624	303	86	358	3,235
Impaired Streams*	30%	21%	46%	15%	33%	2%	16%	48%	25%
Perennial Land Cover (Acres)	871,158	641,830	229,532	721,299	1,154,679	925,198	396,997	271,871	5,212,563
Non-Perennial Land Cover (Acres)	397,721	216,141	335,349	354,752	177,782	303,411	103,890	300,048	2,189,095
Biodiversity Significance (Acres)	341,375	416,904	89,164	328,796	658,635	591,386	202,909	87,892	2,717,060
White Cedar Forest (Acres)	90	24,233	-	3,572	35,171	32,525	762	12	96,365
WHAF Aquatic Connectivity Score	73	76	53	69	79	73	72	58	69
WHAF Riparian Connectivity Score	94	97	79	91	96	96	97	87	92

4. CUMULATIVE IMPACT ANALYSIS

Wetland Loss

As per the Federal Mitigation Rule, wetland loss was analyzed for the entire BSA 5. To quantify wetland loss, the historic extent of wetlands was compared to the current extent. The historic extent of wetlands are wetlands that existed prior to European Settlement (from here on referred to as pre-settlement wetlands). To estimate pre-settlement wetlands, a combination of hydric soil data map unit (DMU) ratings and current wetlands extent was used. Hydric soils, as defined by the United States Department of Agriculture (USDA), are soils that have been formed under conditions of saturation, flooding, and ponding, long enough during the growing season to develop anaerobic conditions in the upper part. Soil DMUs mapped with a hydric rating of 66% and above were used in combination with Palustrine class wetlands from the NWI to estimate the areal coverage of pre-settlement wetlands. Soil mapping processes for hydric soils underestimates the actual extent of wetlands, therefore the assumption was made that wetlands that exist today outside the mapped hydric soils also existed pre-settlement. Using this method, there were approximately 2.6 million acres of wetland in BSA 5 prior to European settlement. Compared to the current extent of wetlands, there has been a 24% loss. The greatest loss has occurred in the Redeye River watershed with 30% of the wetlands lost. The Leech Lake watershed has experienced the least amount of wetland loss with only 16%. Table 4-1 summarizes the total wetland loss for BSA 5 by watershed and the entire area.

Another approach to quantify the area of pre-settlement wetlands was conducted by Anderson & Craig (1984) by analyzing soil maps provided by the Minnesota Soil Atlas for the entire state. They selected soils that were either peat or wet mineral soils and assumed that these represent areas where pre-settlement wetlands once existed. Wet mineral soils are soils mapped as poorly drained mineral soils. They found that there were 18.4 million acres of pre-settlement wetlands across the state. Within BSA 5 they found approximately 2.1 million acres of pre-settlement wetlands. Compared to the extent of wetlands at the time of publishing in 1984 (1.8 million acres), there was a 15% loss in wetland acreage. See Table 4-2 for detailed numbers for each watershed.

Tables 4-1 and 4-2 show the percent lost in BSA 5 from Anderson & Craig (1984) is 15% and the percent lost based on hydric soils and the current NWI is 24%. There are several reasons for this difference including mapping methodologies and the level of accuracy of each method. The difference could also be the result of recent urbanization of BSA 5. Anderson & Craig (1984) data is accurate as of 1984. It is expected that with urbanization and other land cover changes, there has been an increase of wetland loss between 1984 and 2019 (the date of the latest update of the NWI).

Table 4-1. Wetland Loss Based on Hydric Soils and NWI				
Major Watershed	**Pre-settlement Acres**	**Current Acres***	**Wetland Loss (acres)**	**Percent Lost**
Crow Wing River	352,356	250,217	102,139	29%
Leech Lake River	246,273	205,890	40,383	16%
Long Prairie River	165,693	114,096	51,597	31%
Mississippi River- Brainerd	446,106	321,479	124,627	28%
Mississippi River- Grand Rapids	646,866	527,648	119,218	18%
Mississippi River- Headwaters	391,287	317,618	73,669	19%
Pine River	154,634	112,238	42,396	27%
Redeye River	204,266	142,598	61,668	30%
BSA 5 Total	**2,607,482**	**1,991,784**	**615,698**	**24%**
*Based on the NWI, includes only Palustrine class wetlands				

Table 4-2. Wetland Loss Based on Anderson & Craig (1984)			
Major Watershed	**Pre-settlement Acres**	**Current Acres**	**Percent Lost**
Crow Wing River	256,848	205,728	20%
Leech Lake River	202,463	185,235	9%
Long Prairie River	136,480	73,171	46%
Mississippi River- Brainerd	389,933	323,179	17%
Mississippi River- Grand Rapids	503,209	466,944	7%
Mississippi River- Headwaters	441,542	408,587	7%
Pine River	120,559	107,928	10%
Redeye River	93,894	59,238	37%
BSA 5 Total	**2,144,926**	**1,830,011**	**15%**
The county data presented in Anderson & Craig (1984) was processed so that numbers could be summarized by watershed. It was assumed that wetland coverage was equal across the county.			

Banking Analysis

Since passage of the Clean Water Act in 1972 and WCA in 1991, most wetland impacts are regulated by one or both programs and may require mitigation to offset the functions lost as a result of the authorized impacts. Today, credits obtained from wetland mitigation banks are the primary source of mitigation for these impacts. Project-specific mitigation is also an agency accepted option, provided the site meets regulatory and technical eligibility requirements. To assess how wetland banking credits are being used to offset wetland impacts in BSA 5, an analysis of wetland banking activity and the status of the private market and LGRWRP accounts was completed. Banking activity was evaluated by compiling annual credit withdrawals based on the BSA in which the impact occurred. The analysis utilized annual reports obtained from the State of Minnesota wetland banking database from 2016 through 2020. The status of the private market in BSA 5 was assessed using information

from the BWSR Available Wetland Credit listing which displays credits available for purchase based on feedback from the account holders.

Table 4-3 provides a summary of wetland credits withdrawn in each BSA in Minnesota for the period of 2016 through 2020. The withdrawal numbers include transactions for MnDOT, LGRWRP, and standard accounts. Transactions associated with the agricultural wetland bank are not included in the table. As shown, BSA 5 is the third most active BSA in Minnesota generating an average annual credit demand of 73 credits during the period of analysis. However, it should be noted that the average annual number was significantly influenced by several large withdrawals completed in 2020 for the Enbridge Line 3 project. Regardless, this BSA is one of the most active in the state trailing only BSAs 7 (Middle Mississippi River) and 9 (Minnesota River). It is the most active BSA that does not include at least a portion of a major metropolitan area. BSA 5 accounts for approximately 16% of the credits withdrawn statewide each year.

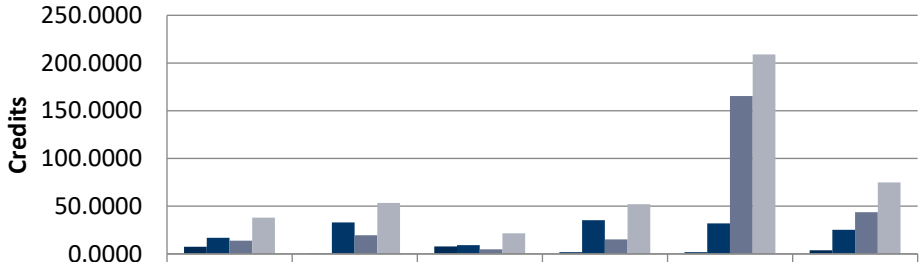
Withdrawal data for BSA 5 was further analyzed to determine the individual type contributions (MnDOT, LGRWRP, and standard) for each year. The results of this analysis are summarized in Figure 4-1. Not surprisingly, transactions from standard bank accounts represent most of the credit withdrawal activity in this BSA followed by the LGRWRP and then MnDOT. On an average annual basis, they represent 60%, 35%, and 5% respectively of the total number of credits withdrawn during the past five years. With respect to mitigation siting requirements, the credit withdrawal data indicates that 83% of the credits used to offset impacts occurring within BSA 5 are coming from wetland banks located within BSA 5.

Table 4-3. Wetland Credits Withdrawn by Bank Service Areas 2016-2020[1]

BSA	2016	2017	2018	2019	2020	Total	Average
1	30	15	29	25	187	286	57
2	10	25	9	9	17	70	14
3	5	12	5	11	36	69	14
4	6	53	10	24	53	146	29
5	38	53	22	52	199	364	73
6	10	27	24	38	23	121	24
7	88	140	120	121	122	592	118
8	44	23	11	56	38	172	34
9	89	151	76	49	84	450	90
10	1	6	0	11	5	23	5
BSA 5 Total	**322**	**506**	**306**	**395**	**764**	**2293**	**459**

[1] Excludes withdrawals from agricultural wetland bank accounts

Figure 4-1
BSA 5 Wetland Credit Withdrawals by Account Type 2016 - 2020



	2016	2017	2018	2019	2020	Average annual
MnDOT	7.4262	0.3400	7.7458	1.8050	1.9640	3.8562
LGRWRP	16.8794	32.8966	9.1603	35.1730	31.8199	25.1858
Standard	13.7483	19.7356	4.6750	15.2374	165.5557	43.7904
Total	38.0539	53.4722	21.5811	52.2154	209.0396	74.8724

CURRENT STATUS

Standard wetland bank ledger information in BSA 5 was compiled and reviewed to provide a snapshot of the amount of credits currently available. This analysis focused solely on credits that were (1) deposited into Minnesota wetland banks as of May 2021, (2) identified as federally approved, and (3) listed for sale on the BWSR Available Wetland Credit listing. This analysis does not include credits from MnDOT or the LGRWRP (the status of credits associated with these state programs is addressed later in this section). The federally approved credits listed for sale in BSA 5 are broken down by major watershed and are provided in Table 4-4. As shown in the table, BSA 5 has a substantial supply of federally approved wetland credits with at least a 10-year supply based on the average annual demand calculated in Table 4-3. Most of the credits (74.5%) are located in the Mississippi- Grand Rapids major watershed. The available credits in this major watershed consist primarily of the fresh (wet) meadow wetland plant community type, although a total of seven different plant community types are listed including a small amount of shrub carr and hardwood/coniferous swamp credits.

MnDOT and LGRWRP credit balances in this BSA are much more limited. Neither program has established a wetland bank in BSA 5 during the past seven years which drew down their respective program balances to near zero over the past two years. Both programs purchased credits from standard banks in 2020 which provided the ability to satisfy their credit needs in the short-term. Presently, MnDOT has a balance of 68.4386 credits. A special general fund appropriation late in 2020 allowed BWSR to acquire approximately 150 credits for the LGRWRP from two banks in BSA 5 with a significant number of these credits being used right away. The LGRWRP is in a better position to meet short-term demand with a total of 89.3094 credits currently available. Both MnDOT and BWSR are pursuing additional credit purchases through a BWSR managed request for proposal issued in March of 2021.

Table 4-4. Summary of Federally Approved Available Credits by Credit Type													
Major Watershed	**Seasonally Flooded Basin**	**Fresh (wet) Meadow**	**Wet Mesic Prairie**	**Sedge Meadow**	**Shallow Marsh**	**Deep Marsh**	**Shallow Open Water**	**Shrub Carr**	**Hardwood or Coniferous Swamp**	**Upland**	**Unknown**	**Total**	**Percent of Total Credits**
Crow Wing River	-	-	-	-	0.2400	-	-	0.6300	-	0.9360	-	**1.806**	**0.2**
Leech Lake River	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Long Prairie River	-	3.9955	-	-	-	-	-	-	-	0.1600	-	**4.1555**	**0.4**
Mississippi River-Brainerd	2.5600	1.7207	-	20.7535	-	-	-	15.2864	0.4718	6.3570	0.5000	**47.6498**	**4.7**
Mississippi River-Grand Rapids	-	668.5457	-	-	70.8811	-	-	14.051	6.9873	-	-	**760.4651**	**74.5**
Mississippi River-Headwaters	-	12.0089	-	1.2104	191.9678	-	-	-	-	-	-	**205.1871**	**20.1**
Pine River	-	-	-	-	-	-	-	-	-	-	-	**0**	**0**
Redeye River	-	0.6000	-	-	-	-	-	-	0.238	-	-	**0.8380**	**0.1**
BSA 5 Total	**2.5600**	**686.8708**	**0**	**21.9639**	**263.0889**	**0**	**0**	**29.9674**	**7.6971**	**7.4530**	**0.5000**	**1,020.6000**	**100**

5. WATERSHED TRENDS AND THREATS

Trends in Wetland Quantity and Quality

Minnesota has adopted a policy goal to achieve a no-net-loss in quantity and quality of wetlands across the state. This is achieved through many regulatory and non-regulatory programs, including WCA. Since 2006, the MPCA and MnDNR have completed routine surveys to assess the status and trends in quantity and quality of wetlands across the state of Minnesota.

The MnDNR is responsible for quantifying the status and trends of wetland quantity across Minnesota. Using remote sensing data, three surveys have been completed: a baseline was established in 2006, the first iteration was in 2009, and the second iteration in 2012.

A three-year study was completed from 2006-2008, to establish a baseline in wetland quantity in Minnesota. It was found that there are 10.62 million acres of wetland across the state. The Prairie Parkland Region in southwestern Minnesota and the Paleozoic Plateau in southeastern Minnesota have considerably less wetlands than central and northern portions of the state. Forested wetland was the most widespread type, covering approximately 4.4 million acres. Emergent wetlands were the next most abundant with 3.1 million acres (Kloiber, 2010).

Between the first (2009) and second (2012) iterations there was a net increase of area that changed from upland to wetland. There was some change from wetland to upland which was due to human intervention. A high proportion of the changes in wetland type and area happened on agricultural land (Kloiber & Norris, 2017). It should be noted that the increase in wetland acreage was primarily in unconsolidated bottom type wetlands. It was also found that conversions between wetland types were primarily from emergent wetlands to cultivated or unconsolidated bottom wetlands.

The MPCA is responsible for assessing the status and trends in wetland quality in Minnesota. This is done by completing two surveys, the Depressional Wetland Quality Assessment (DWQA) and the Minnesota Wetland Condition Assessment (MWCA). The DWQA focuses on vegetation, macroinvertebrates, and water quality for depressional wetlands. It has undergone three iterations in 2007, 2012, and 2017. The MWCA, which covers a broader spectrum of wetlands, was first completed in 2011 to determine a baseline for wetland vegetation quality and to begin quantifying potential human impacts associated with degraded conditions (Minnesota Pollution Control Agency, 2015). It was repeated in 2016 to establish trends.

In 2011, the MWCA baseline survey found that Minnesota has relatively high-quality wetlands, but it is regionally specific. There are more wetlands in northern Minnesota than southern Minnesota which causes the data to be weighted towards the condition of the northern region. About 49% of Minnesota wetlands are in exceptional condition. These wetlands are predominately located in the north-central and northeastern portions of the state. As for the western and southern portions of the state, most wetlands are in fair or poor condition. The baseline survey also found that Minnesota's wetlands, as a whole, are exposed to a low level of stressors, but this is also regionally specific. The northern portions of the state experience low pressure from stressors, but the southern and western regions experience high pressure, specifically from non-native invasive plants (Minnesota Pollution Control Agency, 2015). About two-thirds of BSA 5 has high quality wetlands with low pressure from stressors. The southern third of BSA 5 experiences higher pressure from stressors and has lower quality wetlands.

The results from the first iteration of the MWCA in 2016 found that Minnesota's wetland vegetation continues to be high quality. The results are similar to the baseline with the exception of a statistically significant 3% decrease of wetlands in poor condition. Vegetation quality still varied by region with the north having higher quality and less stressors, and the south and west having lower quality and more impact from stressors. In the

western and southern portions of the state there was a statistically significant increase in the number of fair condition wetlands and a corresponding decrease in poor condition wetlands (Bourdaghs et al., 2019). Wetland vegetation quality in BSA 5 has largely stayed the same since the first baseline assessment in 2011.

There is a very small portion of BSA 5 that falls in the study region for the DWQA, primarily the Redeye River and Long Prairie River watersheds with small portions of the Crow Wing River and Mississippi River- Brainerd watersheds. In 2017, it was found that 58% of plant communities in depressional wetland basins were in fair condition, 25% in poor condition, and 4% in good condition. The most recent iteration for the DWQA changed the vegetation quality methods and therefore cannot be compared to previous data. Based on the relative stability of aquatic macroinvertebrate community condition of the past surveys, there seems to be no significant change in the quality of depressional wetlands and ponds (Genet et al., 2019).

In summary, the vegetation quality of wetlands in Minnesota is high. The southern region tends to have lower quality because there is more pressure from stressors. These stressors are both human intervention and non-native invasive species. As far as areal extent, Minnesota has actually seen an increase in wetlands. It is important to note that there have been many conversions from emergent wetlands to deep-water habitats and ponds. BSA 5 reflects the regional trends in both wetland quality and extent, with more extensive high-quality wetlands in the north and lesser quality, smaller wetlands in the south.

Description of Threats

Wetlands across Minnesota are under threat from many different stressors. In BSA 5, wetlands are threated specifically by the loss of hydrologic storage, pollution, and conversion to upland. These threats are based on the conditions established in the Baseline Conditions section as well as conversations with stakeholders. Although BSA 5 wetlands are relatively high quality, it is important to recognize current and future threats, as well as the impact threats have on prioritizing areas for wetland restoration and protection.

LOSS OF HYDROLOGY STORAGE

The loss of hydrologic storage can be seen through many of the baseline conditions explored above, specifically altered watercourses, riparian and littoral wetlands, and wetland loss. Hydrologic storage is the ability of the landscape to hold water, permanently or temporarily, mainly in lakes, wetlands, and rivers. Storage on the landscape is important for the flood mitigation and water quality (Mitsch & Gosselink, 2015). The Redeye River and Long Prairie River watersheds have the most loss in hydrologic storage due to the amount of ditched wetlands, agriculture and impervious surfaces, and wetland loss. These two watersheds also have the largest amount of wetland loss within BSA 5. Watersheds in the northern and eastern portions of BSA 5 are also experiencing loss in hydrologic storage, although not to the degree of the Redeye River and Long Prairie watersheds.

THREAT OF POLLUTION

Overall, BSA 5 has very high quality wetlands, lakes, and river, with minimal impairments and loss compared to the rest of Minnesota. The threat of pollution is an issue, as are the expanding agriculture and urbanized areas,

and the unique geology of the area. According to the NLCD, 17% of BSA 5 is agriculture and 4% is developed. The U.S. Census showed that between 2000 and 2010, BSA 5 had an 8% increase in population, with the largest increase in the Crow Wing River watershed. The population is expanding which also means there will be an increase in urban development as cities and towns grow. Both agriculture and urbanization introduce new pollutants to the landscape and also decrease the hydrologic storage and the ability of water to filter through soil before entering ground water aquifers. Water quality decreases with an increase in agriculture and development pressure.

The pollution sensitivity of near-surface materials metric within the WHAF demonstrates the vulnerability of groundwater in BSA 5 to pollution. Sand plains, from glacial outwash and wind deposited sand dunes, cover the Redeye River, Crow Wing River, Pine River, and Mississippi River- Brainerd watersheds. These plains transport water and pollutants at a high rate into the surficial sand aquifers. The only Minnesota watersheds with higher susceptibility are those that have Karst geology in the southeastern portion of the state. The threat from a growing population and loss of hydrologic storage exacerbate the threat of pollution to ground water.

CONVERSATION OF WETLAND TO UPLAND

Another major threat within BSA 5 is the conversion of wetland to upland. This is demonstrated in the wetland quantity and quality studies completed by the MnDNR and MPCA. Conversion to upland was seen across BSA 5 and was listed a future threat to wetlands. Conversion to upland primarily occurs when wetlands are drained for agriculture or urban development. Anecdotally, stakeholders have seen an increase in the loss and degradation of riparian and littoral wetlands as development pressure increases. Drained wetlands as mapped in the NWI are concentrated in the Redeye River, Long Prairie River, and Crow Wing River watersheds. There are also portions of the Mississippi River- Grand Rapids and Mississippi River- Brainerd watersheds that have experienced large amounts of wetland drainage, especially along the Mississippi River.

6. STAKEHOLDER INVOLVEMENT

Stakeholders are a crucial part of the CPF development process and were included via virtual meetings. The first meeting took place in July 2021, to introduce the ILF and CPF development process to the stakeholders. A summary of the baseline conditions was presented to gather feedback from stakeholders so metrics could be tailored to BSA 5. Stakeholders invited to participate included: Soil and Water Conservation Districts, Counties, BWSR, MnDNR, MPCA, Leech Lake Bank of Ojibwe, and White Earth Band of Ojibwe. Those that attended included individuals from Soil and Water Conservation Districts, Counties, BWSR, and the MnDNR. Discussions during the meeting highlighted the shared concern for loss of high-quality resources including White Cedar and riparian wetlands. At the meeting, stakeholders identified two additional baseline conditions, hydrologic connectivity and important habitats, to be included in the report. A list of attendees and the material presented is provided in Appendix C-1.

The second stakeholder meeting took place in October 2021. This meeting reviewed the baseline conditions and presented the two conditions, hydrologic connectivity and important habitats, which were added based on the

first meeting. The cumulative impact analysis as well as the BSA 5 trends and threats assessment were also presented. The main focus of the meeting was presenting prioritization criteria for both restoration and preservation, and soliciting feedback from stakeholders. A draft list of the criteria and a preliminary map of prioritized catchments were introduced. The invite list was the same as the first meeting. Those that attended included individuals from Soil and Water Conservation Districts and BWSR. The discussion focused on how to include partially drained wetlands, and threats from increased agriculture and development pressure. Areas and threats specifically mentioned in local plans were also discussed. A list of the attendees and the material presented is provided in Appendix C-2.

The third and final stakeholder meeting took place in January 2022. The purpose of the meeting was to present the prioritization process and final results. A brief refresher of the purpose of the report, the baseline conditions, cumulative impact analysis, and BSA trends and threats was also given. The invite list was similar to the previous two meetings but updated to include some recent staff changes. It included individuals from Soil and Water Conservation Districts, Counties, BWSR, MnDNR, MPCA, Leech Lake Bank of Ojibwe, and White Earth Band of Ojibwe. Those that attended included individuals from Counties, Soil and Water Conservation Districts, and BWSR. There was some concern from attendees about the lack of private ownership in the northern part of the Leech Lake River watershed reducing the opportunity for restoration and preservation. Additionally, there was some concern that areas north of the Whitefish Chain of Lakes in the Pine River watershed should have been more targeted due to development pressure. Ultimately, the weighting derived from the stakeholder survey focused on groundwater pollution sensitivity and not as much on development pressure. A list of the attendees and the material presented is provided in Appendix C-3.

7. PRIORITIZATION METHODS FOR SELECTING AND IMPLEMENTING MITIGATION ACTIVITIES

The geographic scale used to identify priority areas for wetland mitigation in this plan is the catchment. The MnDNR has defined catchment to be “the smallest delineated and digitized drainage area mapped by the MnDNR Watershed Delineation Project.” Specifically, MnDNR Level 8 catchments were used. The catchment scale was selected for two primary reasons. First, the prioritization process can be conducted at a finer scale which allows for more specific identification of areas where wetland mitigation may benefit watershed health. At the same time, the number of catchments in BSA 5 is not excessive and the process can be completed in a reasonable amount of time with meaningful results. Second, the MnDNR has developed large amounts of watershed data at the catchment level that can be easily accessed to support the prioritization process which reduces the time associated with the GIS-based analyses.

BSA 5 is made up of 1,600 catchments distributed across the eight major watersheds as follows: Crow Wing River has 273 catchments, Leech Lake River has 158 catchments, Long Prairie River has 128 catchments, Mississippi River- Brainerd has 250 catchments, Mississippi River- Grand Rapids has 277 catchments,

Mississippi River- Headwaters has 242 catchments, Pine River has 189 catchments, and Redeye River has 83 catchments (Figure 7-1).

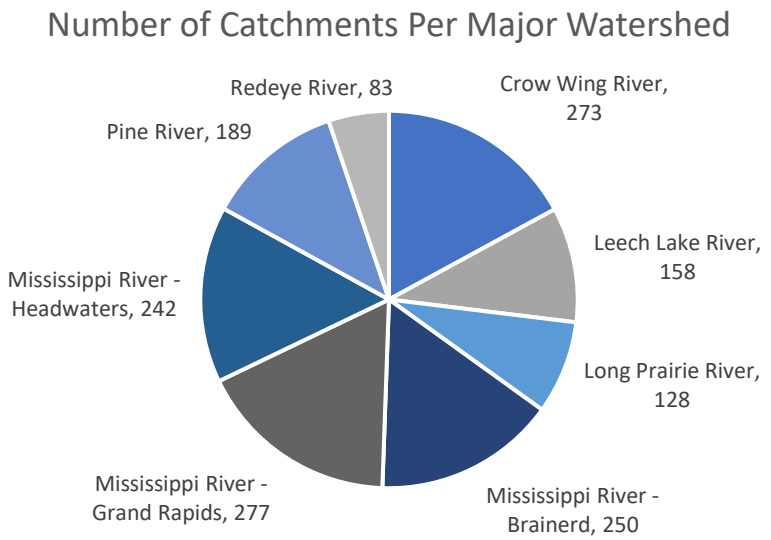


Figure 7-1. Chart showing the number of catchments within each major watershed.

In previous CPF Reports, prioritization of catchments focus solely on wetland restoration. This CPF is unique because of the inclusion of preservation in the prioritization process. In BSA 5, preservation plays a large role because of the intact wetlands already on the landscape and small amounts of urbanization present. Criteria and weighting were different for restoration and preservation which is reflective of local goals and current land use. It also should be noted that preservation is not the direct inverse of restoration. Although some criteria are inversed, different criteria were considered and different weights were assigned by stakeholders to both restoration and preservation. A comparison of catchments prioritized for restoration only, preservation only, or for both can be seen in Figure D-1.

Criteria Selection

Criteria for catchment prioritization were selected by stakeholders attending the second stakeholder meeting. BWSR and ISG staff served as facilitators of the discussion and selection process by suggesting criteria for restoration and preservation and then seeking stakeholder input. After the meeting, each criterion was evaluated for availability and suitability of GIS-based data. As stated previously, criteria were selected for both restoration and preservation separately. The biggest difference in the analysis between restoration and preservation is that preservation considers several more criteria. This is reflective of the important and intact habitats that are unique to BSA 5, such as white cedar forests. A list and description of the restoration criteria can be seen in Table 7-1. Preservation criteria and descriptions can be seen in Table 7-2. For several of the criteria the data used for restoration and preservation are the same but the values were inverted. The only criterion that was the same for both preservation and restoration was Ground Water Pollution which is based on the near-surface pollution sensitivity dataset from the WHAF.

RESTORATION CRITERIA

A total of eight different criteria were selected for restoration prioritization. They include *Altered Streams, Development Pressure, Drained Wetlands, Ground Water Pollution, Lake and River Impairments, Local Plans, Perennial Cover,* and *Wetland Loss*. The specific criterion and description of data used can be found in Table 7-1.

Table 7-1. Restoration Criteria and Description of Data

Criterion	Description
Altered Streams	This is a ratio of total stream miles classified by the MPCA altered watercourses project as *Impounded* and *Altered* to the total miles of watercourses. Lakes and *No-definable Channel* classification were removed due to the high number of lakes in this BSA and duplicate mapped features.
Development Pressure	These are areas that have had a high degree of change from non-impervious to impervious surfaces from 2001 to 2016 as mapped by the National Land Cover Database.
Drained Wetlands	The total area of wetlands, relative to catchment area, that have a "d" modifier in the National Wetland Inventory.
Ground Water Pollution*	This is based on the near-surface pollution sensitivity dataset from the WHAF. It is a measure of the travel time it takes for water to infiltrate to a depth of 10 feet. Areas of high sensitivity were prioritized.
Impairments	A combination of lake and river impairments as mapped by the MPCA impaired waters project (updated 2020) and the WHAF water quality non-point source score. Areas with both high number of impairments and non-point sources were prioritized.
Local Plans	These are areas specifically called out in One Watershed One Plan reports and WRAPS reports for wetland restoration. Scores were assigned as follows: 10: specific geographies and wetland restoration actions called out in the plan, 7: wetland restoration is called out as a priority in multiple spots with details given related to BMPs and entities participating but less specifics, 4: wetland restoration generally mentioned as important but there are few specifics, and 1: wetland restoration is not mentioned at all.
Perennial Cover	*Perennial* cover as mapped in the National Land Cover Database, which includes *forest*, *grassland,* and *wetland*. Areas of low amounts of *perennial* cover relative to catchment area were prioritized.
Wetland Loss	Areas that have experienced high amounts of wetland loss, relative to catchment area, since European Settlement. This data was produced for this report. Details can be found in the Baseline Conditions section.
*Same criterion as preservation	

PRESERVATION CRITERIA

A total of 11 criteria were included in the prioritization of catchments for wetland preservation. The criteria include *Altered Streams, Current Protection, Development Pressure, Ground Water Pollution, Lake and River Impairments, Local Plans, Perennial Cover, Areas of Biodiversity Significance, Wetland Loss, Wetlands Near Lake and River Shores*, and *White Cedar Forests*. The specific criterion and description of data used can be found in Table 7-2.

Table 7-2. Preservation Criteria and Description of Data	
Criterion	**Description**
Altered Streams	This is a ratio of total stream miles classified by the MPCA altered watercourses project as *Natural* to the total miles of watercourses. Lakes were removed because the high number of lakes in this BSA skewed the data. Catchments with fewer altered streams scored higher.
Current Protection	Modeling completed by the MnDNR Fisheries found a relationship between protection (i.e. publicly owned or protected by conservation easements) and disturbance in watersheds which can help prioritize areas (MnDNR, 2013). They categorized the relationship into four categories: *Vigilance*: watersheds with at least 75% of their area protected and less than 25% disturbed land are reasonably protected from future disturbance; *Protection*: watersheds that have less than 75% of their area protected, and less than 25% disturbance need additional protection to avoid future water quality degradation; *Full Restoration*: Between 40% and 75% of the watershed is protected, and disturbance is between 25% and 60% have a realistic chance for full restoration; *Partial Restoration*: watersheds with less than 25% of their area protected, and more than 60% disturbance, are too expensive and difficult to restore water quality. For the purpose of this study, each category was assigned a score: *Vigilance*: 4, *Protection*: 10, *Full Restoration*: 7, and *Partial Restoration*: 1. Disturbance and protection were computed using readily available GIS data.
Development Pressure	These are areas that have had a low degree of change from non-impervious to impervious surfaces from 2001 to 2016 as mapped by the National Land Cover Database.
Ground Water Pollution*	This is based on the near-surface pollution sensitivity dataset from the WHAF. It is a measure of the travel time it takes for water to infiltrate to a depth of 10 feet. Areas of high sensitivity were prioritized.
Impairments	A combination of lake and river impairments as mapped by the MPCA impaired waters project (updated 2020) and the WHAF water quality non-point source score. Areas with both a low number of impairments and non-point sources were prioritized.
Local Plans	These are areas specifically called out in BWSR's One Watershed One Plan reports and WRAPS reports for wetland protection. Scores were assigned as follows: 10: specific geographies and wetland protection actions called out in the plan, 7: wetland protection is called out as a priority in multiple spots with details given related to BMPs and entities participating but less specifics, 4: wetland protection generally is mentioned as important but there are few specifics, and 1: wetland protection is not mentioned at all.
Perennial Cover	*Perennial* cover, as mapped in the National Land Cover Database which includes *forest*, *grassland*, and *wetland*. Areas of high amounts of *perennial* cover relative to catchment area were prioritized.
Areas of Biodiversity Significance	Areas of biodiversity significance as mapped by the Minnesota Biological Survey. Acres of areas ranked as *Below, High, Moderate*, and *Outstanding* were weighted, with *Outstanding* having the highest weight and *Below* and unranked having the lowest weights. Catchments with large areas categorized as *Outstanding* were prioritized.
Wetland Loss	Areas that have experienced low amounts of wetland loss, relative to catchment area, since European Settlement. This data was produced for this report. Details can be found in the Baseline Conditions section.

Table 7-2. Preservation Criteria and Description of Data	
Criterion	**Description**
Wetlands Near Lakes and River	These are wetlands mapped by the National Wetland Inventory within 20-feet of river and lakeshore, relative to catchment area. Catchments with a high amount of these wetlands were prioritized.
White Cedar Forests	White cedar forests as mapped by the MnDNR Forest Stand Inventory, relative to catchment area. Areas with a high number of white cedar forests were prioritized.
*Same criterion as restoration	

Development of Criterion Maps

GIS transformation of spatially explicit data characterizing each criterion were normalized through a reclassification process to generate maps that captured the potential for a catchment to improve watershed health through wetland restoration and preservation. The geoprocessing for each criterion followed a straightforward and repeatable process (Figure 7-2).

First, GIS data representing each criterion was obtained and associated with each catchment in BSA 5. If a catchment value had not been assigned (GIS data obtained from the WHAF typically had predetermined criterion scores for each catchment), a value was calculated for each catchment using raw data. For example, the number of ditched wetlands was determined by dividing the area of NWI wetlands with a "d" modifier by the total area of the catchment and multiplying the result by 100.

The resulting criterion scores were then normalized from 0 to 100 for each major watershed by dividing each catchment criteria value by the highest value in that major watershed. The normalized results were then classified into ten classes using the natural breaks tool in ArcGIS in an ascending order of priority (Reclassify step in Figure 7-2). In other words, low scores are catchments with lower potential for wetland mitigation to improve watershed health and high scores represent areas that would have a higher potential to improve watershed health for both restoration and preservation.

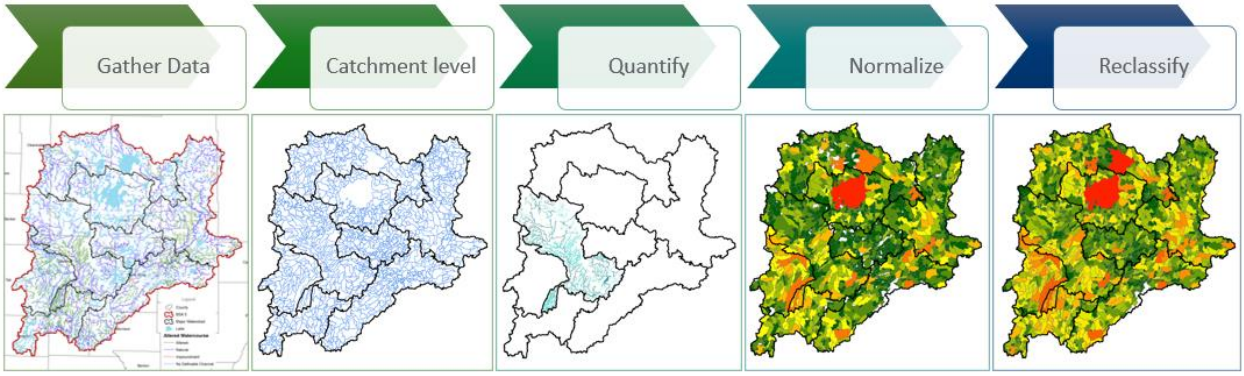


Figure 7-2. Data transformation process.

The process described above and in Figure 7-2 was used for all criteria except local plans and current protection. For those two criteria specific scores were given to each catchment based on the data. The description of the process and scoring used for current protection can be found in Table 7-2. For local plans, the process and scoring can be found in Table 7-1 and 7-2.

Weighting Derived from Stakeholder Input

Stakeholders were offered the opportunity to weight criteria based on the perceived value within their work area. A simple survey via Survey123 was sent out and the stakeholders had three weeks to respond. Within the survey, stakeholders were asked to rank the criteria from more important to least important for restoration and preservation separately. There were seven responses to the survey. The results of the survey are shown in Tables 7-3 and 7-4. The rank of the criteria determined the weight it would receive in the final prioritization.

Weighting was calculated by using the rank sum methodology. Once the rank was assigned by stakeholders the associated weight was multiplied by the criterion score for each catchment. All of the weighted criterion scores were summed together to get the final prioritization score. Catchments with higher scores were prioritized more for restoration and/or preservation. Unweighted results for restoration can be seen in Figure D-2 and for preservation in Figure D-3. The weighted results for restoration can be seen in Figure D-4 and for preservation in Figure D-5.

Table 7-3. Restoration Ranks Assigned by Stakeholders and Resulting Weights

Rank	Criterion	Weight
1	Groundwater Pollution	0.2222
2	Development Pressure	0.1944
3	Local Plans	0.1667
4	Altered Streams	0.1389
5	Drained Wetlands	0.1111
6	Impairments	0.0833
7	Wetland Loss	0.0556
8	Perennial Cover	0.0278

Table 7-4. Preservation Ranks Assigned by Stakeholders and Resulting Weights		
Rank	**Criterion**	**Weight**
1	Groundwater Pollution	0.1547
2	Local Plans	0.1401
3	Current Protection	0.1300
4	Wetlands near lakes and rivers	0.1198
5	Natural Streams	0.0998
6	Wetland Loss	0.0853
7	Impairments	0.0751
8	Sensitive Species	0.0649
9	Perennial Cover	0.0547
10	Development Pressure	0.0456
11	White Cedar	0.0300

Designation of Priority Catchments

The analyses completed to this point separated catchments within each watershed based on their expected potential to benefit watershed health through wetland restoration or preservation activities. The next step in the process was to take these results and identify the catchments that will be designated as prioritized for wetland mitigation projects. This required finding a breakpoint in the prioritization outputs that balanced the need for sufficient wetland mitigation opportunities with maximizing benefits to the watershed. For example, designating only a small number of catchments as high priority areas may not result in enough opportunities for projects when a search is initiated through a selection process. Similarly, identifying a large number of catchments as high priority areas may decrease the potential benefits to the watershed because the value of the prioritization process is diluted, and sites could be selected in catchments that scored markedly lower than others.

For BSA 5, all catchments with prioritization scores in the top third of the distribution for each major watershed were identified as a high priority area. Using this method, 157 catchments were identified as high priority areas for both restoration and preservation, 387 catchments were prioritized for preservation only, and 390 were prioritized for restoration only. A table showing the number of catchments prioritized for restoration only, preservation only, and both by major watershed can be seen in Table 7-5. Figure D-6 shows the prioritized catchments for restoration. Prioritized catchments for preservation can be seen in Figure D-7. A map comparison of the catchments prioritized for restoration and preservation can be seen in Figure D-1.

For restoration, a total of 2,757,729 acres of BSA 5 were prioritized. The watershed with the largest area prioritized was Mississippi River- Grand Rapids, with 608,931 acres (46% of the watershed area). The watershed with the least area prioritized was Pine River, with 130,292 acres (26% of the watershed area). Maps for individual watersheds showing the prioritized catchments for restoration can be seen in Figures D-8 through D-15. Table 7-6 lists the acres prioritized for each watershed as well as the percent of the total area for both preservation and restoration.

For preservation, a total of 2,102,264 acres of BSA 5 were categorized as high priority. The watershed with the largest area prioritized was Mississippi River- Headwaters, with 468,030 acres (38% of the watershed area). The watershed with the least area prioritized was Redeye River, with 144,676 acres (25% of the watershed area). Maps showing the prioritized catchments for preservation for each individual watershed can be seen in Figures D-16 through D-23.

Table 7-5. Number of Catchments Prioritized for Each Watershed

Major Watershed	Preservation Only	Restoration Only	Both	Total
Crow Wing River	76	79	17	**172**
Leech Lake River	35	35	19	**89**
Long Prairie River	38	38	6	**82**
Mississippi River- Brainerd	65	65	20	**150**
Mississippi River- Grand Rapids	68	68	26	**162**
Mississippi River- Headwaters	42	42	40	**124**
Pine River	44	44	20	**108**
Redeye River	19	19	9	**47**
BSA 5 Total	**387**	**390**	**157**	**934**

Table 7-6. Area of Prioritized Catchments Per Watershed

Major Watershed	Preservation		Restoration	
	Acres	Percent of Total Area	Acres	Percent of Total Area
Crow Wing River	299,138	24%	467,074	37%
Leech Lake River	224,172	26%	208,744	24%
Long Prairie River	151,658	27%	247,083	44%
Mississippi River- Brainerd	235,648	22%	459,992	43%
Mississippi River- Grand Rapids	427,736	32%	608,931	46%
Mississippi River- Headwaters	468,030	38%	448,486	36%
Pine River	151,205	30%	130,292	26%
Redeye River	144,676	25%	187,126	33%
BSA 5 Total	**2,102,264**	**28%**	**2,757,729**	**37%**

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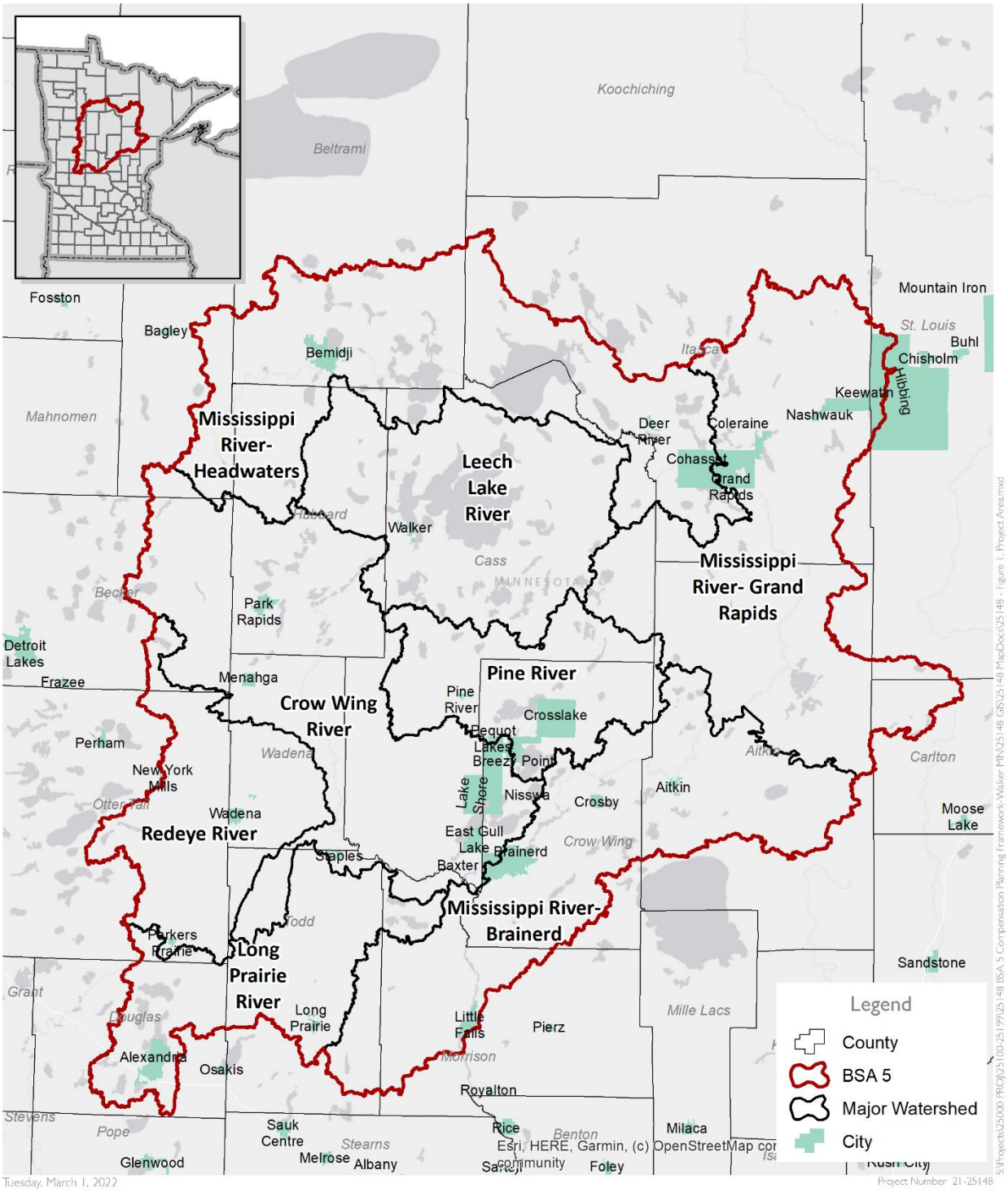
Appendix A: Acronyms

Acronym	Full Name
1W1P	One Watershed One Plan
BSA	Bank Service Area
BWSR	Minnesota Board of Water and Soil Resources
CPF	Compensation Planning Framework
DMU	Data Map Unit
DWQA	Depressional Wetland Quality Assessment
HUC	Hydrologic Unit Code
ILF	In-Lieu Fee Program
LGRWRP	Local Government Road Wetland Replacement Program
LiDAR	Light Detection and Ranging- remote sensing method for measuring elevations
MnDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MnGEO	Minnesota Geospatial Information Office
MPCA	Minnesota Pollution Control Agency
MWCA	Minnesota Wetland Condition Assessment
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NPC	Minnesota Native Plant Community
NWI	National Wetlands Inventory- specifically for Minnesota
USACE	United State Army Corps of Engineers
USDA	Unites States Department of Agriculture
USFS	United States Forest Service
VEGMOD	Historic Vegetation Model
WCA	Wetland Conservation Act
WHAF	Watershed Health Assessment Framework
WRAPS	Watershed Restoration and Protection Strategy Report

Appendix B: Baseline Condition Maps

Figure B-1. Project Location



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1 in = 20 miles

N

Project Area
Compensation Planning Framework
BSA 5, Minnesota

Figure B-2. Ecological Classification

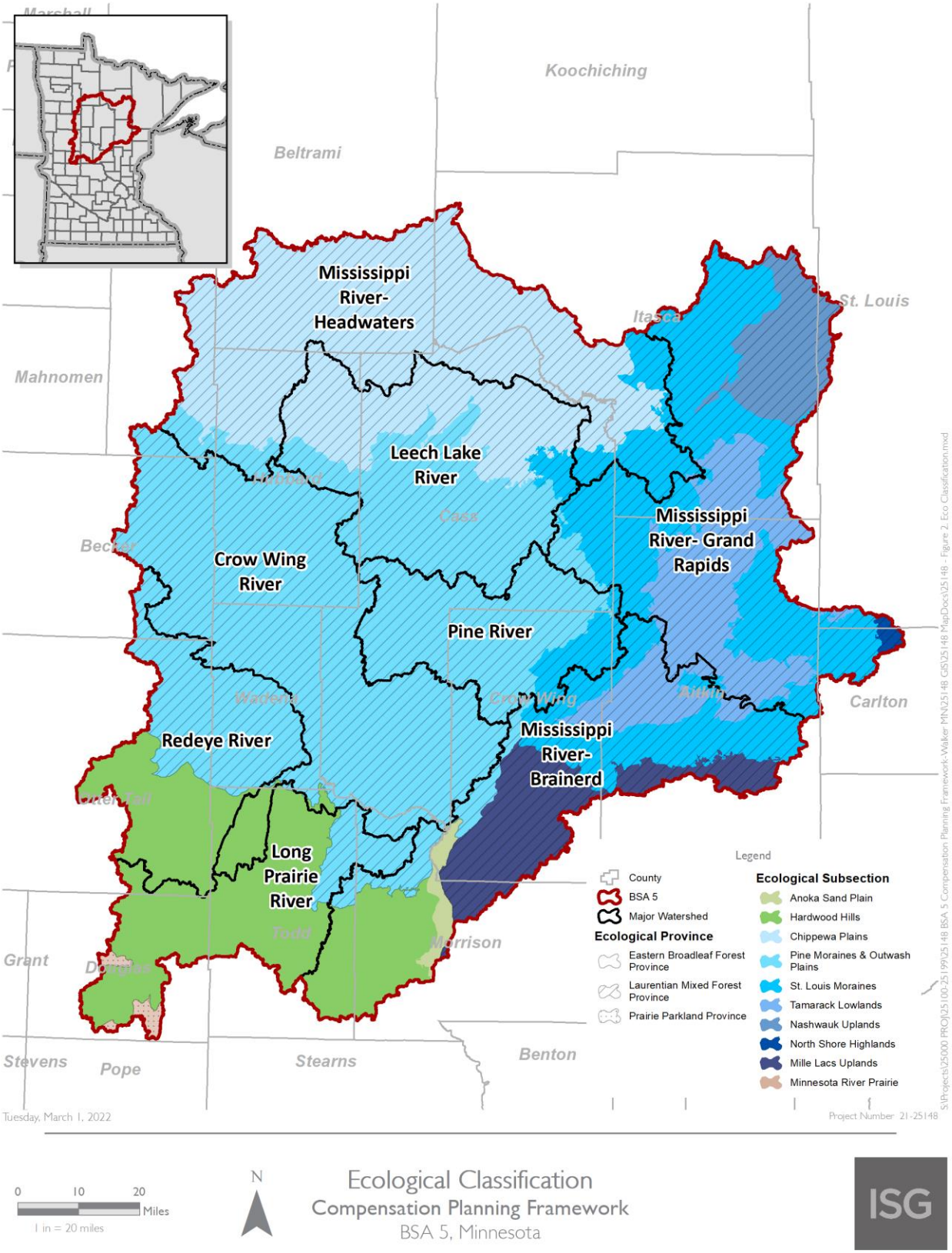


Figure B-3. Pre-settlement Vegetation

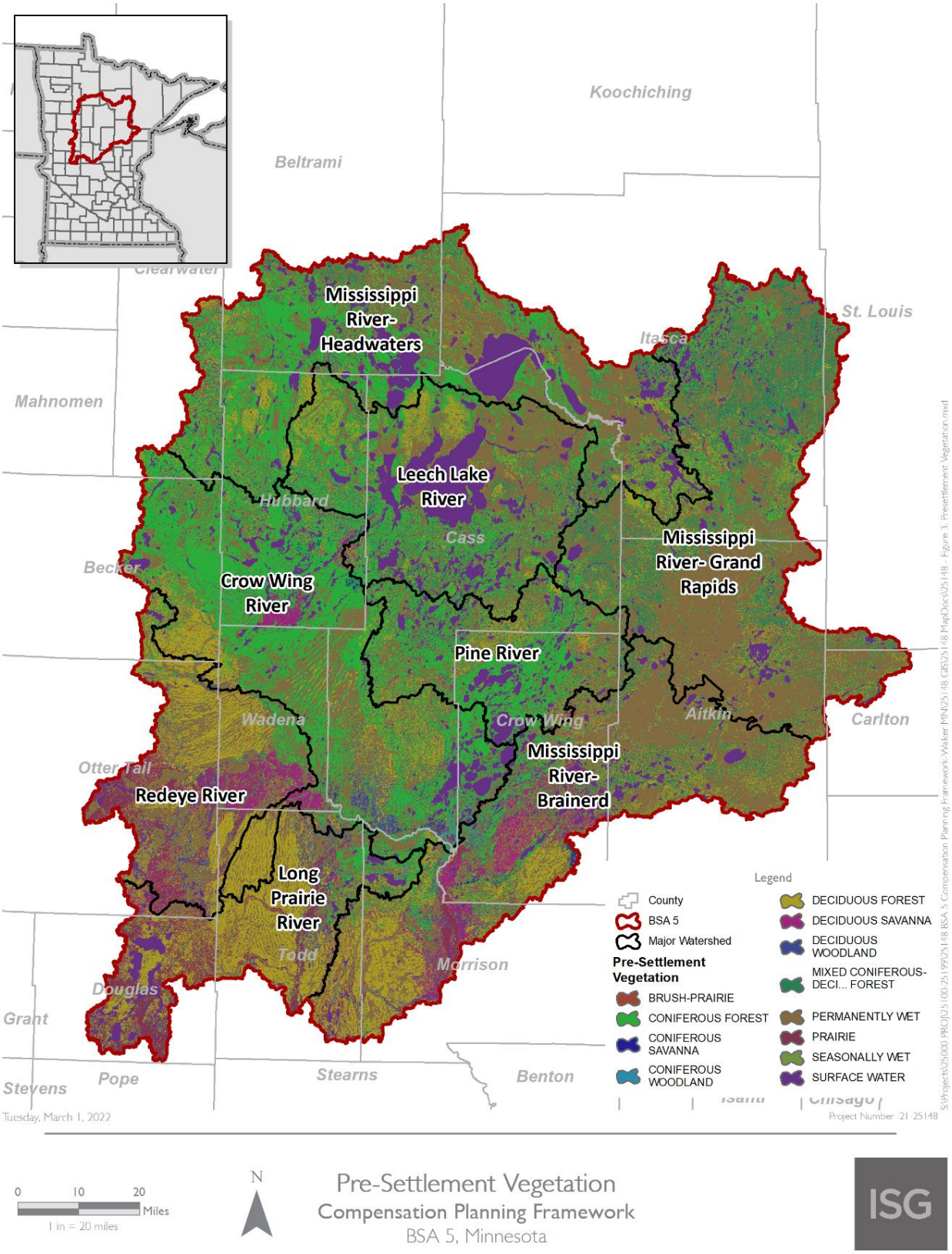


Figure B-4. Wetlands

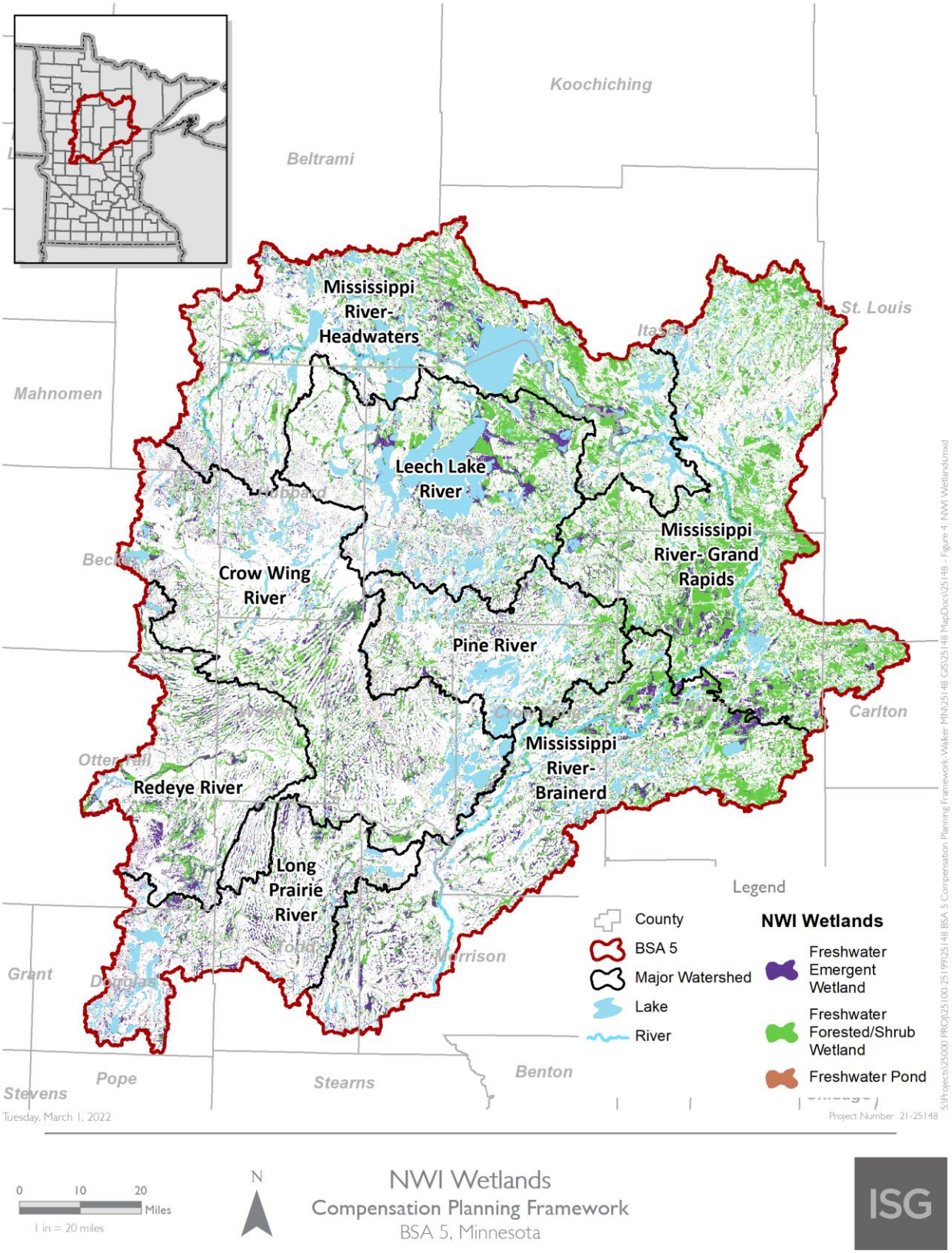


Figure B-5. Lakes and Watercourses

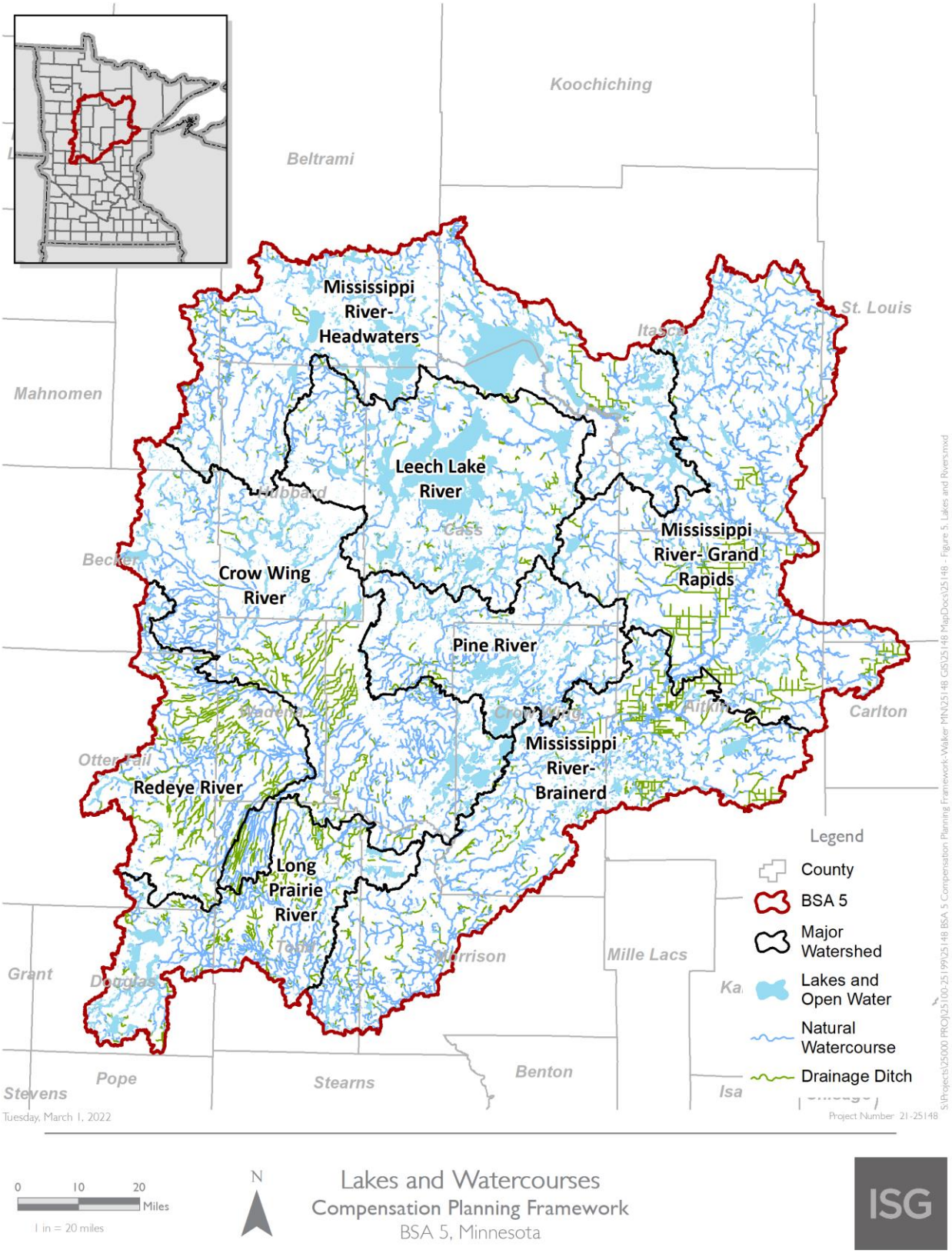


Figure B-6. Altered Watercourses

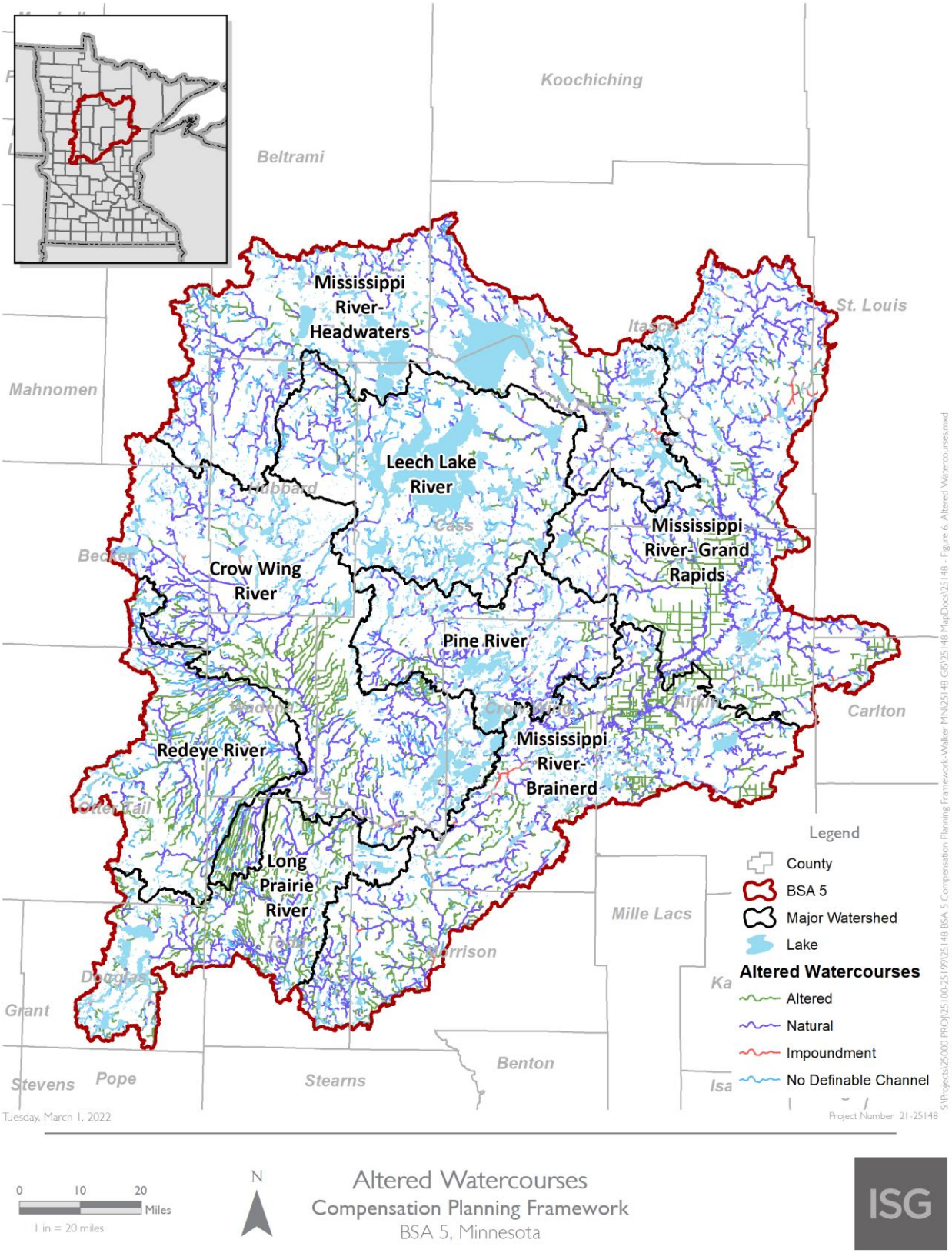


Figure B-7. Water Quality

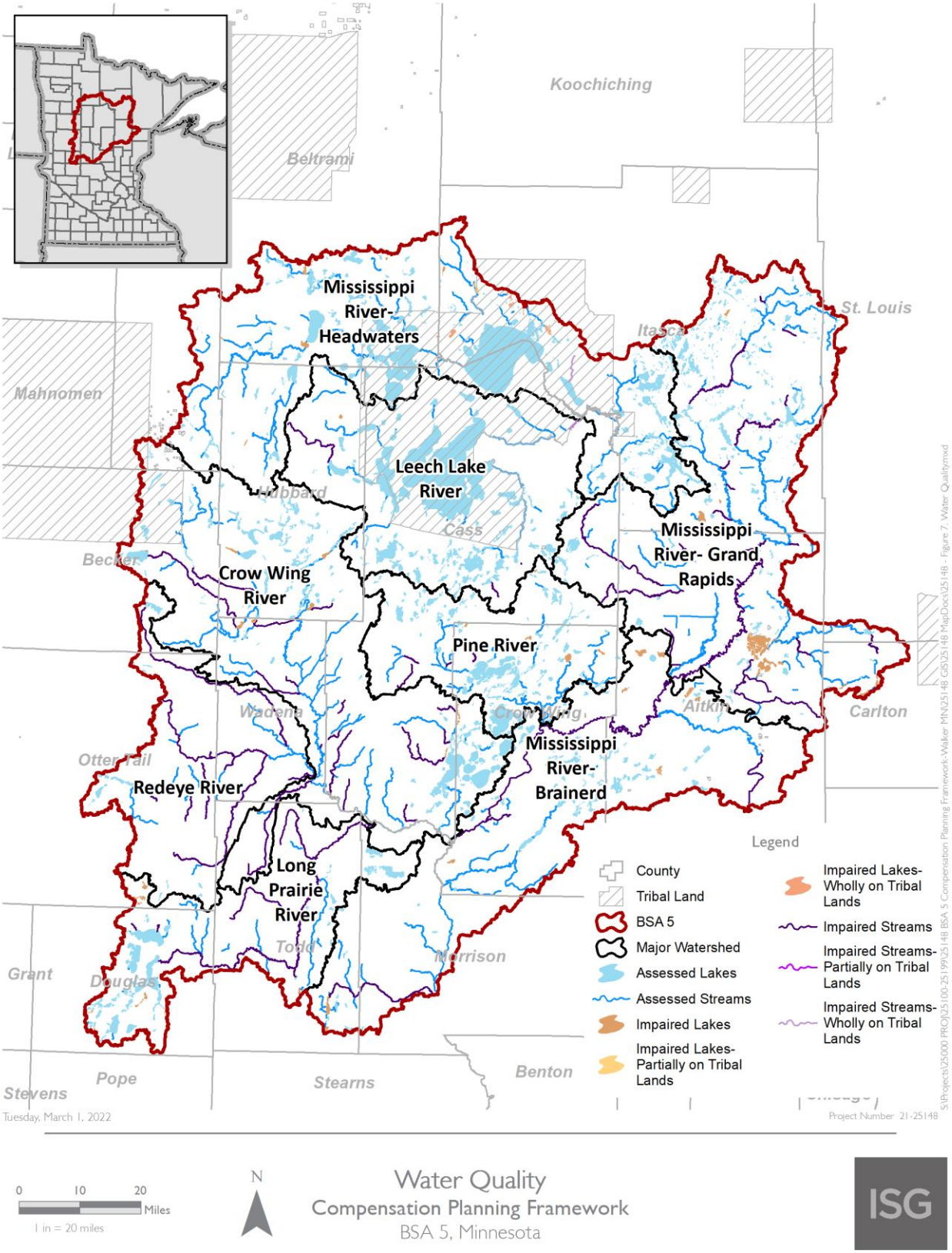


Figure B-8. Land Cover

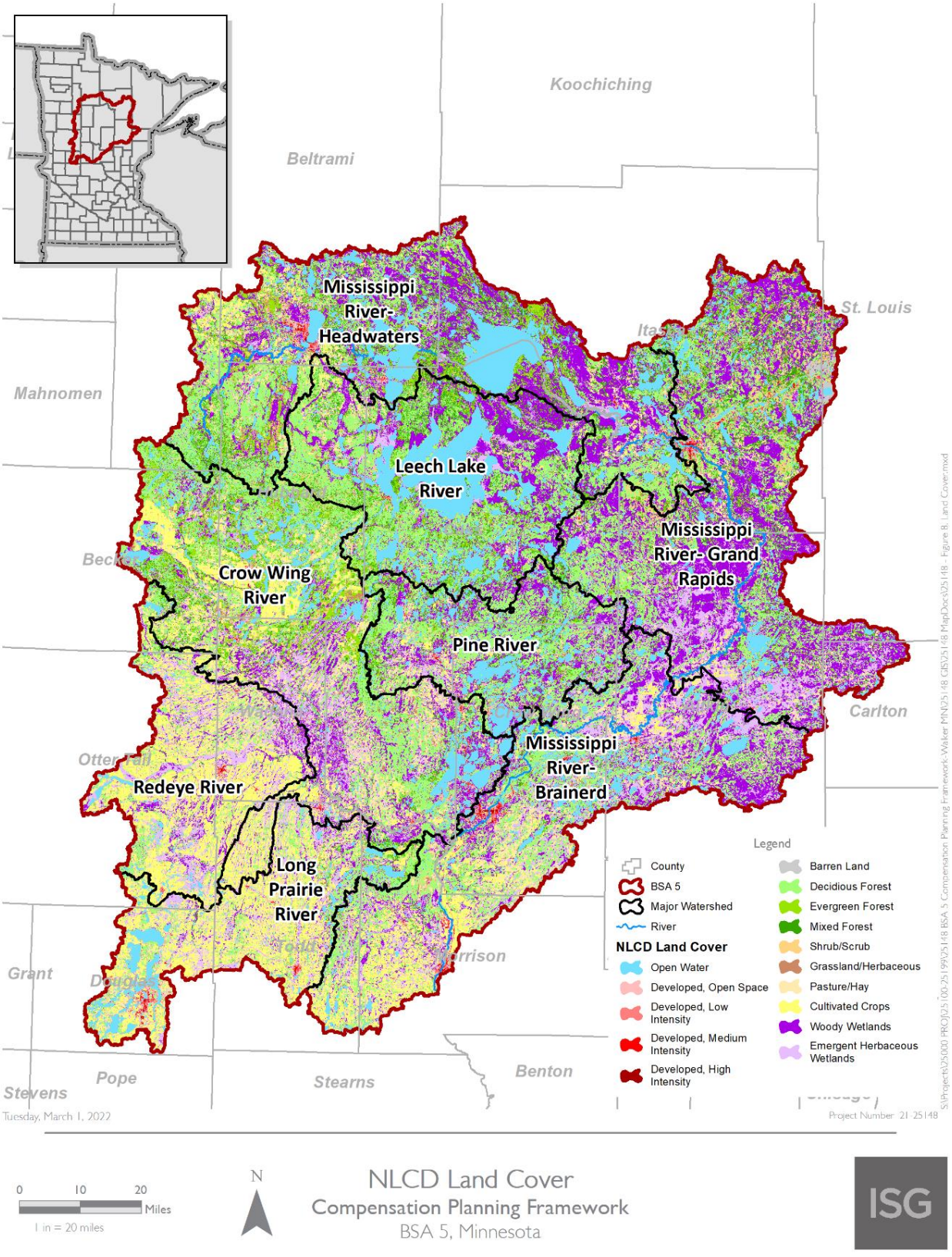


Figure B-9. Perennial Land Cover

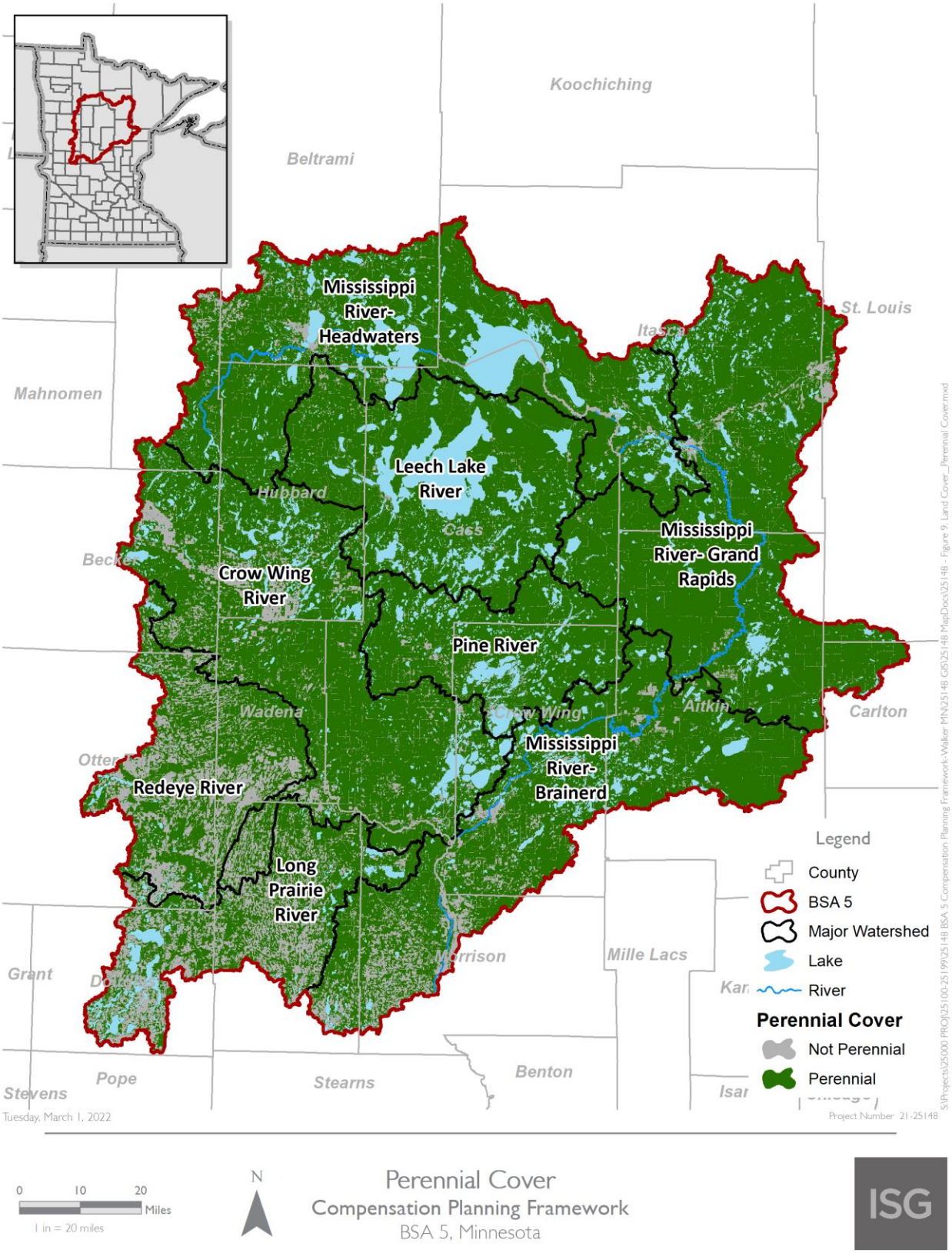


Figure B-10. Areas of Biodiversity Significance

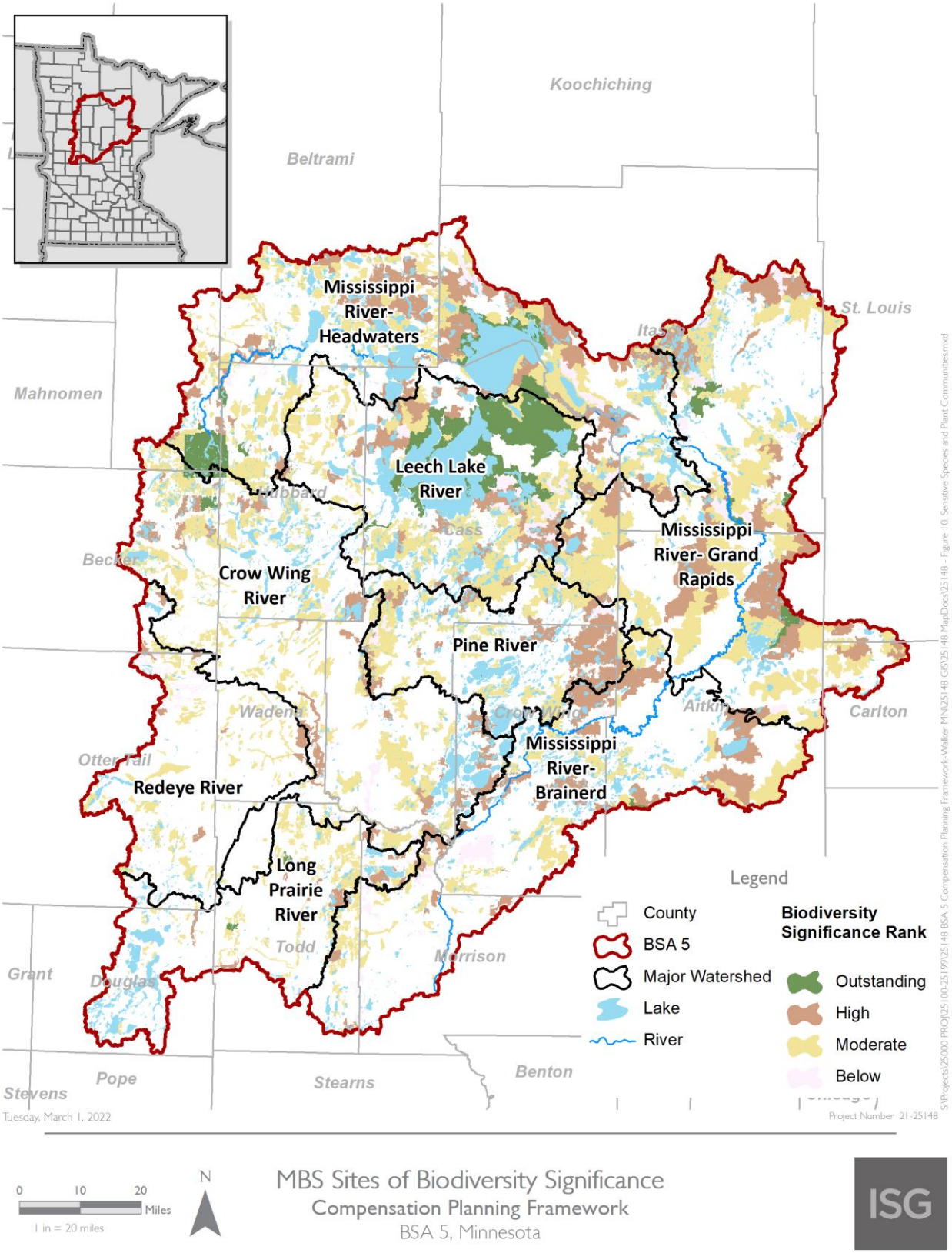


Figure B-11. WHAF Aquatic Connectivity Scores

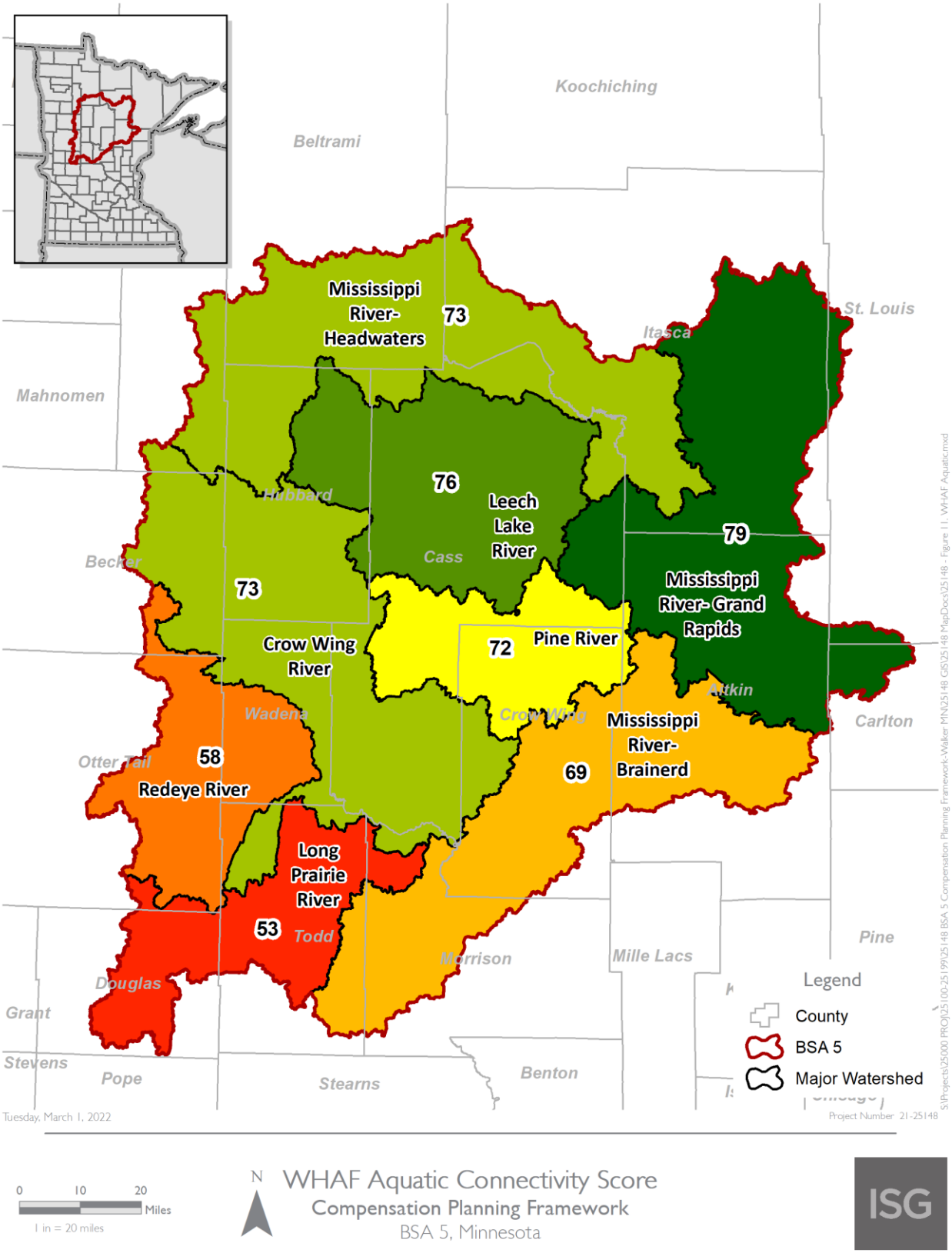


Figure B-12. White Cedar

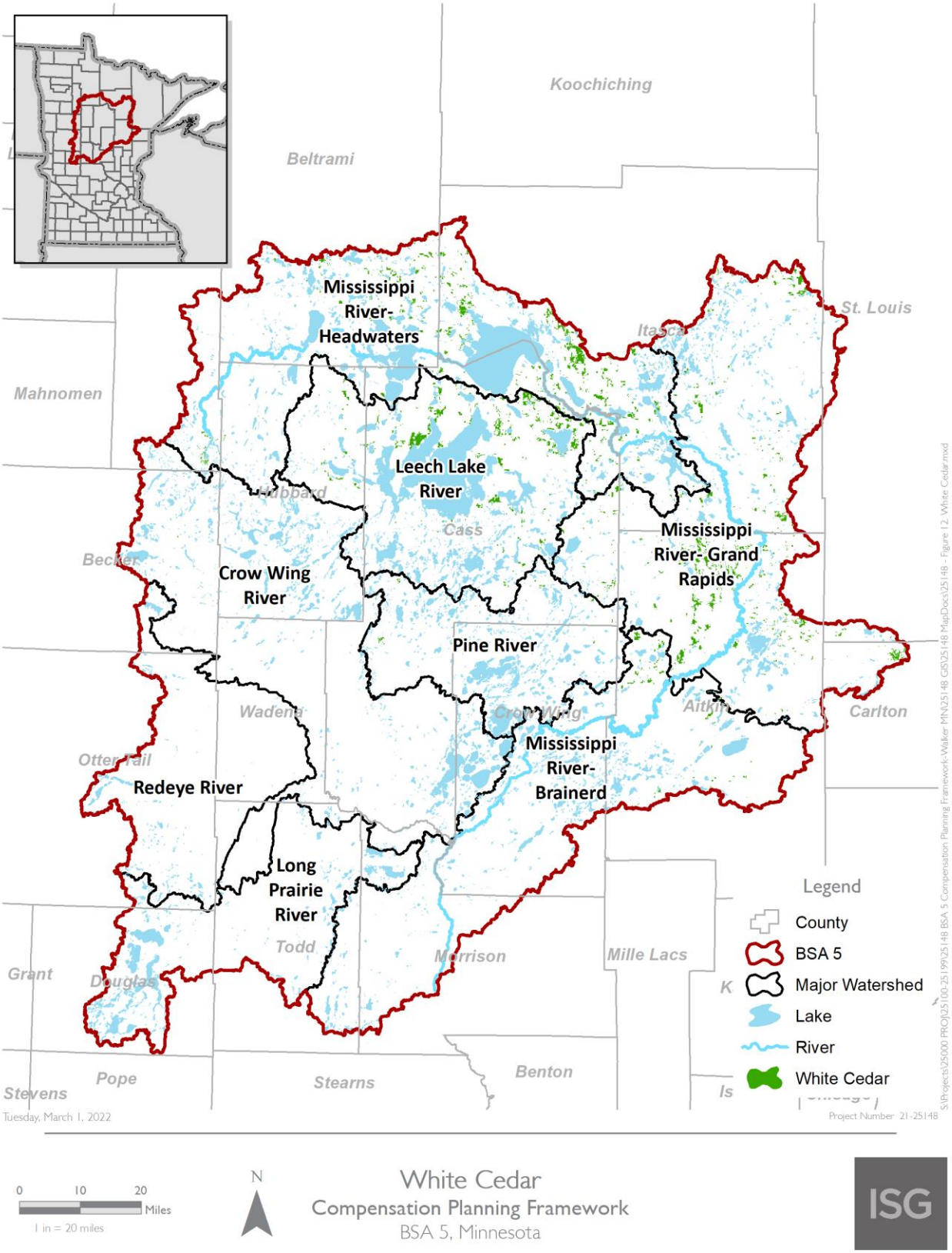
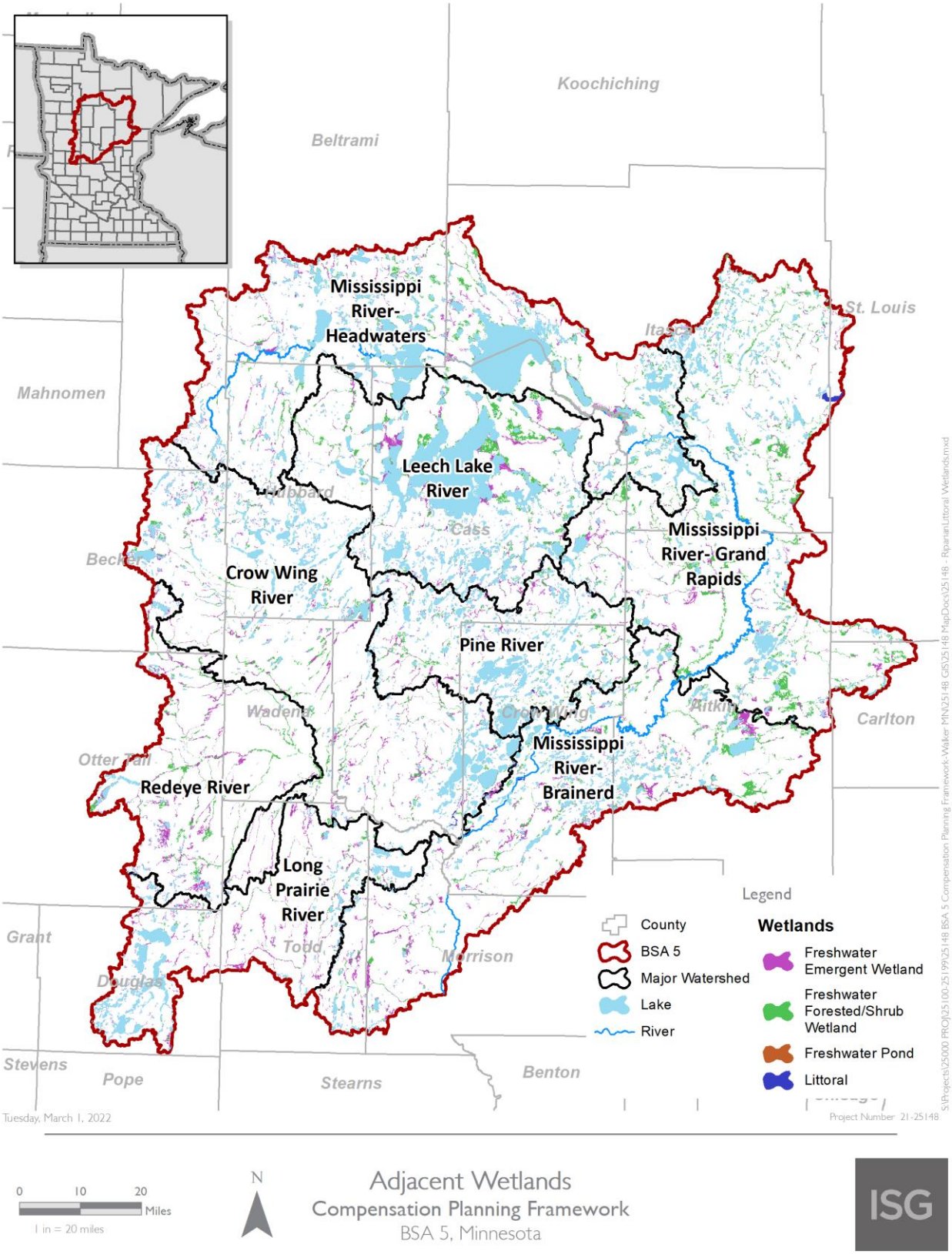


Figure B-13. Riparian and Littoral Wetlands



Appendix C: Stakeholder Meeting Attendees and Presentations

C-1. July 2021 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Thomas	Roloff	Thomas.Roloff@CrowWing.us	Crow Wing County
Sheila	Boldt	sheila@cwswcd.org	Crow Wing Soil & Water Conservation District
Cade	Steffenson	cade.steffenson@state.mn.us	BWSR
Kelly	Condiff	kelly.condiff@co.cass.mn.us	Cass SWCD
Brandon	Spain-Brist	brandon.hcswcd@gmail.com	Hubbard County SWCD
Bryan	Malone	bryan.malone@co.becker.mn.us	Becker SWCD


WETLAND
BANK
&
EASEMENT
AREA
In Lieu Fee Program
+ Compensation
Planning Framework

1


Compensation Planning
Framework Team

2


Compensation Planning Framework (CPF) Team
Julie Blackburn, CFM
Paul Marston, CFM
Dennis Rodacker

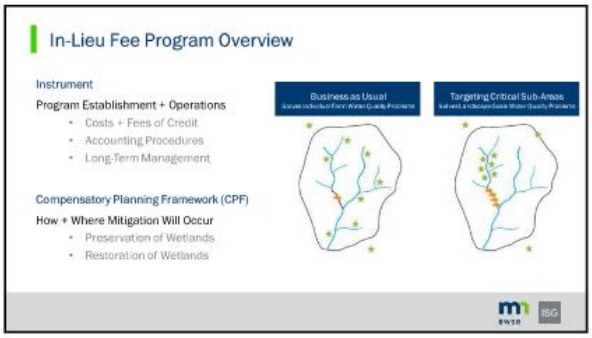
3


In-Lieu Fee Program +
Compensation Planning
Framework Overview

4


In-Lieu Fee Program Overview
In-Lieu Fee (ILF)
Fee based wetland mitigation program based on watershed approach that allows for the use of advanced credits.

5


In-Lieu Fee Program Overview
Instrument
Program Establishment + Operations
Costs + Fees of Credit
Accounting Procedures
Long-Term Management
Compensatory Planning Framework (CPF)
How + Where Mitigation Will Occur
Preservation of Wetlands
Restoration of Wetlands
Business as Usual
Targeting Critical Sub-Areas

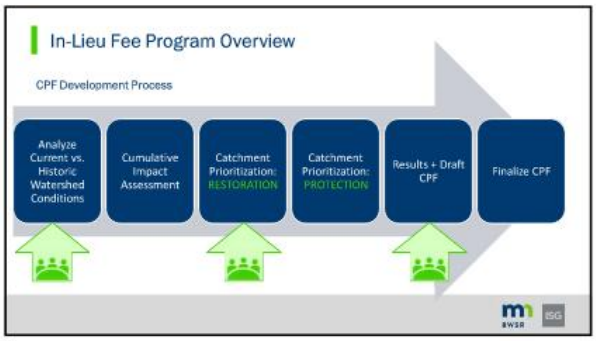
6


In-Lieu Fee Program Overview
Use of the CPF
1
Road Program Access to Advanced Credits
Guide for future road banks
2
Private Commercial Banks
Bankers use CPF to locate potential bank sites
CPF credits will have more value than non-CPF credits
New WCA Rules
3
Local Regulatory + Non-Regulatory Work
One Watershed One Plan
SWCD or other local projects

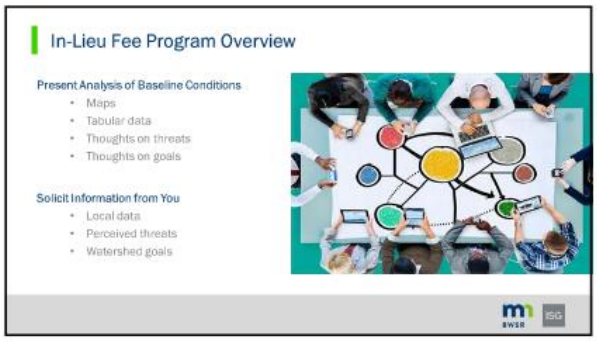
7


In-Lieu Fee Program Overview
Key CPF Development Component
Stakeholder Input
Nothing replaces local knowledge
Input on appropriate data sources
State + Local
Leads us through local plans
Identifies the most important watershed goals

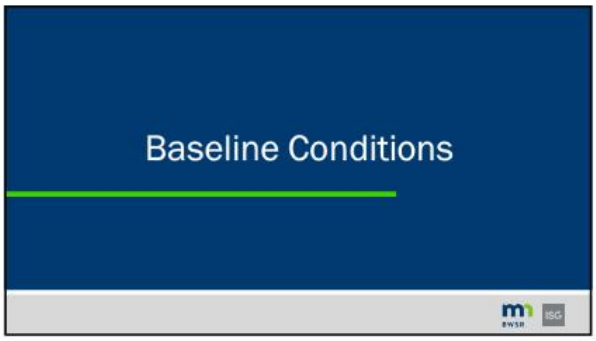
8


In-Lieu Fee Program Overview
CPF Development Process
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Catchment Prioritization: PROTECTION
Results + Draft CPF
Finalize CPF

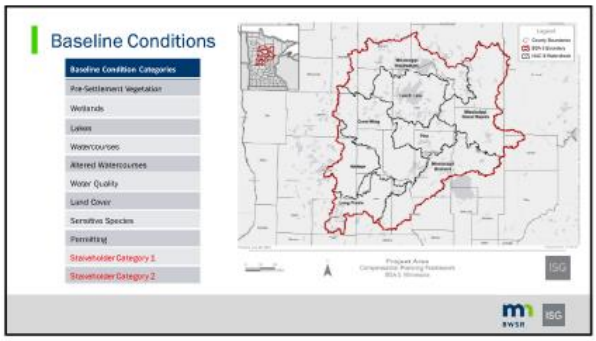
9


In-Lieu Fee Program Overview
Present Analysis of Baseline Conditions
Maps
Tabular data
Thoughts on threats
Thoughts on goals
Solicit Information from You
Local data
Perceived threats
Watershed goals

10


Baseline Conditions

11


Baseline Conditions
Baseline Condition Categories
Pre-Settlement Vegetation
Wetlands
Lakes
Watercourses
Altered Watercourses
Water Quality
Land Cover
Sensitive Species
Permitting
Stakeholder Category 1
Stakeholder Category 2

12

Baseline Conditions

Pre-Settlement Vegetation

- Natural landscape prior to European settlement
- MNDOT's VEGMOD used to classify vegetation type
  - Vegetation present from 1848 – 1907
  - Surveyor's observations combined with modern terrain and soils data
- Landscape dominated by forest and wetlands

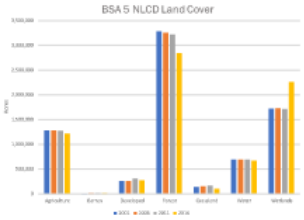
HUC - 8	Wetland	Forest	Prairie	Water
Mississippi River - Headwaters	34%	52%	1%	14%
Mississippi River - Grand Rapids	53%	41%	0%	6%
Leech Lake	29%	69%	2%	20%
Crow Wing	24%	64%	5%	7%
Pine	26%	58%	3%	13%
Mississippi - Brainerd	42%	35%	13%	8%
Redeye	33%	41%	23%	3%
Long Prairie	24%	47%	20%	8%
BSA 5 Total	35%	49%	7%	10%

13

Baseline Conditions

Land Cover (current)

- Analysis of NLCD Data
  - 2016 uses updated Landsat
- Landscape dominated by forest followed by wetlands and agriculture
- Land cover stays relatively stable with greatest loses seen in forest cover from 2001 to 2016



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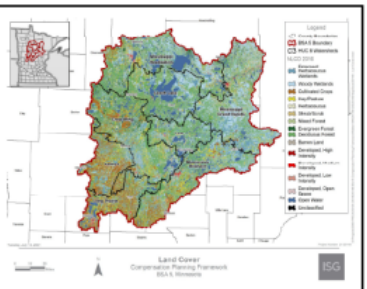
Baseline Data

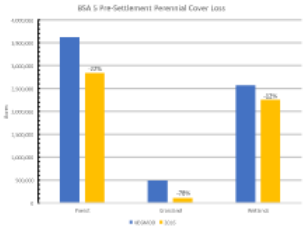


15

Baseline Conditions

Perennial Cover Loss

- Comparison of pre-settlement perennial landscape to NLCD 2016
  - Reflects impacts of European settlement and continued development
- Greatest area loss is seen in forest cover (785,358 acres) while grassland/prairie sees largest percentage loss
  - Losses can be attributed to conversion to agriculture followed by development



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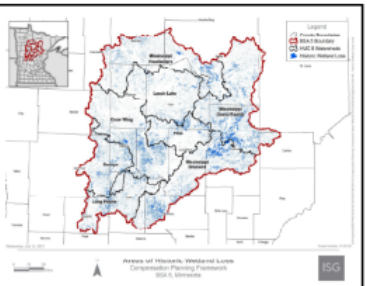
Baseline Data



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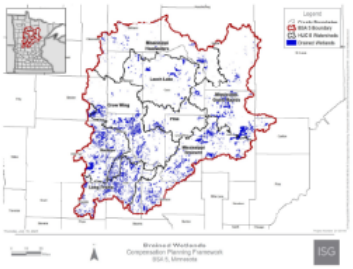
Baseline Data



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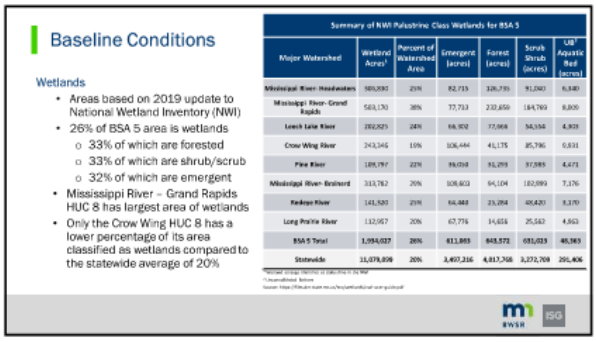

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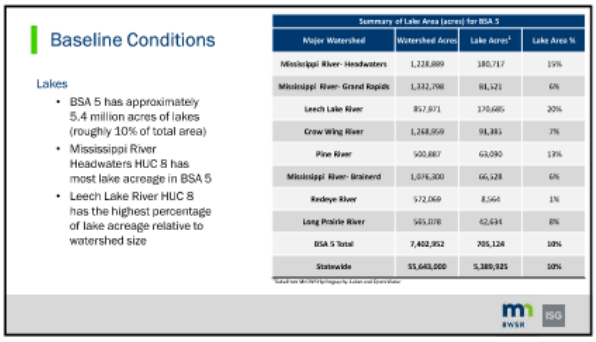

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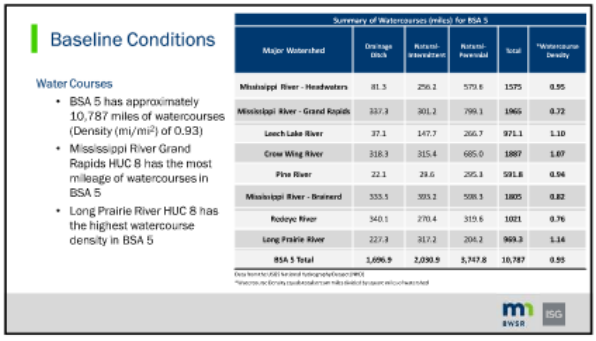

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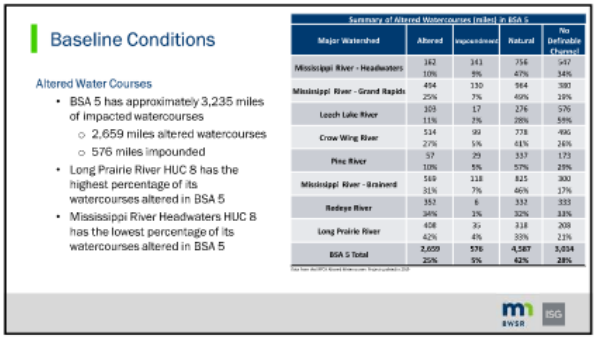

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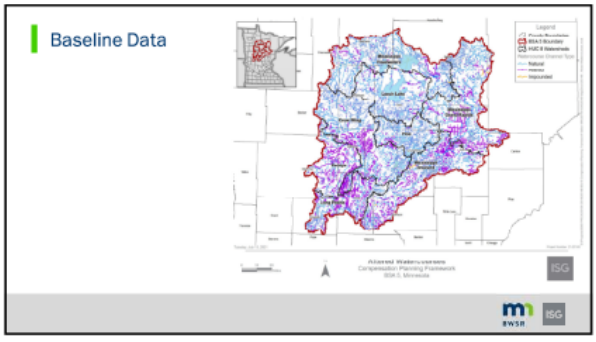

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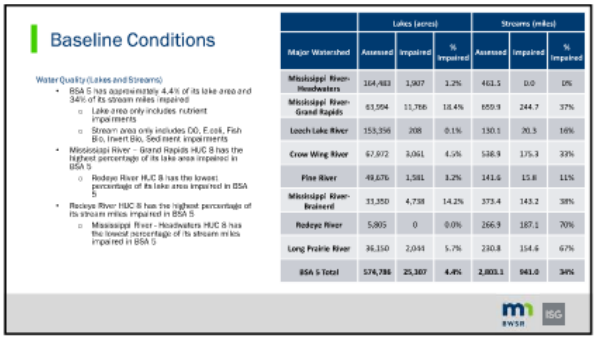

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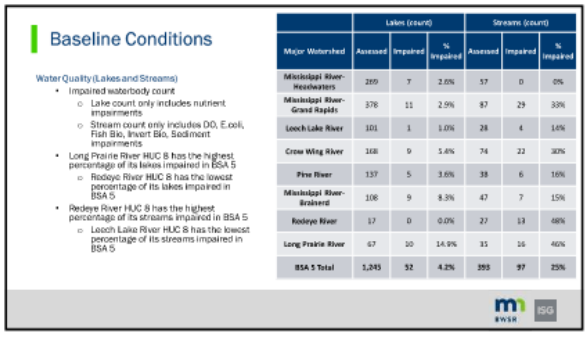

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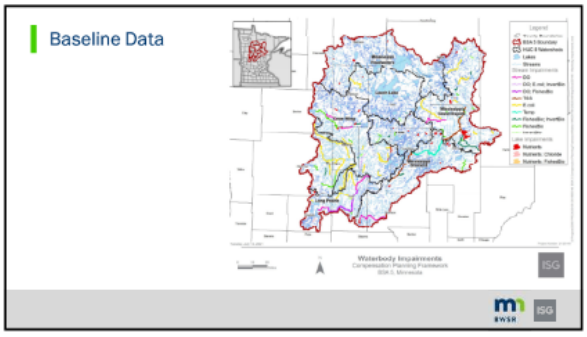

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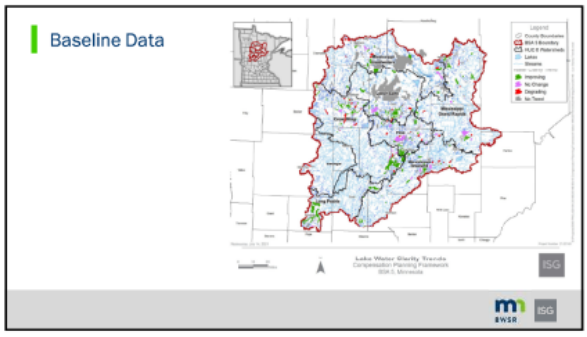

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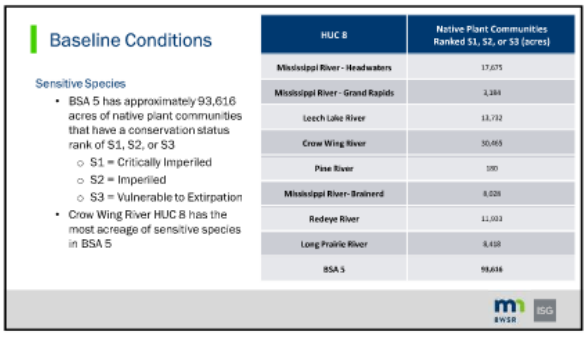

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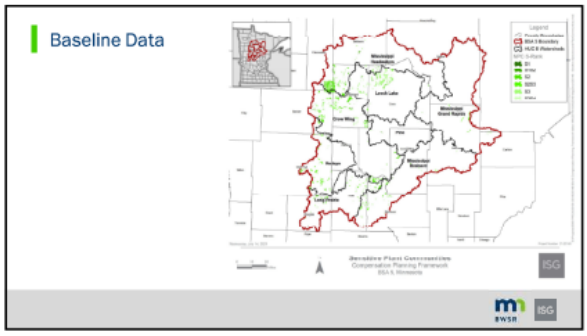

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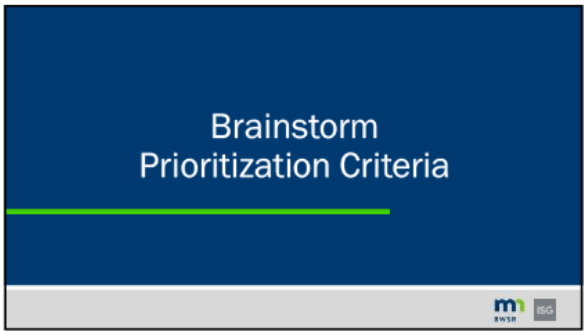

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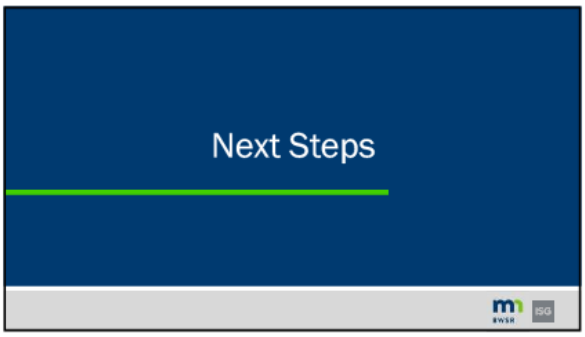
Brainstorm Prioritization Criteria
Baseline Condition Categories
Pre-Settlement Vegetation
Wetlands
Lakes
Watercourses
Altered Watercourses
Water Quality
Land Cover
Sensitive Species
Permitting
Stakeholder Category 1
Stakeholder Category 2
Sensitive Groundwater Areas
Proximity to Roads
Riparian Habitat Connectivity
Areas of High-Quality Habitat
Wildlife Action Network (WAN)
Aquatic Connectivity
Your Ideas!

31


Next Steps

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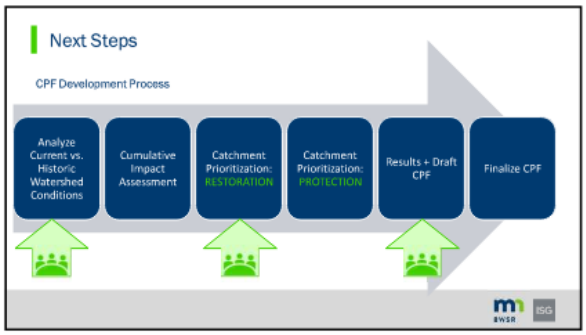
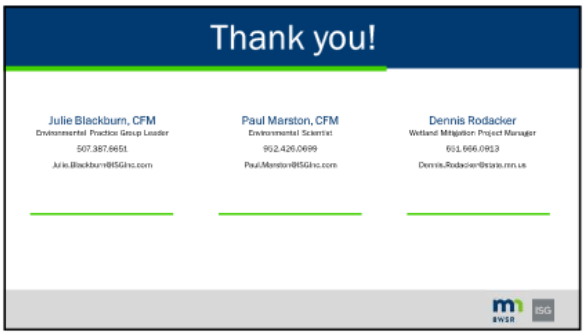

Next Steps
CPF Development Process
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Catchment Prioritization: PROTECTION
Results + Draft CPF
Finalize CPF

33


Thank you!
Julie Blackburn, CFM
Environmental Practice Group Leader
507.387.6651
Julie.Blackburn@ISGinc.com
Paul Marston, CFM
Environmental Scientist
952.426.0699
Paul.Marston@ISGinc.com
Dennis Rodacker
Wetland Mitigation Project Manager
651.666.0813
Dennis.Rodacker@state.mn.us

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C-2. October 2021 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Ben	Underhill	Ben.underhill@eot.mnswcd.org	East Otter Tail SWCD
Lynda	Ponting	Lynda.ponting@state.mn.us	BWSR

C-2. October 2021 Stakeholder Meeting Presentation

1

2

3

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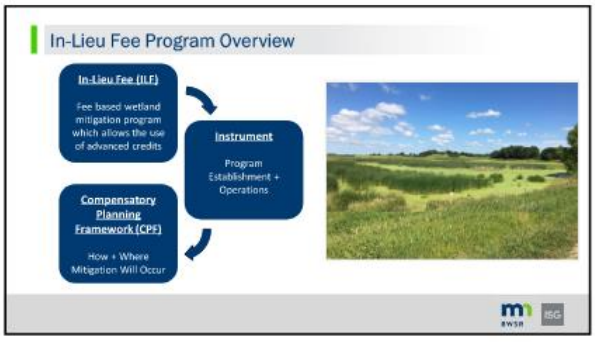

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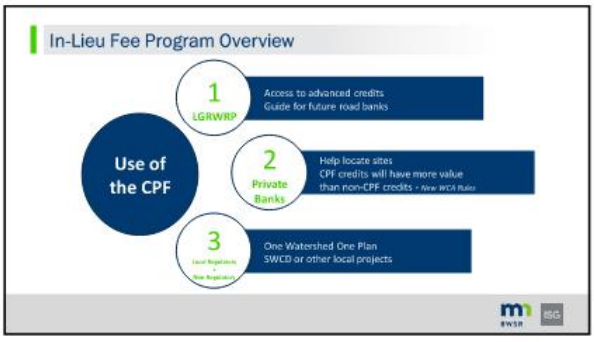
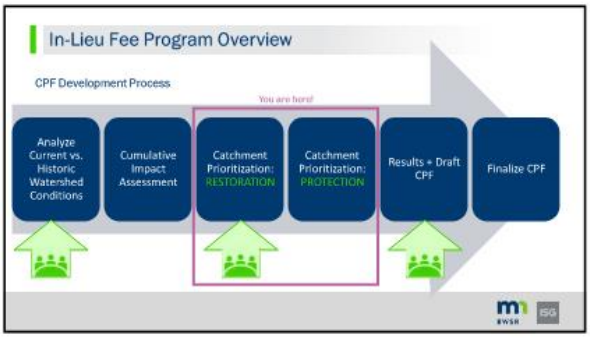


6


In-Lieu Fee Program Overview
Key CPF Development Component
Stakeholder Input
Nothing replaces local knowledge
Input on appropriate data sources
State + Local
Leads us through local plans
Identifies the most important watershed goals

7


In-Lieu Fee Program Overview
CPF Development Process
You are here!
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Catchment Prioritization: PROTECTION
Results + Draft CPF
Finalize CPF

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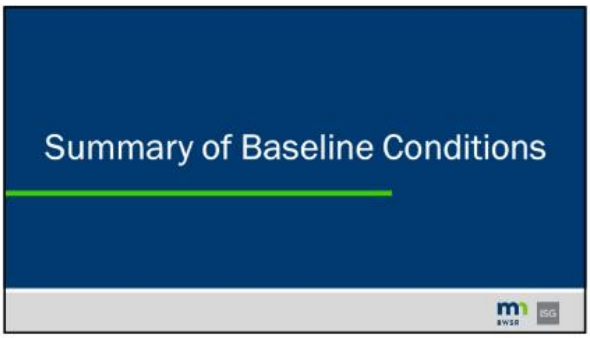
Summary of Baseline Conditions

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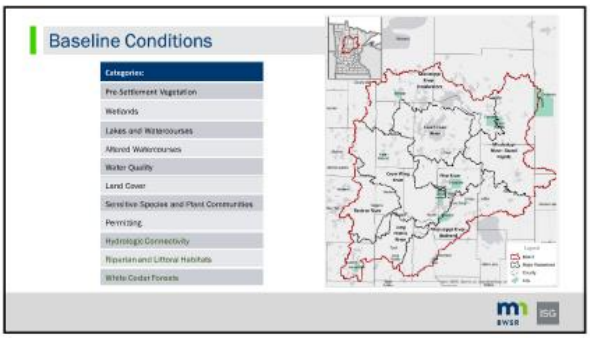
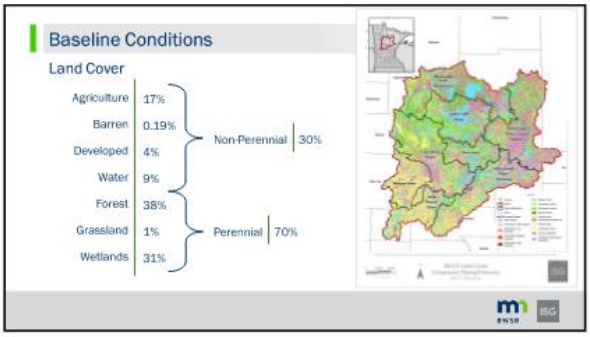
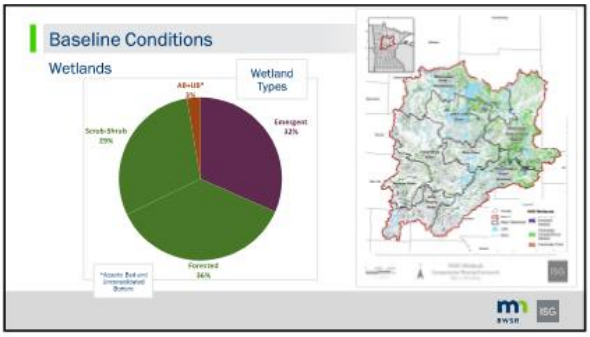

Baseline Conditions
Categories:
Pre-Settlement Vegetation
Wetlands
Lakes and Watercourses
Altered Watercourses
Water Quality
Land Cover
Sensitive Species and Plant Communities
Permitting
Hydrologic Connectivity
Riparian and Littoral Habitats
White Cedar Forests

10


Baseline Conditions
Land Cover
Agriculture 17%
Barren 0.19%
Developed 4%
Water 9%
Non-Perennial 30%
Forest 38%
Grassland 1%
Wetlands 31%
Perennial 70%

11


Baseline Conditions
Wetlands
Wetland Types
Scrub-Shrub 25%
Emergent 32%
Forested 36%

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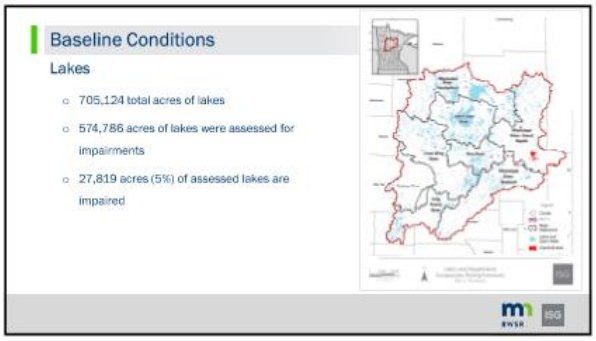

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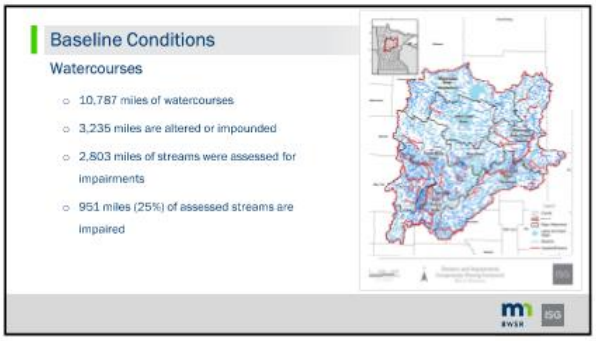

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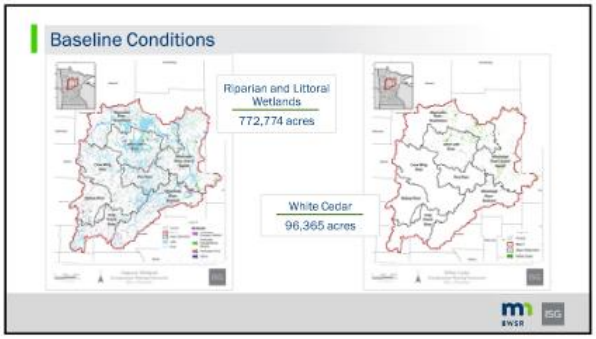

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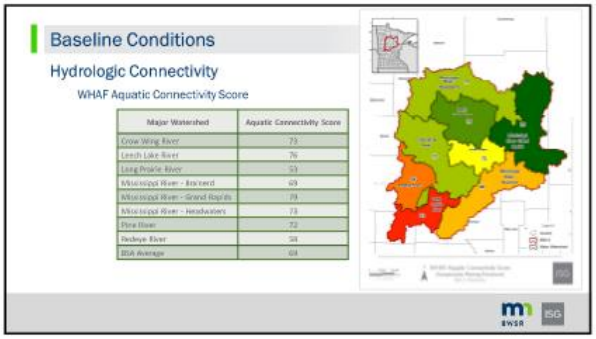

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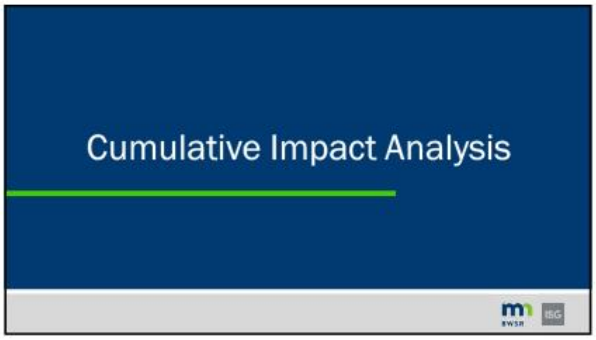

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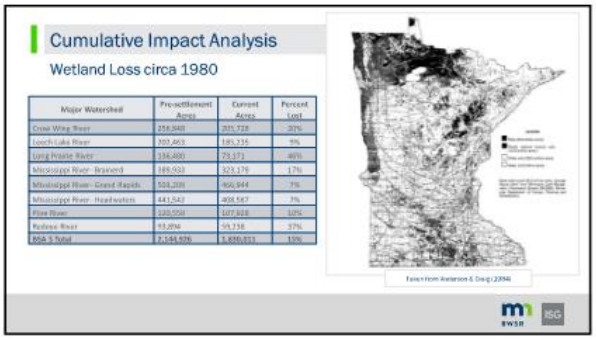

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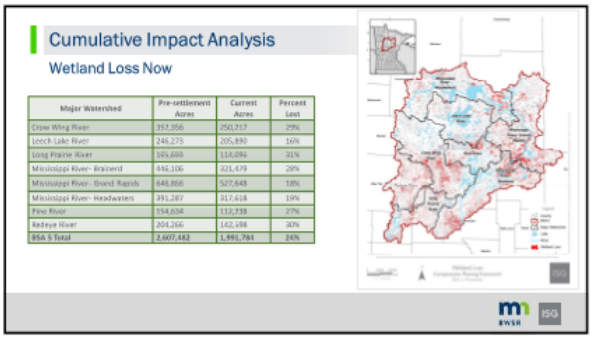

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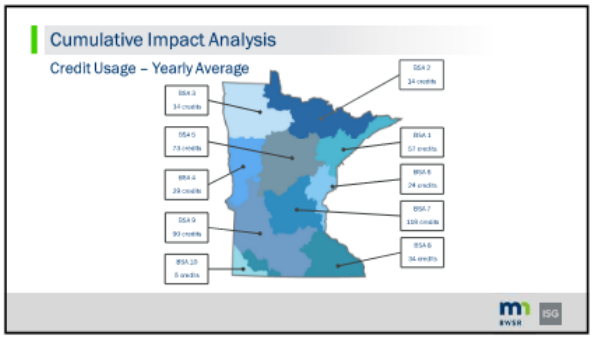

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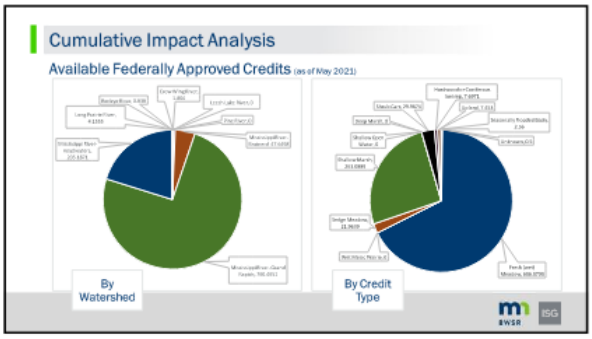

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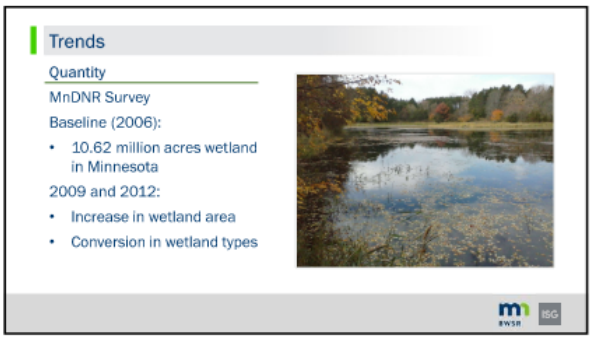

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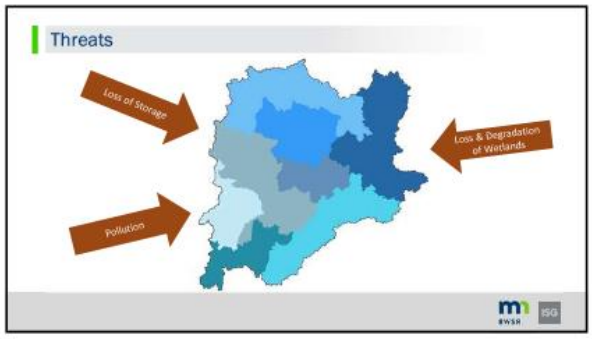

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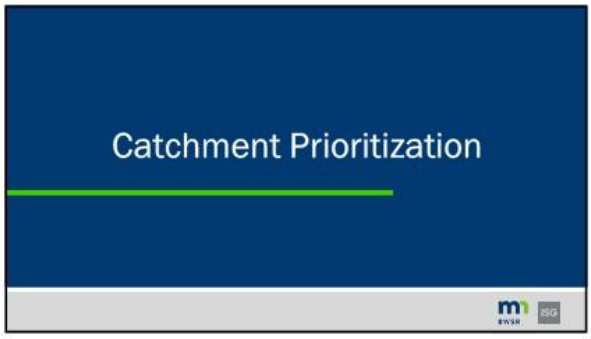

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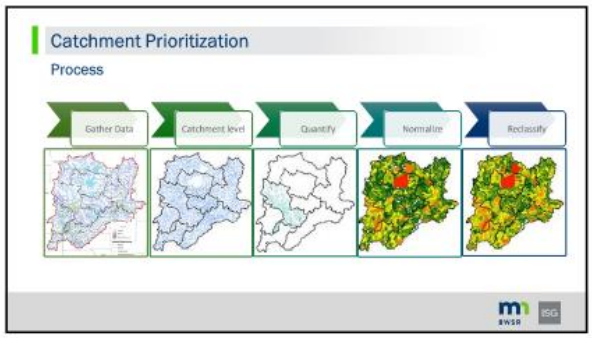

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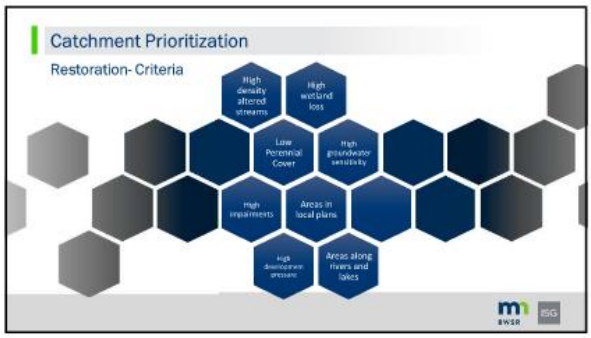

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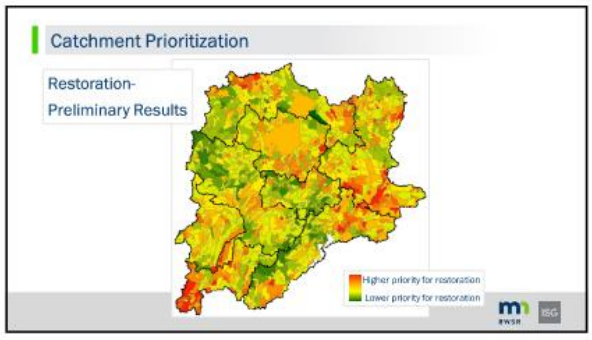

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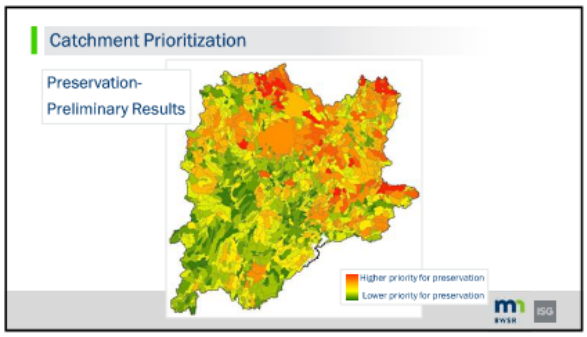

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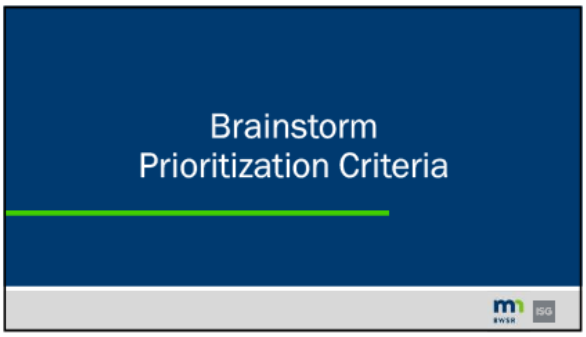

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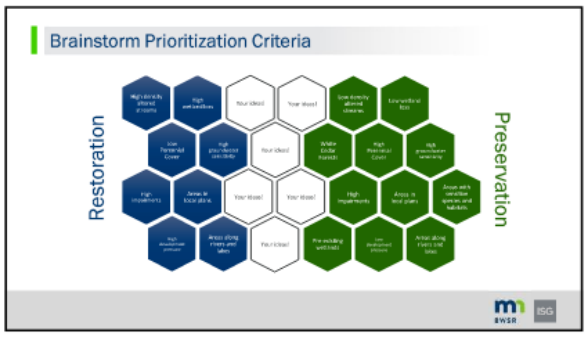

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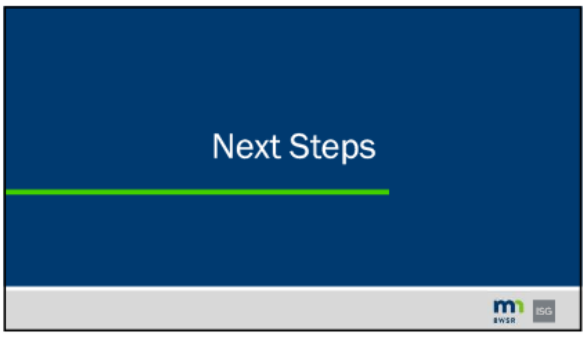

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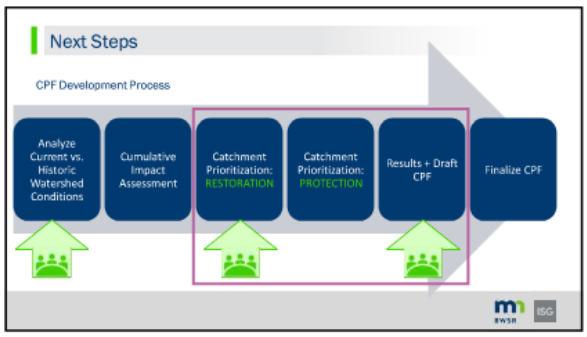

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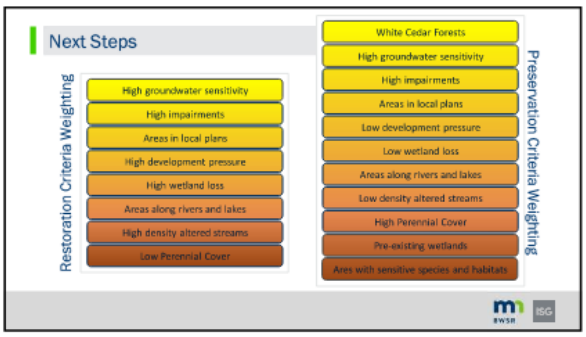

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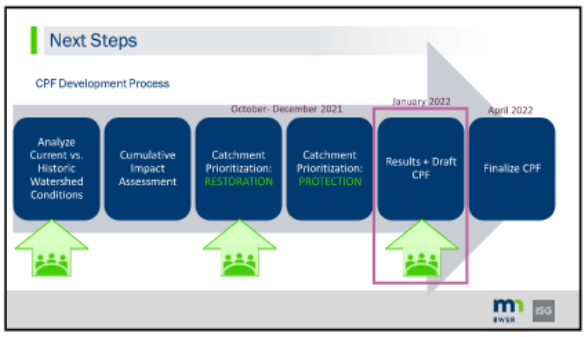
Next Steps
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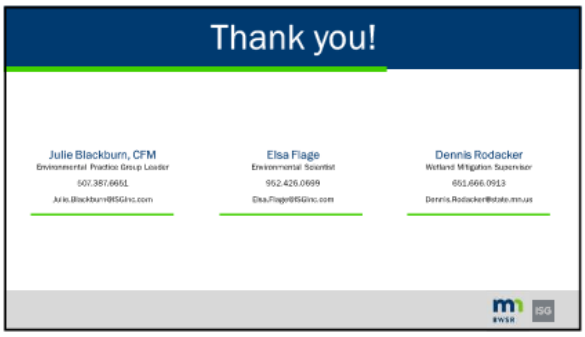
Thank you!
Julie Blackburn, CFM
Environmental Practice Group Leader
507.387.6661
Elsa Flage
Environmental Scientist
952.426.0699
Dennis Rodacker
Wetland Mitigation Supervisor
651.666.0913

38

C-3. January 2022 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Sheila	Boldt	sheila@cwswcd.org	Crow Wing SWCD
Kelly	Condiff	kelly.condiff@co.cass.mn.us	Cass County WCA Coordinator
Mitchell	Janson	mitchell.janson@wadena.mnswcd.org	Wadena SWCD Technician
Steve	Hofstad	steve.hofstad@state.mn.us	BWSR Wetland Specialist

C-3. January 2022 Stakeholder Meeting Presentation

1

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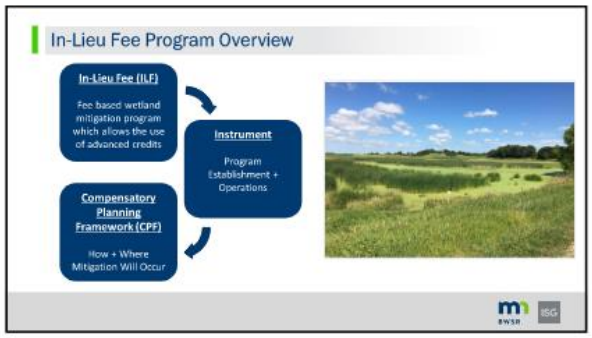

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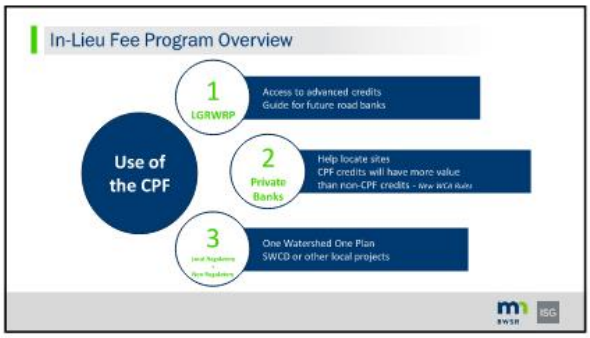
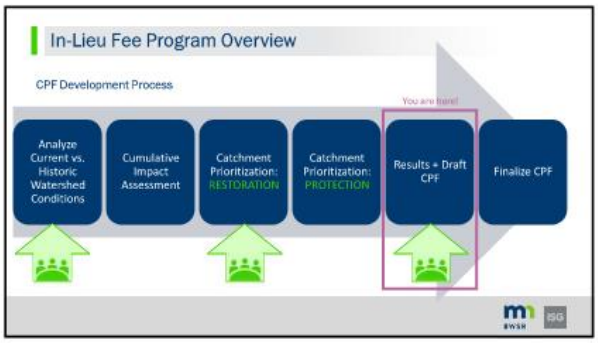


6


In-Lieu Fee Program Overview
Key CPF Development Component
Stakeholder Input
Nothing replaces local knowledge
Input on appropriate data sources
State + Local
Leads us through local plans
Identifies the most important watershed goals

7


In-Lieu Fee Program Overview
CPF Development Process
You are here!
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Catchment Prioritization: PROTECTION
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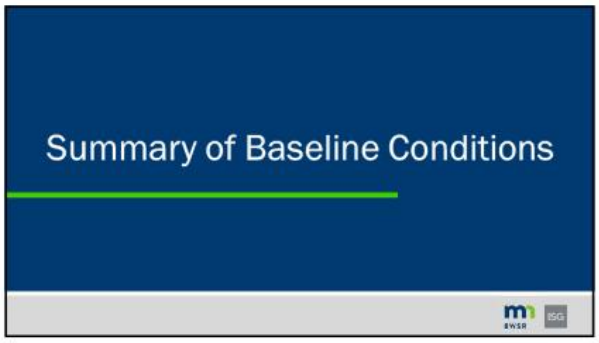
Finalize CPF

8


Summary of Baseline Conditions

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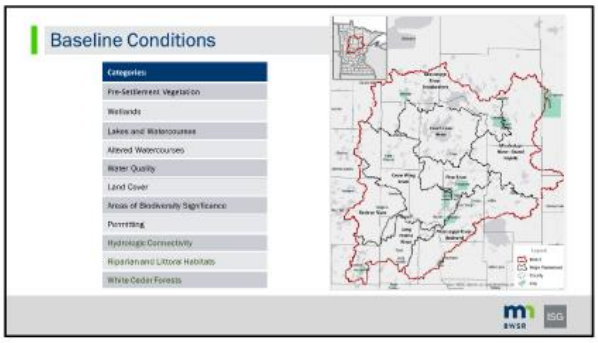
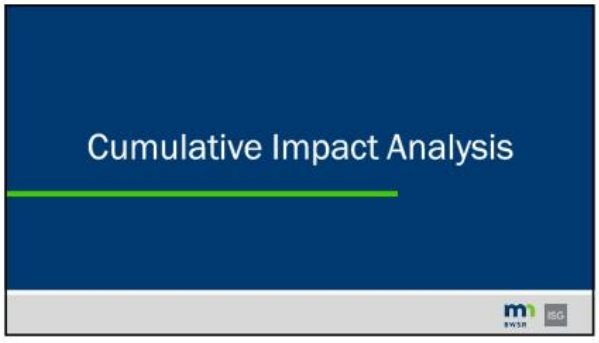

Baseline Conditions
Categories
Pre-Settlement Vegetation
Wetlands
Lakes and Watercourses
Altered Watercourses
Water Quality
Land Cover
Areas of Biodiversity Significance
Permitting
Hydrologic Connectivity
Riparian and Littoral Habitats
White Cedar Forests

10


Cumulative Impact Analysis

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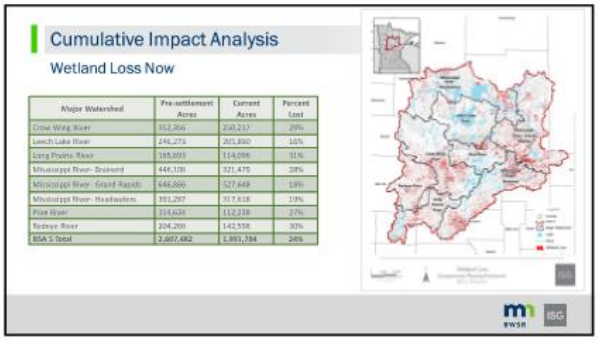
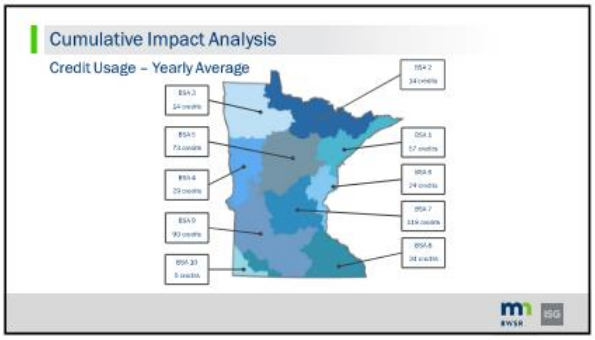

Cumulative Impact Analysis
Wetland Loss Now
Major Watershed
Pre-settlement Acres
Current Acres
Percent Lost
Crow Wing River 352,264 250,217 29%
Leech Lake River 246,273 205,880 16%
Long Prairie River 165,693 114,096 31%
Mississippi River- Brainerd 446,108 321,475 28%
Mississippi River- Grand Rapids 646,866 527,648 18%
Mississippi River- Headwaters 391,287 317,618 19%
Pine River 154,634 112,238 27%
Redeye River 204,260 142,558 30%
BSA 5 Total 2,607,482 1,991,784 24%

12



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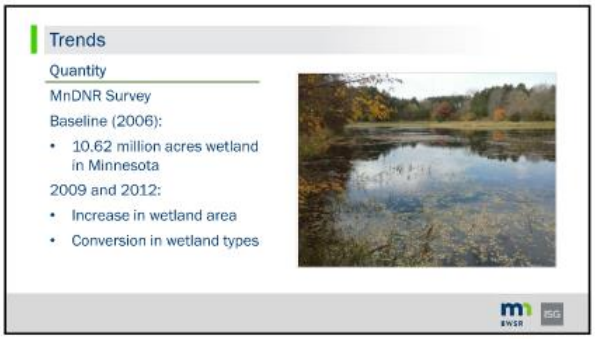

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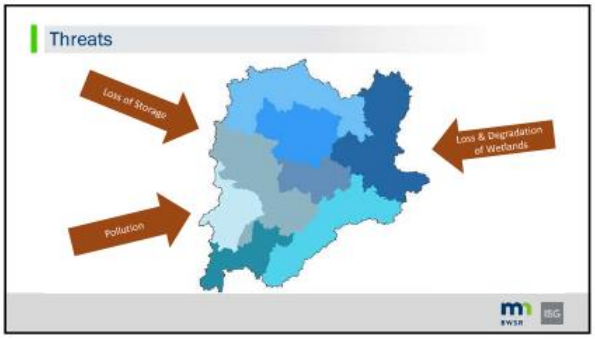

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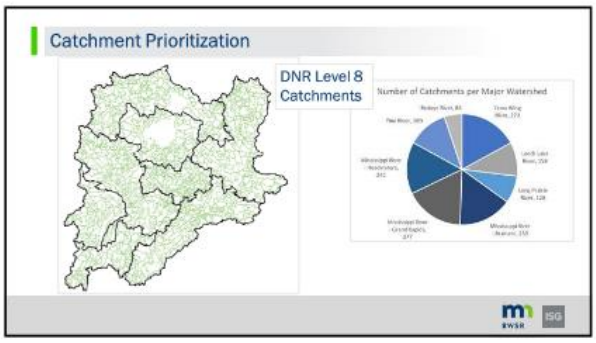

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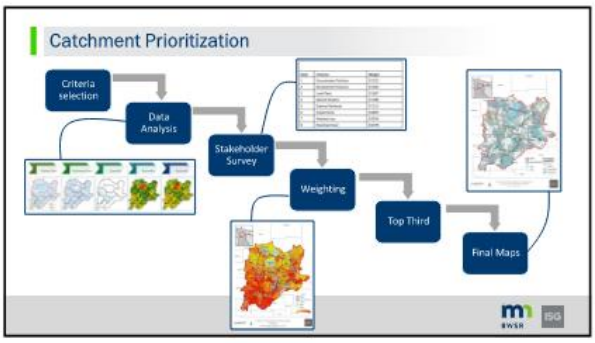

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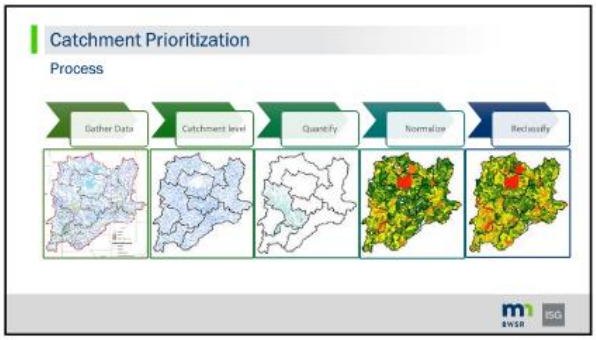

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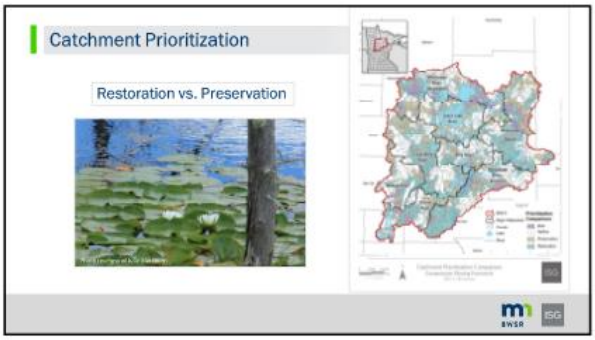

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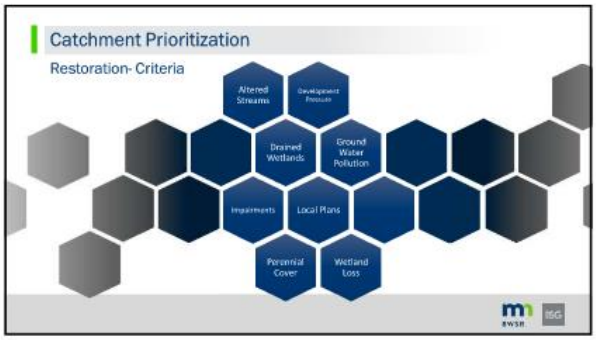

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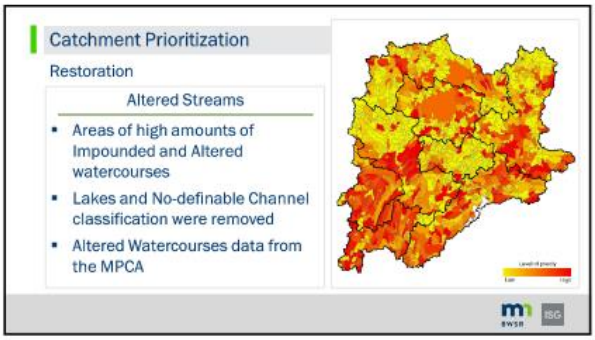

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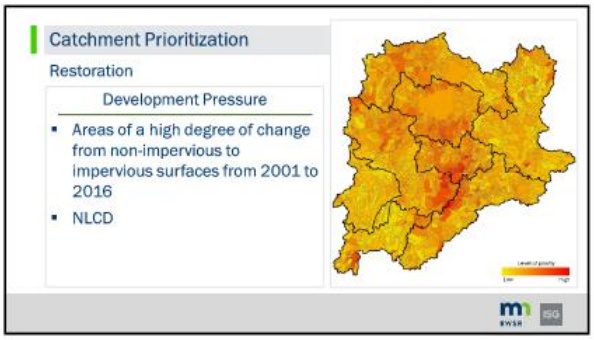

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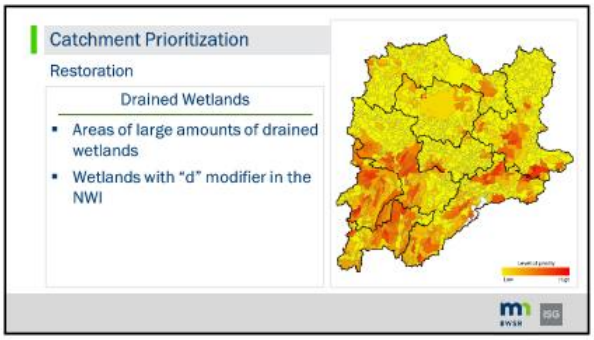

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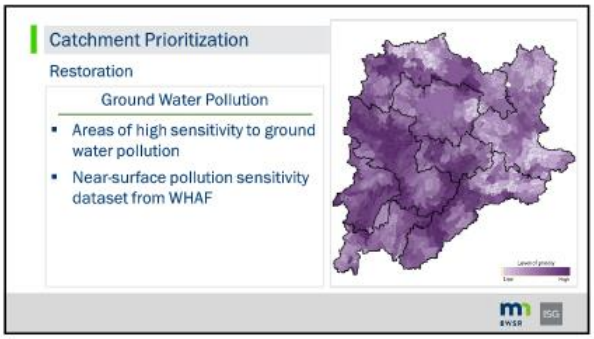

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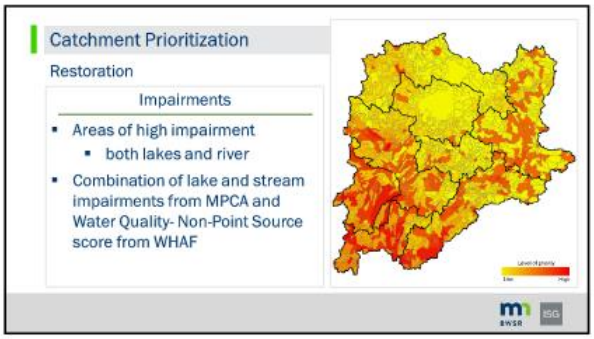

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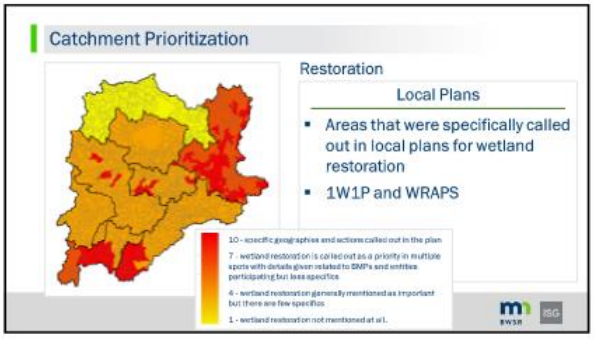

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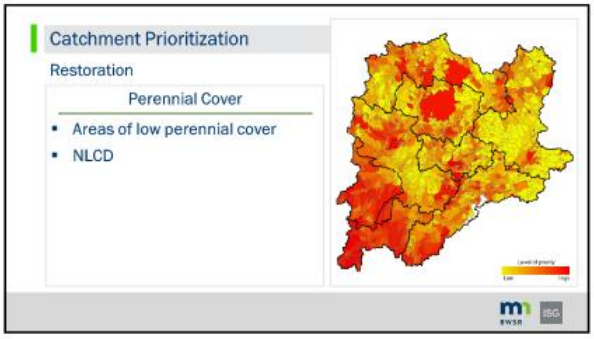

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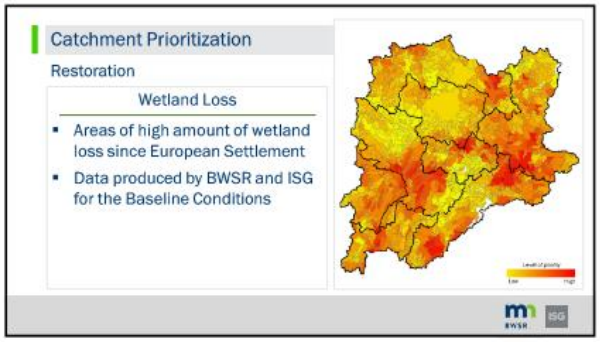

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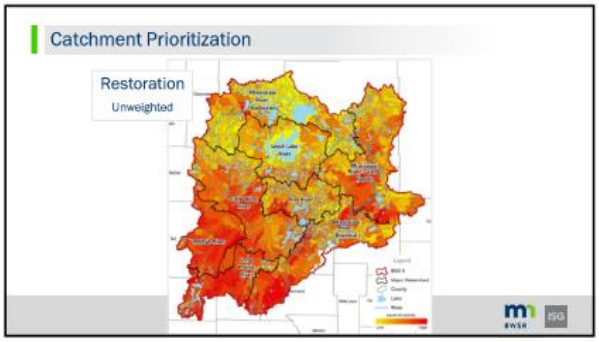

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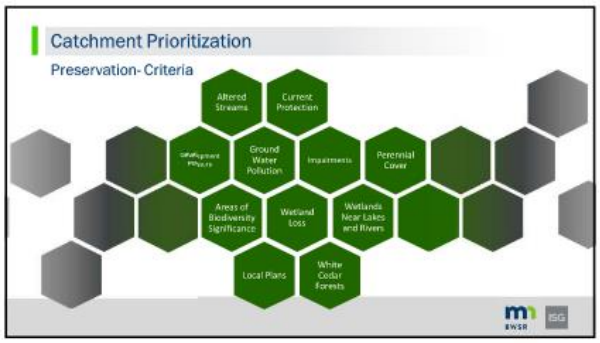

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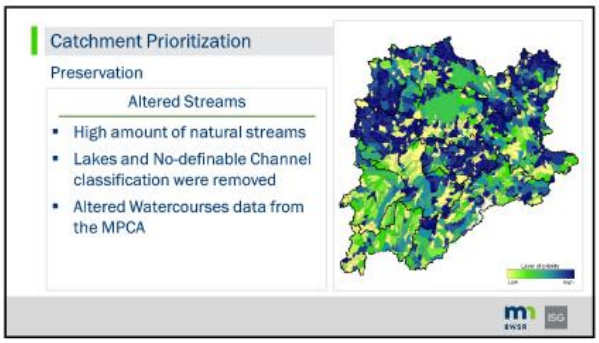

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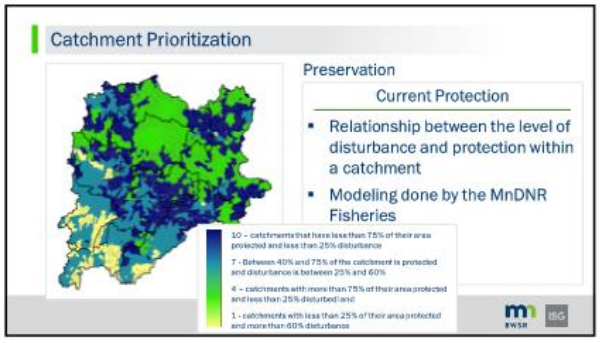

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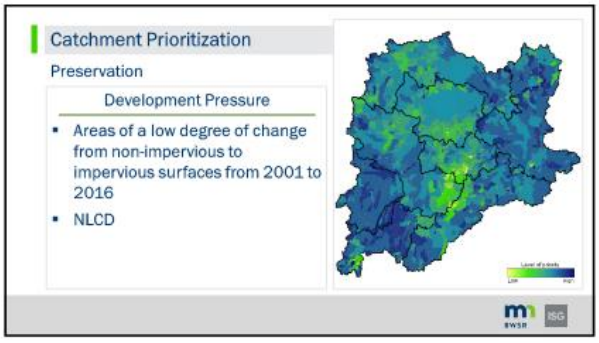

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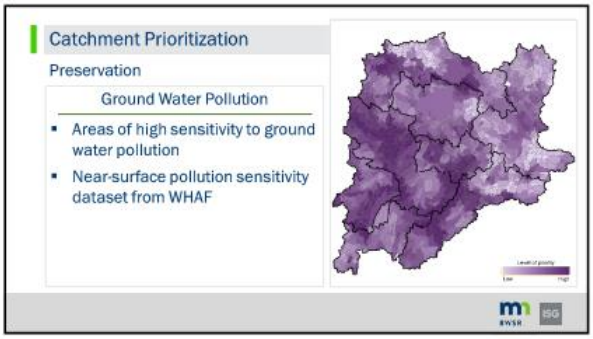

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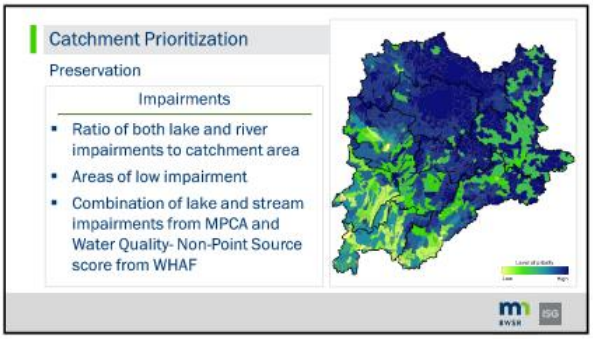

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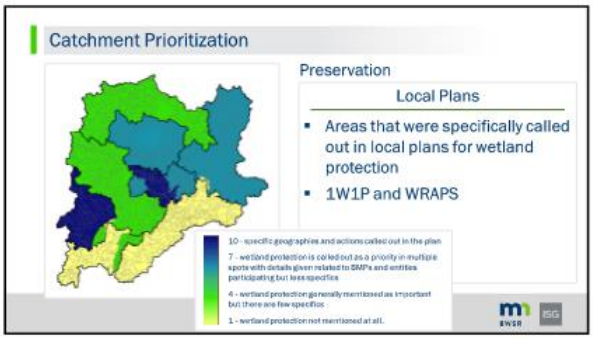

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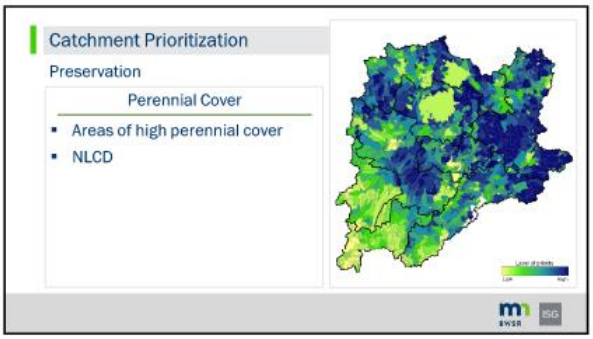

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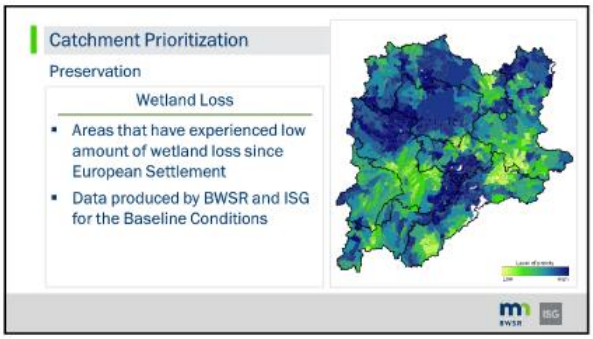

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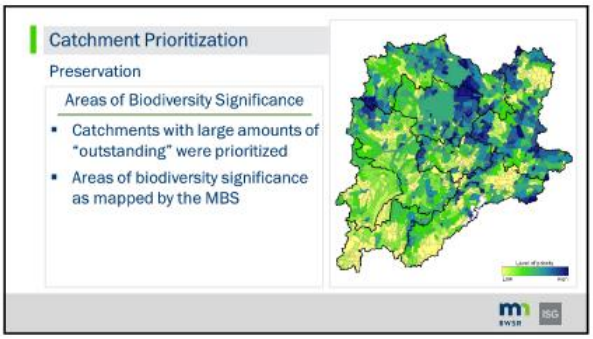

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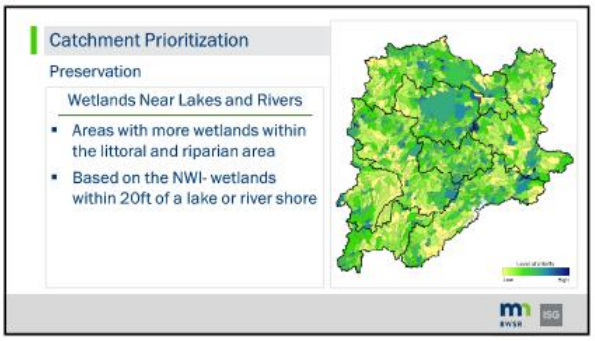

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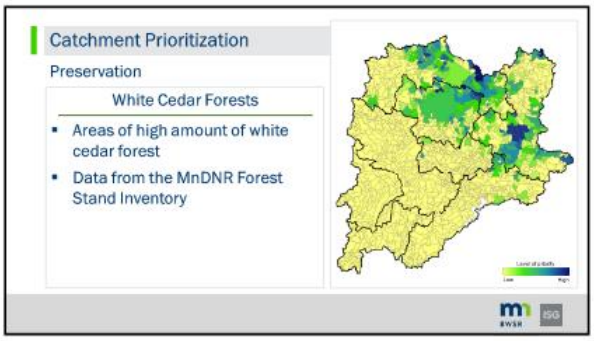

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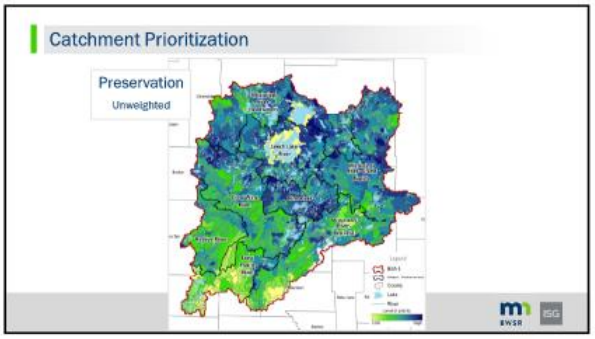

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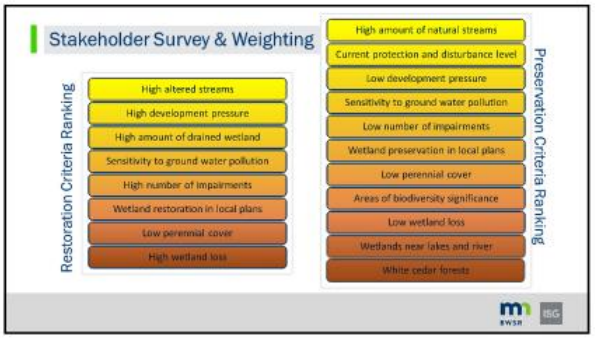

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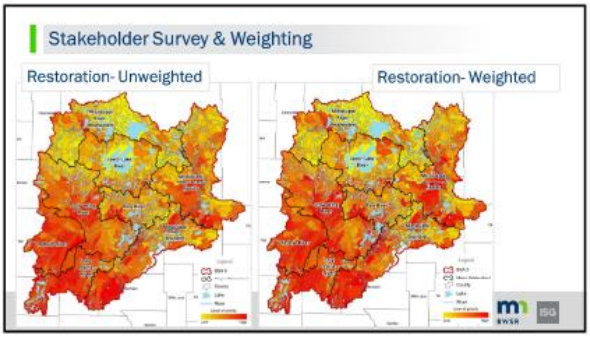

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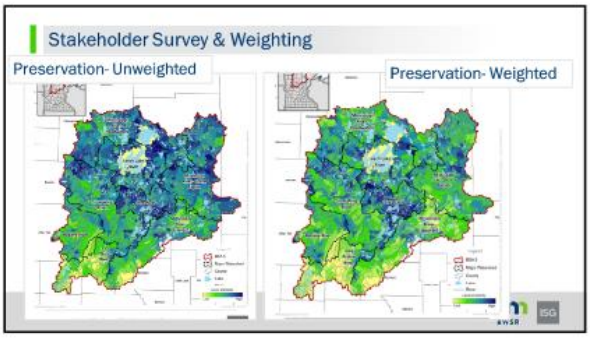

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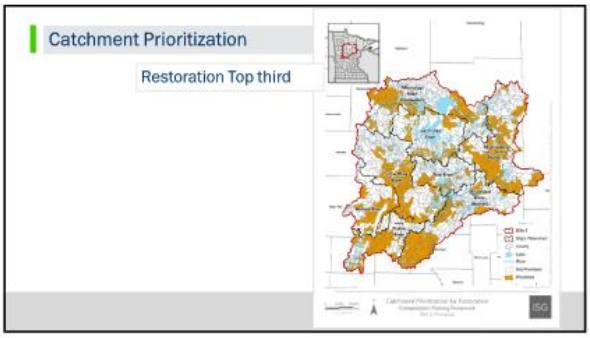

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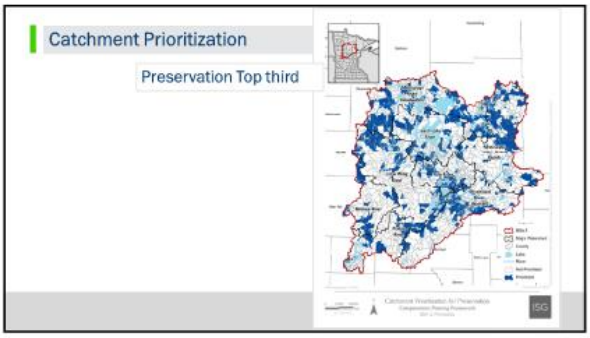

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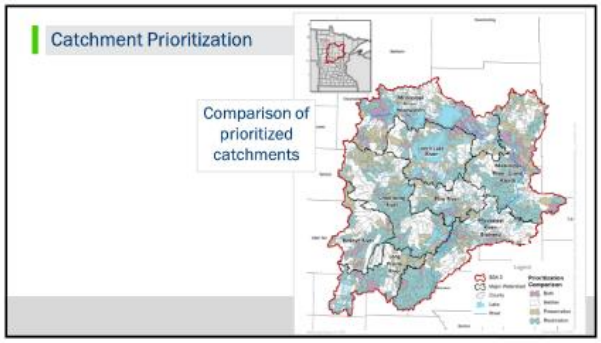
Catchment Prioritization
Comparison of prioritized catchments

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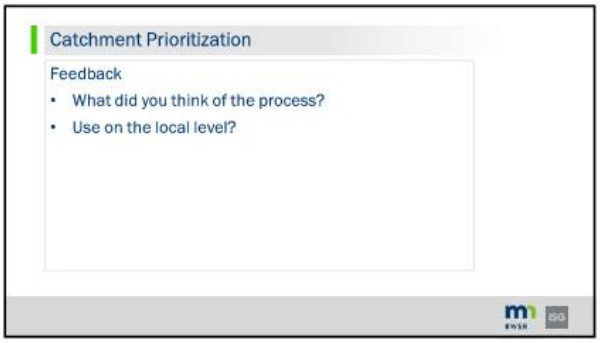
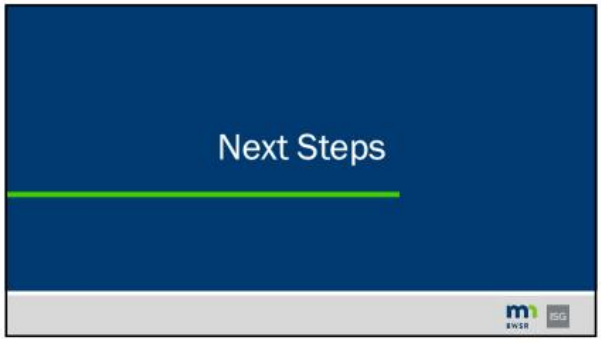

Catchment Prioritization
Feedback
• What did you think of the process?
• Use on the local level?

56


Next Steps

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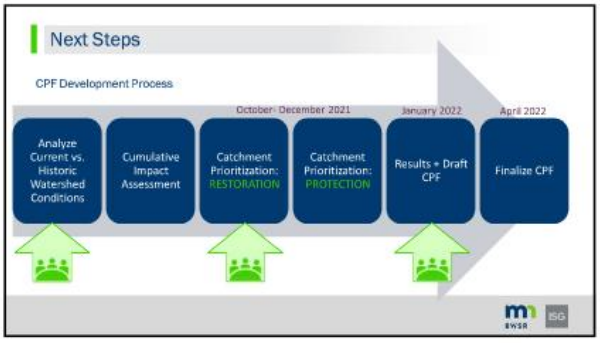
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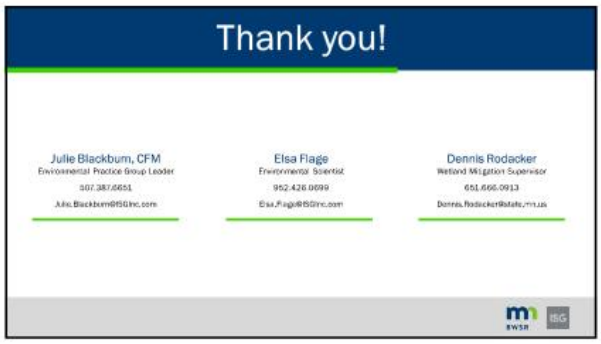
Thank you!
Julie Blackburn, CFM
Environmental Practice Group Leader
507.387.6651
Julie.Blackburn@ISGInc.com
Elsa Flage
Environmental Scientist
952.426.0699
Elsa.Flage@ISGInc.com
Dennis Rodacker
Wetland Mitigation Supervisor
651.666.0913
Dennis.Rodacker@state.mn.us

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Appendix D: Catchment Prioritization Maps

Figure D-1. Catchment Prioritization Comparison

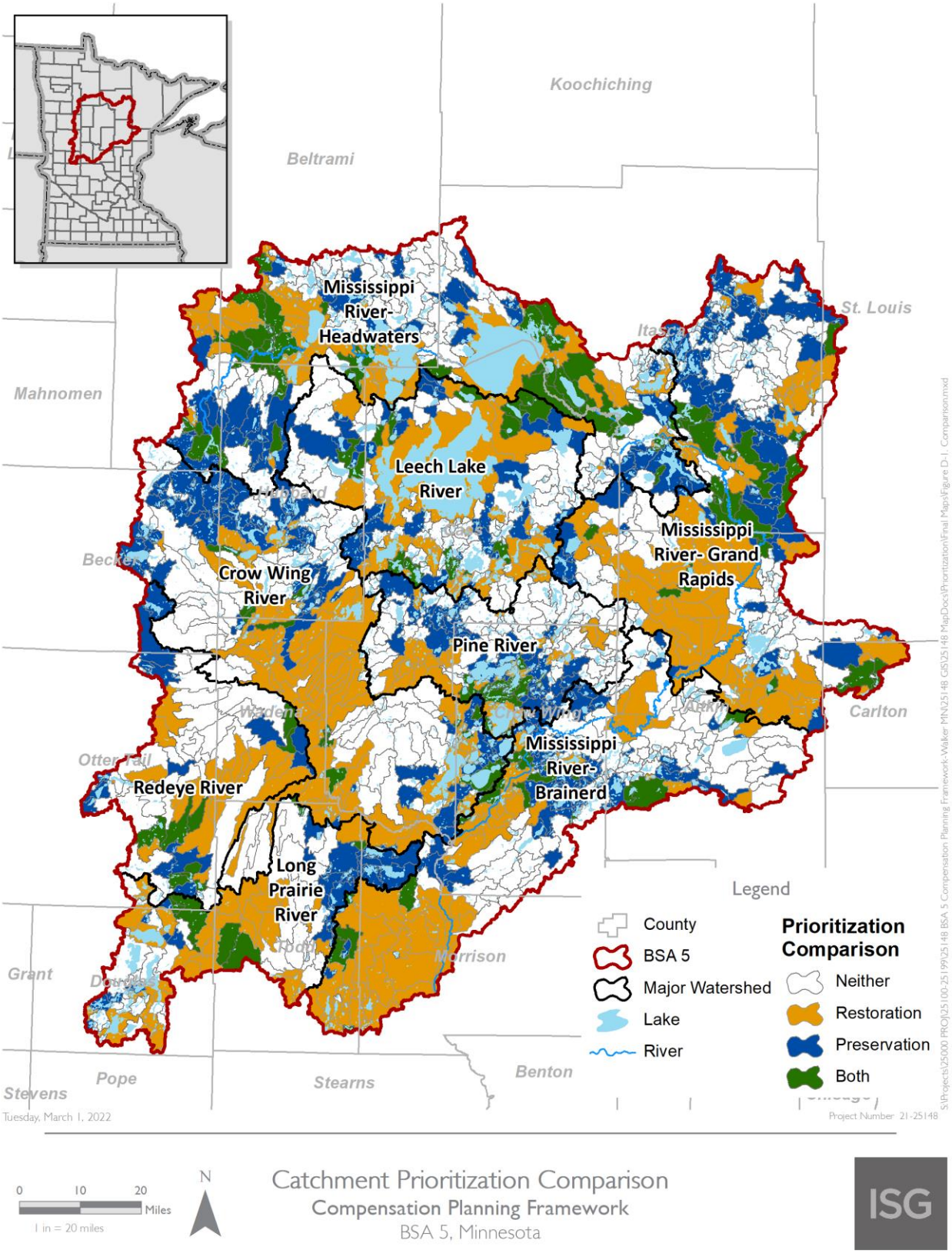

Figure D-2. Unweighted Restoration Catchment Prioritization

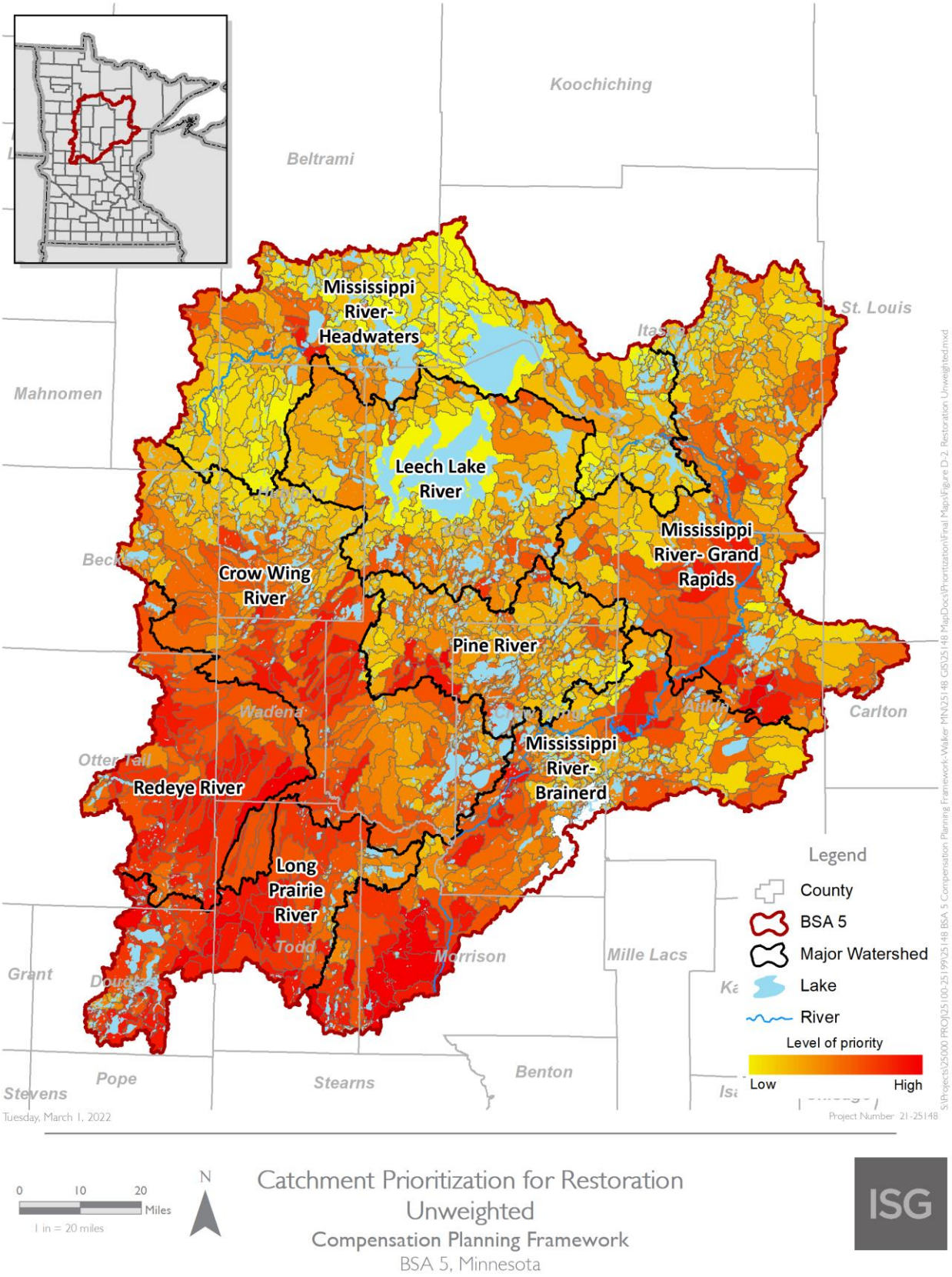

Figure D-3. Unweighted Preservation Catchment Prioritization

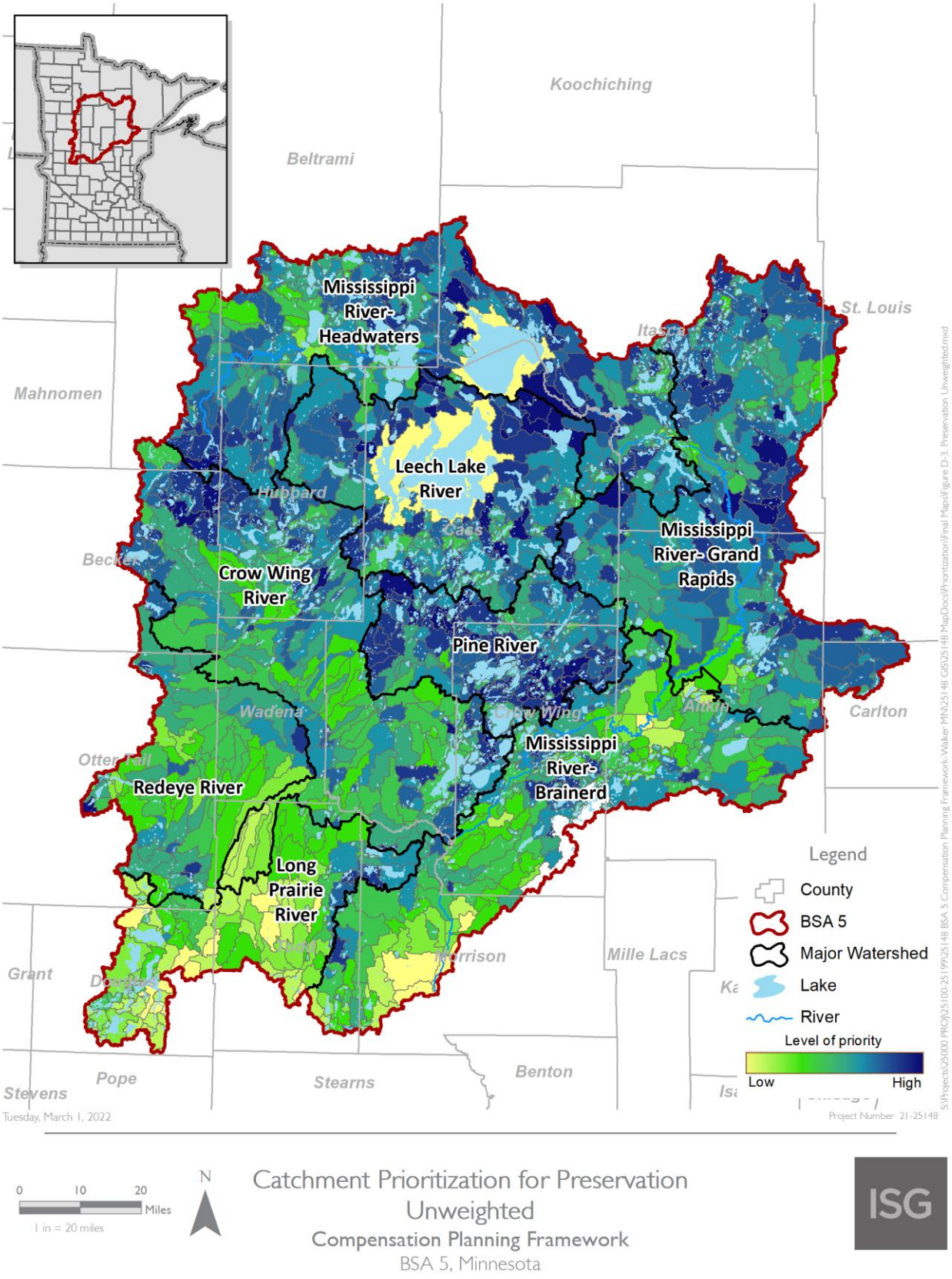

Figure D-4. Weighted Restoration Catchment Prioritization

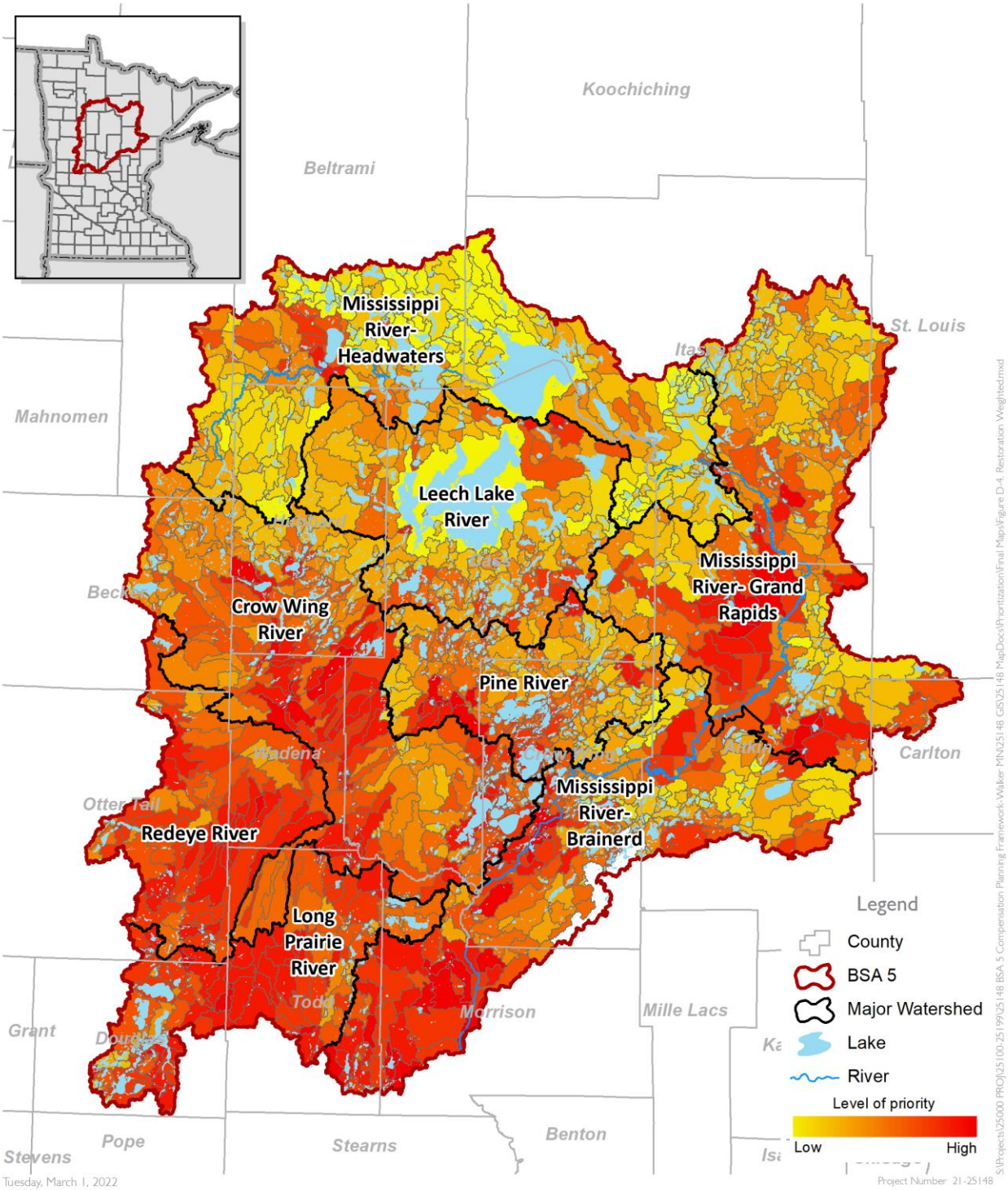

Figure D-5. Weighted Preservation Catchment Prioritization

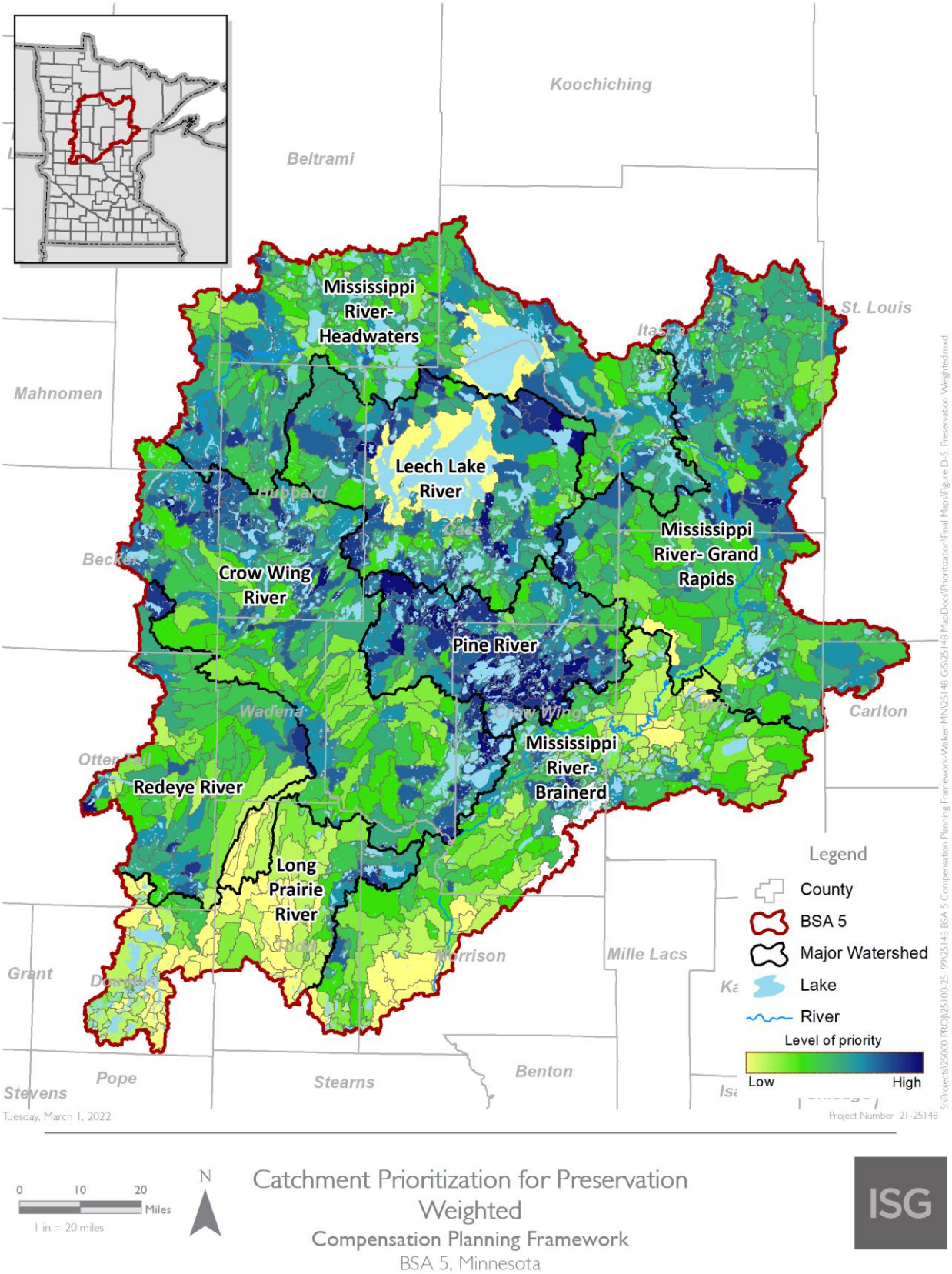

Figure D-6. Final Restoration Catchment Prioritization

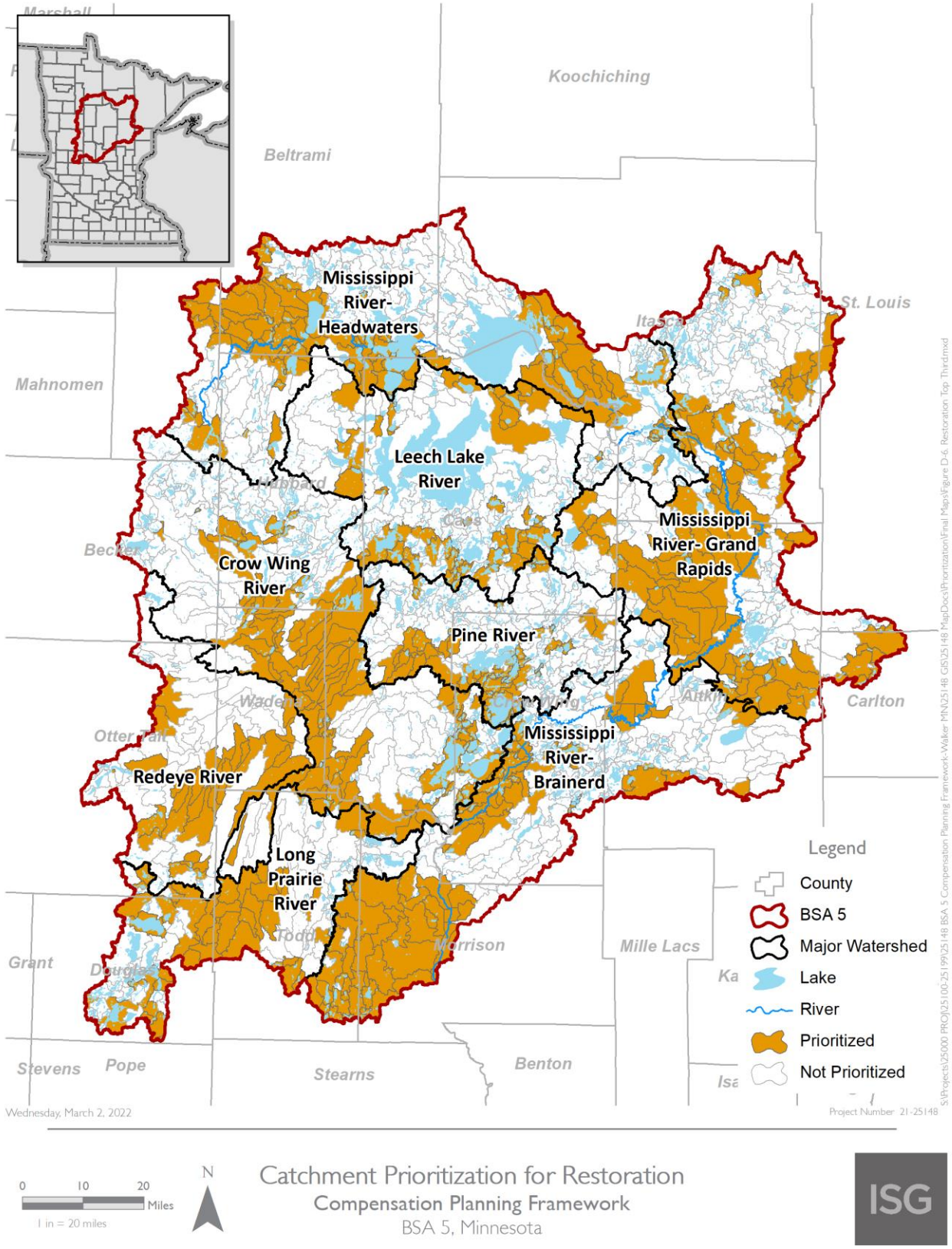

Figure D-7. Final Preservation Catchment Prioritization

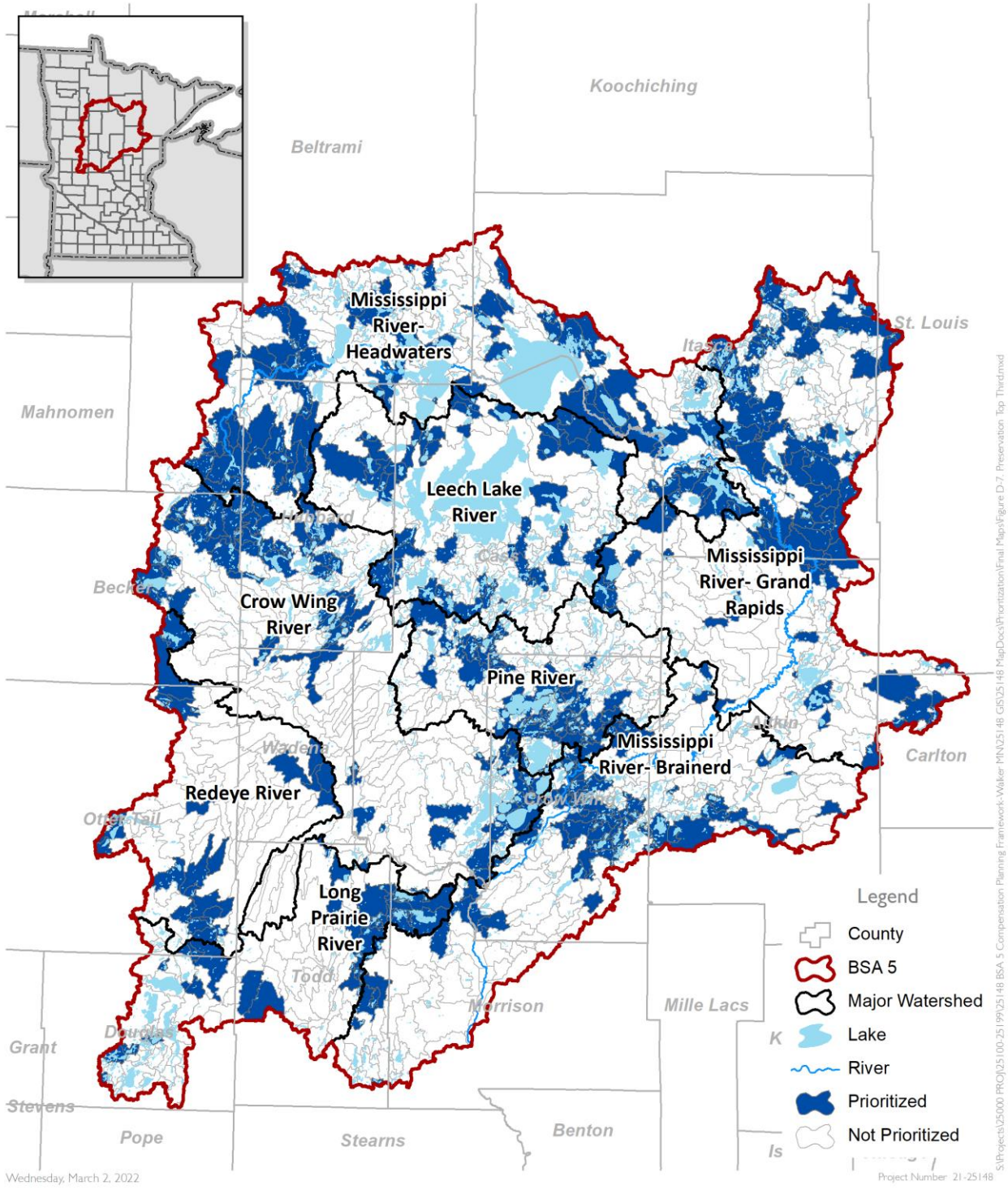

Figure D-8. Final Restoration Catchment Prioritization – Crow Wing River Watershed

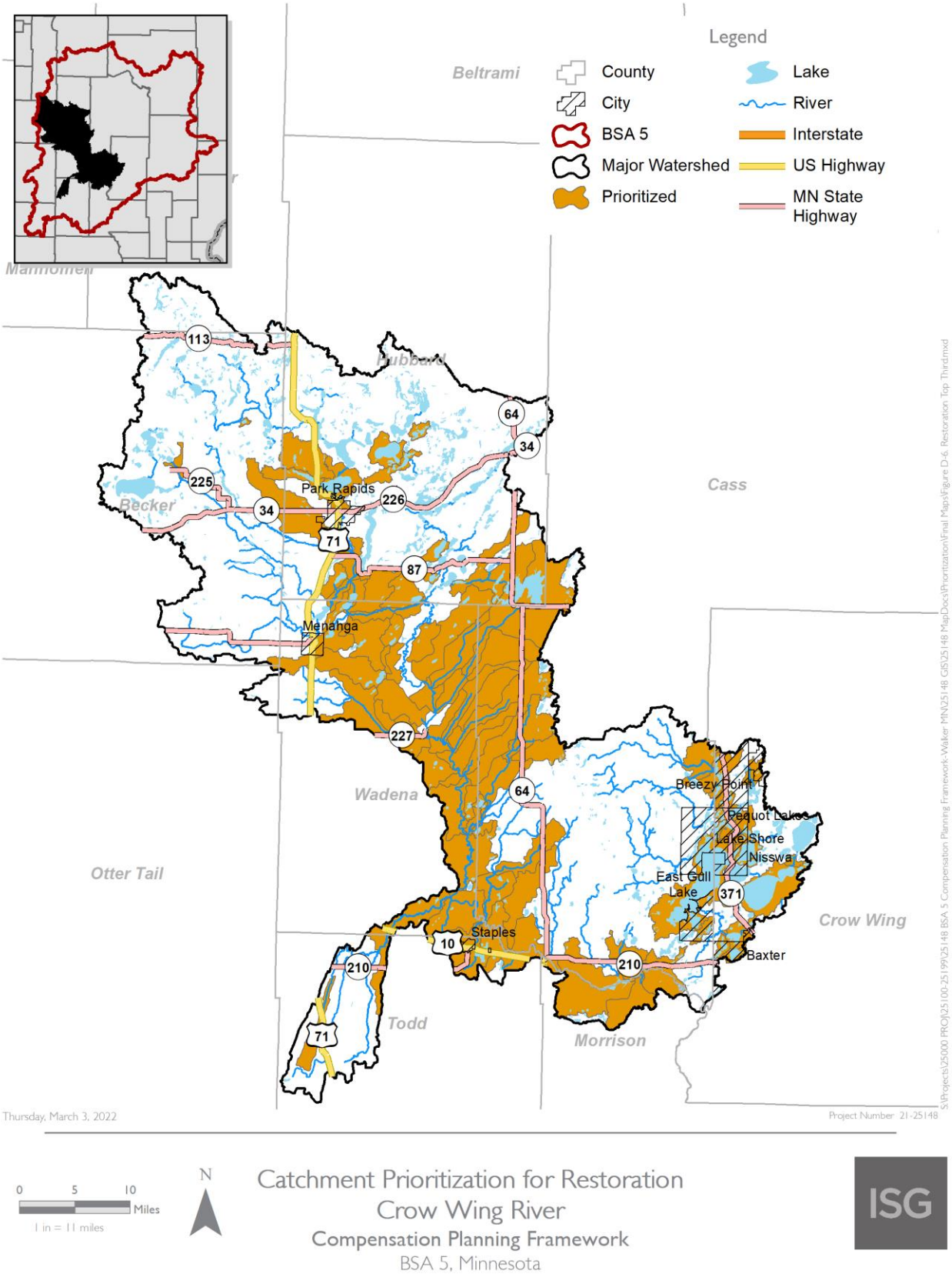

Figure D-9. Final Restoration Catchment Prioritization – Leech Lake River Watershed

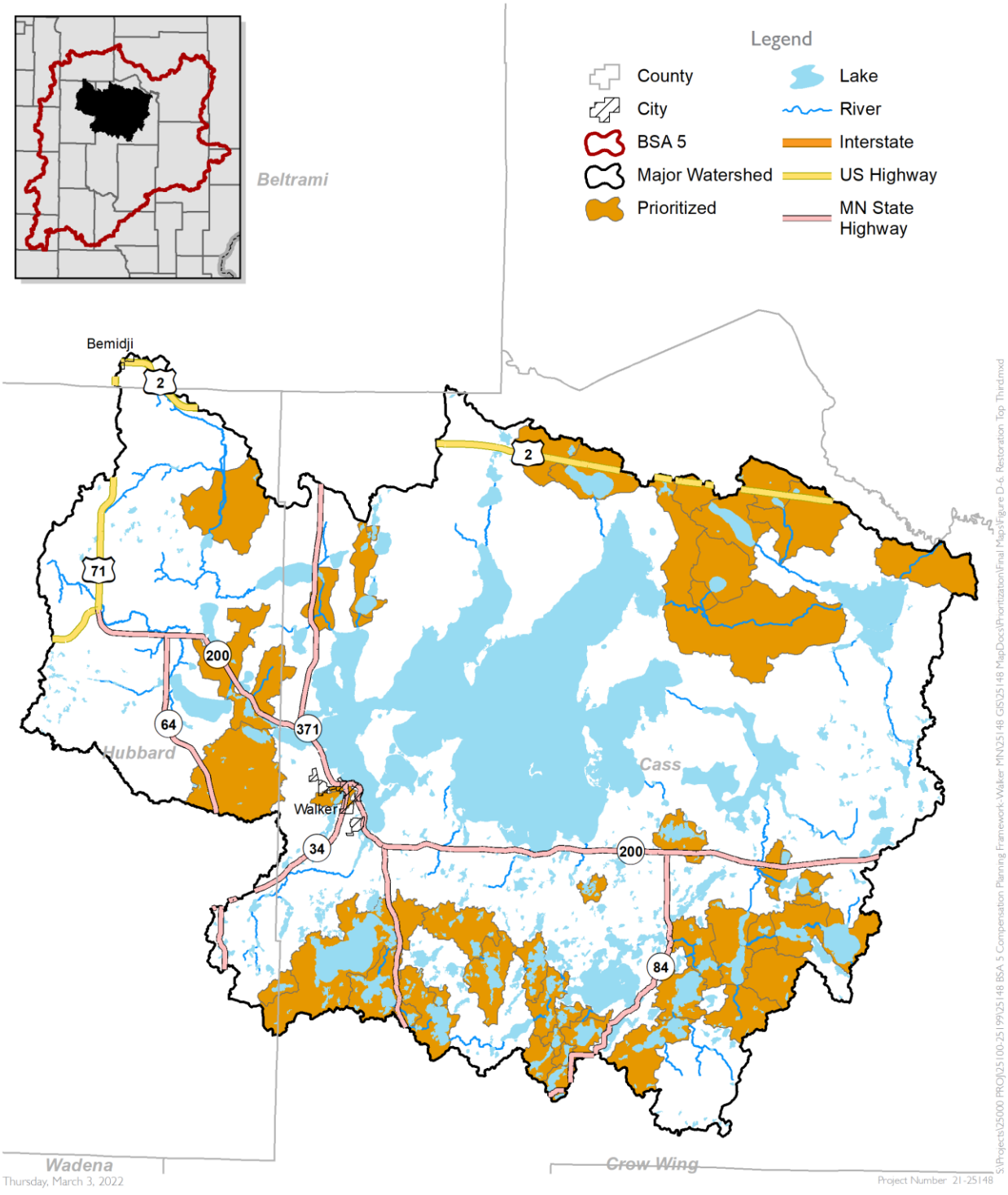

Figure D-10. Final Restoration Catchment Prioritization – Long Prairie River Watershed

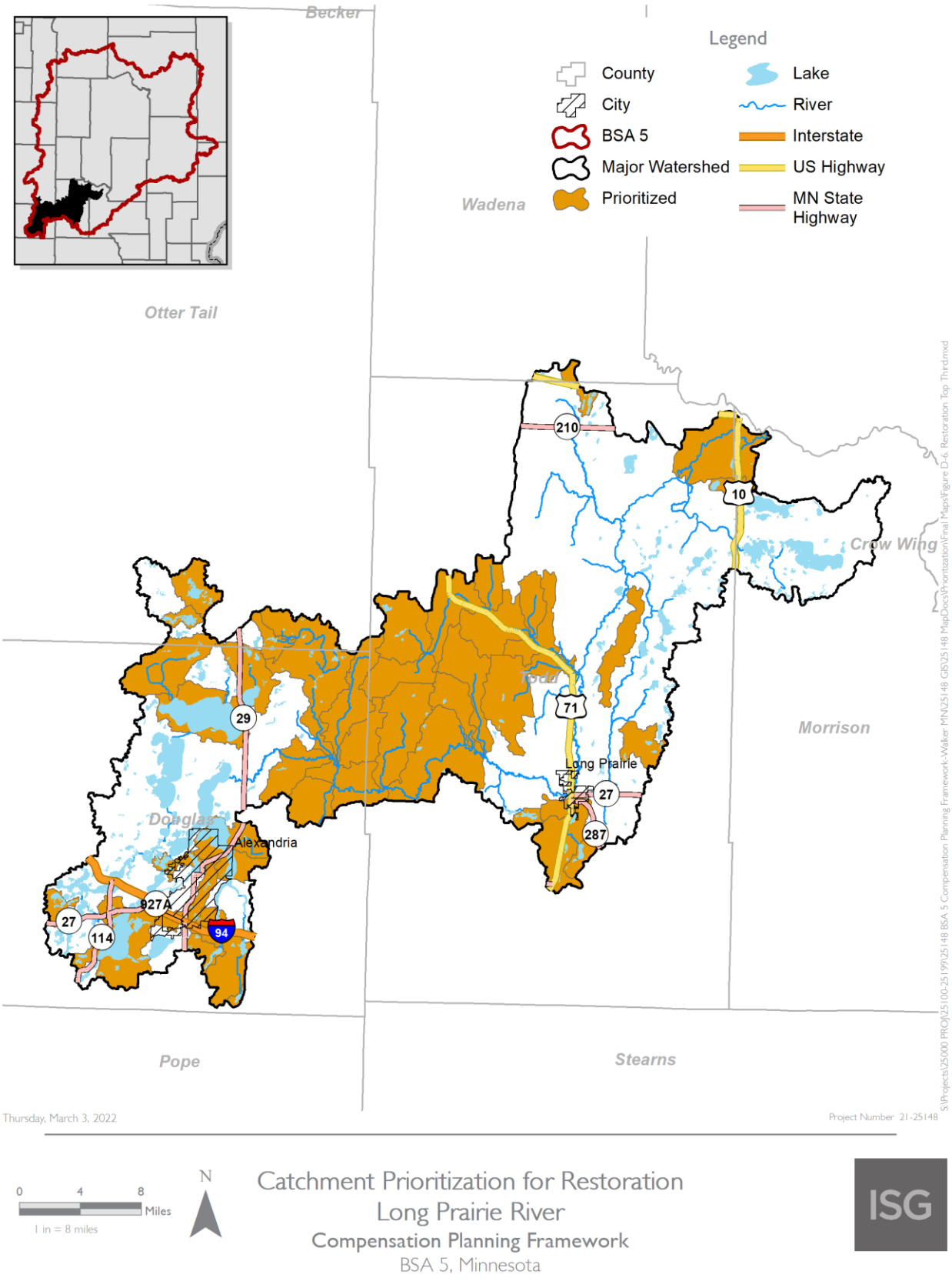

Figure D-11. Final Restoration Catchment Prioritization – Mississippi River- Brainerd Watershed

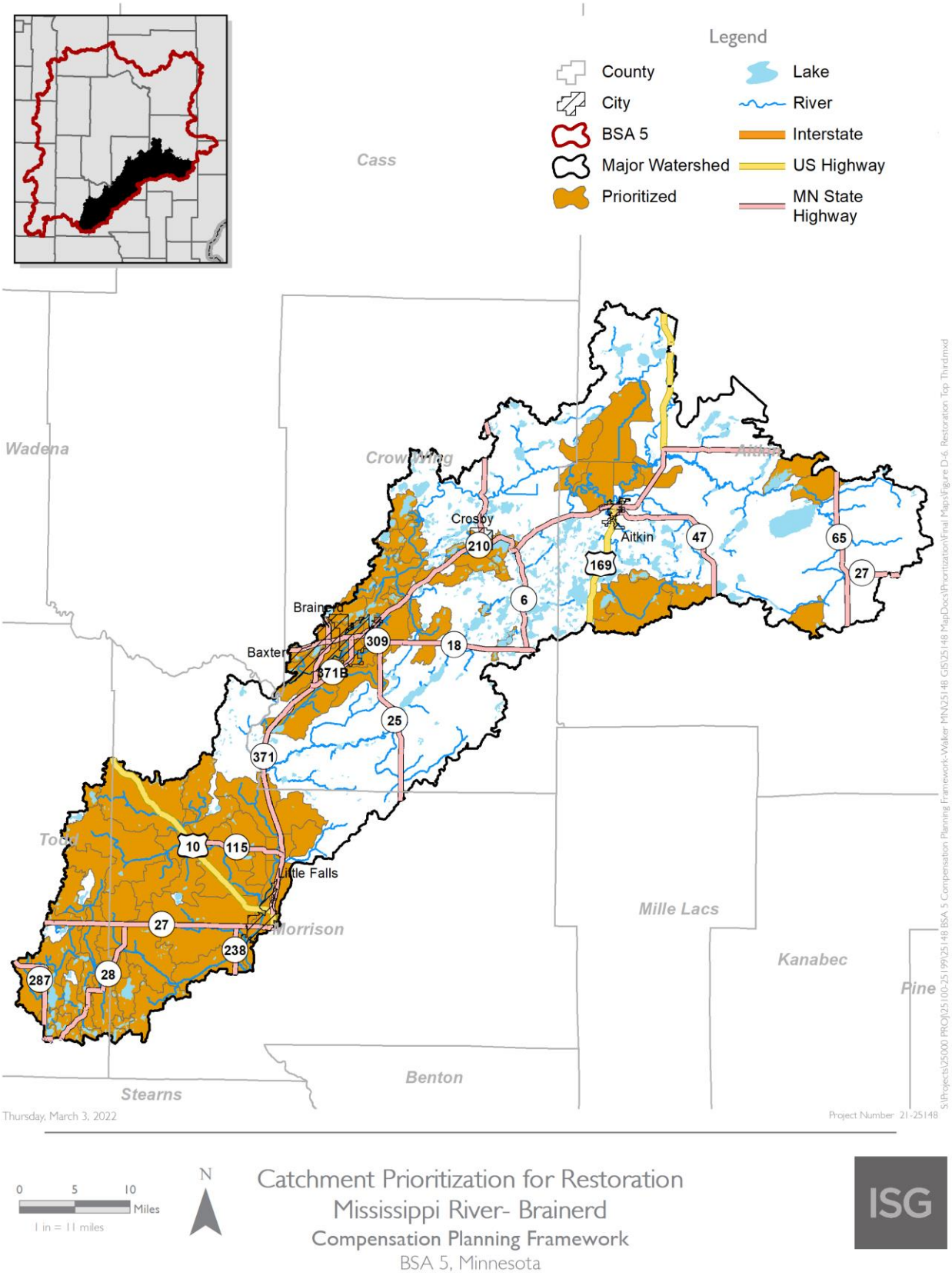

Figure D-12. Final Restoration Catchment Prioritization – Mississippi River- Grand Rapids Watershed

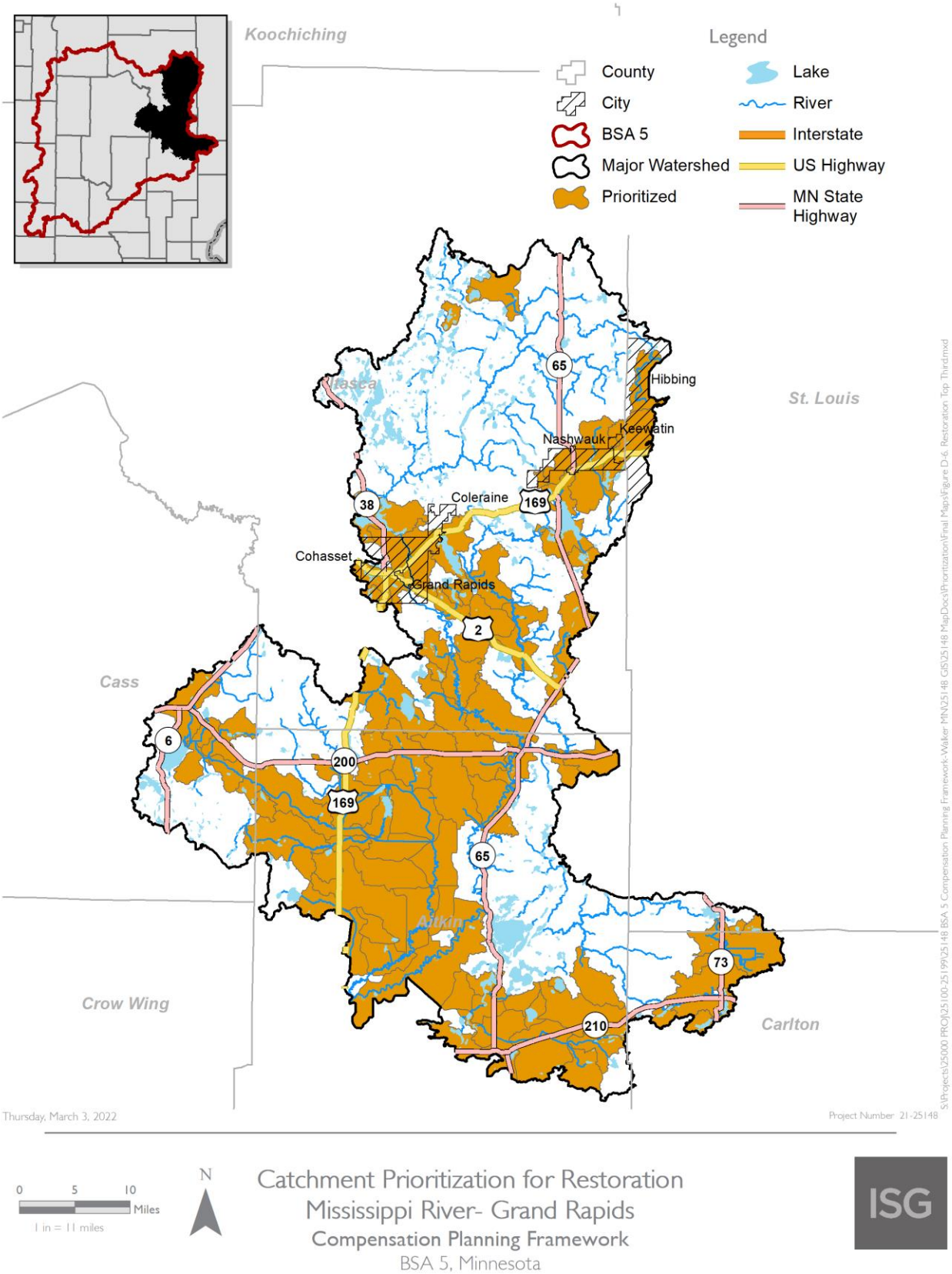

Figure D-13. Final Restoration Catchment Prioritization – Mississippi River- Headwaters Watershed

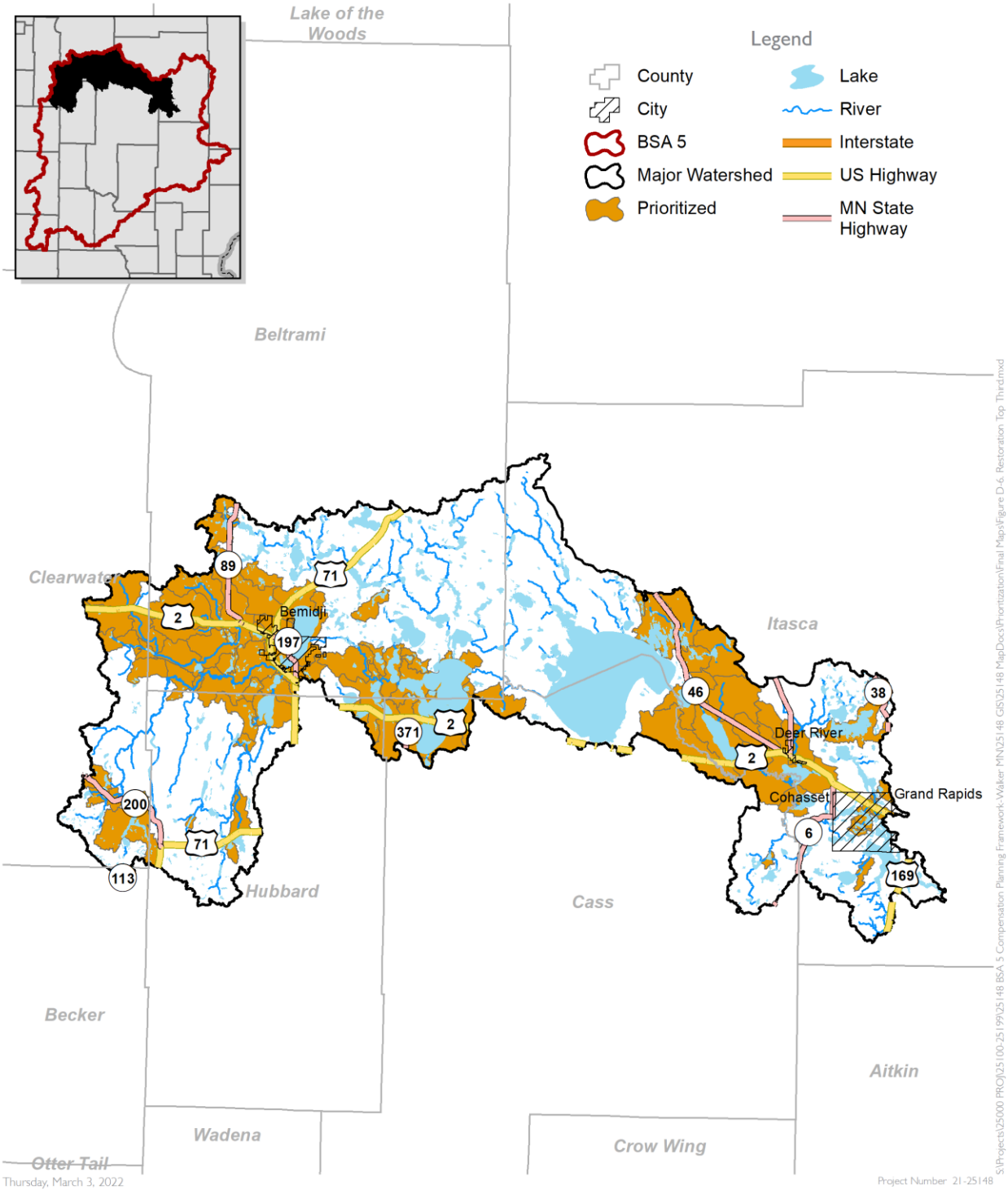

Figure D-14. Final Restoration Catchment Prioritization – Pine River Watershed

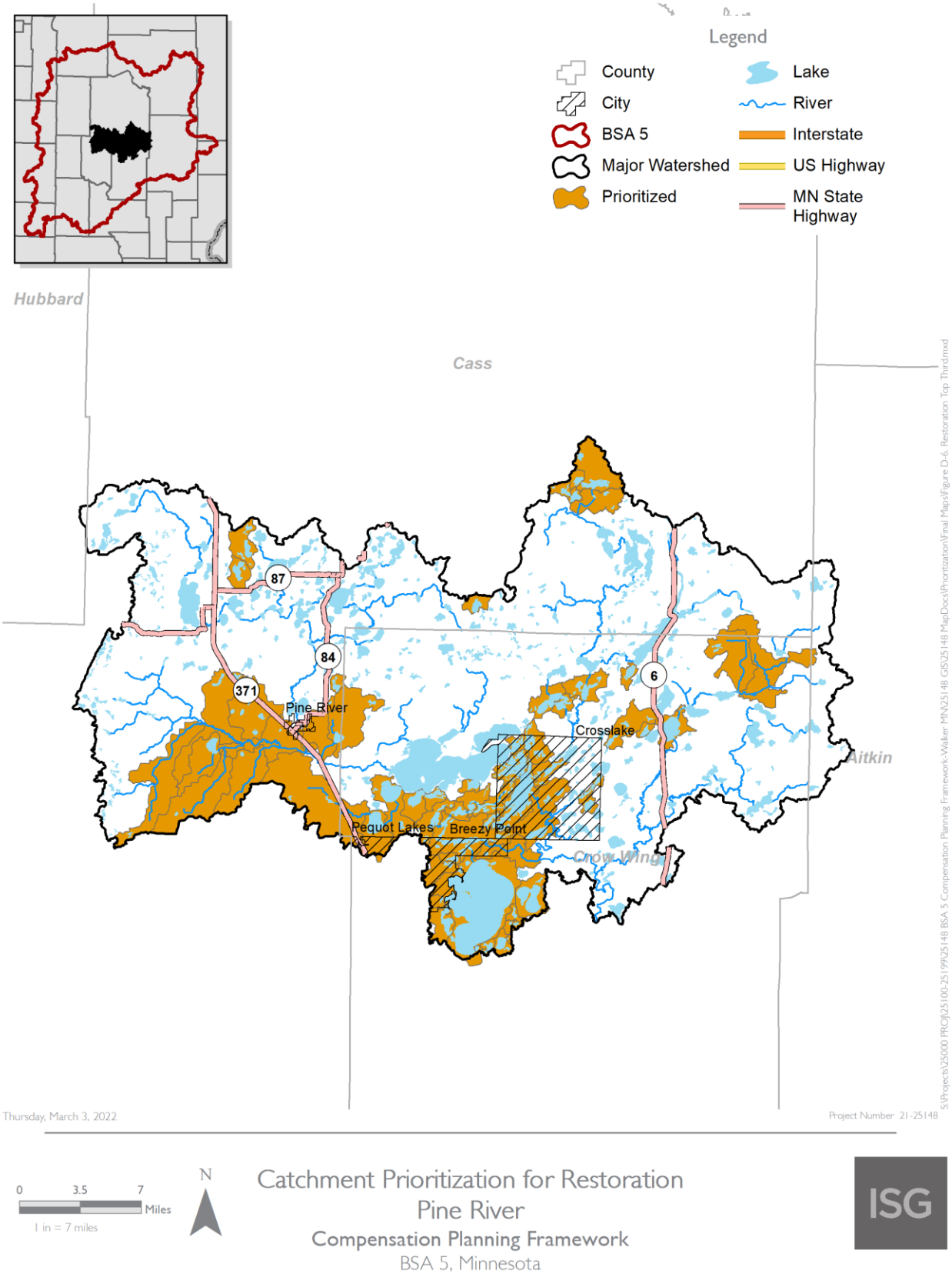

Figure D-15. Final Restoration Catchment Prioritization – Redeye River Watershed

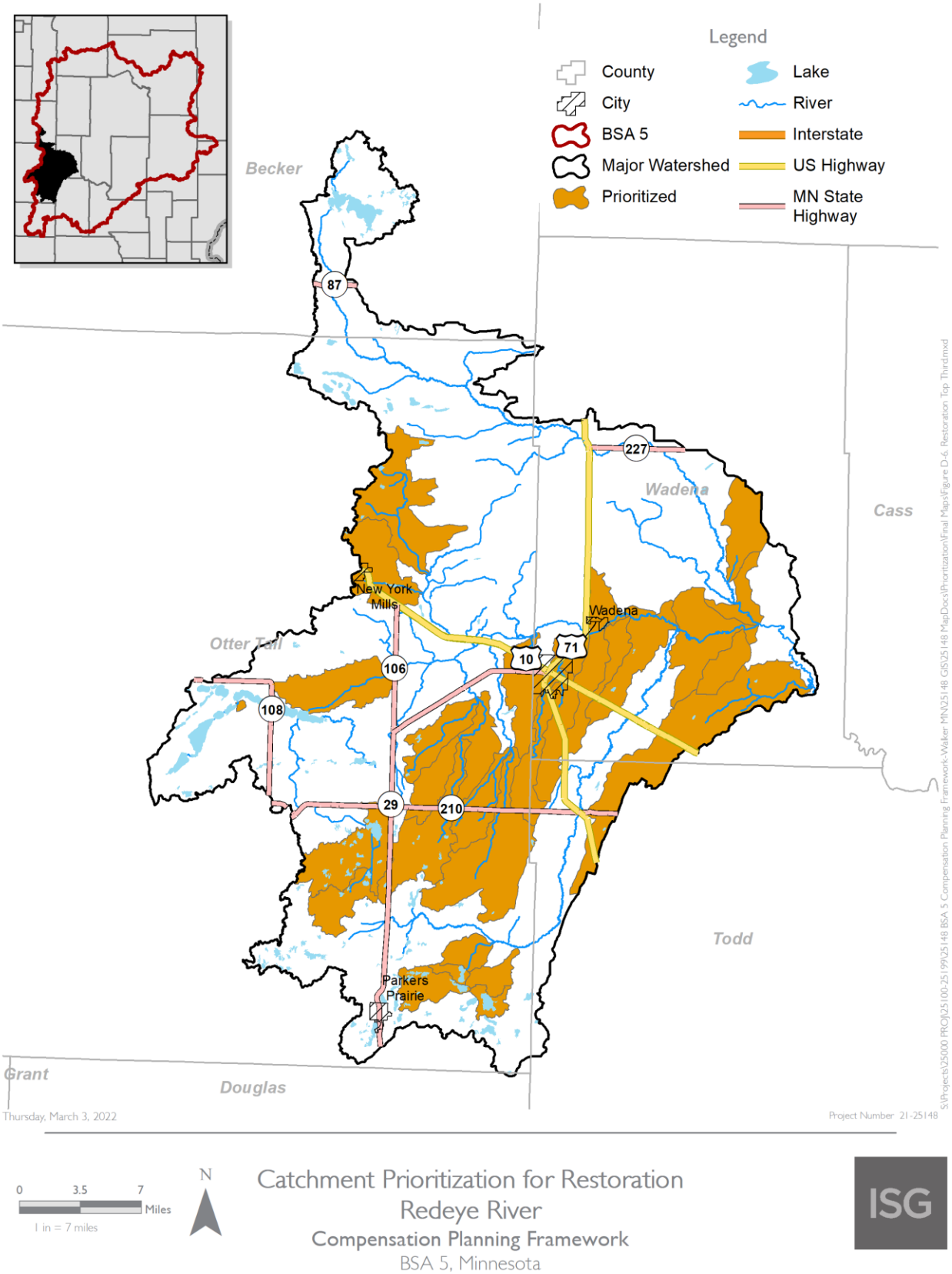

Figure D-16. Final Preservation Catchment Prioritization – Crow Wing River Watershed

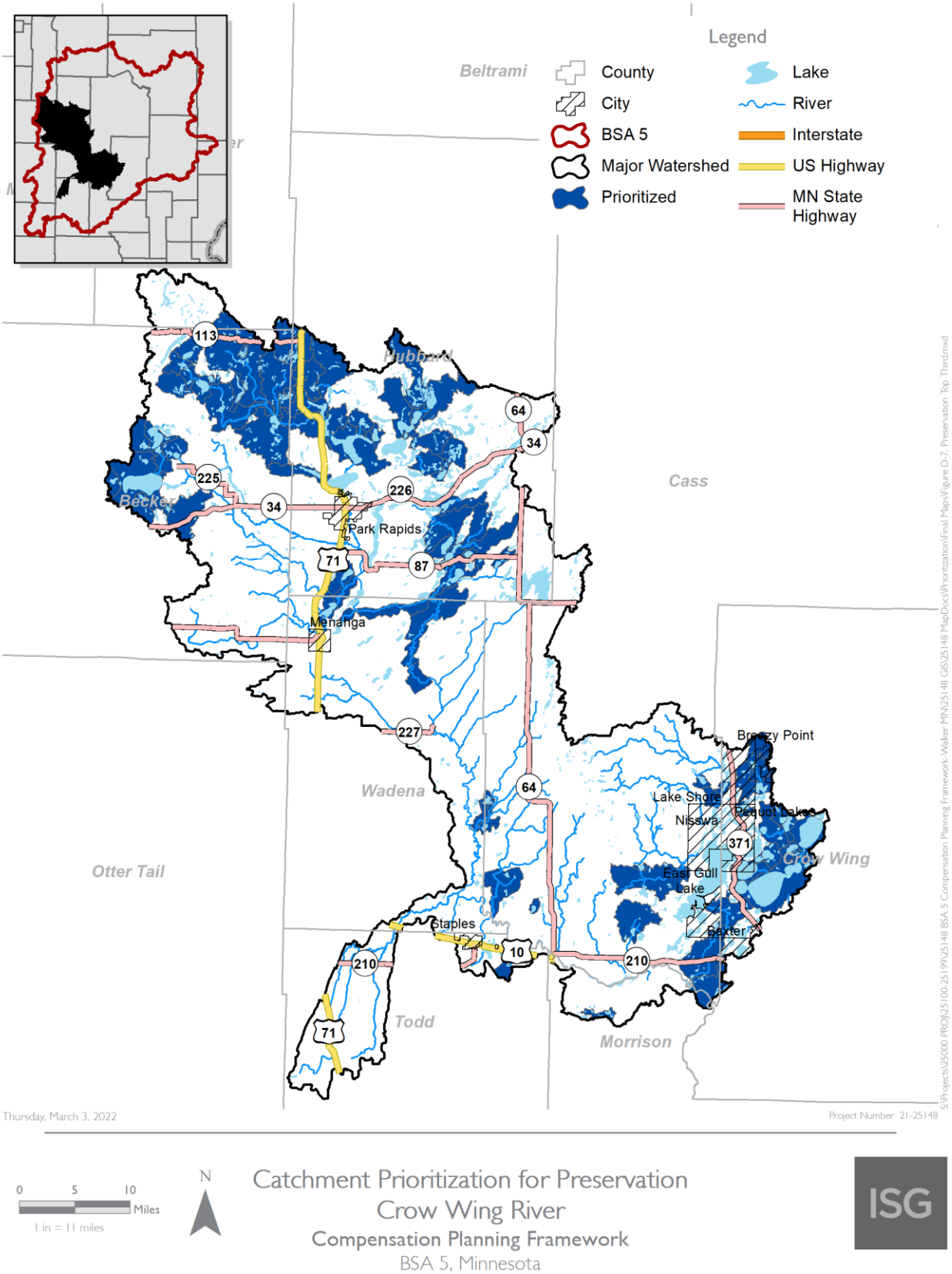

Figure D-17. Final Preservation Catchment Prioritization – Leech Lake River Watershed

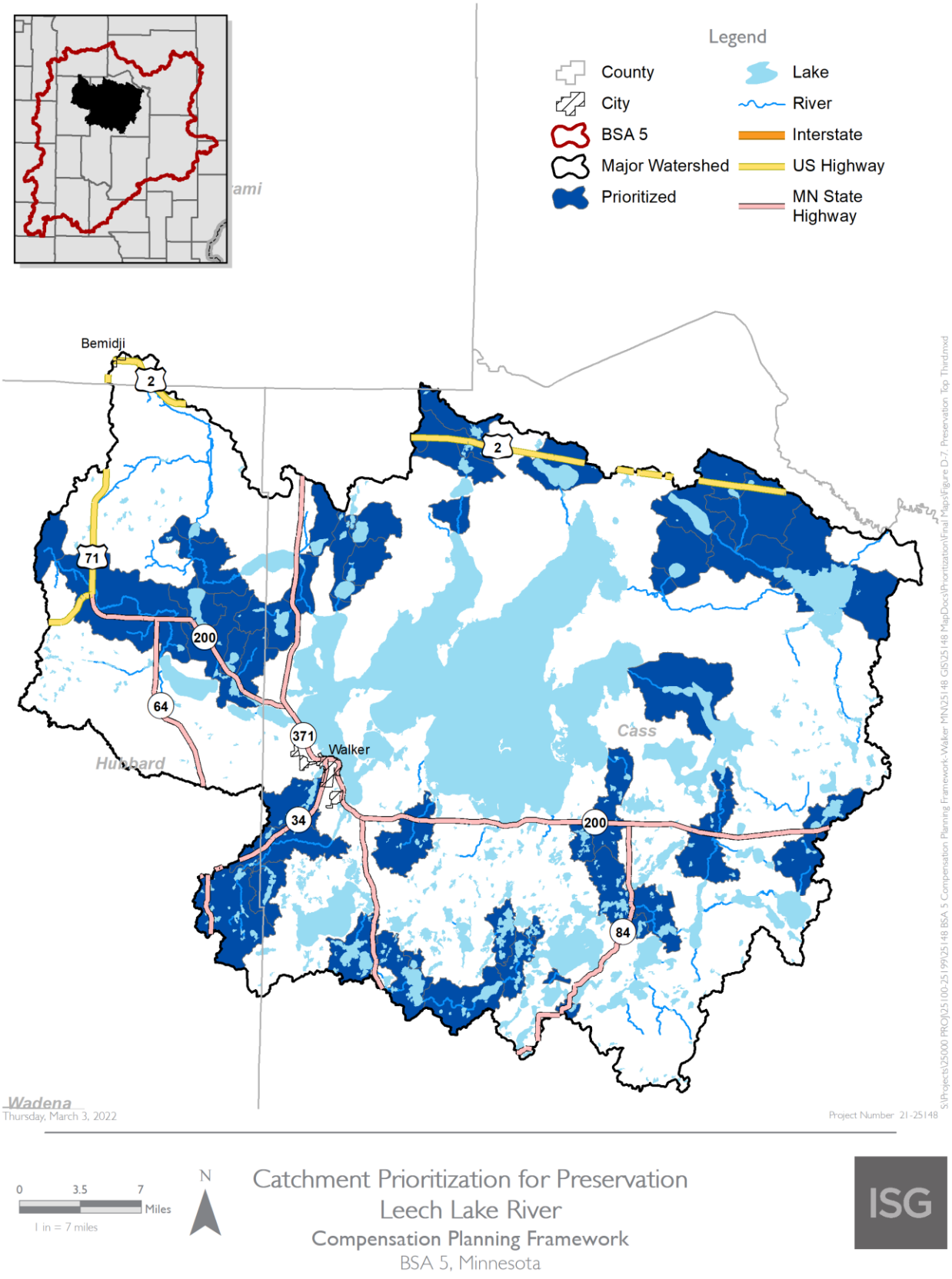

Figure D-18. Final Preservation Catchment Prioritization – Long Prairie River Watershed

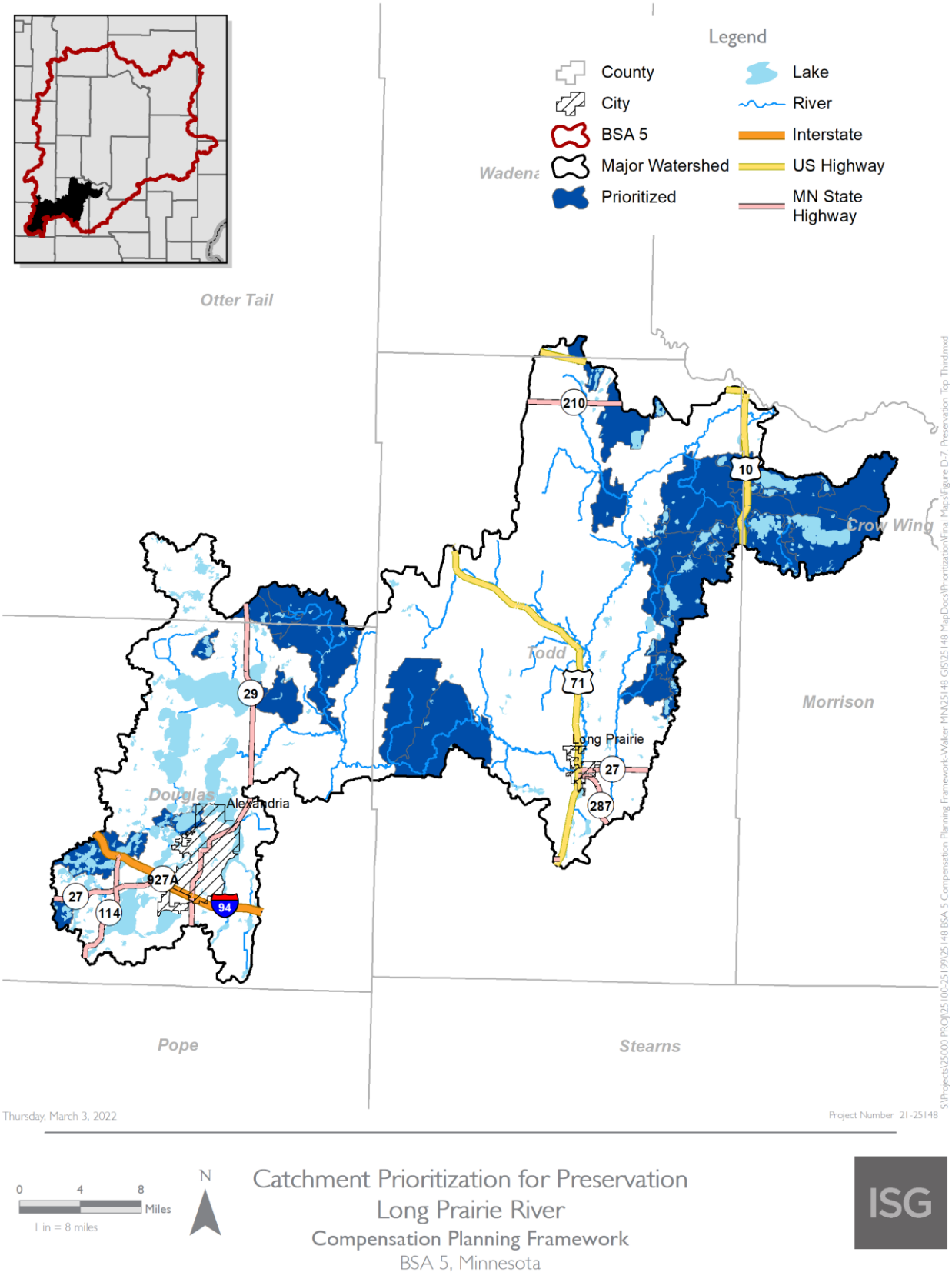

Figure D-19. Final Preservation Catchment Prioritization – Mississippi River- Brainerd Watershed

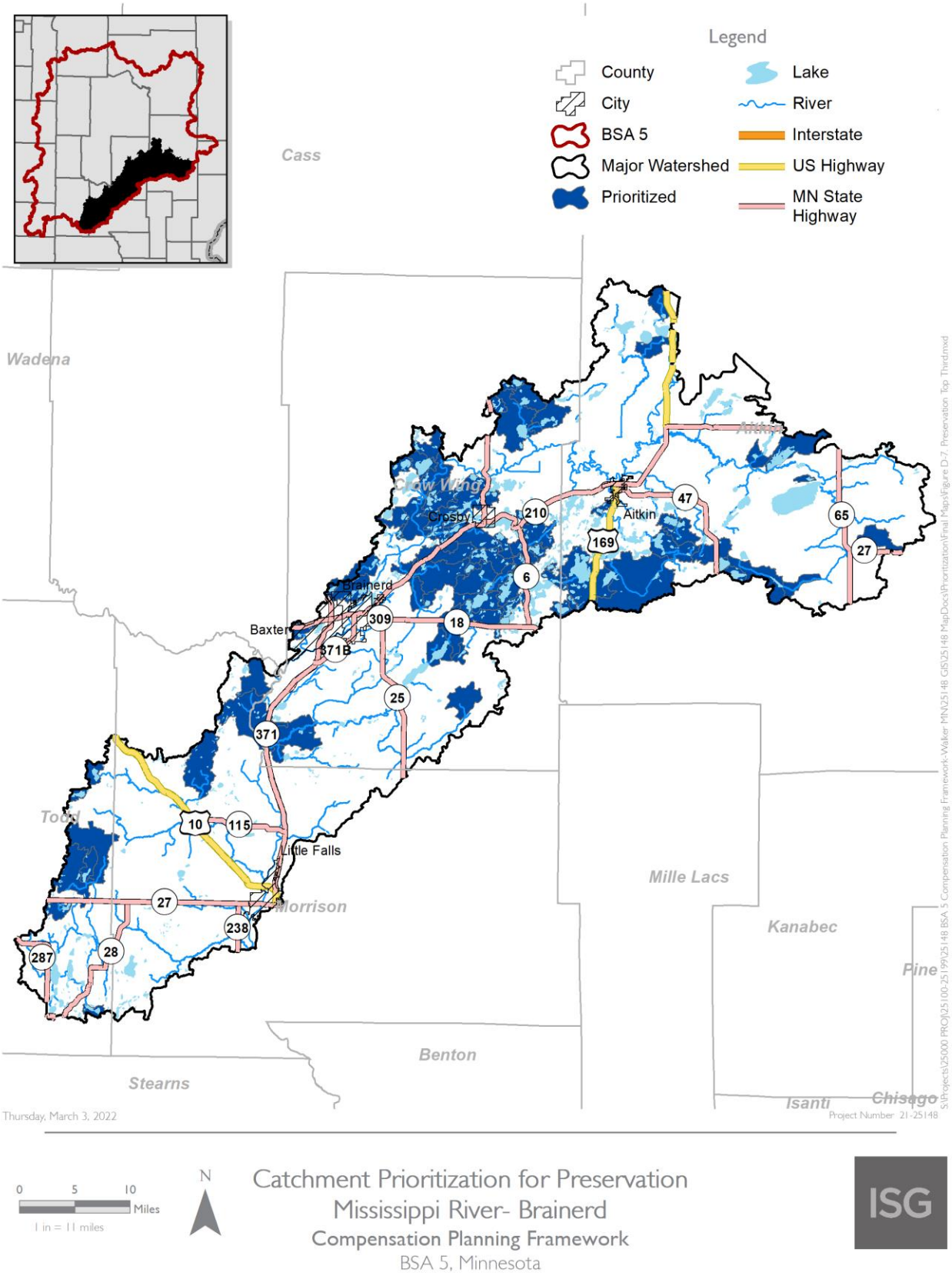

Figure D-20. Final Preservation Catchment Prioritization – Mississippi River- Grand Rapids Watershed

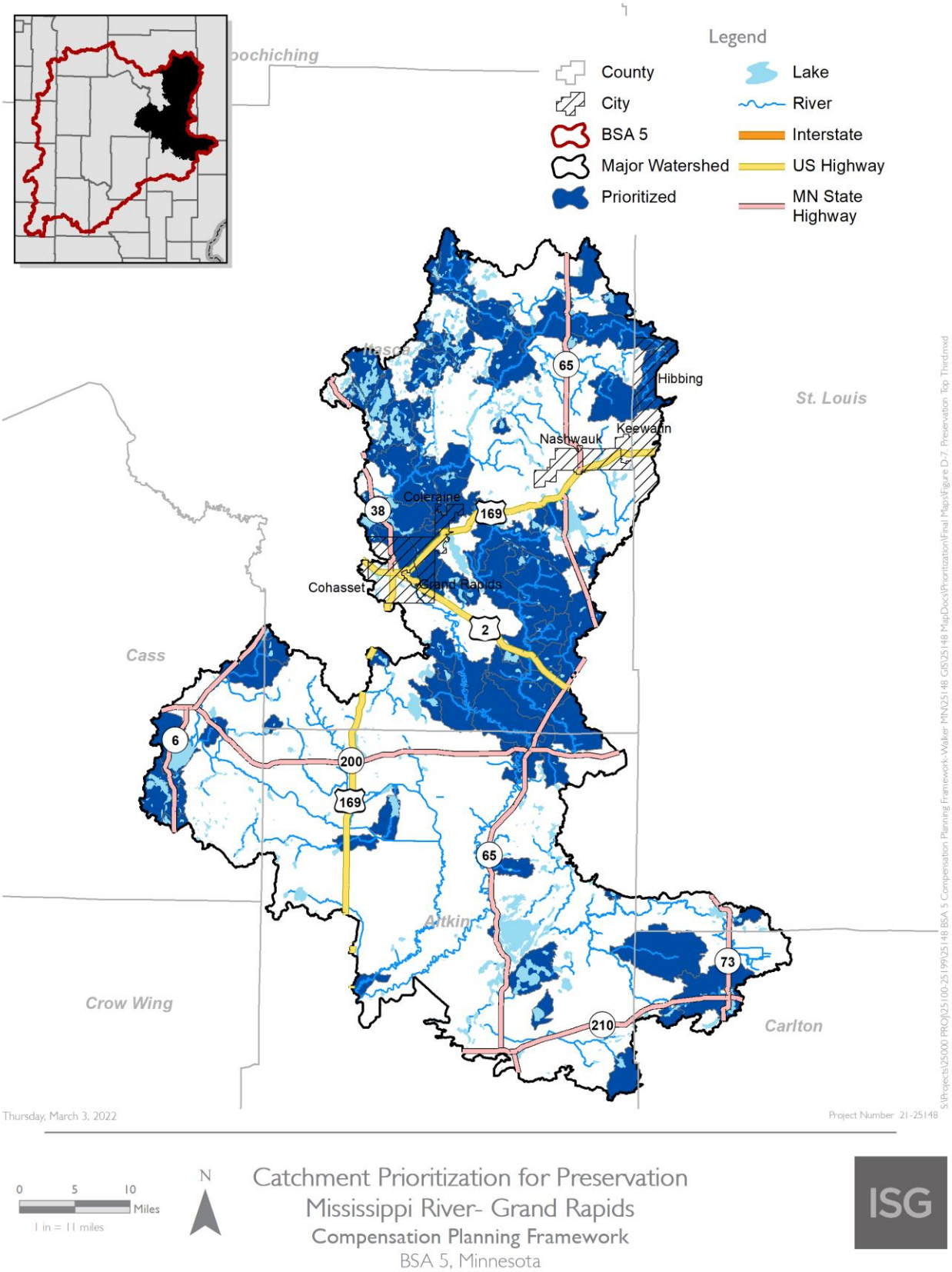

Figure D-21. Final Preservation Catchment Prioritization – Mississippi River- Headwaters Watershed

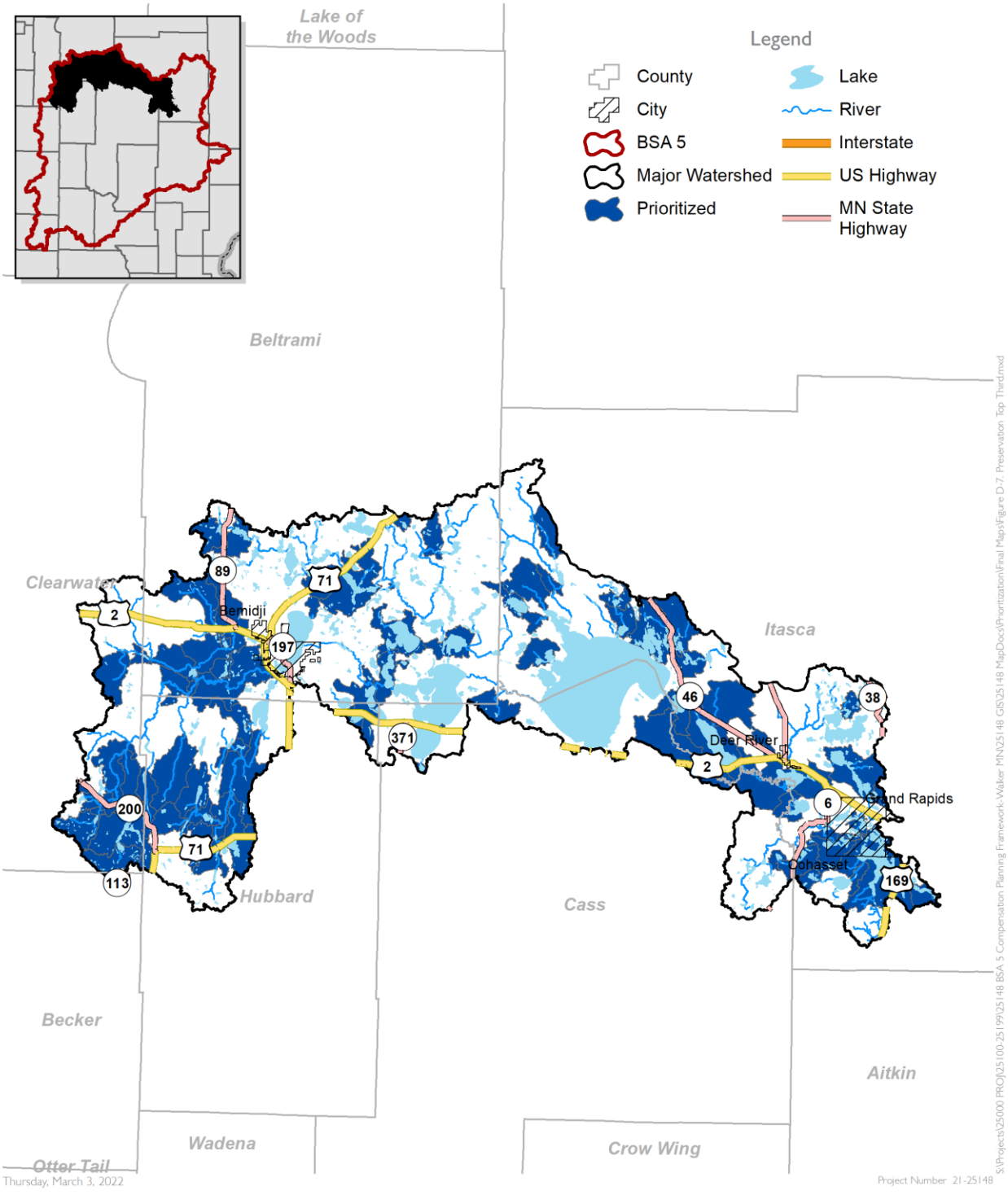

Figure D-22. Final Preservation Catchment Prioritization – Pine River Watershed

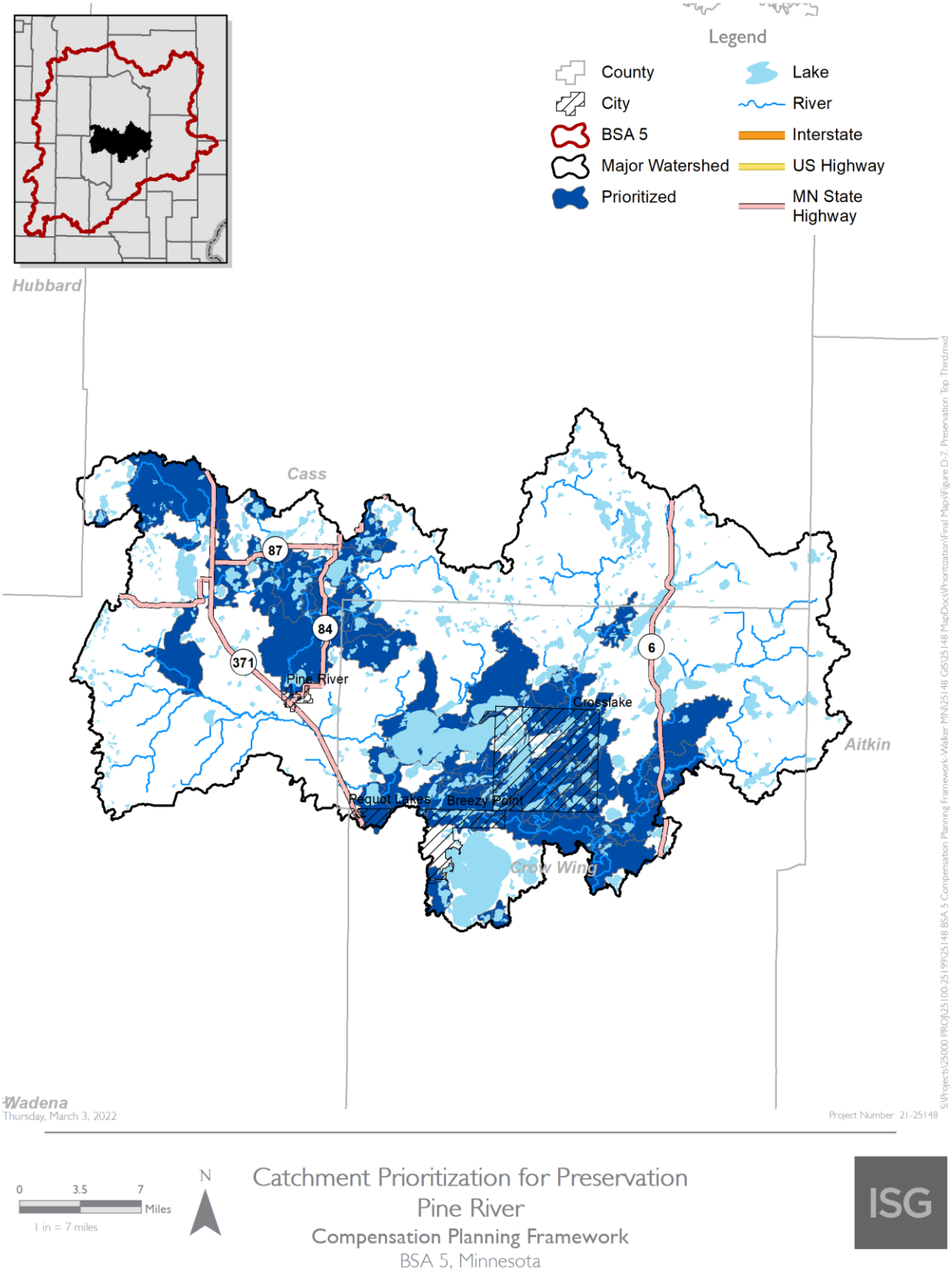

Figure D-23. Final Preservation Catchment Prioritization – Redeye River Watershed