Bank Service Area 1
Compensation Planning Framework

Watershed Based Approach to Wetland Compensatory Mitigation

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TABLE OF CONTENTS

TABLES

APPENDICES

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1. INTRODUCTION

This Compensation Planning Framework (CPF) provides documentation for a watershed-based approach to compensatory wetland mitigation in the Western Lake Superior Wetland Bank Service Area in northeastern Minnesota, also referred to as Bank Service Area (BSA) 1, 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 siting of replacement sites as a requirement for 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). Initially, the ILF will be focused on credit generation for the Local Government Road Wetland Replacement Program (LGRWRP) which is administered by the Minnesota Board of Water and Soil Resources (BWSR). 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 Western Lake Superior Wetland Bank Service Area (BSA 1), which is part of the Great Lakes Basin. The Western Lake Superior Basin has a unique Hydrologic Unit Code (HUC) of 0401. BSA 1 spans approximately 3.9 million acres and 7 counties in northeastern Minnesota. The boundary of BSA 1 ranges from the cities of Grand Portage in the north to Carlton in the south. Lake Superior is the eastern border and to the west is Hibbing (Figure B-1). According to the National Land Cover Database (NLCD), in 2019 land cover in BSA 1 was primarily natural, undeveloped space. Woody wetlands cover approximately 40% of BSA 1, along with mixed, deciduous, and evergreen forest covering an additional 44% (Table 2-1). Only about 4% of BSA 1 is developed. The land use across the remaining area includes open water, shrub/scrub, emergent wetlands, hay/pasture, grassland, barren land, and cultivated crops. BSA 1 contains 5 major watersheds (HUC 8) including Lake Superior North (Major Watershed number 1; HUC8 ID 04010101), Lake Superior South (2; 04010102), St. Louis River (3; 04010201), Cloquet River (4; 04010202), and Nemadji River (5; 04010301). The major watersheds are shown in Figure B-1 and described in the following paragraphs.

Table 2-1. Current Land Cover from the National Land Cover Database	
Landcover (NLCD 2019)	**Percent Area**
Woody Wetlands	40%
Mixed Forest	19%
Deciduous Forest	15%
Evergreen Forest	10%
Open Water	4%
Developed	4%
Shrub/Scrub	3%
Emergent Herbaceous Wetlands	2%
Pasture/Hay	2%
Grassland/Herbaceous	1%
Barren Land	1%
Cultivated Crops	< 1%
Land cover data from the National Land Cover Database (NLCD) for BSA 1	

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 one province intersects with BSA 1: Laurentian Mixed Forest. 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 four are present in BSA 1. 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, 9 of the subsections are represented within BSA 1. Maps of the provinces, and subsections can be found in Figure B-2. Each province and subsection are 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.

LAURENTIAN MIXED FOREST PROVINCE

The Laurentian Mixed Forest province covers the entire area of BSA 1. 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.-c). There are nine subsections within BSA 1.

St. Louis Moraines Subsection

The St. Louis Moraines subsection is heavily forested and has many lakes and wetlands. This subsection is a small sliver on the western side of BSA 1 and covers about 80,000 acres, entirely within the St. Louis River watershed. 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.-h).

Tamarack Lowlands Subsection

Also, on the western side of BSA 1 is the Tamarack Lowlands subsection. This subsection covers approximately 1 million acres of BSA 1, spanning across two of the major watersheds, St. Louis River and Cloquet River. The topography of this subsection is mostly flat with some gently rolling hills and includes extensive wetland coverage as it was once covered by Glacial Lake Upham. The wetlands have peat soils, making the land marginal for agriculture (MnDNR, n.d.-i).

Border Lakes Subsection

The northwestern tip of BSA 1 is the Border Lakes subsection. This subsection falls entirely within the Lake Superior – North watershed and comprises approximately 420,000 acres. Thin glacial drift soils on top of bedrock characterize this subsection. Deep stream valleys cutting through bedrock and large lakes are common throughout. Wetlands are not as common in this subsection because of the lack of soil and exposed bedrock. The area is almost entirely covered by forest, some of which was never logged due to inaccessibility (MnDNR, n.d.-a).

Laurentian Uplands

The Laurentian Uplands subsection is located in the north central region of BSA 1. It spans 3 major watersheds including Lake Superior – North, St. Louis River, and Cloquet River and covers approximately 240,000 acres. Both the St. Louis and Cloquet rivers intersect this subsection on their way to Lake Superior. It is characterized by brown glacial sediment deposits. Soils are predominantly well drained sandy loam with pockets of peat in the low-lying wetland areas. Most of the subsection is forested and there is some mining activity in the northwest corner (MnDNR, n.d.-d).

Nashwauk Uplands Subsection

The Nashwauk Uplands subsection covers the northwestern edge of BSA 1. It comprises a relatively small area of BSA 1, approximately 188,000 acres, all within the St. Louis River 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 south to Lake Superior (MnDNR, n.d.-f).

North Shore Highlands Subsection

Covering the largest area within BSA 1, about 1.4 million acres, is the North Shore Highlands subsection. This subsection bisects BSA 1, bordering Lake Superior along the north shore and extending to Cloquet on the west. 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.-g).

Toimi Uplands Subsection

The entirety of the Toimi Uplands subsection is located within BSA 1. The approximately 340,000 acres are split between the St. Louis River and Cloquet River watersheds. This subsection is distinguished from others by its rolling topography. Drumlin ridges are oriented in a southwest-northeast direction, paralleling the north shoreline of Lake Superior creating a washboard like arrangement. Streams and small lakes are common in the low-lying areas between drumlin ridges. Upland soils are rocky, well drained sandy loam (MnDNR, n.d.-j).

Glacial Lake Superior Plain Subsection

Nearly all of the Glacial Lake Superior Plain subsection resides within BSA 1. This subsection extends into Wisconsin and follows the basin of Glacial Lake Superior. Approximately 109,000 acres lie within the St. Louis River and Nemadji River watersheds. Although there are no natural lakes in this subsection, there are many rivers and small streams that carve out valleys up to 150 feet deep. The subsection historically was covered in forest and coniferous swamps growing on top of well drained clay and sandy soils (MnDNR, n.d.-b).

Mille Lacs Uplands Subsection

The Mille Lacs Uplands subsection covers approximately 109,000 acres across the Nemadji River and St. Louis River watersheds in the southern tip of BSA 1. 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.-e).

Table 2-2. Area (Acres) of Ecological Subsections Broken Down by Each Major Watershed within BSA 1										
Provence:	**Laurentian Mixed Forest**									
Section:	**Northern Minnesota Drift and Lake Plaines**		**Northern Superior Uplands**					**Southern Superior Uplands**	**Western Superior Uplands**	
Subsection:	**St. Louis Moraines**	**Tamarack Lowlands**	**Border Lakes**	**Laurentian Uplands**	**Nashwauk Uplands**	**North Shore Highlands**	**Toimi Uplands**	**Glacial Lake Superior Plain**	**Mille Lacs Uplands**	**Total**
Cloquet River	-	22,733	-	27,151	-	269,205	188,480	-	-	**507,569**
Lake Superior – North	-	-	423,422	78,415	-	513,364	-	-	-	**1,015,201**
Lake Superior – South	-	-	-	-	-	399,152	-	-	-	**399,152**
Nemadji River	-	-	-	-	-	101	-	88,917	87,798	**176,817**
St. Louis River	81,671	979,716	-	136,910	188,391	251,465	150,812	20,706	21,785	**1,831,456**
BSA 1 Total	**81,671**	**1,00449**	**423,422**	**242,476**	**188,391**	**1,433,287**	**339,292**	**109,623**	**109,584**	**3,930,196**

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.

LAKE SUPERIOR – NORTH

The Lake Superior – North watershed (HUC 04010101) is located along the Northeastern corner of BSA 1. It includes two counties: Cook and Lake. The population within the watershed, based on the 2010 U.S. Census, was 5,901 (MnDNR, 2015b). The primary industries are tourism and recreation (MPCA, 2018b). Land use does not vary much across the watershed. Most of the land use is forest, wetland, or open water (MnDNR, 2015b). Some of the Boundary Waters Canoe Area (BWCA) is located within this watershed. Less than 1% of land is used for crops and approximately 2% of land is developed, predominantly in communities along the shore of Lake Superior (MnDNR, 2015b). Water quality within the watershed is extremely good (MPCA, 2018b) and local planning efforts have prioritized preserving and improving water quality by increasing stormwater management regulations and working to improve impaired waters (Cook County et al., 2017).

The landscape within the watershed is relatively consistent across the watershed, transitioning from steep slopes and rocky terrain adjacent to Lake Superior to pristine lakes in the west. The watershed spans three different ecological subsections, including the Border Lakes, Laurentian Uplands, and North Shore Highlands. About 22% of the watershed is considered wetland. Forested wetlands are dominant, comprising 21% with emergent herbaceous wetlands covering an additional 1%. Soils in the Lake Superior – North watershed are glacial till complexes, unconsolidated deposits of sand, gravel, clay, and silt, and areas of exposed bedrock (MPCA, n.d.). The watershed receives an average of 29.9 inches of precipitation every year, most of which (10.7 inches) falls during the summer (June through August) (MnDNR, 2019b).

LAKE SUPERIOR – SOUTH

The Lake Superior – South watershed (HUC 04010102) is located on the east side of central BSA 1. It has a population of 68,249 according to the 2010 U.S. Census and covers two counties: Lake and St. Louis. The watershed is primarily forested (65%) but has a high number of wetlands (25%). Development is low across the watershed (6%) with pockets of concentrated development between greater Duluth and Two Harbors, Minnesota along the North Shore. The northern two thirds of this watershed was included in One Watershed, One Plan efforts for the Lake Superior – North watershed to the north. Stakeholders identified improving stormwater management and impaired waters as priorities for protecting water quality within the watershed (Cook County et al., 2017).

Within the Lake Superior – South watershed, the vegetation is uniform while the underlying soil type varies. The entire watershed is located within the North Shore Highland ecological subsection. This area is a covered by mixed forest (31%), deciduous forest (24%), and evergreen forest (8%), with woody wetlands also covering a significant are (24%). Two dominant soil types linearly bisect the watershed, with clay dominant soils adjacent to Lake Superior and silt and sand dominated soils further inland (MnDNR, 2017b). Average annual precipitation is 30.1 inches, with the majority occurring during summer (11.4 inches, June – August) (MnDNR, 2019c).

ST. LOUIS RIVER

The St. Louis River watershed (HUC 04010201) covers the western side of BSA 1. It covers five counties including St. Louis, Carlton, Itasca, Aitkin, and Lake. Based on the 2010 U.S. Census the population in the watershed was 137,563 (MnDNR, 2015c). More than half of the watershed is covered with wetlands (57%), followed by forest (31%). Development in this watershed is less than 4% and is primarily focused around Duluth and along the Iron Range toward Hibbing. It has a riche and extensive history of iron ore, taconite, and aggregate mining, as well as timber harvesting, and peat mining. There are several areas of localized pollution within the watershed along the iron range and near the urbanized area of Duluth (MnDNR, 2015c), which correspond with the MPCA Watershed Restoration and Protection Strategy Report (WRAPS) sub watershed priority areas (MPCA, 2018c). These WRAPS priority areas include West Swan River – East Swan River (0401020106), Partridge River (0401020101) and Upper Whiteface River (0401020108) (MPCA, 2018c).

Compared to other major watersheds within the BSA, the landscape within the St. Louis River watershed is heterogeneous. The nearly 2 million acres within the watershed spans eight ecological subsections including the Tamarack Lowlands, North Shore Highlands, Nashwauk Uplands, Toimi Uplands, Laurentian Uplands. St. Louis Moraines, Mille Lacs Uplands, and Glacial Lake Superior Plain. Over half of all land area is a wetland, with forested and shrub-scrub wetlands dominating the landscape. Wetlands change to mixed forest in the northeast and southeast corners of the St. Louis River watershed, where soil become thinner and higher in clay content (MnDNR, 2017d). Average annual precipitation is 28.4 inches, with the majority occurring during summer (11.8 inches, June – August) (MnDNR, 2019d).

CLOQUET RIVER

The Cloquet River watershed (HUC 04010202) is in the center of BSA 1, separating the St. Louis River watershed from the Lake Superior – South watershed. It covers two counties including St. Louis and Lake. Based on the 2010 U.S. Census the population was 8,692 (MnDNR, 2015a). Approximately 90% of the watershed is covered with wetlands (47%) and forests (43%). Development is low across the watershed, with the population concentrated in the southern half near large lakes (MnDNR, 2015a). According to the MPCA WRAPS, the watershed has minimal human disturbance compared to other watersheds throughout the state, but pressure to develop areas for lake/country homes and recreational purposes is moderate (MPCA, 2018a).

The Cloquet River watershed is situated in a transitional area of the BSA, where rocky forests to the east give way to bogs and peatlands to the west. The watershed spans four ecological subsections including the Laurentian Uplands, North Shore Highlands, Tamarack Lowlands, and Toimi Uplands. Nearly half of the area

across the watershed has hydric soils (46.2%), especially the south and southwestern regions of the watershed (MnDNR, 2017a). Precipitation is largely uniform, with an average of 29.9 inches of precipitation falling per year, with the majority occurring during summer (11.8 inches, June – August) (MnDNR, 2019a).

NEMADJI RIVER

The Nemadji River watershed (HUC 04010301) is located on the eastern border of BSA 1. It covers two counties: Carlton and Pine. The 2010 U.S. Census listed the population in the watershed at 3,902. The landscape of the watershed is mostly made up of forest (42%) and wetland (32%), with development covering only 3% of the watershed area. There are no large cities within this watershed (MnDNR, 2017c).

The ecological subsections within this watershed include the Glacial Lake Superior Plain and the Mille Lacs Uplands. A small portion of the watershed, roughly 175 acres, is located within the North Shore Highlands. Of the wetland areas, forested wetlands dominate the landscape at 87%, with emergent wetlands making up 12%. Soils vary across the watershed but are predominantly loam with some areas of high sand and clay, as well as organic matter. The watershed receives about 30.8 inches of precipitation a year. In the summer the average is 12.6 inches and in the winter it is 2.8 inches (MnDNR, 2017c).

3. BASELINE CONDITIONS

The baseline conditions section analyzes and describes the current conditions of water resources across BSA 1. 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. The two dominant vegetation categories were forest, including coniferous and mixed forest areas, and wetlands, predominantly marshes, bogs and coniferous swamps. Forest categories dominated the major watersheds adjacent to Lake Superior, which transitioned to wetland dominated categories moving westward across BSA 1.

Table 3-1. Summary of Pre-Settlement Vegetation for BSA 1												
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
Cloquet River	3%	1%	46%	14%	-	26%	10%	-	-	-	-	-
Lake Superior – North	7%	2%	19%	20%	-	42%	10%	-	-	-	-	-
Lake Superior – South	1%	-	20%	33%	-	38%	6%	-	-	-	-	1%
Nemadji River	2%	-	32%	37%	1%	12%	15%	1%	-	-	-	1%
St. Louis River	3%	1%	63%	6%	-	21%	7%	-	-	-	-	-
BSA 1 Total	**4%**	**1%**	**43%**	**15%**	**-**	**28%**	**8%**	**-**	**-**	**-**	**-**	**-**
Category Total	**4%**	**44%**		**51%**					**-**			

Wetlands

The current extent of wetlands in BSA 1 is based on the 2019 update of the Minnesota National Wetland Inventory (NWI) provided by the MnDNR (Kloiber et al., 2019). BSA 1 has approximately 1.2 million acres of palustrine wetlands (Figure B-4). Riverine and Lacustrine wetlands were not included in this analysis because they are commonly associated with non-wetland deepwater habitat in the Cowardin classification system. Approximately 31% of the entire BSA 1 is palustrine wetlands, which is higher than the statewide percentage of 20%. The two most prevalent classes or types of wetlands in BSA 1 include forested wetlands (707,686 acres; 58% of the wetlands in BSA 1) and scrub shrub wetlands (396,077 acres; 32% of the wetlands in BSA 1). Emergent wetlands account for about 8% of the wetlands in BSA 1 (98,866 acres) and unconsolidated bottom and aquatic bed wetlands account for only about 2% (20,208 acres). On the watershed level, the St. Louis River watershed has the greatest area of wetlands with 759,420 acres (41% of the watershed area). Cloquet River and the Nemadji River also had significant areas of wetlands relative to their watershed size, 30% and 27% respectively. Table 3-2 includes the exact numbers and a comparison with the whole BSA 1 and statewide numbers.

ORGANIC SOILS

Organic soils are a unique feature in BSA 1. They are important for peatland wetland formation and impact other natural resources across the BSA. It is important to include them as a baseline condition because of their role in the development or preservation of boreal peatlands, a unique wetland system. For the purpose of this report three categories are included within organic soils to get a holistic view across the landscape and across land use types. These include soils mapped as histosols, soils with a histic epipedon, and wetlands mapped as peatlands. Histosols are soils that formed within organic materials. It is a soil without permafrost where the upper 80cm are more than half organic (USDA, 1999). A histic epipedon is a soil horizon or layer that forms at or near the surface which consists of organic material and is characterized by saturation and reduction (USDA, 1999). Peatlands can be mapped several ways but for this report the Hydrogeomorphic (HGM) wetland classification system was used to define a peatland. The HGM classification system aims to be a generic approach to classification. It emphasizes the geomorphic position, the water source, and the hydrodynamics of a wetland (Brinson, 1993). As such, there are seven broad classes, of which only six occur within Minnesota (Kloiber et al., 2019). In the HGM, peatlands (also referred to as Organic Flats) are wetlands that occur on a nearly level landform. Their hydrology is not influenced by stream, river, or flow-through ditches and the soil type is predominately organic. To map the extent of peatlands within BSA 1, the Minnesota 2019 NWI was used as it includes the HGM classification. It should be noted that for summarizing wetlands previously in this report the Cowardin classification system was used. There is no defined relationship between the Cowardin and HGM classifications. Therefore, wetlands that are classified as peatlands within HGM could fall into any of the palustrine wetland class within the Cowardin system. But not all palustrine wetlands would be considered peatlands. The combination of histosol soils, soils with histic epipedons, and peatlands was used to characterize the extent of organic soils in BSA 1 in order to achieve a holistic analysis.

Organic soils within BSA 1 cover approximately 32% of the BSA area (1,269,352 acres; Figure B-5). The majority of the organic soils are located in the southwestern corner of the BSA, within the St. Louis River major watershed (822,519 acres). As you travel north and east across the BSA the total amount of organic soils decreases and becomes smaller and more disjointed. This is likely largely attributed to geology, which consists of more bedrock outcroppings and rocky terrain in the northern sections of BSA 1. The Nemadji River watershed has the lowest watershed area covered by organic soils (14% of the watershed area). Table 3-3 shows the amounts of distribution of organic soils across the BSA.

Table 3-2. Acres of Wetland							
Major Watershed	Watershed Acres	Palustrine				Total Wetland Acres	Percent Watershed Wetland
		Emergent	Forested	Scrub-Shrub	AB+UB*		
Cloquet River	507,569	14,353	94,505	41,699	2,588	153,145	30%
Lake Superior - North	1,015,869	16,355	127,110	38,178	6,316	187,958	19%
Lake Superior - South	399,372	7,568	48,271	17,130	2,071	75,040	19%
Nemadji River	176,843	5,005	22,502	18,744	1,022	47,273	27%
St. Louis River	1,831,469	55,585	415,298	280,326	8,211	759,420	41%
BSA 1 Total	**3,931,123**	**98,866**	**707,686**	**396,077**	**20,208**	**1,222,837**	**31%**
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							

Table 3-3. Acres of Organic Soils			
Major Watershed	Watershed Acres	Organic Soils Acres	Percent Watershed
Cloquet River	507,569	167,557	33%
Lake Superior - North	1,015,869	179,799	18%
Lake Superior - South	399,372	74,595	19%
Nemadji River	176,843	24,882	14%
St. Louis River	1,831,469	822,519	45%
BSA 1 Total	**3,931,123**	**1,269,352**	**32%**
Organic soils area a combination of Histosol soils, soils with Histic Epipedon, and wetlands defined as "Peatland" in HGM classification in the 2019 NWI			

Lakes

According to the MnDNR Hydrography data, BSA 1 has approximately 138,745 acres of lakes (Figure B-6). About 4% of the BSA 1 area is lakes. The Lake Superior – North watershed has the largest average of lakes, with 63,986 acres. The Superior National Forest and the Boundary Waters Canoe Area Wilderness are located within this watershed and have a high concentration of lakes. The second highest acreage of lakes is in the St. Louis River watershed with 40,702 acres. The area of lakes in all watersheds can be found in Table 3-44. The five largest lakes in BSA 1 include Island Lake Reservoir (8,000 acres in Cloquet River watershed), Whiteface Reservoir (4,567 acres in St. Louis River watershed), Brule (4,327 acres in Lake Superior – North watershed), Boulder (3,260 acres in Cloquet River watershed), and Fish Lake Flowage (3,259 acres in Cloquet River watershed). Lake Superior was not included in this analysis.

Table 3-4. Summary of Lake Area (Acres) for BSA 1			
Major Watershed	**Watershed Acres**	**Lake Acres[1]**	**Lake Area %**
Cloquet River	507,569	29,613	6%
Lake Superior - North	1,015,869	63,986	6%
Lake Superior - South	399,372	2,463	1%
Nemadji River	176,843	1,981	1%
St. Louis River	1,831,469	40,702	2%
BSA 1 Total	**3,931,123**	**138,745**	**4%**
[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 (unknown, intermittent or perennial), is provided in Table 3-55. 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 1. The majority of the watercourses within BSA 1 are categorized as Natural- Perennial (4,347 miles; Figure B-7). The St. Louis River watershed has the most miles of watercourses due to the St. Louis River. The Nemadji River watershed has the highest density of watercourses (1.7).

Table 3-5. Summary of Watercourses (Miles) for BSA 1						
Major Watershed	**Drainage Ditch**	**Natural-Unknown Flow Regime**	**Natural-Intermittent**	**Natural-Perennial**	**Total**	***Watercourse Density**
Cloquet River	38	117	43	476	**674**	**0.9**
Lake Superior - North		236	120	1,312	**1,668**	**1.1**
Lake Superior - South	13	59	257	687	**1,017**	**1.6**
Nemadji River	2	29	154	283	**467**	**1.7**
St. Louis River	802	274	317	1,589	**2,982**	**1.0**
BSA 1 Total	**854**	**714**	**892**	**4,347**	**6,808**	**1.1**
*Watercourse Density is the number of stream miles per square mile 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 where habitat has been compromised

through hydrologic alteration. Streams where 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-8). There are very little impounded watercourses within BSA 1. Of the watersheds that have impounded watercourses, Cloquet watershed has the most. Within the altered category, the St. Louis River watershed has the most miles. Natural watercourses far exceed the other categories. Exact lengths of altered watercourses and the category for each watershed can be found in Table 3-66.

Table 3-6. Summary of Altered Watercourses (Miles) in BSA 1

Major Watershed	Altered	Impounded	Natural	No Definable Channel
Cloquet River	60	6	506	103
Lake Superior - North	1	0	1,533	136
Lake Superior - South	23	2	922	71
Nemadji River	17	1	410	39
St. Louis River	1,141	4	1,641	202
BSA 1 Total	**1,241**	**14**	**5,012**	**551**
Data from the MPCA Altered Watercourses Project updated in 2019				

Water Quality

Water quality in BSA 1 was assessed using the MPCA 303(d) impaired waters list of. Data for lakes, streams, and wetlands were updated in 2022. Not all 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 (DO), fish bioassessments, aquatic macroinvertebrate bioassessments, nitrate, nutrients and eutrophication biological indicators, sulfate, turbidity, and total suspended solids (TSS). Lakes and streams that were assessed and located partially or wholly within tribal lands are included in this analysis. Across BSA 1, 519 lakes were assessed, and 18 lakes were found to be impaired (Figure B-9). Of the impaired lakes, none were located partially or wholly on tribal land. The St. Louis River watershed had the highest percentage (10%) of its lakes impaired. Lake Superior – North and Lake Superior - South watersheds had the lowest percentage of their lakes impaired with no impairments. Colby Lake (539 acres) within the St. Louis River watershed is nearly impaired for nutrients. **Error! Reference source not found.**7 includes assessed and impaired lake area and percentage for each watershed.

In addition to evaluating the number of impaired waterbodies, lakes and streams that are nearly impaired or barely impaired (nearly/barely) for one or more impairments were also evaluated. The MPCA identifies nearly/barely waterbodies by analyzing water quality data to determine what waterbodies are close to the impairment thresholds. This information is helpful to establish more context for impaired waterbodies as well as identify waterbodies that aren't included in the impairment analysis but are nearing impairment thresholds. An important consideration when evaluating nearly/barely waterbodies is that these categorizations are based on

the waterbody's designated use classification (i.e. aquatic life and aquatic recreation), not specific parameters, so it is possible for a stream to be impaired for one aquatic life parameter (i.e. dissolved oxygen) but also be listed as nearly impaired for aquatic life due to another parameter (TSS, nutrients and eutrophication biological indicators, etc.) nearing the threshold. There are nine lakes in BSA 1 that are nearly impaired, two lakes within the Lake Superior - North watershed, two lakes within the St. Louis River watershed, one lake in the Nemadji River watershed, and four lakes in the Cloquet River watershed. There is one lake that is barely impaired which is located within the Cloquet River watershed. The list of nearly/barely lakes is presented below in Table 3-8.

Table 3-7. Assessed and Impaired Lakes

Major Watershed	Assessed		Impaired		% Impaired
	Acres	Count	Acres	Count	
Cloquet River	23,959	56	27	1	2%
Lake Superior - North	53,732	273	-	-	0%
Lake Superior - South	1,327	18	-	-	0%
Nemadji River	1,233	16	134	1	6%
St. Louis River	37,126	156	5,159	16	10%
BSA 1 Total	**117,377**	**519**	**5,320**	**18**	**3%**
Data includes lakes wholly and partially on tribal lands					

Table 3-8. Nearly/Barely Waterbodies

Major Watershed	Lake ID	Lake Name	Lake Area (acres)	Nearly/Barely
Lake Superior - North	16-0359-00	Agnes	65.9	Nearly
	16-0643-00	Richey	99.7	Nearly
St. Louis River	69-0696-00	West Twin	117.5	Nearly
	69-0856-00	Carey	143.9	Nearly
Nemadji River	09-0011-00	Lac La Belle	28.2	Nearly
Cloquet River	38-0755-00	Sullivan	51.1	Nearly
	69-0023-00	Indian	53.1	Nearly
	69-0521-00	Leora	256.9	Nearly
	69-0522-00	Winkle	34.0	Nearly
	38-0751-00	Thomas	145.4	Barely

Regarding streams, there were 385 individual stream reaches assessed across BSA 1 and 53 of those reaches were found to be impaired (Figure B-10). None of the impaired stream reaches were partially or wholly on tribal land. The Nemadji River watershed had the highest percentage of its stream reaches impaired at 44%. The Lake Superior – North and Cloquet River watersheds had the lowest percent impairments with 2% and 6% respectively.

Nearly/barely data for streams was also analyzed. Two stream reaches within the St. Louis River watershed are nearly impaired for one or more Aquatic Life impairments (DO, TSS, nutrients, fish bioassessment, or

macroinvertebrate assessment) including a 10.6-mile reach of the Pine River and a 6.5-mile reach of Barber Creek. See Table 3-99 for assessed and impaired stream miles and percentages in each watershed.

Table 3-9. Assessed and Impaired Streams					
Major Watershed	**Assessed**		**Impaired**		**% Impaired**
	Miles	**Count***	**Miles**	**Count***	
Cloquet River	237	34	9	2	6%
Lake Superior - North	402	84	11	2	2%
Lake Superior - South	328	66	99	11	17%
Nemadji River	182	27	87	12	44%
St. Louis River	1,042	174	224	26	15%
BSA 1 Total	**2,191**	**385**	**430**	**53**	**14%**
*Count is the number of stream reaches not individual streams Data includes streams wholly and partially on tribal lands					

Land Cover

The 2019 National Land Cover Dataset (NLCD) was used to analyze the current land cover across BSA 1. 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*. Unclassified area was excluded from the analysis. Table 3-1010 includes the landcover classification breakdown within each individual watershed.

The majority of land cover in BSA 1 is classified as *Forest* (47%) with the second highest category being *Wetlands* at 42% (Figure B-11). Although the wetland area as mapped in the NWI and the NLCD are similar (27% and 31% of BSA 1 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 Lake Superior – North, Lake Superior – South, and Nemadji River watersheds. *Wetlands* are the highest in the predominantly inland watersheds of St. Louis River and Cloquet River.

Table 3-10. Land Cover Percentage of Each Watershed in 2019							
Major Watershed	**Agriculture**	**Barren**	**Developed**	**Forest**	**Grassland**	**Water**	**Wetlands**
Cloquet River	1%	< 1%	3%	43%	1%	6%	47%
Lake Superior – North	< 1%	< 1%	2%	69%	1%	6%	22%
Lake Superior – South	2%	< 1%	6%	65%	1%	1%	25%
Nemadji River	12%	< 1%	3%	50%	1%	1%	34%
St. Louis River	3%	1%	5%	31%	1%	3%	57%
BSA 1 Total	**2%**	**1%**	**4%**	**47%**	1%	**4%**	**42%**
Data from the National Land Cover Database. Categories simplified based on 2019 NLCD categories							

Perennial Cover

In addition to analyzing land cover, perennial cover was evaluated using the 2019 NLCD. Of the seven classes, *Forest*, *Grassland*, and *Wetlands* were categorized as *Perennial*. *Agriculture*, *Barren*, and *Developed* were

classified as *Non-Perennial*. *Water* and any uncategorized data were omitted from the analysis. As can be seen in Figure B-12 and **Error! Reference source not found.**11 all individual watersheds have over 93% Perennial cover, with Lake Superior – North watershed having the highest perennial coverage (98%). BSA 1-wide, 95% of the area is in *Perennial* cover and 5% is in *Non-perennial*.

Table 3-11. Acres of Perennial and Non-Perennial Cover in 2019

Major Watershed	Perennial	Non-Perennial	Total
Cloquet River	464,094	13,551	**477,645**
Lake Superior - North	932,778	19,949	**952,727**
Lake Superior - South	370,242	25,565	**395,807**
Nemadji River	168,617	6,151	**174,768**
St. Louis River	1,664,978	109,906	**1,774,884**
BSA 1 Total	**3,600,709**	**175,121**	**3,775,830**

Based on the 2019 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. This dataset was developed over 30 years. Initial surveys were conducted starting in the 1990's to inventory and map Minnesota's native plant communities. Sites were selected on a county basis using aerial photos to identify locations where native plant communities would be present. As a result, not all potential areas of biodiversity significance were chosen, and it is likely some boundaries within mapped areas have shifted over time.

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 1, approximately 2.1 million acres (54% of the total area of BSA 1) was surveyed for biodiversity significance (Figure B-13). The majority of sites across BSA 1 (24%) were ranked as *Moderate*. The majority of sites within the Lake Superior – North watershed were ranked as *High* (27%), while the majority in the remaining four watersheds (Cloquet River, Lake Superior – South, Nemadji River, and St. Louis River) were ranked as *Moderate*. Lake Super – North had more than double the acres ranked as *Outstanding* compared to all other watersheds, with about 165,000 acres or 16% area ranked as *Outstanding*. The watersheds with the most sites

ranked as *Below* were Nemadji River and St. Louis River, with 14% and 4% respectively. Acres and percentages for each watershed and BSA wide can be found in Table 3-122.

Table 3-12. Acres of Areas of Biodiversity Significance and Rank										
Major Watershed	**Below**		**Moderate**		**High**		**Outstanding**		**Grand Total**	
Cloquet River	11,437	2%	140,475	28%	83,301	16%	20,750	4%	**255,962**	**50%**
Lake Superior – North	24,335	2%	207,339	20%	270,288	27%	165,788	16%	**667,751**	**66%**
Lake Superior – South	2,552	1%	121,632	30%	53,311	13%	17,461	4%	**194,957**	**49%**
Nemadji River	24,510	14%	44,657	25%	24,968	14%	23,875	14%	**118,009**	**67%**
St. Louis River	68,626	4%	414,073	23%	326,505	18%	64,133	4%	**873,338**	**48%**
BSA 1 Total	**131,460**	**3%**	**928,176**	**24%**	**758,373**	**19%**	**292,008**	**7%**	**2,110,017**	**54%**
Data updated 2023										

High Quality Water Resources

High quality water resources were characterized as waterbodies that support ecologically significant fish and plant species including cisco, trout, and wild rice. Cisco refuge lakes were characterized by the MnDNR in 2012 as lakes that are deep and clear enough to still support suitable cisco habitat even after significant climate warming. Trout lakes represent the legally designated trout lakes as identified in Minnesota Rules Chapter 6264.0050. They are inland lakes that are actively managed by DNR Fisheries for trout species including rainbow trout, brook trout, brown trout, and splake. The data was updated in 2018. Similarly, trout streams represent the legally designated trout streams and tributaries as identified in Minnesota Rules Chapter 6264. The dataset was updated in 2020 and includes only protected streams and tributaries. Wild rice waters data was provided by the 1854 Treaty Authority, which aims to promote cooperative management and protection efforts between tribal and non-tribal agencies. The dataset includes locations passed on through oral history and locations surveyed by a variety of organizations including the DNR, US Forest Service, and MPCA. The majority of the data was collected from 1996-2019.

BSA wide, there were 17 lakes spanning 17,034 acres of habitat suitable for cisco under climate change projections. Nearly all the cisco refuge lakes were concentrated in the Lake Superior – North major watershed (16 of the 17 lakes), specifically within the boundary waters canoe area. One lake within the St. Louis River watershed just east of Eveleth was also identified as suitable habitat for cisco. According to the trout lakes data, BSA 1 has approximately 68 lakes and 1,989 stream reaches of trout habitat (Figure B-14). The Lake Superior – North watershed has the highest number of trout lakes, with 54 lakes spanning 1,952 acres. St. Louis River watershed had the second highest number of trout lakes (8 lakes). The Nemadji River watershed did not have any lakes that support trout. Regarding stream habitat for trout, there were 1,989 reaches traveling 2,937 miles identified across the BSA. The majority of trout streams are located along the eastern side of the BSA adjacent to Lake Superior. The Lake Superior – North watershed has 671 stream reaches that support trout habitat and Lake Superior – South watershed has 592 trout stream reaches. All major watersheds within BSA 1 contain trout streams. Additionally, all major watersheds within BSA 1 contain waterbodies that support wild rice. These

waterbodies are largely concentrated within the St. Louis River watershed (103 waterbodies) and the Lake Superior – North watershed (90 waterbodies), on edges of shallow lakes, floodplains of creeks, and emergent wetlands. The Lake Superior – South and Nemadji River watersheds have very few (3 each) mapped waterbodies that support wild rice habitat. All high-quality water resource data for each watershed and BSA wide can be found in Table 3-13 and on Figure B-14.

Table 3-13. High Quality Water Resources

	Cisco Habitat		Trout Habitat				Wild Rice Habitat
Major Watershed	Number of Lakes	Lake Acres	Number of Lakes	Lake Acres	Number of Stream Reaches	Length of Stream Reaches (mi)	Number of Wild Rice waterbodies
Cloquet River	-	-	3	121	110	211	45
Lake Superior – North	16	16,582	54	1,952	671	1,154	90
Lake Superior – South	-	-	3	55	592	798	3
Nemadji River	-	-	-	-	232	374	3
St. Louis River	1	453	8	245	384	399	103
BSA 1 Total	**17**	**17,034**	**68**	**2,373**	**1989**	**2,937**	**244**

Landownership

A unique characteristic in BSA 1 and an important consideration for this report is the landownership. To summarize landownership the most up to date parcel information was used. It was then categorized based on the owner into 10 categories which can be seen in Table 3-14. To further define the landownership parcels owned by City, County, Education, Federal, State or Tribal were all categorized as Public. Parcels that were Industry, Private, Private Conservation, Utility, and ones missing a label (NULL) were categorized as Private.

The majority of the land is publicly owned (62% of the BSA or 2.4 million acres). The remaining 38% is owned by private entities or individuals (Figure B-15). Within the publicly owned land, Counties own approximately 875,000 acres, and the federal government owns 780,000 acres. The rest of the publicly owned land is distributed between tribes, state, city, and universities. Of the privately owned land the vast majority is owned by individuals (1.3 million acres). Industry owns approximately 78,000 acres and the remaining is for utilities or private conservation. On a watershed level, four watersheds have more than 50% of the land owned by public entities. The remining watershed, the Nemadji River watershed, has 37% of the watershed owned by public entities. The Nemadji River watershed also has the highest percentage of private landownership with 63% of the watershed area privately owned.

Table 3-14. Landownership													
Major Watershed	Public							Private					Grand Total
	City	County	Education	Federal	State	Tribal	Public Total	Industry	Private	Private Conservation	Utility	Private Total	
Cloquet River	2,256	201,467		69,044	52,119		**324,887**	13,574	123,851	1,557	22,071	**161,052**	**485,940**
Lake Superior - North	639	4,845		548,785	200,226	43,641	**828,136**	14,288	119,962	4,300	963	**139,513**	**967,649**
Lake Superior - South	4,916	140,938	394	23,855	36,404	10	**206,517**	22,481	163,264	1,897	151	**187,794**	**394,311**
Nemadji River	31	22,057	78	11	42,613		**64,790**		109,647	852	115	**110,614**	**175,405**
St. Louis River	18,086	476,475	4,261	138,286	262,721	44,389	**944,218**	27,796	785,510	17,320	19,450	**850,075**	**1,794,293**
BSA 1 Total	**25,929**	**875,782**	**4,733**	**779,981**	**594,084**	**88,040**	**2,368,549**	**78,138**	**1,302,234**	**25,926**	**42,750**	**1,449,049**	**3,817,597**

Permitting Analysis

Permits issued under the U.S. Army Corps of Engineers (USACE) Regulatory Program were reviewed for the five-year period between January 2017 and December 2021. This review focused on authorized impacts to wetlands (e.g., filling or draining) that resulted in a permanent loss of the resource.

Table 3-155 provides a summary of authorized wetland impacts between 2017 and 2021. 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 St. Louis River watershed experienced the greatest amount of wetland impacts over this period. This is due to large-scale mining projects that are unique to this BSA. The remaining watersheds have significantly less impacts as impacts are generally correlated with the level of development.

Table 3-15. Acres of Permitted Wetland Impact	
Major Watershed	**Acres of Impact**
Cloquet River	2.8
Lake Superior – North	4.1
Lake Superior – South	203.0
Nemadji River	4.3
St. Louis River	1,023.6
BSA 1 Total	**1,237.8**
Data from 2017 to 2021 provided by the U.S. Army Corps of Engineers	

4. CUMULATIVE IMPACT ANALYSIS

Wetland Loss

Wetland loss was analyzed for the entire BSA 1. 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 1.6 million acres of wetland in BSA 1 prior to European settlement. Compared to the current extent of wetlands (1.2 million acres), there has been a 23% loss. The greatest loss has occurred in the Cloquet River watershed with 28% of the wetlands lost. The Nemadji River watershed has experienced the least amount of wetland loss with only 17%. Table 4-1 summarizes the total wetland loss for BSA 1 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 1 they found approximately 824,000 acres of pre-settlement wetlands. Compared to the extent of wetlands at the time of publishing in 1984 (777,000 acres), there was a 6% 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 1 from Anderson & Craig (1984) is 6% and the percent lost based on hydric soils and the current NWI is 23%. The most likely reasons for this major difference are mapping methodologies and the level of accuracy of each method, but it could also be due to land use changes and urbanization across the BSA.

Table 4-1. Wetland Loss Based on Hydric Soils and NWI				
Major Watershed	**Pre-settlement Acres**	**Current Acres***	**Wetland Loss (acres)**	**Percent Lost**
Cloquet River	211,586	153,231	58,355	28%
Lake Superior – North	230,011	187,273	42,738	19%
Lake Superior – South	97,725	74,718	23,007	24%
Nemadji River	57,146	47,273	9,873	17%
St. Louis River	992,627	759,026	233,602	24%
BSA 1 Total	**1,589,096**	**1,221,521**	**367,575**	**23%**
*Based on the NWI, includes only Palustrine class wetlands				

Table 4-2. Wetland Loss Based on Anderson & Craig (1984)			
Major Watershed	**Pre-settlement Acres**	**Acres as of 1984**	**Percent Lost**
Cloquet River	126,916	119,707	6%
Lake Superior – North	60,708	60,037	1%
Lake Superior – South	74,660	71,427	4%
Nemadji River	45,351	42,173	7%
St. Louis River	515,911	483,883	6%
BSA 1 Total	**823,546**	**777,226**	**6%**
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 1, an analysis of wetland banking activity and the current credit inventory in the private market and LGRWRP accounts was completed. Banking activity was evaluated by compiling annual credit withdrawals for wetland banks located in BSA 1. The analysis utilized annual reports obtained from the State of Minnesota wetland banking database from 2018 through 2022. Credit inventory in the private market in BSA 1 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 2018 through 2022. The withdrawal numbers include transactions for MnDOT, LGRWRP, and standard accounts. Transactions associated with the agricultural wetland bank are extremely rare in this part of the state and are not included in the table. As shown, BSA 1 is the second most active BSA in Minnesota generating an average

annual credit demand of 129 credits during the period of analysis which is 19% of the credits withdrawn on average each year. It is important to note that BSA 1 is also the most variable with respect to credit demand. This is attributable to natural resource extraction (mining) and energy projects that consume large amounts of credits on a periodic basis. This explains the dramatic increase in withdrawals in calendar years 2020 through 2022 relative to the preceding two years.

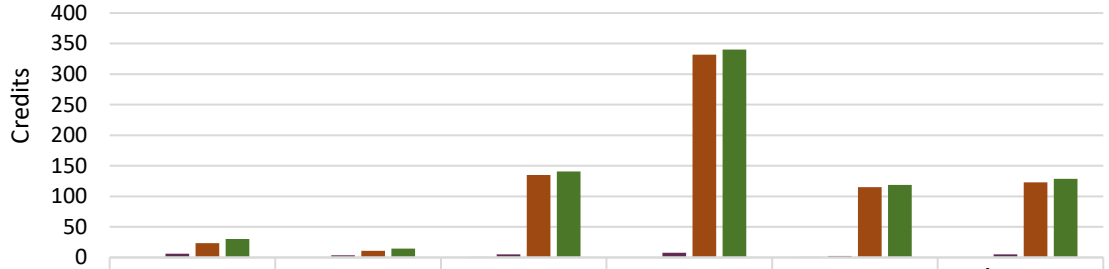
Withdrawal data for BSA 1 was further analyzed to determine the individual type contributions (MnDOT, LGRWRP, and standard) for each year. The results of this analysis are summarized in Figure 4-1. Not surprisingly, transactions from standard bank accounts represent most of the credit withdrawal activity in this BSA followed by the LGRWRP and then MnDOT. On an average annual basis, they represent 95%, 4%, and 1% respectively of the total number of credits withdrawn during the past five years. As mentioned previously, credit withdrawals associated with mining and energy infrastructure projects was responsible for a significant amount (approximately 91%) of the credit demand between 2019 and 2020.

Table 4-3. Wetland Credits Withdrawn by Bank Service Areas 2018-2022[1]

BSA	2018	2019	2020	2021	2022	Total	Average
1	30	15	141	340	119	**645**	129
2	8	18	31	25	10	**91**	18
3	18	38	81	94	88	**319**	64
4	10	24	53	106	17	**210**	42
5	22	52	199	136	127	**536**	107
6	24	38	23	26	4	**115**	23
7	120	121	122	155	142	**660**	132
8	26	52	44	82	27	**232**	46
9	66	57	66	135	88	**411**	82
10	0.5	7	5	0.2	23	**36**	7
Total	**325**	**421**	**765**	**1099**	**645**	**3255**	651

[1] Excludes withdrawals from agricultural wetland bank accounts

Figure 4-1
BSA 1 Wetland Credit Withdrawals by Account Type 2018-2022



	2018	2019	2020	2021	2022	Average Annual
MnDOT	0.57	0.2553	1.066	0.34	1.11	0.6683
Road Program	6.235	3.634	4.933	7.9718	2.605	5.0758
Standard	23.6213	10.7723	134.9061	331.6892	115.0218	123.2021
Total	30.4263	14.6616	140.9051	340.0010	118.7368	128.9462

CURRENT STATUS

Standard wetland bank ledger information in BSA 1 was compiled and reviewed to provide a snapshot of the number of credits currently available. This analysis focused on credits that were deposited into Minnesota wetland banks as of December 2023 and 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 total number of federally approved credits listed for public sale in BSA 1 is 703.1538 credits spread amongst six banks with the majority associated with Ecosystem Investment Partners Lake Superior Bank. The number of state-only approved credits in the BSA is 24.5017 from five different banks. It is unknown what amount of this credit inventory is under contract and thus not available to future permittees to satisfy mitigation requirements. Regardless, it is reasonable to conclude that BSA 1 has a substantial supply of publicly available wetland credits with at least a 4-year supply based on the average annual demand for standard credits calculated in Table 4-3.

MnDOT and LGRWRP credit balances in this BSA are sufficient to meet expected demand for at least the next five years. MnDOT presently has a balance of 19.9547 credits across three accounts that will meet their program demand for at least the next ten years based on the five-year annual average calculated for this analysis. The LGRWRP has an approximate five-year supply of credits with a total available balance of 27.1180 credits. Neither of these programs has an active bank in this service area nor any proposed projects in the agency review process. Therefore, these balances are expected to slowly decrease over the next five years with no additional deposit of credits unless they are purchased from existing banks, an approach BWSR has been utilizing for the past eight years in this BSA.

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. No area within BSA 1 falls in the study region for the DWQA, as it focuses on depressional wetlands in southern Minnesota. 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). BSA 1 has exceptional quality wetlands with low pressure from stressors. Most stressors are localized and cause minimal impacts.

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 1 has largely stayed the same since the first baseline assessment in 2011. There was a decrease in exceptional and good condition wetlands and an increase in fair and poor/absent condition wetlands, but it was not a statistically significant difference.

In summary, the vegetation quality of wetlands in Minnesota is high. The northern region tends to have higher quality wetlands and low pressure from stressors. These stressors are both from human intervention and non-native invasive species but are localized with minimal widespread impacts. 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 1 reflects the regional trends in both wetland quality and extent, with a lot of high-quality wetlands across the region.

Description of Threats

Wetlands across Minnesota are under threat from many different stressors. In BSA 1, wetlands are threatened specifically by land use change, pollution, and invasive species. These threats are based on the conditions established in the Baseline Conditions section as well as conversations with stakeholders. Although BSA 1 wetlands are high quality and the threats localized, it is important to recognize current and future threats, as well as the impact threats have on prioritizing areas for wetland restoration and protection.

LAND USE CHANGE

BSA 1 has experienced changes in land use with an increase in development in the city centers. According to the NLCD from 2001 to 2016, 40% of the catchments in BSA 1 experienced an increase in development. The average increase in development was 37 acres. Most of the development was centered around the major cities along the North Shore and the Iron Range.

Changes in land use and loss of wetland areas can have economic impacts and impact the ecosystems for wildlife that rely on these wetland habitats. Loss of habitat results in less biodiversity as species can struggle to survive when relying on food and shelter in a wetland. These changes are impactful to wetlands and surrounding areas by depleting areas of water storage, which can cause flooding events, and changing landscapes due to erosion and sediment transport. Loss of wetlands can also have societal and ecological impacts as wetlands have recreational value.

THREAT OF POLLUTION

Overall, BSA 1 has very high-quality wetlands, lakes, and river, with minimal impairments and loss compared to the rest of Minnesota. The threat of pollution is a combination of the expanding industrial and urbanized areas and the unique geology of the area. According to the NLCD, 17% of BSA 1 is agriculture and 4% is developed. The U.S. Census showed that between 2000 and 2010, BSA 1 had an 8% increase in population, with the largest increase in the Lake Superior - South watershed. The population is expanding which also means there will be an increase in urban development as cities and towns grow. There is also a unique threat to the BSA and increasing pollution from expanding industry. Industry, 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 1 to pollution. Bedrock covers the majority of the Lake Superior - North and Lake Superior – South watersheds. Bedrock in this area tends to fracture and these fractures act like large pipes, allowing deep penetration of pollutants from the surface into bedrock aquifers. In addition, the unique geology, the access to minable ores, and relatively low development makes this BSA a focus for industry. With more large scale projects expected in the future, the threat of pollution only grows.

INVASIVE SPECIES

Invasive species are a serious problem for the future of our wetlands and can cause economic and ecological harm. Invasive species like Purple Loosestrife (*Lythrum salicaria*), and Emerald Ash Borer (*Agrilus planipennis*) put native species in Minnesota, and specifically in BSA 1, at risk. Invasive species can crowd out native plants and limit sunlight, they can hinder water flow, and reduce wildlife habitat. The impact that invasive species can have on wetlands in BSA 1 includes changes in hydrology from dense root systems, lowered biological diversity due to outcompeting invasive species, and loss of native canopy cover from invasive pests. The Emerald Ash Borer in particular, targets black ash which is an essential dominant tree species in Black Ash Swamps. These swamps are essential for timber, habitat biodiversity, carbon storage, and cultural resources. There currently are no tree species that could replace Black Ash should they be drastically impacted by Emerald Ash Borer

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 February 2023, 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 1. Stakeholders invited to participate included: Soil and Water Conservation Districts, Counties, Cities, Tribal, BWSR, MnDNR, MPCA, EPA, and USACE. Those that attended included individuals from Soil and Water Conservation Districts, Counties, BWSR, and the MnDNR. Following the presentation on baseline conditions, stakeholders were asked to identify additional baseline condition categories that could be considered for the CPF. Suggestions included peatlands, nearly/barely impaired waterbodies as identified based on MPCA's

analysis, wetlands near trout habitat, groundwater quality and quantity, drinking water sources, and WRAPS priority streams. Based on feedback gathered at the first meeting, baseline condition categories were added for peatlands and organic soils, nearly/barely waterbodies, high quality water resources which are waterbodies that support ecologically significant fish and plant species including cisco, trout, and wild rice, and landownership. A list of attendees and the material presented is provided in Appendix C-1.

The second stakeholder meeting took place in June 2023. A review of the updated baseline conditions, cumulative impact analysis, and draft prioritization criteria was presented to stakeholders to solicit feedback. This included a draft list of the prioritization criteria and a preliminary map of prioritized catchments based on the criteria. The invite list was the same as the first stakeholder meeting. Those that attended included individuals from SWCDs, City of Duluth, MnDNR, and BWSR. The discussion focused on concerns around upland areas that have lost wetlands and their water storage benefits due to development, which is a top priority to combat flooding issues that have occurred in recent years. Stakeholders also recommended reviewing completed One Watershed One Plans, or Comprehensive Watershed Management Plans, for additional preservation criteria to consider. A list of the attendees and the material presented is provided in Appendix C-2.

The third and final stakeholder meeting took place in October 2023. The purpose of the meeting was to present the prioritization process and final results including weighting values that were developed using stakeholder survey feedback. 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 the same to the previous two meetings. Those that attended included individuals from Counties, SWCDs, MnDNR, and BWSR. 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 1 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 1 is made up of 712 catchments distributed across the five major watersheds as follows: Cloquet River has 92 catchments, Lake Superior – North has 242 catchments, Lake Superior – South has 66 catchments, Nemadji River has 31 catchments, and St. Louis River has 281 catchments (Figure 7-1).

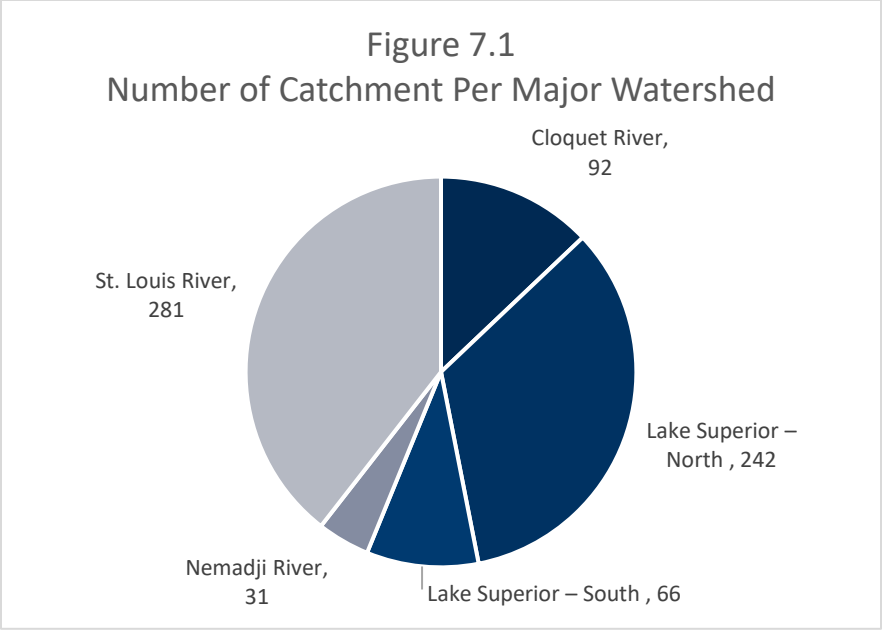


Figure 7-1. Chart showing the number of catchments within each major watershed.

In previous CPF Reports, prioritization of catchments focused solely on wetland restoration. This CPF is unique because of the inclusion of preservation in the prioritization process. In BSA 1, 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 may be 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. Some differences in the analysis between restoration and preservation included more criteria for preservation and differences in the stakeholder ranking (especially for Local Plans criterion). This is reflective of the important and intact habitats that are unique to BSA 1 and the local priorities. 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. There was a concerted effort to not duplicate criteria between restoration and preservation. This is due to the difference in nature and priorities between the two.

RESTORATION CRITERIA

A total of eight different criteria were selected for restoration prioritization. They include *Altered Streams, Drained Wetlands, Ground Water Pollution, Lake and River Impairments, Lake Phosphorus Sensitivity (LPSS), Local Plans, Wetland Loss, and WRAPS Stream Priorities*. 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.
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.
Lakes of Phosphorus Sensitivity Significance (LPSS)	Lakes of Phosphorus Sensitivity Significance (LPSS) presents a ranked list of priority lakes based on sensitivity to additional phosphorus loading. Catchments with more area of LPSS lakes 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.
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.
WRAPS Stream Protection Priorities	Streams that currently support biological communities are a priority for protection. Catchments with more stream miles of priority protection streams will be prioritized for wetland restorations to protect streams from potential of future degradation.

PRESERVATION CRITERIA

A total of 11 criteria were included in the prioritization of catchments for wetland preservation. The criteria include *Areas of Biodiversity Significance, Current Protection, Development Pressure, Lakes of Biological Significance, Local Plans, Scientific Natural Areas, Trout Streams and Lakes, White Cedar Forest, and Wild Rice Waters.* The specific criterion and description of data used can be found in Table 7-2. The criteria chosen for this study generally aligns with the guidance information provided by USACE and BWSR within the document:

Guidance on Evaluating Potential Wetland Preservation Sites for Eligibility to Provide Compensatory Mitigation/Replacement in Minnesota (USACE & BWSR, 2017).

Table 7-2. Preservation Criteria and Description of Data

Criterion	Description
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.
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.
Lakes of Biological Significance	Lakes of biological significance (LBS) as mapped by the Minnesota Department of Natural Resources. Lakes are assigned a rating of Moderate, High, and Outstanding based on aquatic plant, fish, bird, and amphibian communities. Catchments with large areas of LBS lakes categorized as Outstanding and High 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.
Scientific and Natural Area	Sites meeting the criteria to qualify as a Scientific and Natural Area (SNA), as determined by the DNR, can be rare and important to maintaining biological diversity. Catchments with more SNA area were prioritized.
Trout Streams and Lakes	Wetlands directly adjacent to or at the headwaters of a designated trout stream can provide a source of hydrology, shade, temperature moderation, and other functions necessary for trout survival. Such wetlands are extremely valuable to the trout stream and its watershed. Catchments with more trout stream miles and lake acreage 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.

Table 7-2. Preservation Criteria and Description of Data	
Criterion	**Description**
Wild Rice Waters	Wild Rice waters are both ecologically and culturally significant making preservation of adjacent areas a priority. Catchments with more Wild Rice waters were prioritized.

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 1. 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.

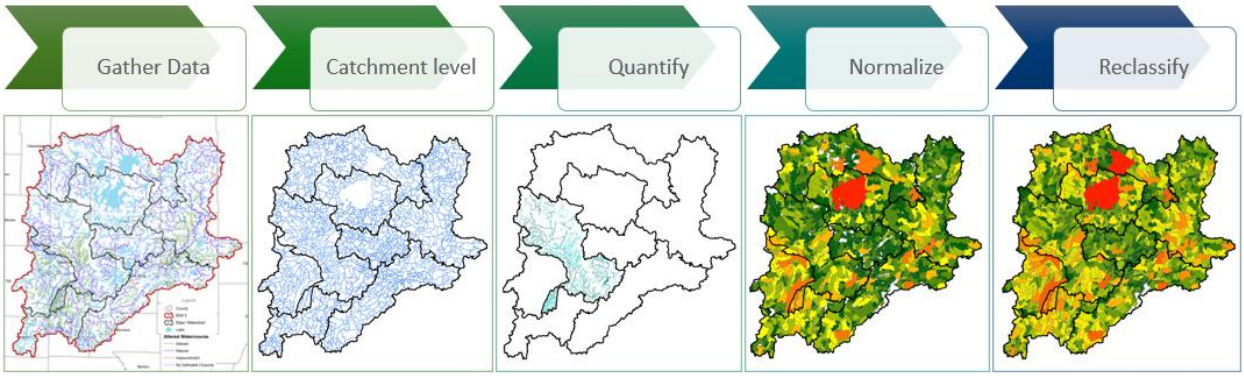


Figure 7-2. Data transformation process.

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 the criterion descriptions within 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 nine 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	Local Plans	0.2222
2	Wetland Loss	0.1944
3	Ground Water Pollution	0.1667
4	Drained Wetlands	0.1389
5	Impairments	0.1111
6	Altered Streams	0.0833
7	WRAPS	0.0556
8	LPSS	0.0278

Table 7-4. Preservation Ranks Assigned by Stakeholders and Resulting Weights

Rank	Criterion	Weight
1	Areas of Biological Significance	0.2
2	Trout Streams and Lakes	0.1778
3	Current Protection	0.1556
4	Local Plans	0.1333
5	Development Pressure	0.1111
6	White Cedar Forest	0.0889
7	Lakes of Biological Significance	0.0667
8	SNA	0.0444
9	Wild Rice Waters	0.0222

Designation of Priority Catchments

The analyses completed to this point separated catchments within each major 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 prioritized catchments 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. To this purpose, catchments that fell within the top third of the prioritization scores were run through an opportunity filter, to be described later, and considered prioritized. It should be noted that the top third was determined by the number of catchments, not the area.

In addition to establishing a breakpoint, the prioritized catchments were run through several opportunity filters to preemptively remove catchments that have little to no opportunity for project establishment. These filters considered landownership, areas currently being mined, and wetland loss. The breakpoint or threshold for these filters was determined for the entire BSA by evaluating the data and applying professional judgement. For the landownership filter, catchments with 96% or more of land that was Federally owned (where conservation easements cannot by conveyed to the State) were removed from prioritization. Similarly for mining, catchments with 70% or more of their area within active mines were removed from prioritization. For wetland loss, any catchment with zero acres of loss were removed. Any catchments that were prioritized and then removed due to the filters, were replaced with a catchment with the next highest prioritization score. This was done so that the total number of catchments within the top third remained the same for each watershed.

For BSA 1, all catchments with prioritization scores in the top third of the score distribution within each major watershed that also passed all three opportunity filters were identified as a high priority area. Using this method, a total of 362 catchments were prioritized, 114 catchments were identified as high priority areas for both restoration and preservation, 125 catchments were prioritized for preservation only, and 123 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 1,644,919 acres of BSA 1 were prioritized. The major watershed with the largest area prioritized was St. Louis River with 784,464 acres. The major watershed with the least prioritized area was Nemadji River, with 97,792 acres. Maps for individual watersheds showing the prioritized catchments for restoration can be seen in Figures D-8 through D-12. Table 7-6 lists the acres prioritized for each watershed as well as the percent of the total BSA area for both preservation and restoration.

For preservation, a total of 2,145,462 acres of BSA 1 were categorized as high priority. The major watershed with the largest area prioritized was St. Louis River, with 943,190 acres. The major watershed with the least area prioritized was Nemadji River, with 99,651 acres. Maps showing the prioritized catchments for preservation for each individual watershed can be seen in Figures D-13 through D-17.

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

Major Watershed	Preservation Only	Restoration Only	Both	Total
Cloquet River	16	16	15	**47**
Lake Superior – North	36	36	45	**117**
Lake Superior – South	14	14	8	**36**
Nemadji River	5	4	6	**15**
St. Louis River	54	53	40	**147**
BSA 1 Total	**125**	**123**	**114**	**362**

Table 7-6. Area of Prioritized Catchments Per Watershed

Major Watershed	Preservation		Restoration	
	Acres	Percent of BSA Area	Acres	Percent of BSA Area
Cloquet River	303,372	8%	201,105	5%
Lake Superior – North	608,874	15%	439,024	11%
Lake Superior – South	190,375	5%	122,533	3%
Nemadji River	99,651	3%	97,792	2%
St. Louis River	943,190	24%	784,464	20%
BSA 1 Total	**2,145,462**	**55%**	**1,644,919**	**42%**

8. CONCLUSION

This CPF report established baseline conditions, analyzed wetland trends and threats, gathered stakeholder input, and prioritized catchments for wetland restoration and preservation within BSA 1. The prioritized catchments have high public value and identify areas where wetland restoration or preservation efforts are expected to provide the greatest benefit to watershed health. The primary use of the CPF is determining the preferred location of future compensatory wetland mitigation sites for the ILF program. In addition, due to the BSA specific data and local input used in prioritization, the CPF can be helpful in guiding the location of private (standard) bank establishment. The CPF can also be used for establishing or updating other watershed based planning documents or selecting non-regulatory restoration projects. Data used within this CPF will be periodically updated and can be requested from BWSR.

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Appendix A: Acronyms

Acronym	Full Name
1W1P	One Watershed One Plan
BMP	Best Management Practice
BSA	Bank Service Area
BWCA	Boundary Waters Canoe Area Wilderness
BWSR	Minnesota Board of Water and Soil Resources
CPF	Compensation Planning Framework
DMU	Data Map Unit
DO	Dissolved Oxygen
DWQA	Depressional Wetland Quality Assessment
EPA	Environmental Pollution Agency
GIS	Global Information Systems
HGM	Hydrogeomorphic wetland classification system
HUC	Hydrologic Unit Code
ID	Identifier
ILF	In-Lieu Fee Program
LBS	Lakes of Biological Significance
LGRWRP	Local Government Road Wetland Replacement Program
LiDAR	Light Detection and Ranging- remote sensing method for measuring elevations
LPSS	Lakes of Phosphorus Sensitivity Significance
MBS	Minnesota Biological Survey
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
NWI	National Wetlands Inventory- specifically for Minnesota
SNA	Scientific Natural Area
SWCD	Soil Water Conservation District
TSS	Total Suspended Solids
USACE	United State Army Corps of Engineers
USDA	Unites States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
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

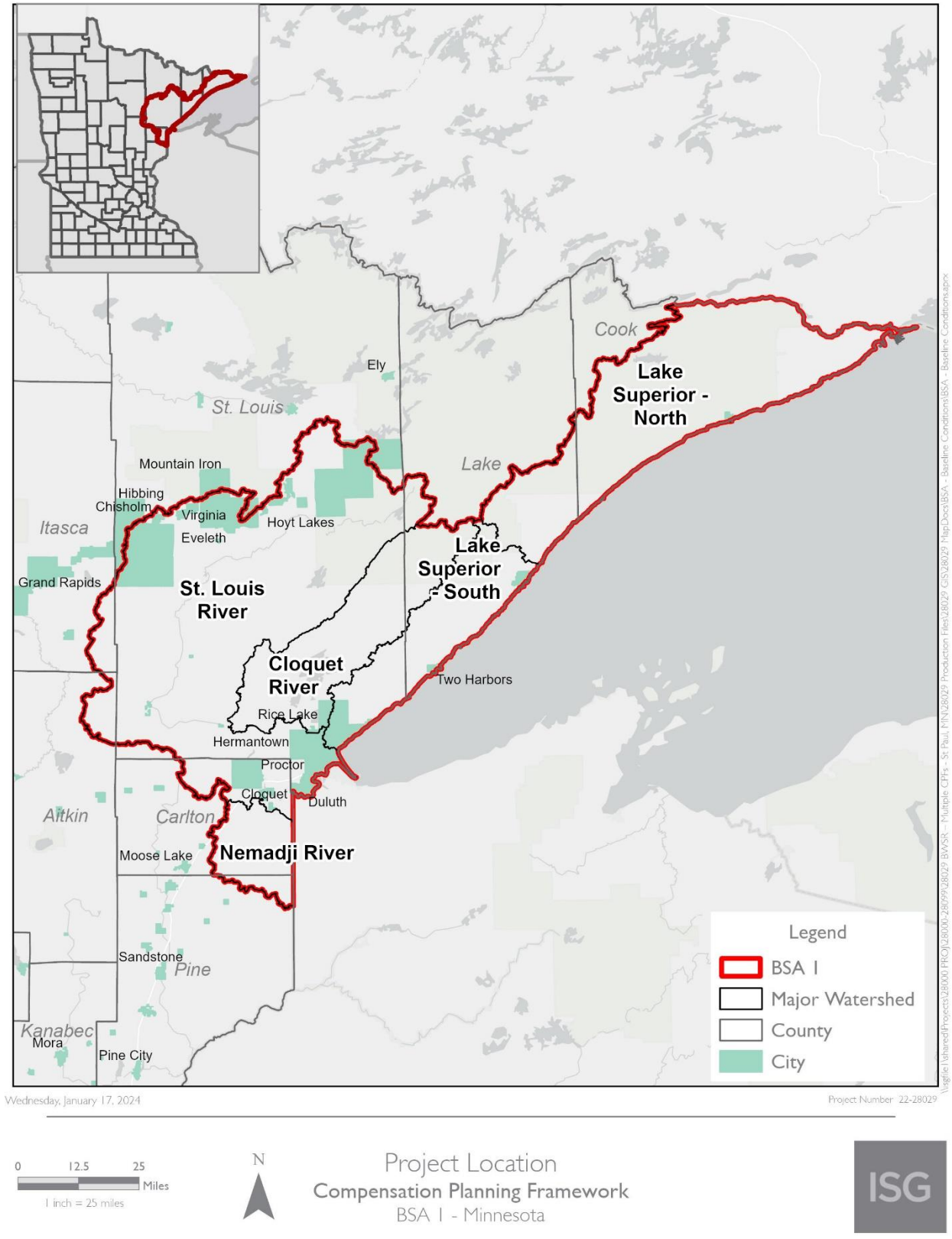


Figure B-2. Ecological Classification

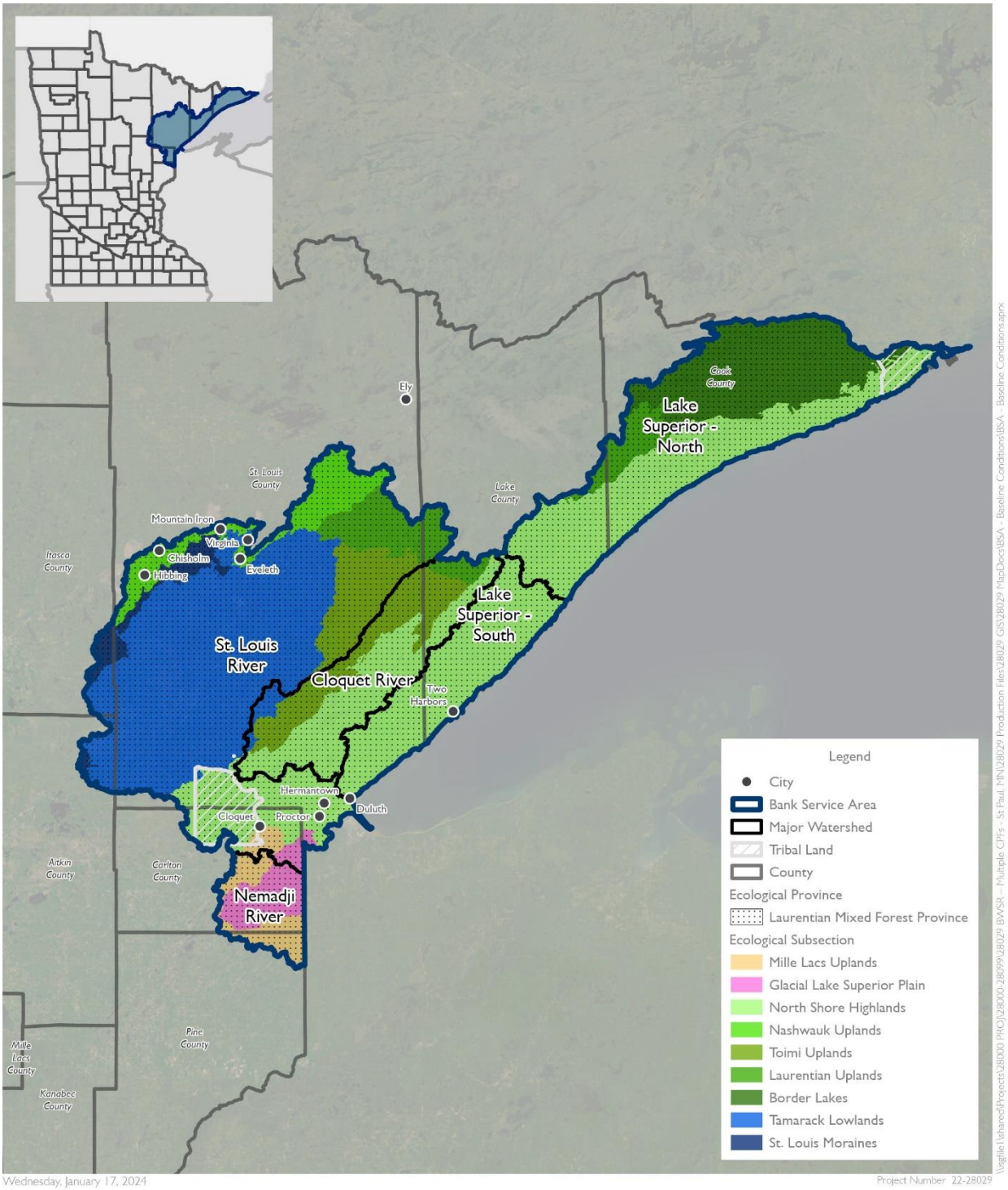


Figure B-3. Pre-settlement Vegetation

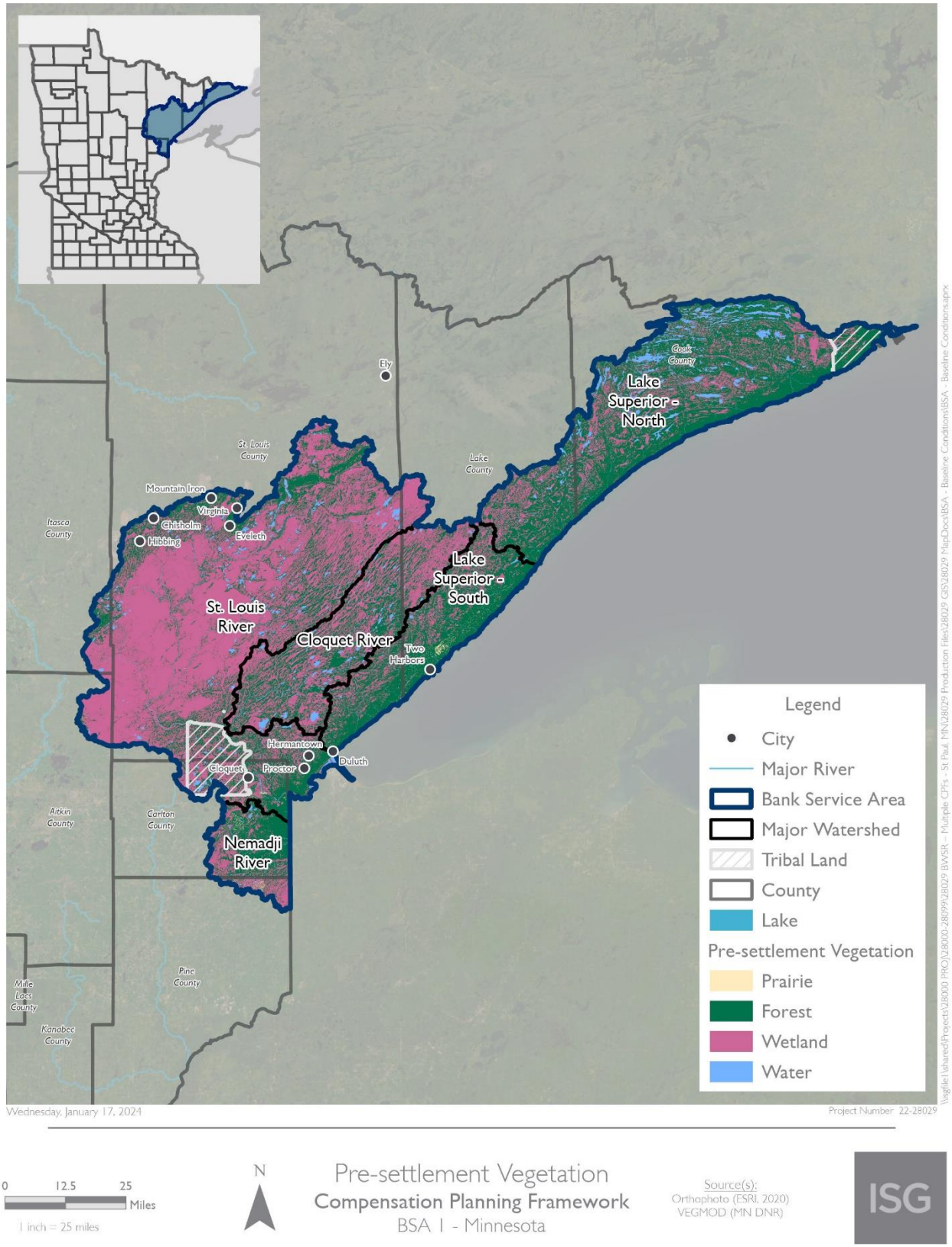


Figure B-4. Wetlands

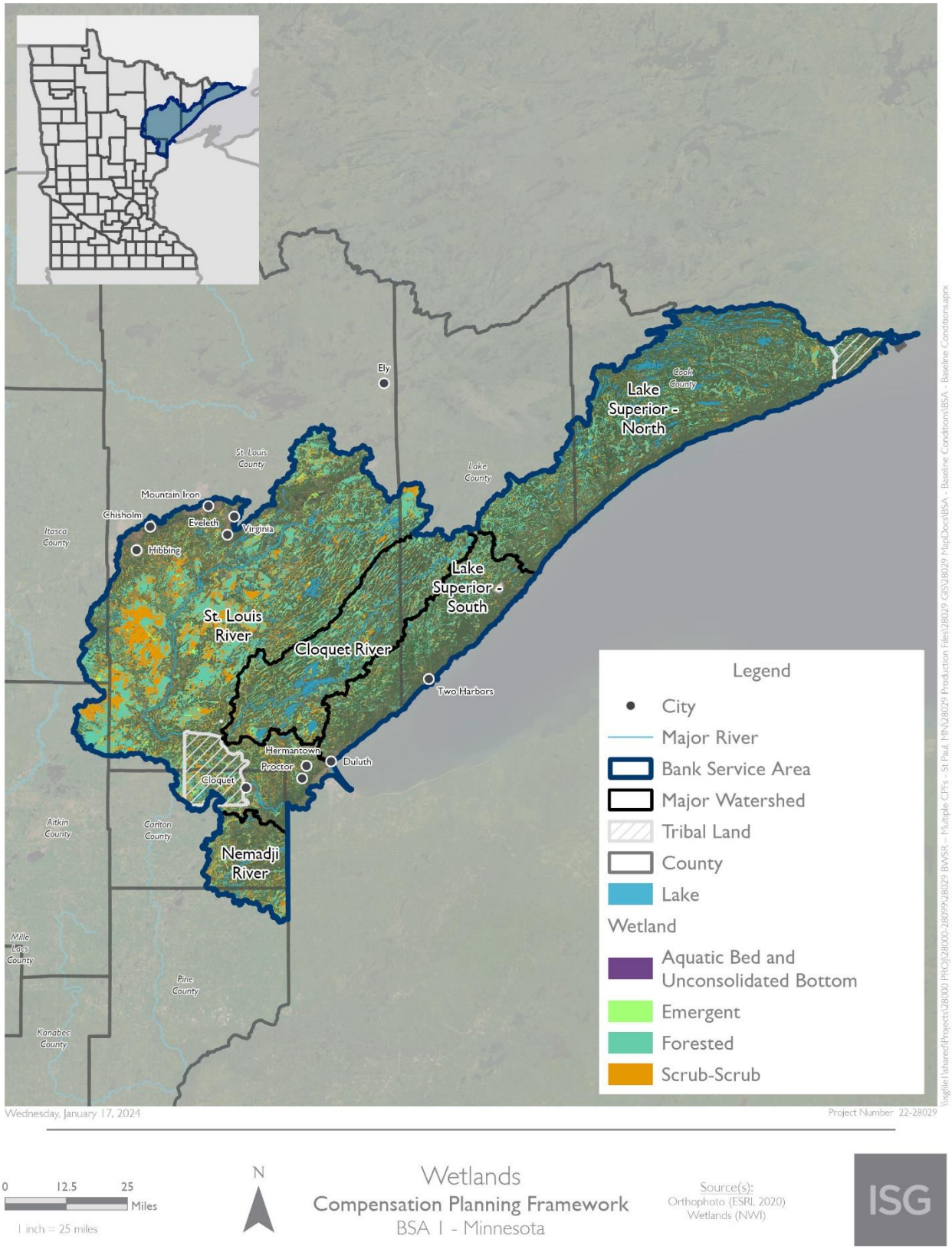


Figure B-5. Organic Soils

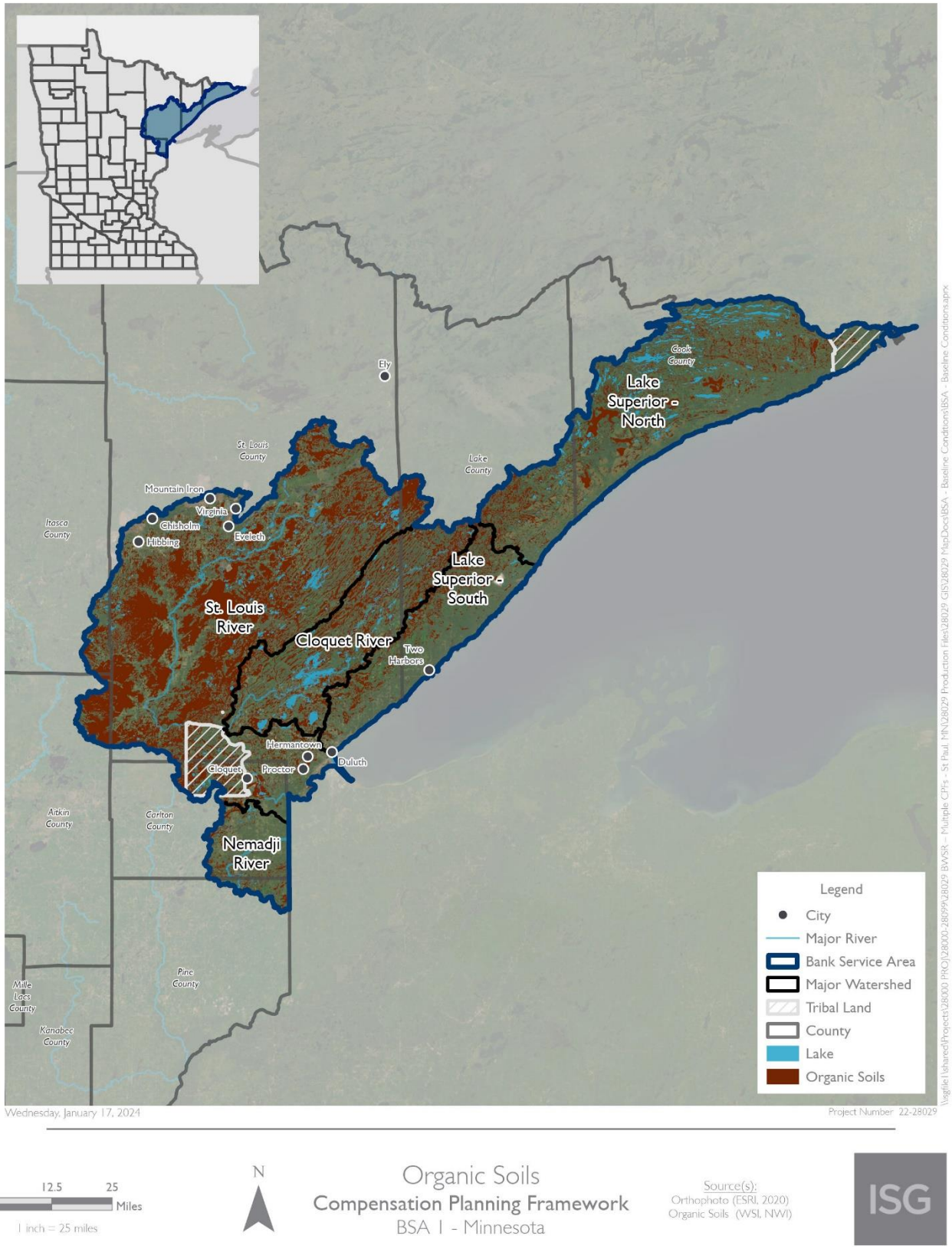


Figure B-6. Lakes

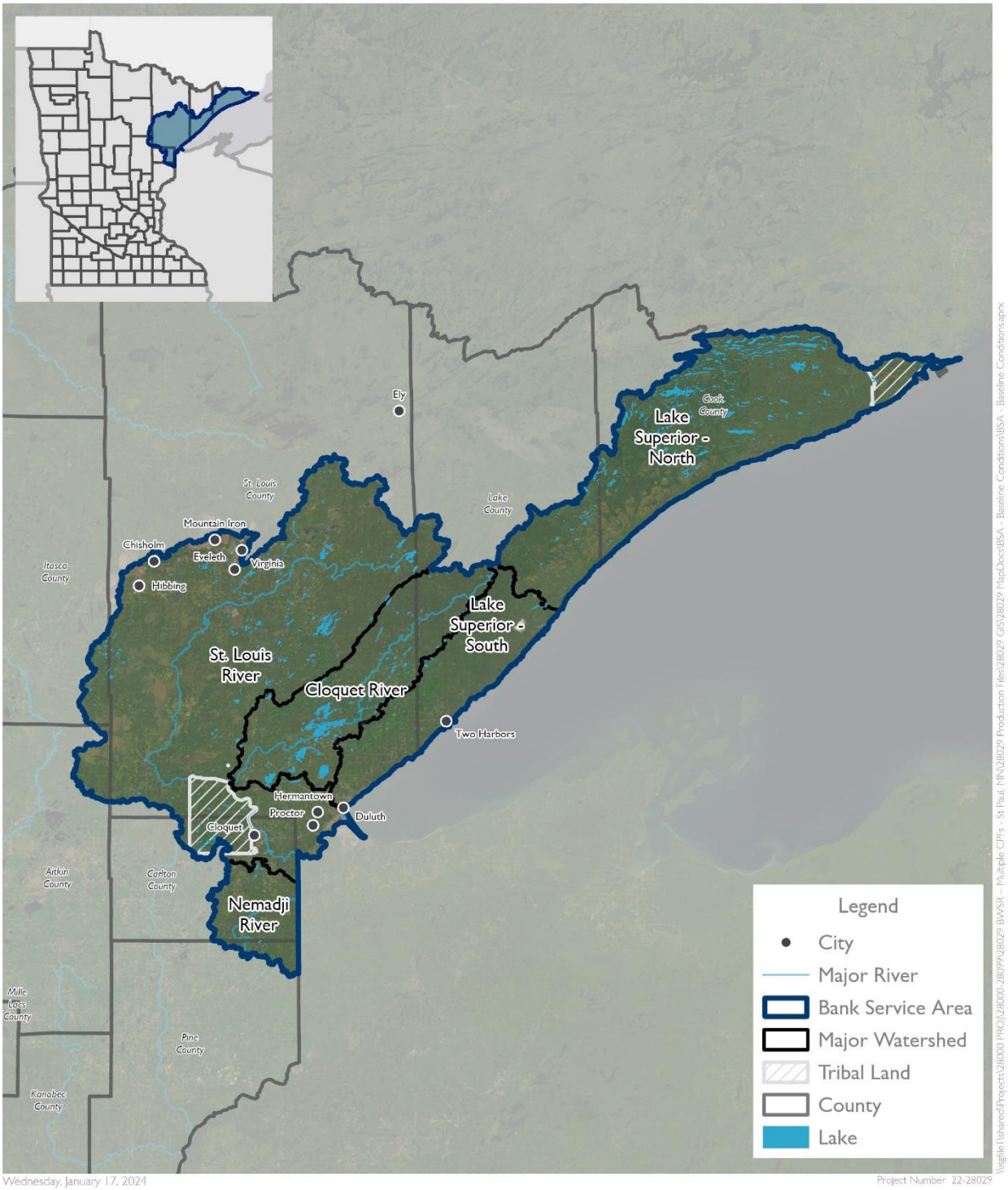


Figure B-7. Watercourses

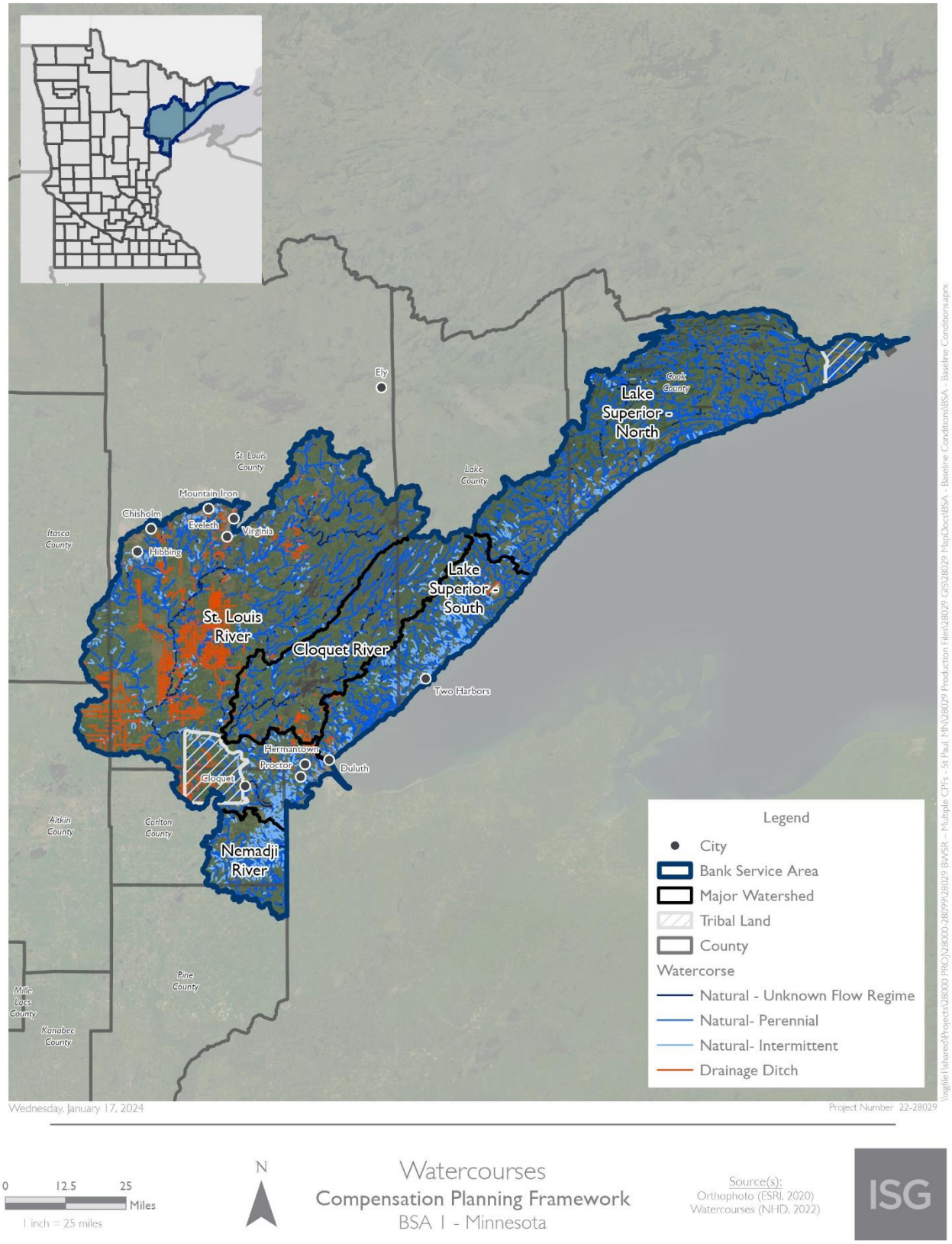
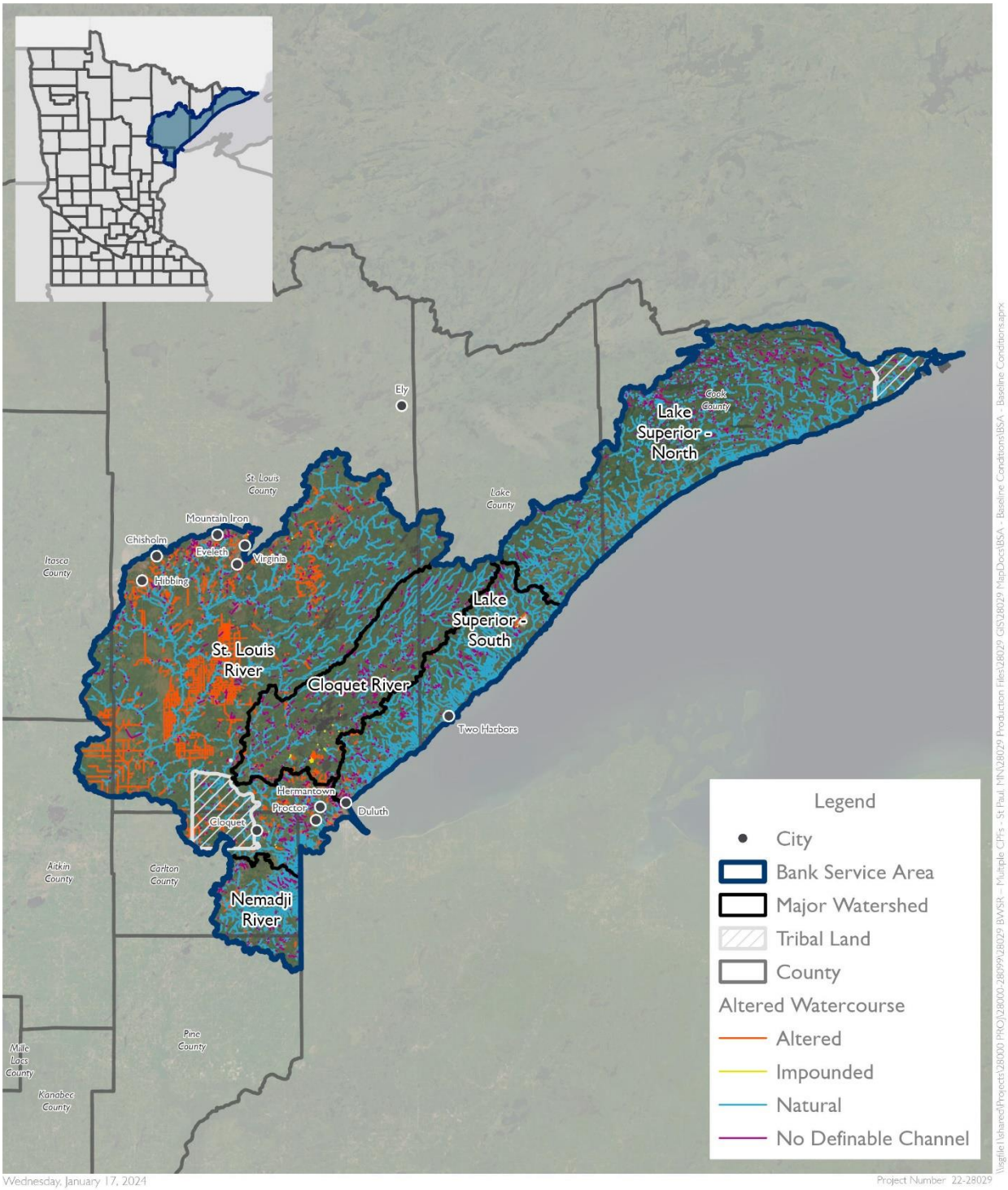


Figure B-8. Altered Watercourses



0 12.5 25 Miles
1 inch = 25 miles

N

Altered Watercourses
Compensation Planning Framework
BSA 1 - Minnesota

Source(s):
Orthophoto (ESRI, 2020)
Altered Watercourses (MPCA, 2019)

ISG

Figure B-9. Water Quality- Lakes

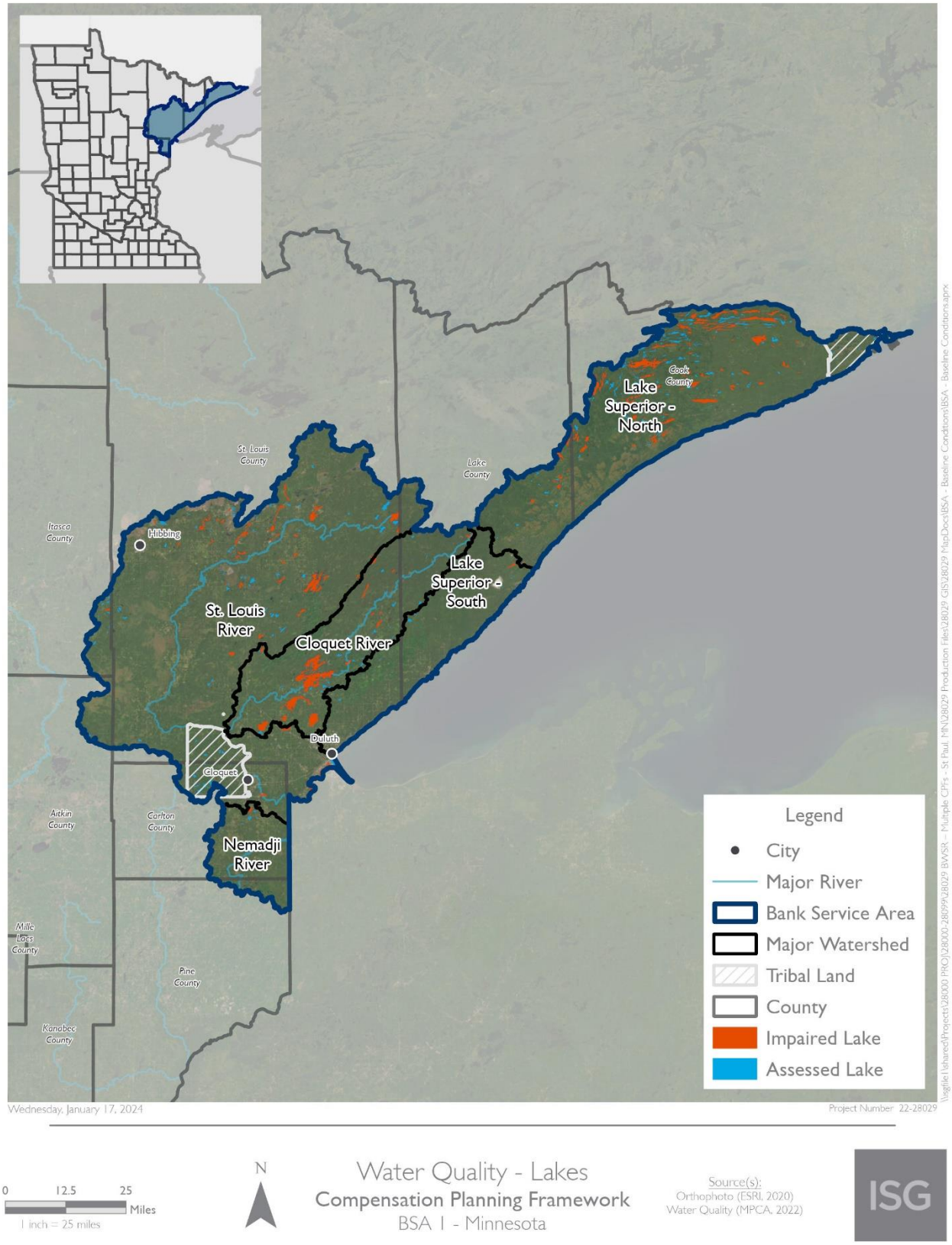


Figure B-10. Water Quality- Streams

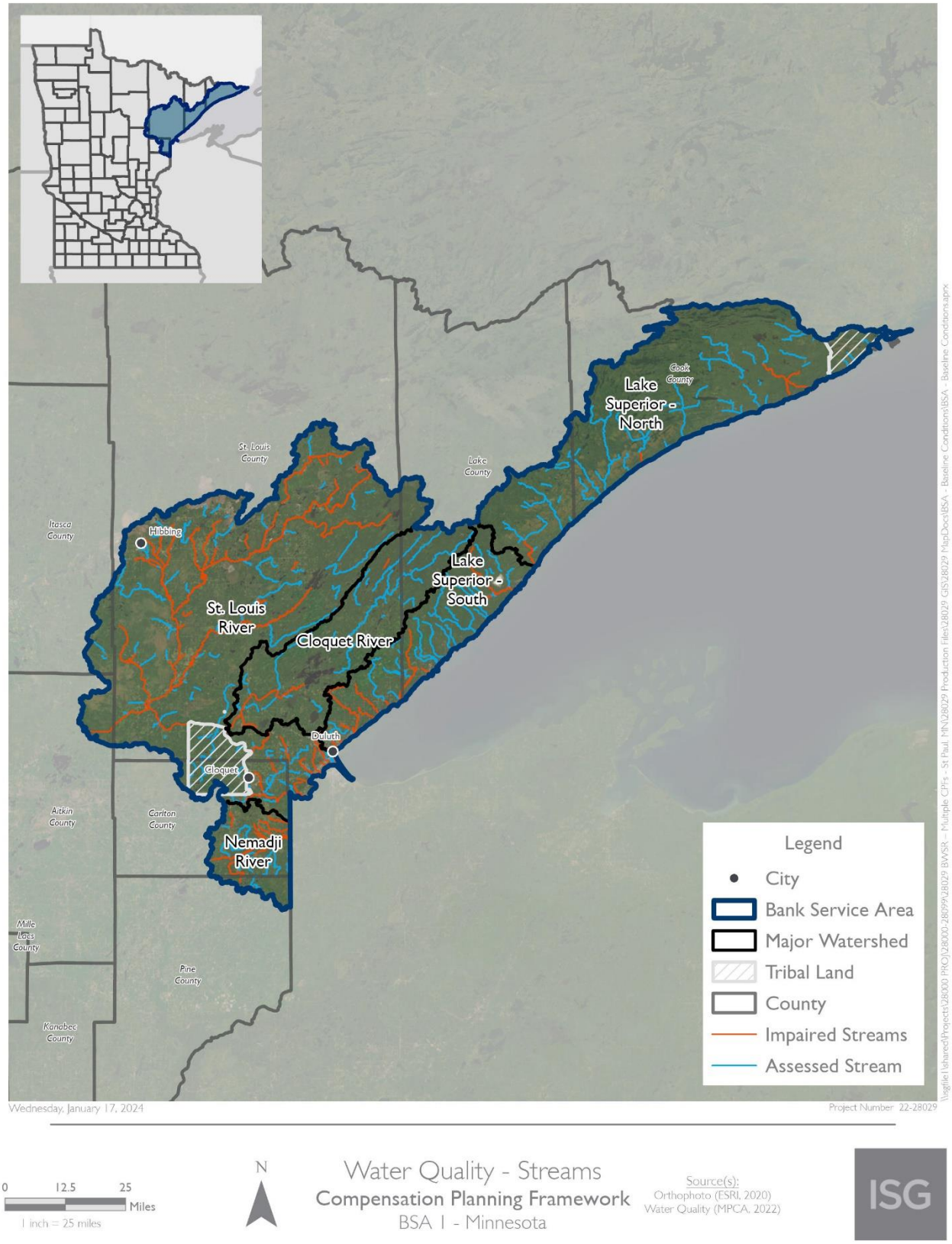


Figure B-11. Land Cover

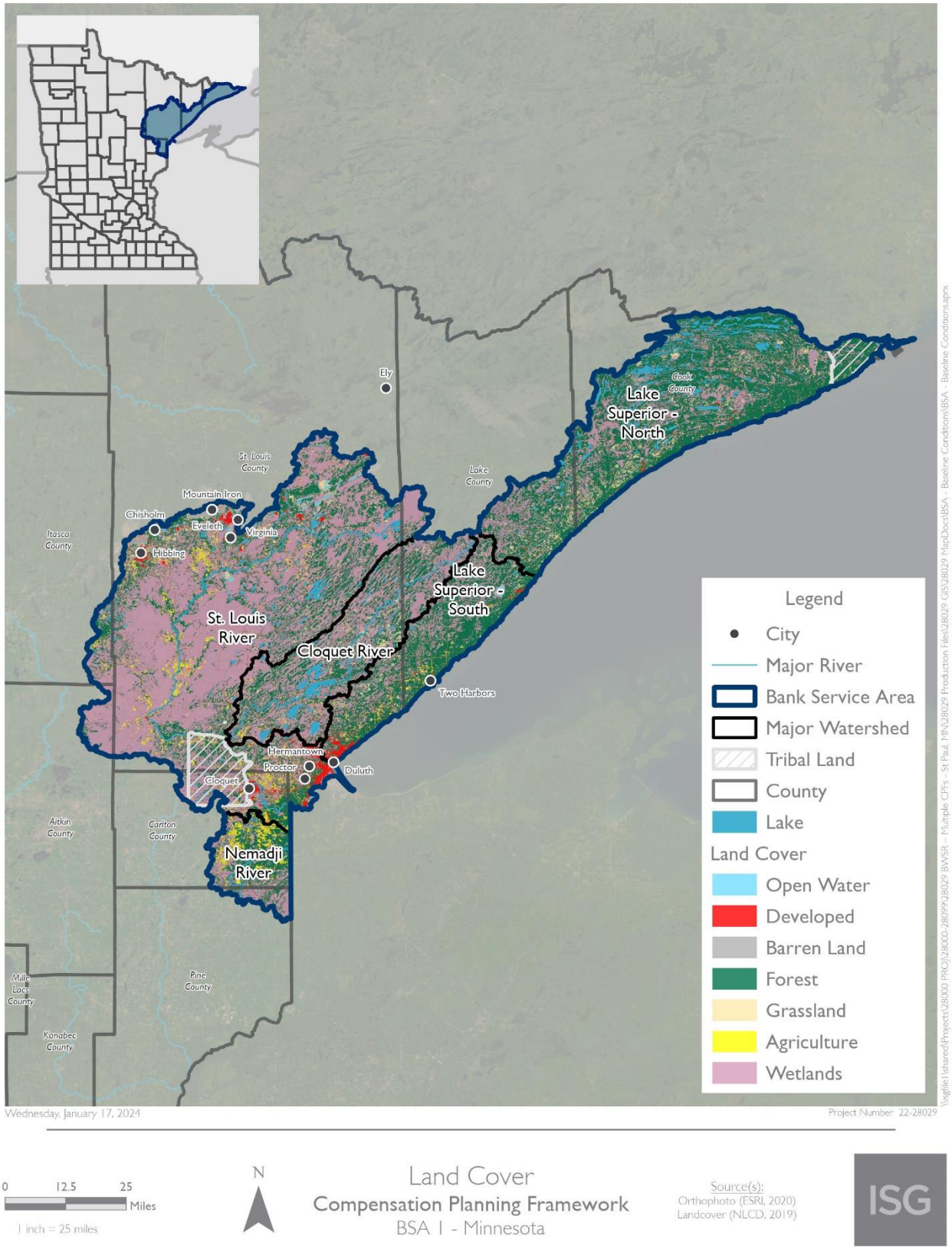


Figure B-12. Perennial Land Cover

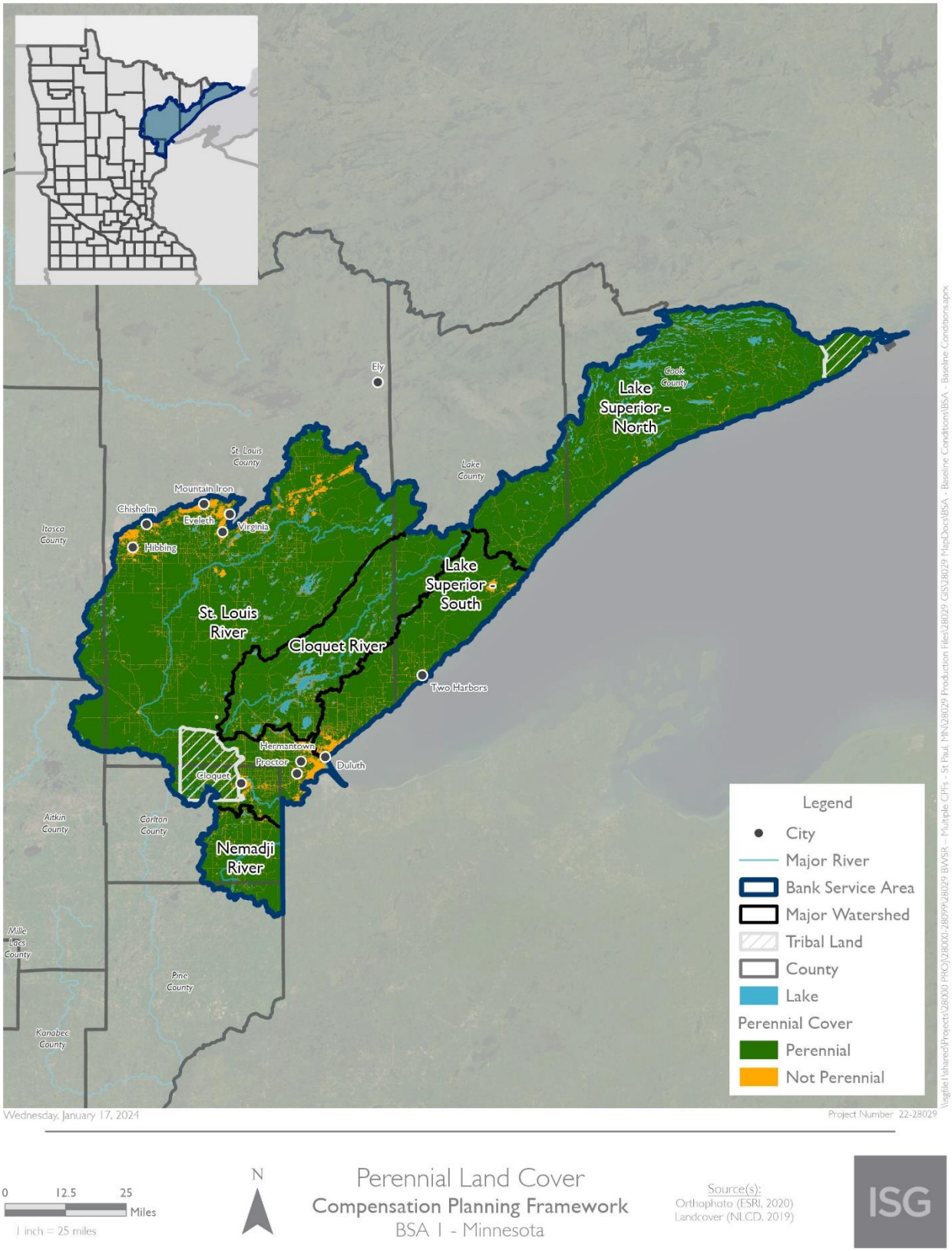


Figure B-13. Areas of Biodiversity Significance

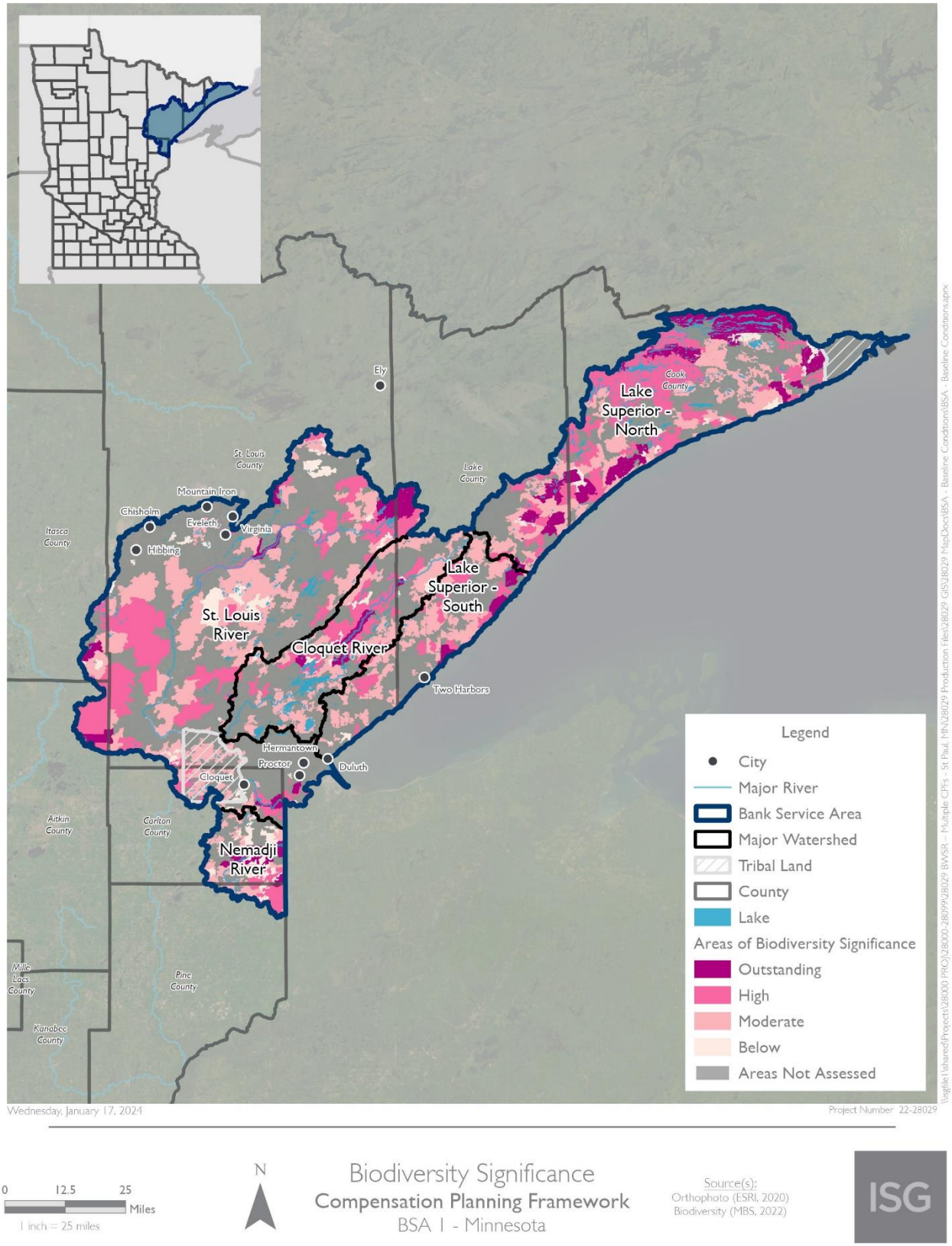


Figure B-14. High Quality Water Resources

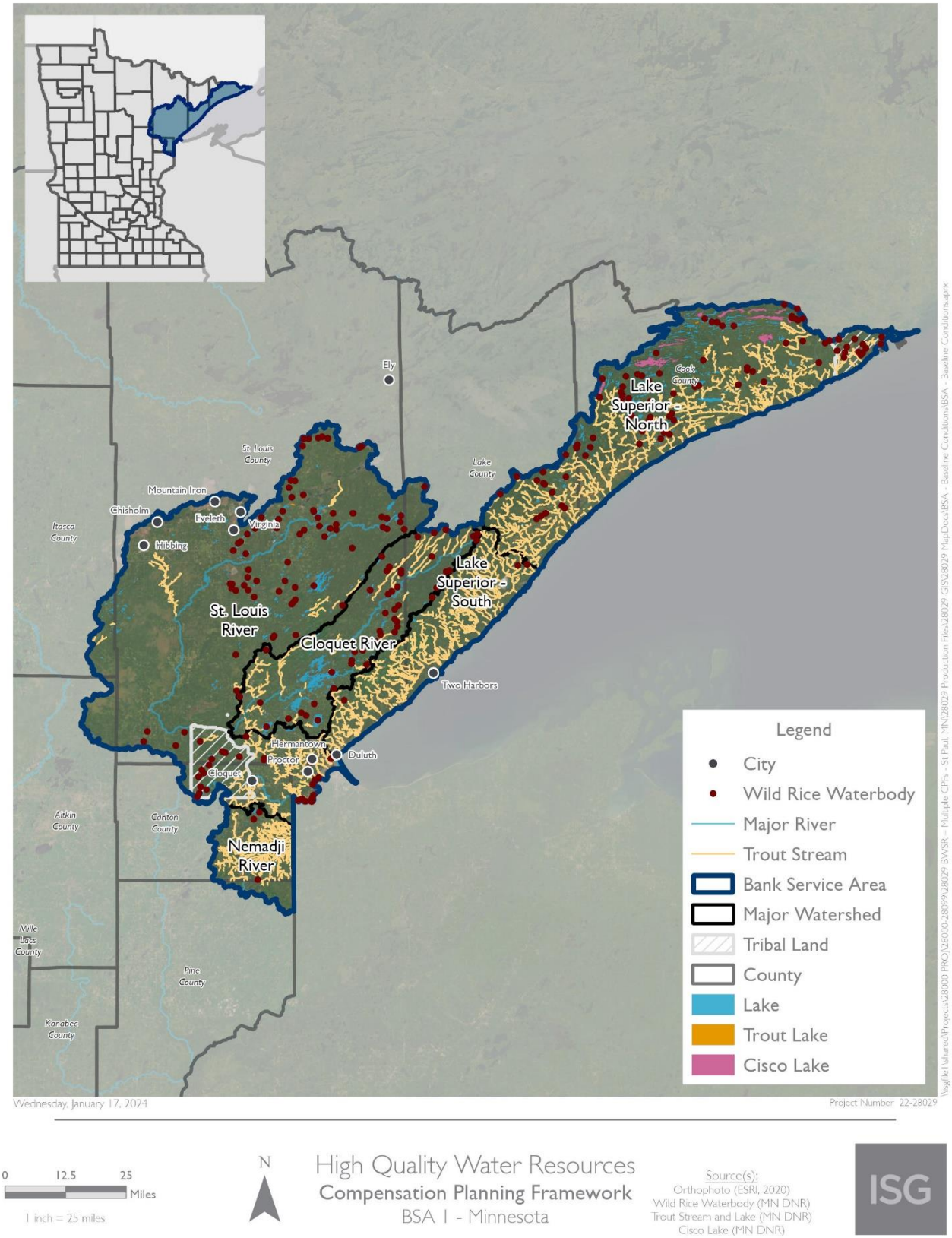
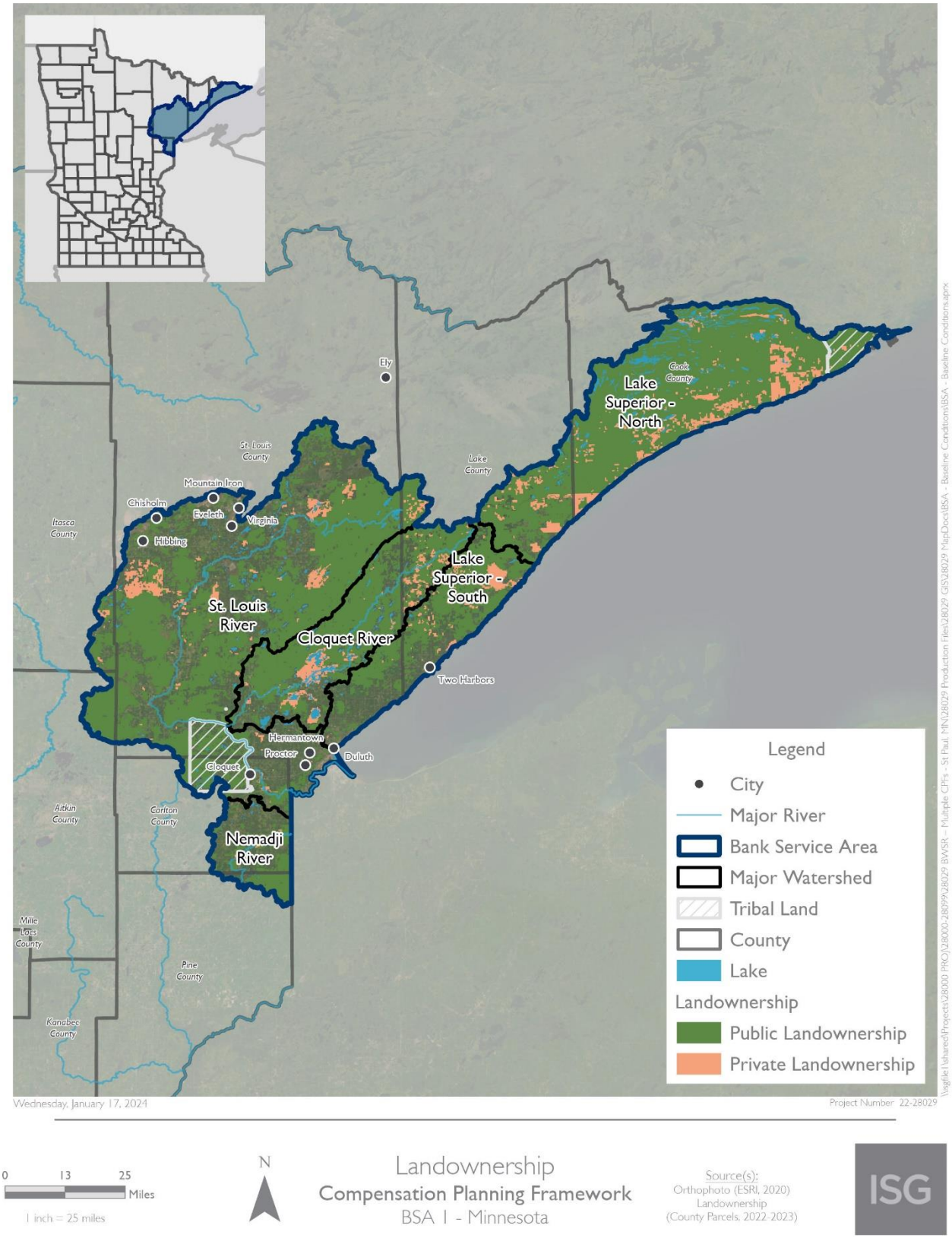


Figure B-15. Landownership

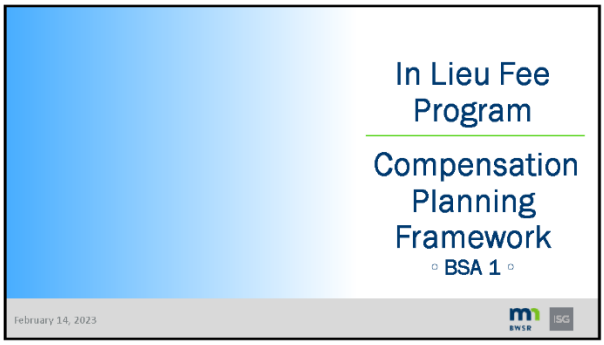


Appendix C: Stakeholder Meeting Attendees and Presentations

C-1. Meeting 1- February 2023 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Melanie	Bomier	melanie.bomier@carltonswcd.org	Carlton SWCD - Assistant Manager
John	Chell	johnchell21@yahoo.com	Northern Counties Land Use Coordinating Board
Kyle	Deming	kdeming@duluthmn.gov	WCA - City of Duluth
Nayere	Ghazanfarpour	Nayere.Ghazanfarpour@state.mn.us	MnDNR Area Hydrologist
Richard	Gitar	richardgitar@fdlrez.com	Fond du Lac
Kari	Hedin	kari.hedin@co.lake.mn.us	WCA - Lake County
Mark	Lindhorst	lindhorstm@stlouiscountymn.gov	WCA - St. Louis County
Phil	Norvitch	phil@nslswcd.org	North St. Louis SWCD
Becca	Reiss	becca@nslswcd.org	North St. Louis SWCD
Nancy	Schuldt	nancyschuldt@fdlrez.com	Fond du Lac
Brianna	Speldrich	brianna.speldrich@state.mn.us	MnDNR Area Hydrologist

C-1. Meeting 1- February 2023 Stakeholder Meeting Presentation



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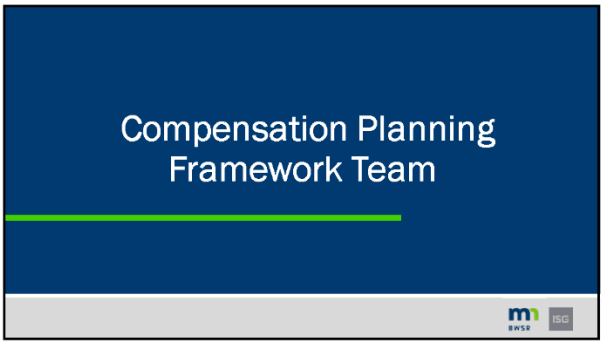

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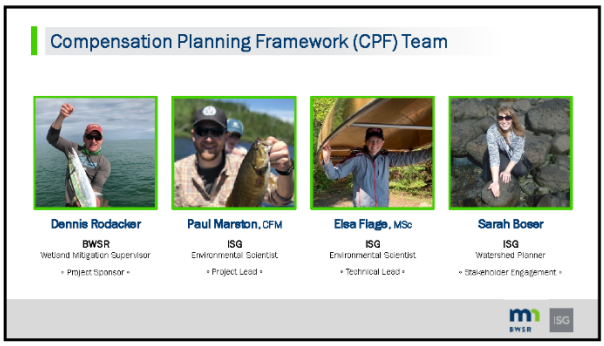

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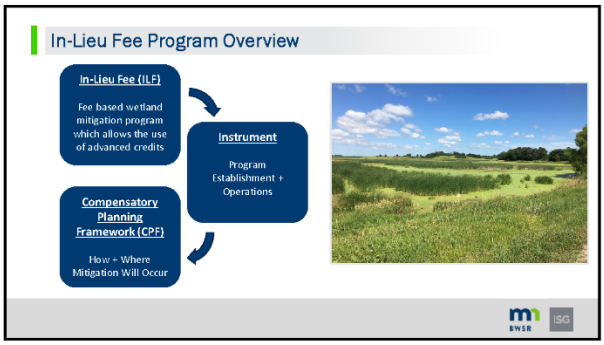

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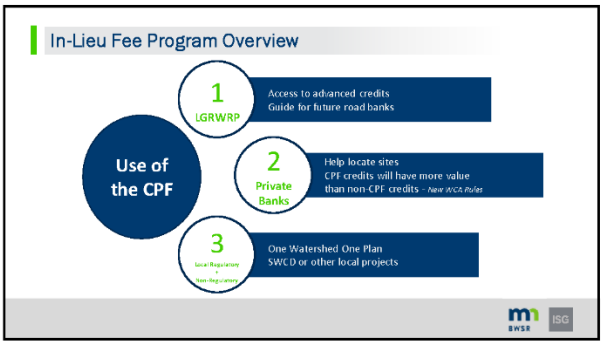
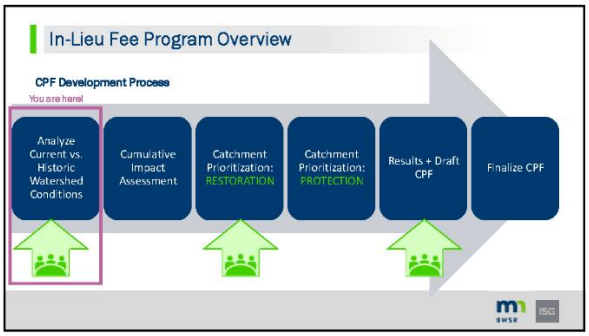


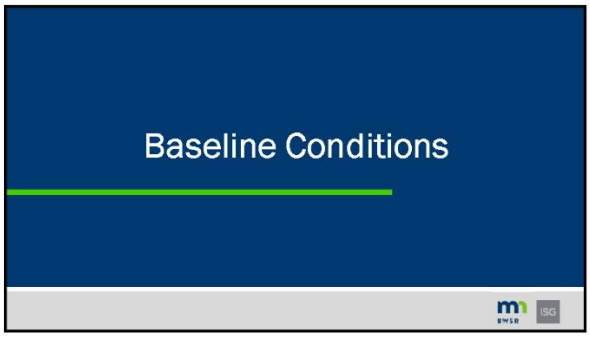
6


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

8


Baseline Conditions

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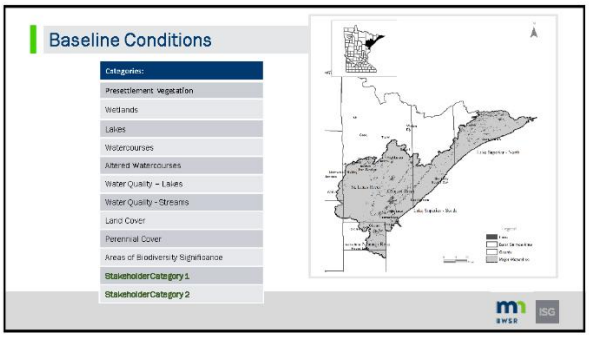
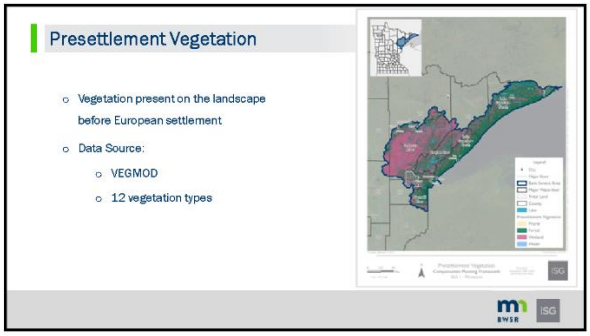
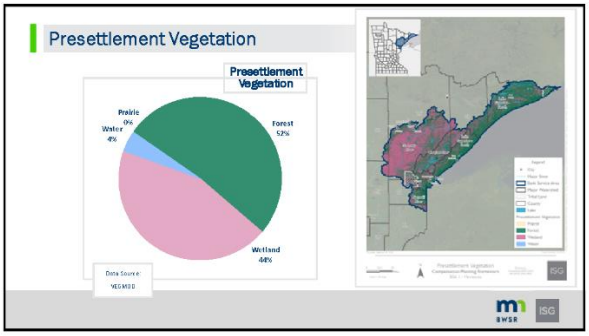

Baseline Conditions
Categories:
Presettlement Vegetation
Wetlands
Lakes
Watercourses
Altered Watercourses
Water Quality – Lakes
Water Quality - Streams
Land Cover
Perennial Cover
Areas of Biodiversity Significance
StakeholderCategory 1
StakeholderCategory 2

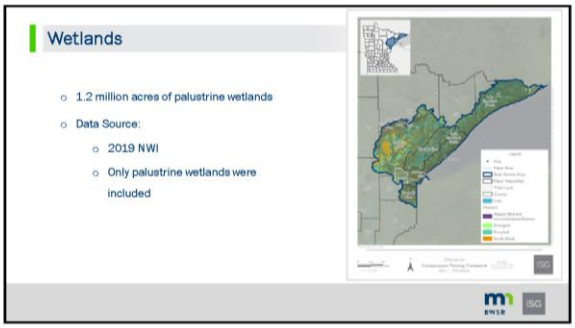
10


Presettlement Vegetation
Vegetation present on the landscape before European settlement
Data Source:
VEGMOD
12 vegetation types

11


Presettlement Vegetation
Presettlement Vegetation
Prairie 0%
Water 4%
Forest 52%
Wetland 44%
Data Source:
VEGMOD

12



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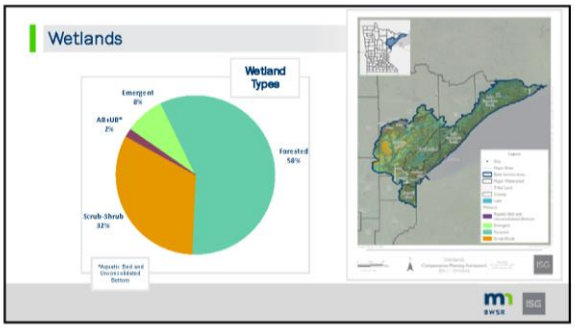

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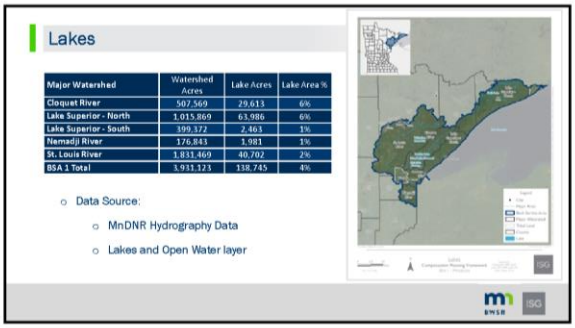

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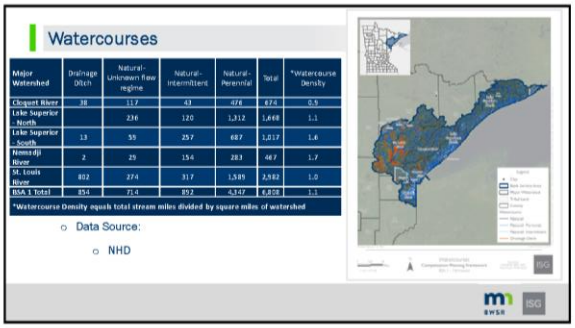

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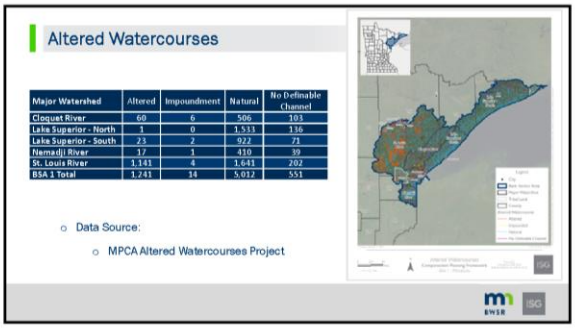

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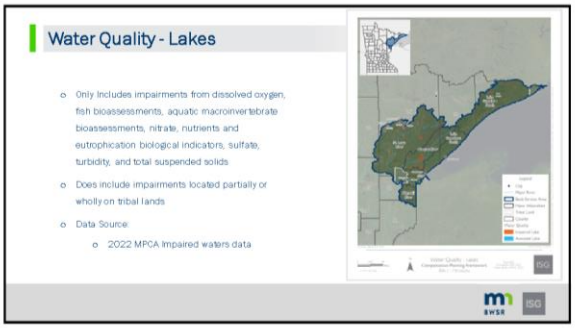

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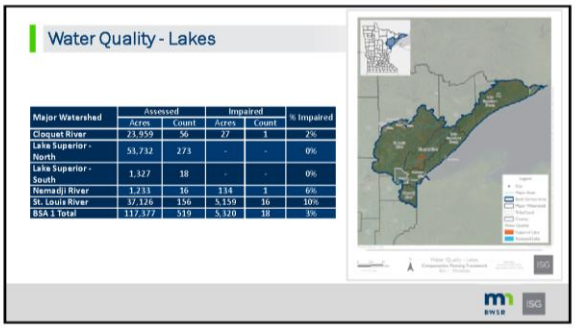

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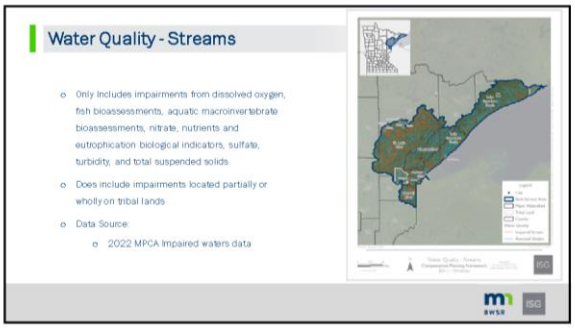

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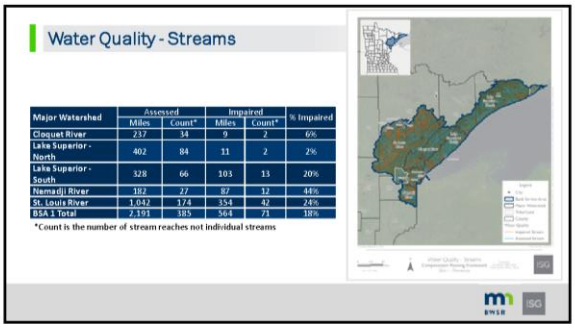

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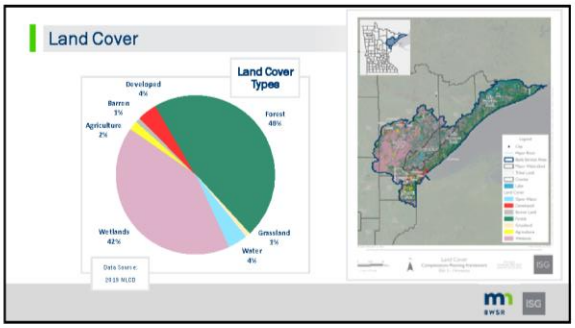

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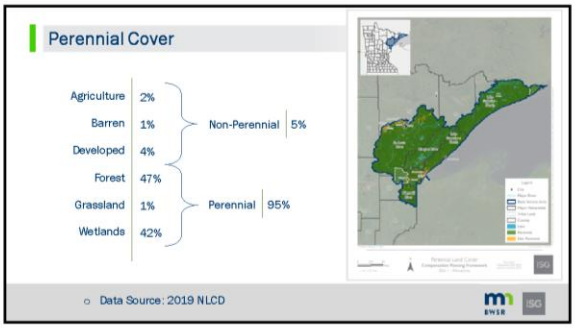

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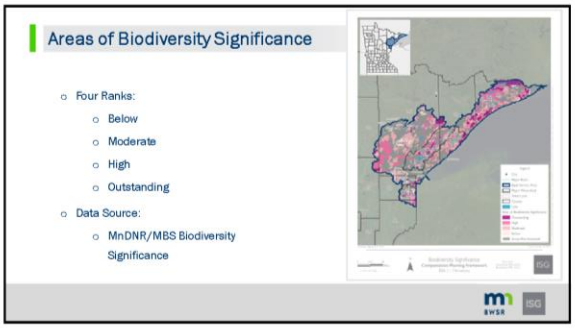

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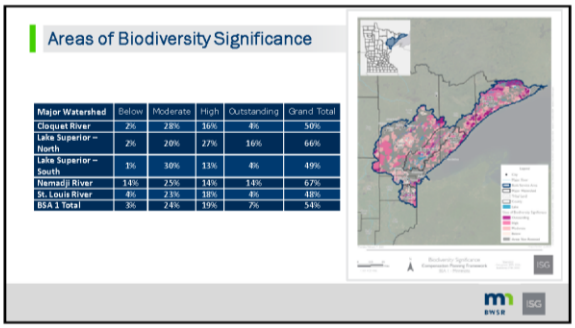

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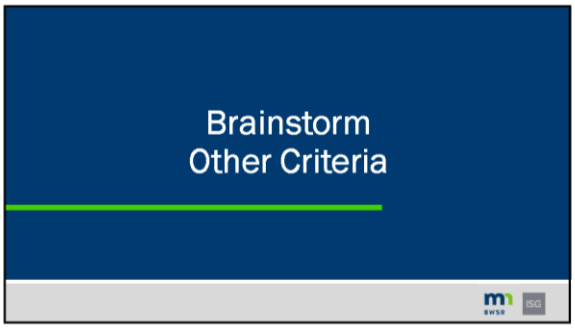

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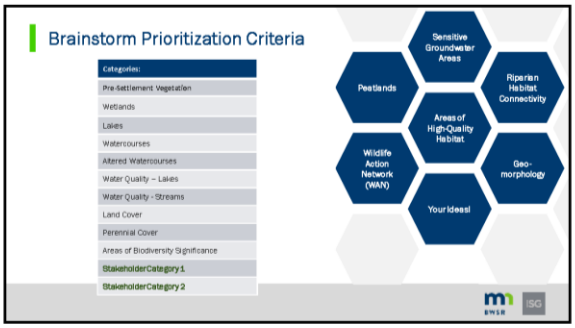

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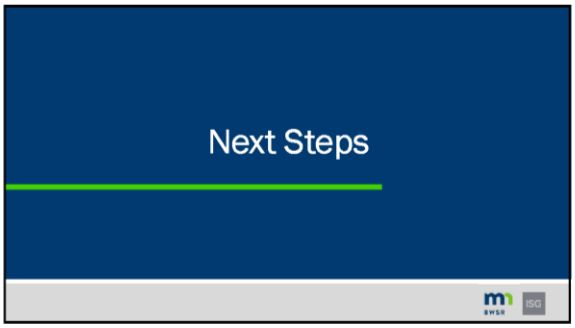

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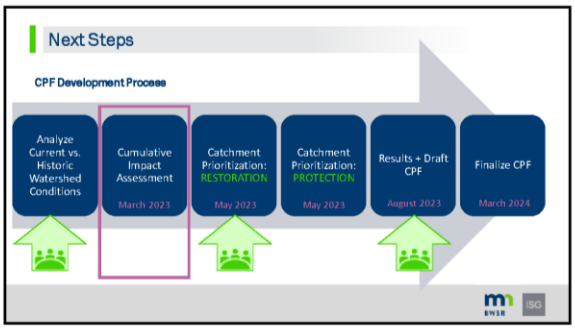

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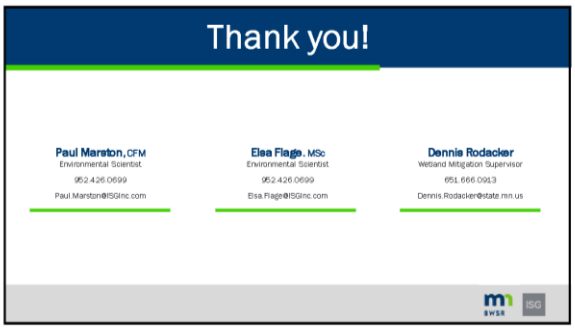
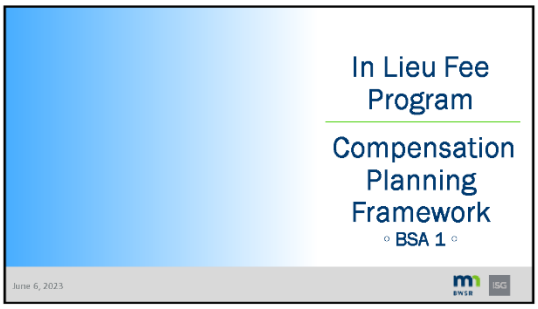


30

C-2. Meeting 2- June 2023 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Melanie	Bomier	melanie.bomier@carltonswcd.org	Carlton SWCD - Assistant Manager
Danielle	Braund	danielle.braund@state.mn.us	MnDNR Area Hydrologist
Kyle	Deming	kdeming@duluthmn.gov	WCA - City of Duluth
David	Demmer	david.demmer@state.mn.us	BWSR
Henry	Egland	henry.egland@co.aitkin.mn.us	WCA - Aitkin County
Sam	Martin	samuel.martin@state.mn.us	MnDNR Area Hydrologist
Marissa	Merriman	marissa.v.merriman@usace.army.mil	IRT (USACE)
Phil	Norvitch	phil@nslswcd.org	North St. Louis SWCD
Laurel	Wilson	lwilson@grandportage.com	Grand Portage Band Lake Superior Chippewa

C-2. Meeting 2- June 2023 Stakeholder Meeting Presentation



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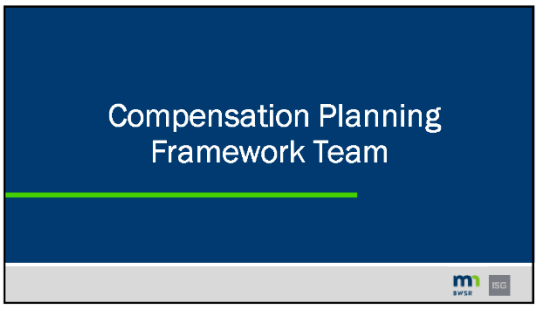

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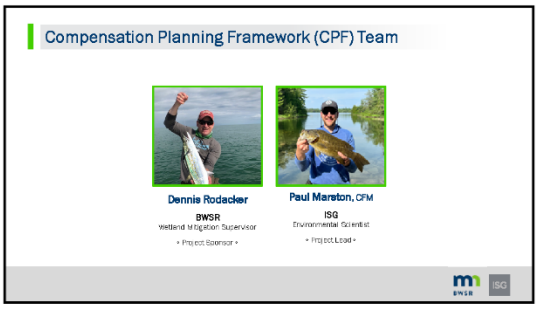

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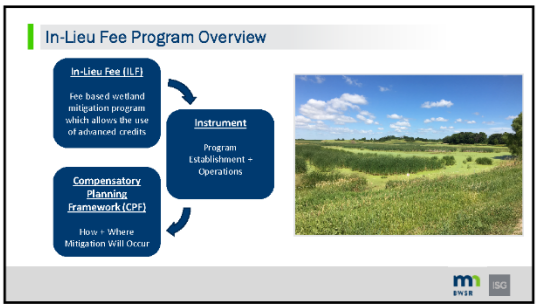

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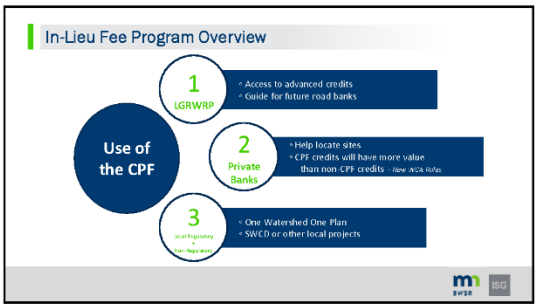

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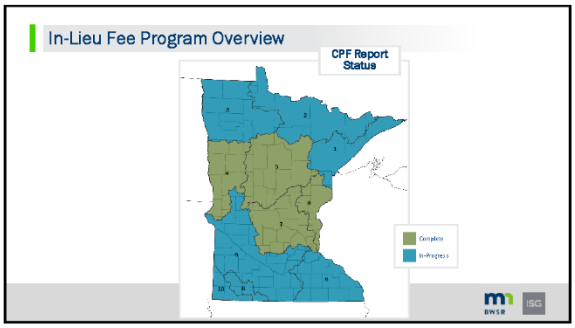
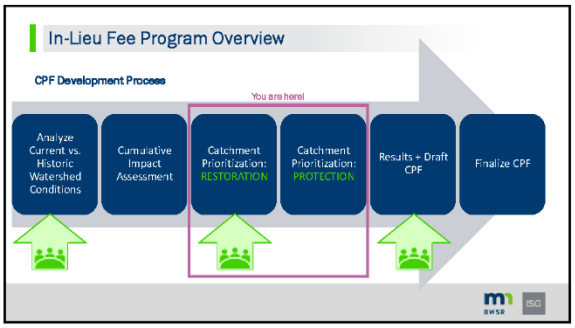

In-Lieu Fee Program Overview
CPF Report Status

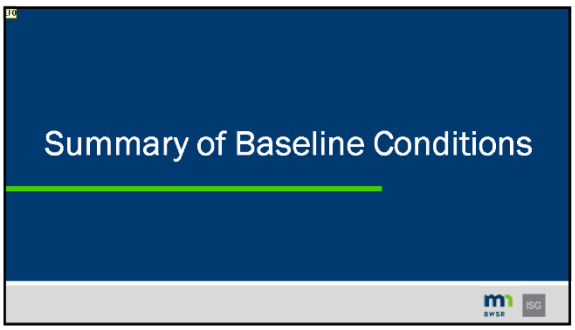
7


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

8


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

9


Summary of Baseline Conditions

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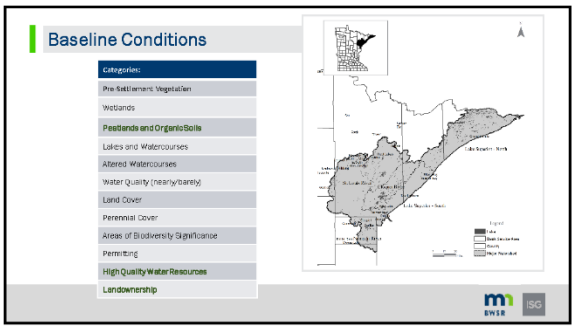
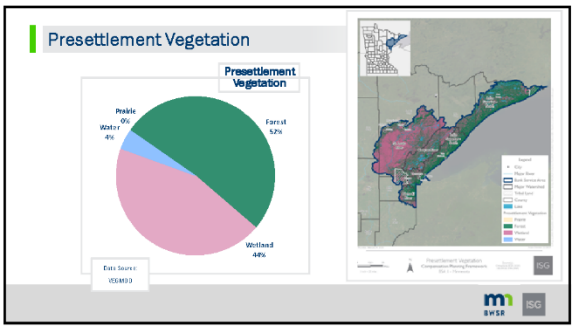
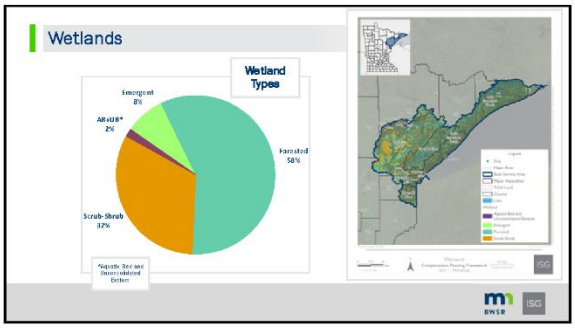

Baseline Conditions
Categories:
Pre-Settlement Vegetation
Wetlands
Peatlands and Organic Soils
Lakes and Watercourses
Altered Watercourses
Water Quality (nearly/barely)
Land Cover
Perennial Cover
Areas of Biodiversity Significance
Permitting
High Quality Water Resources
Landownership

11


Presettlement Vegetation
Presettlement Vegetation
Prairie 9%
Water 4%
Forest 52%
Wetland 44%

12



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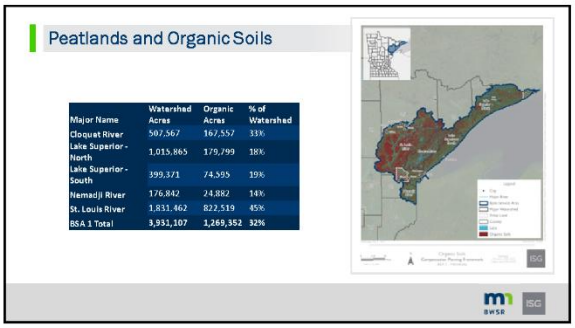

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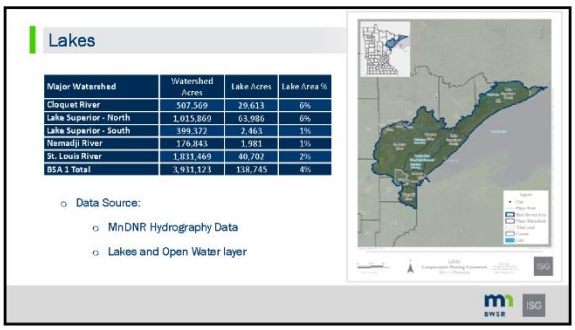

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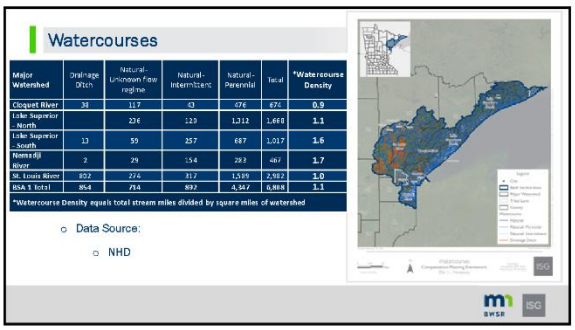

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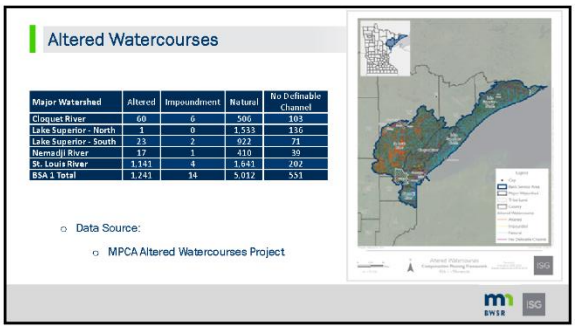

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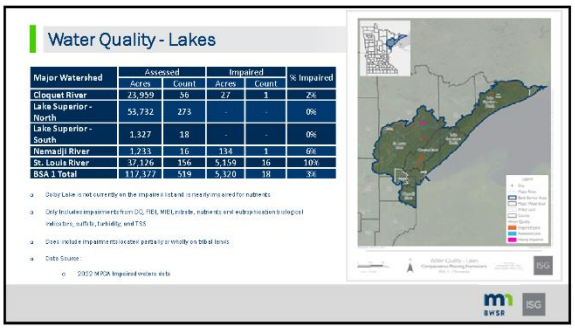

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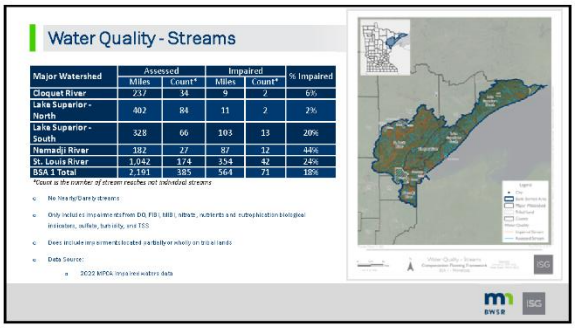

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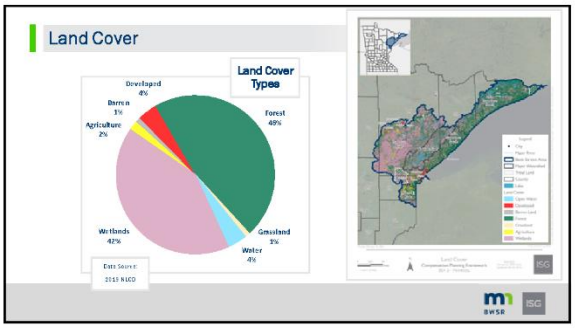

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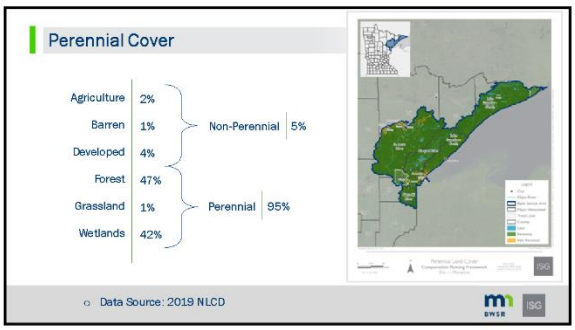

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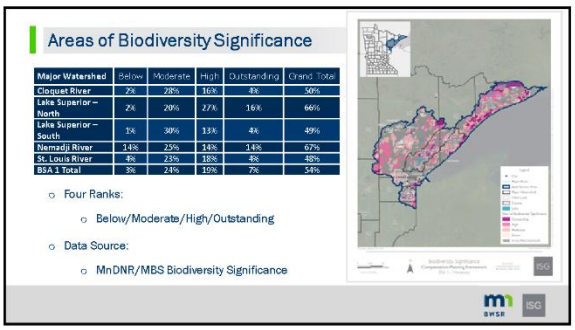

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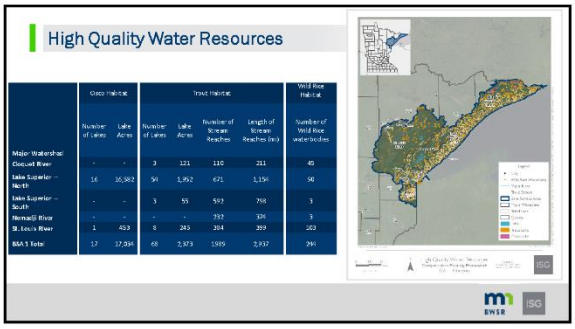

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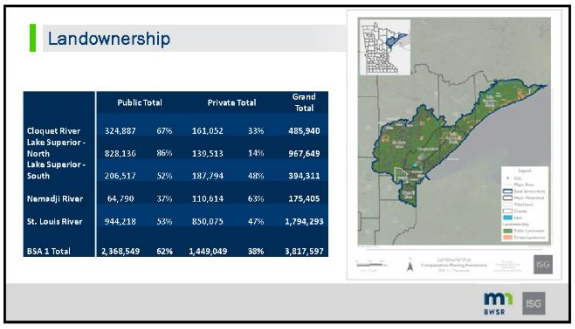


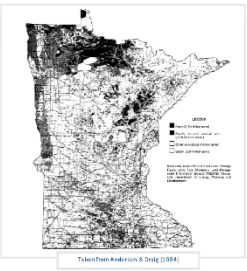
24

Cumulative Impact Analysis

25

Cumulative Impact Analysis

	Total Watershed Area	Presettlement Wetlands (soils + NWI)	Current Wetlands (NWI)	Wetland Loss	% Loss
BSA 1 Total	3,931,235	1,589,096	1,221,521	367,575	9%

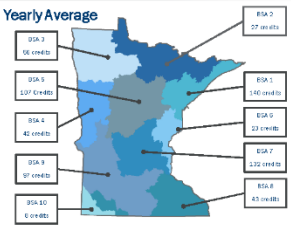


Taken from Anderson & Craig (1984)

26

Cumulative Impact Analysis

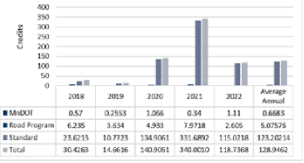
Credit Usage – Yearly Average



27

Cumulative Impact Analysis

Figure 4-1
BSA 1 Wetland Credit Withdrawals
by Account Type 2018-2022



	2018	2019	2020	2021	2022	Average Annual
MnDOT	0.57	0.2553	1.066	0.34	1.11	0.6683
Road Program	6.235	3.634	4.933	7.9718	2.605	5.07575
Standard	23.6215	10.7723	134.9061	331.6892	115.0218	123.20214
Total	30.4263	14.9636	140.9061	340.0010	118.7368	128.9462

28

Cumulative Impact Analysis

Available Credits (as of March 2023)

Standard Banks
Publicly Available
602 credits

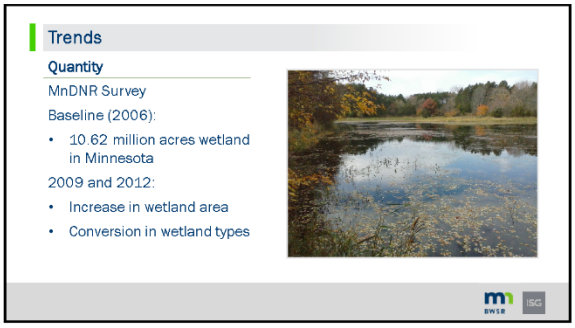
MnDOT Banks
20 credits

LGRWRP Banks
30 credits

29

BSA
Trends and Threats

30



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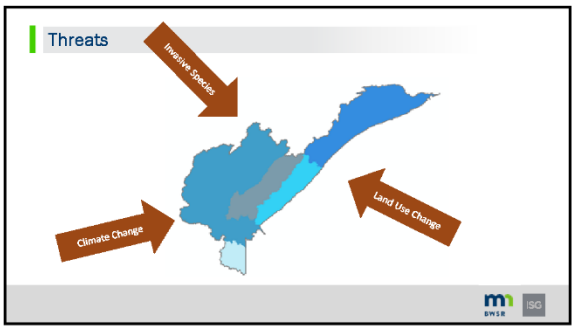

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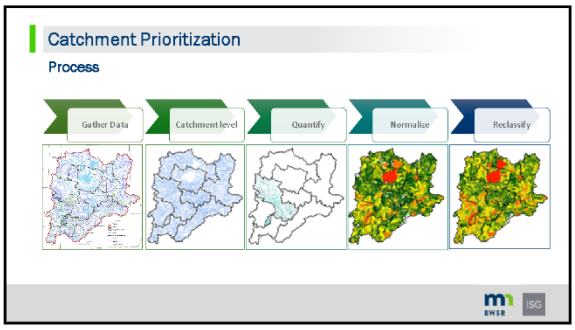

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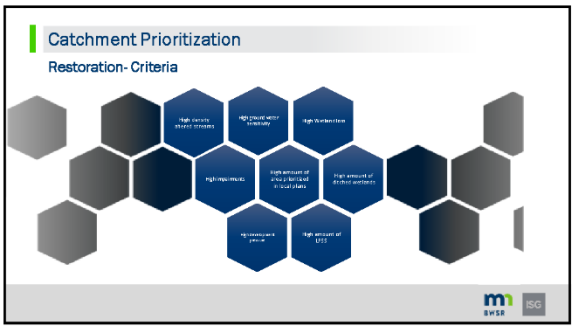

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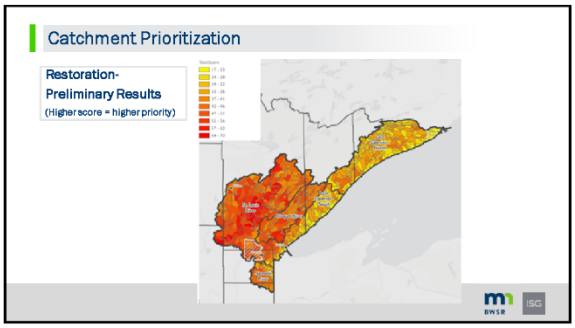

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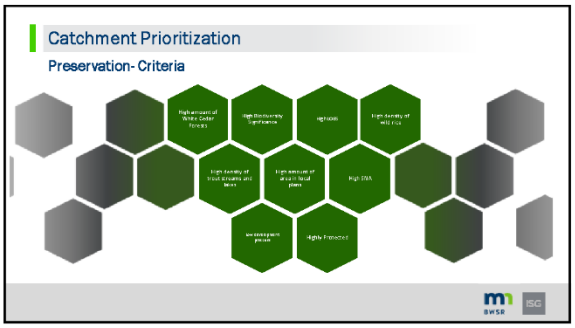

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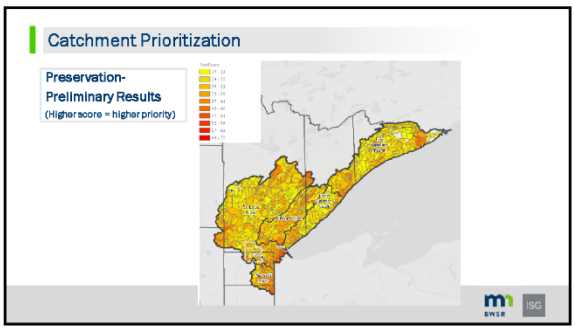

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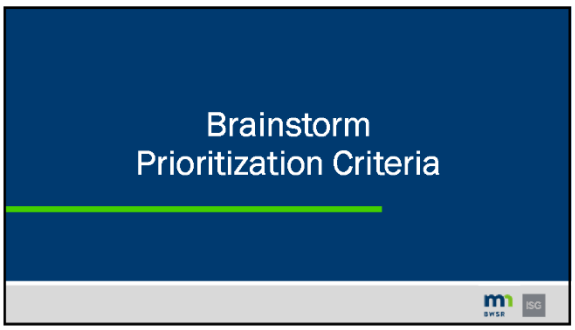

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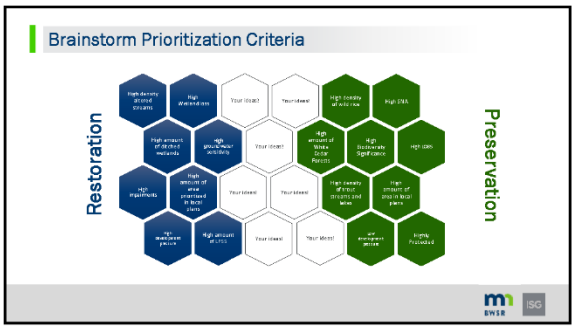

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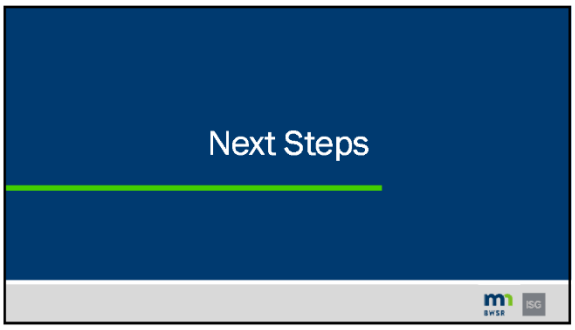

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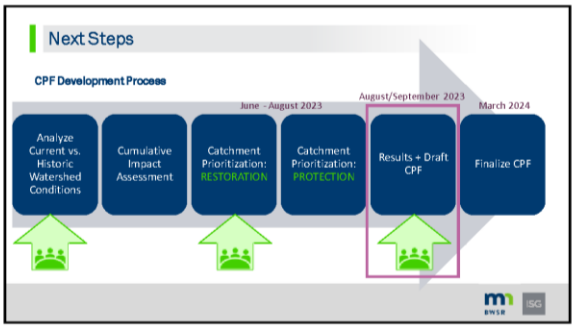
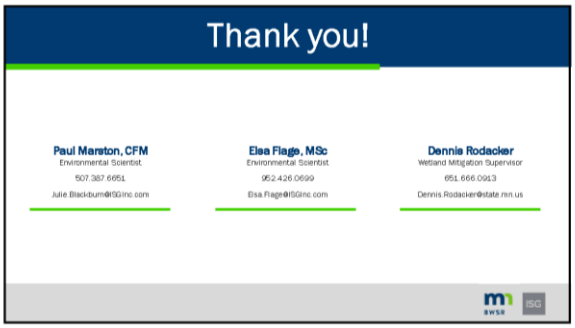

Next Steps
CPF Development Process
June - August 2023
August/September 2023
March 2024
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Catchment Prioritization: PROTECTION
Results + Draft CPF
Finalize CPF

43


Thank you!
Paul Marston, CFM
Environmental Scientist
507.387.6651
Julie.Blackburn@ISGinc.com
Elsa Flage, MSc
Environmental Scientist
952.426.0699
Elsa.Flage@ISGinc.com
Dennis Rodacker
Wetland Mitigation Supervisor
651.666.0913
Dennis.Rodacker@state.mn.us

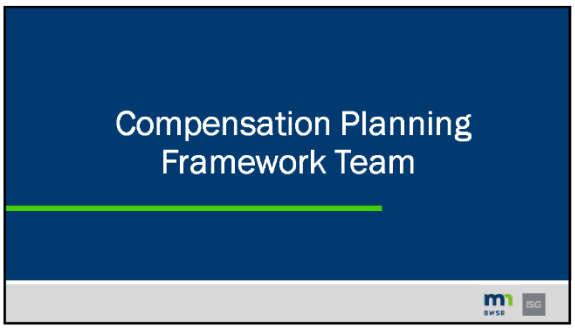
44

C-3. Meeting 3- October 2023 Stakeholder Meeting List of Attendees

First Name	Last Name	Email	Organization
Kyle	Deming	kdeming@duluthmn.gov	WCA - City of Duluth
Kari	Hedin	kari.hedin@co.lake.mn.us	WCA - Lake County
Sam	Martin	samuel.martin@state.mn.us	MnDNR Area Hydrologist
Becca	Reiss	becca@nslswcd.org	North St. Louis SWCD
Tara	Solem	tara.solem@co.lake.mn.us	Lake County SWCD

C-3. Meeting 3- October 2023 Stakeholder Meeting Presentation

1



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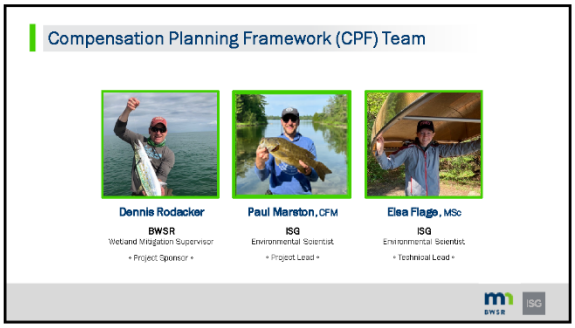

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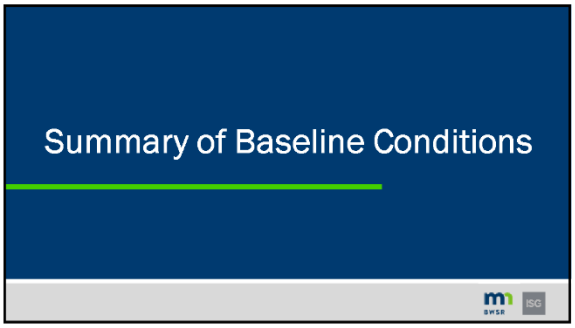

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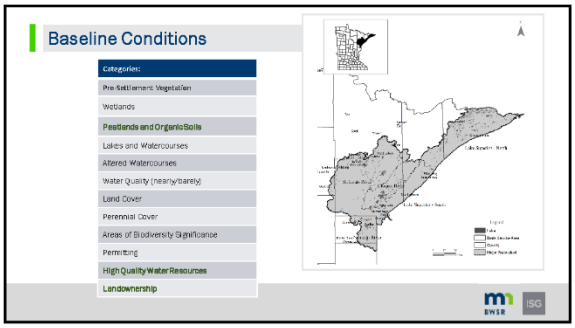

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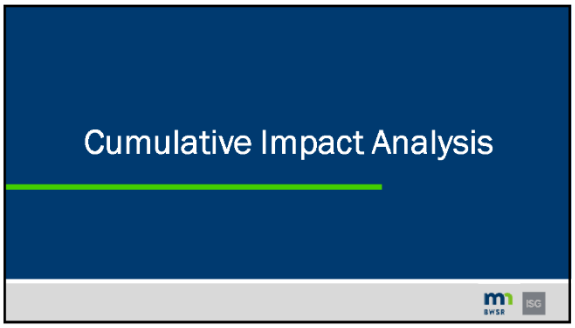

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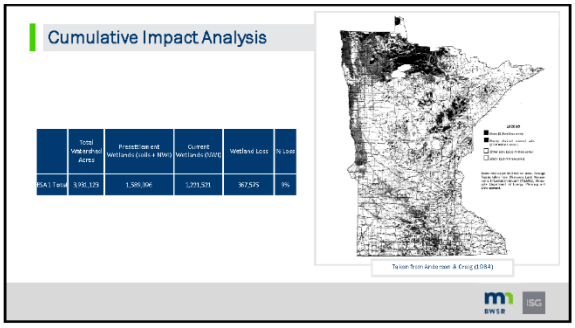
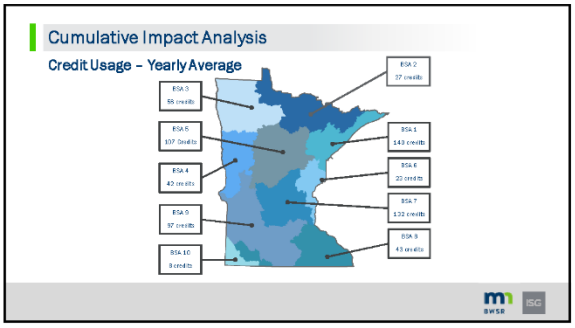
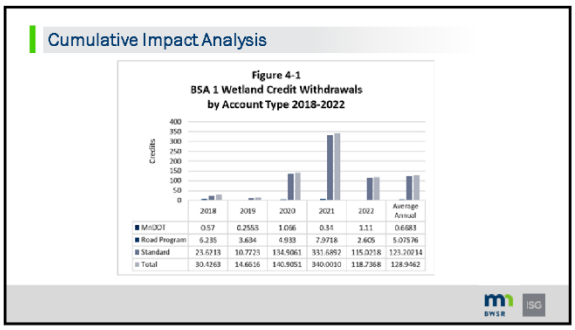

Cumulative Impact Analysis

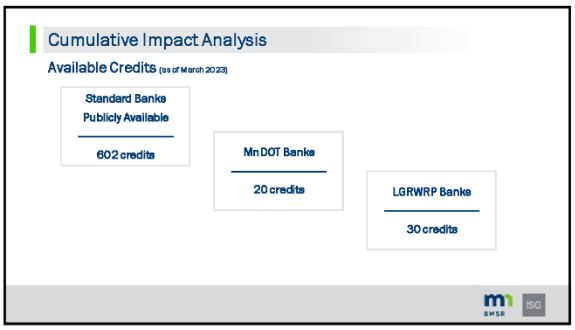
7


Cumulative Impact Analysis
Credit Usage – Yearly Average

8


Cumulative Impact Analysis
Figure 4-1
BSA 1 Wetland Credit Withdrawals
by Account Type 2018-2022

9


Cumulative Impact Analysis
Available Credits
Standard Banks
Publicly Available
602 credits
MnDOT Banks
20 credits
LGRWRP Banks
30 credits

10

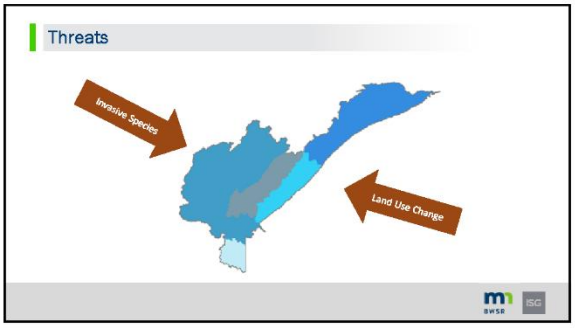

BSA
Trends and Threats

11


Trends
Quantity
MnDNR Survey
Baseline (2006):
10.62 million acres wetland in Minnesota
2009 and 2012:
Increase in wetland area
Conversion in wetland types

12

13



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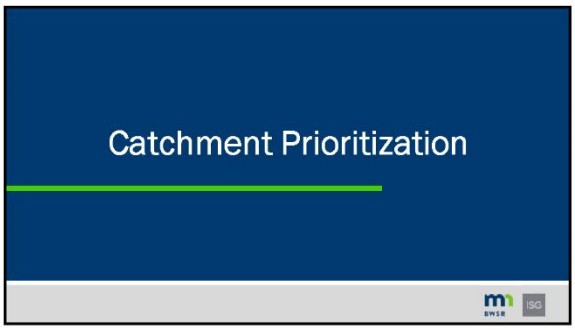

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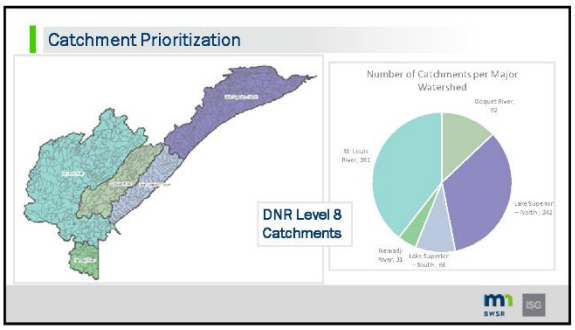

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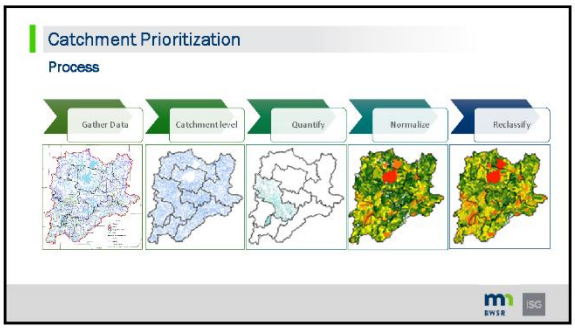

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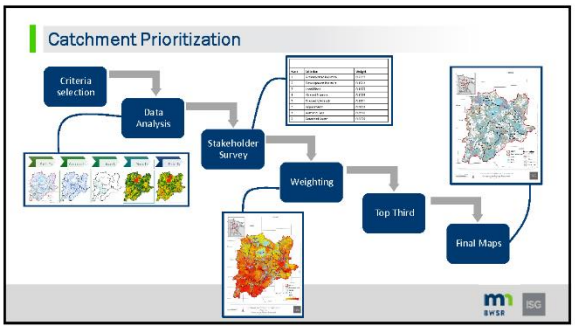

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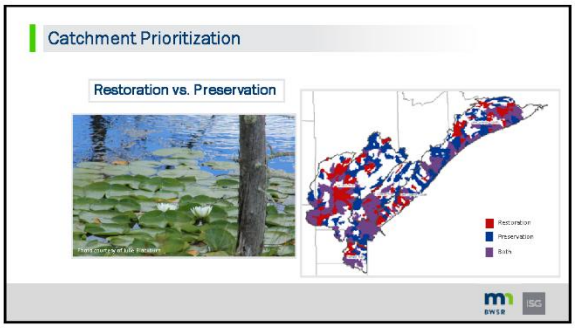

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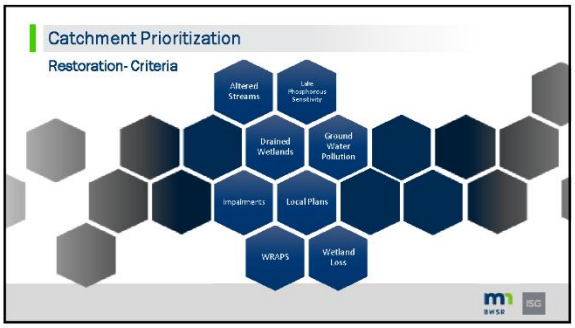

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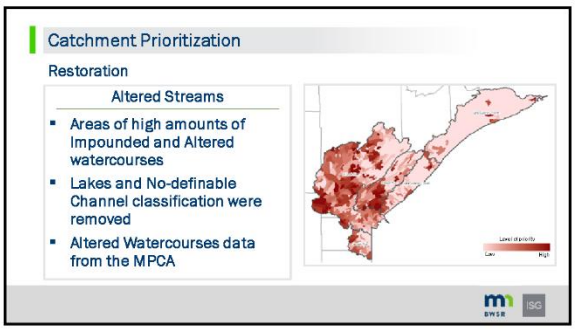

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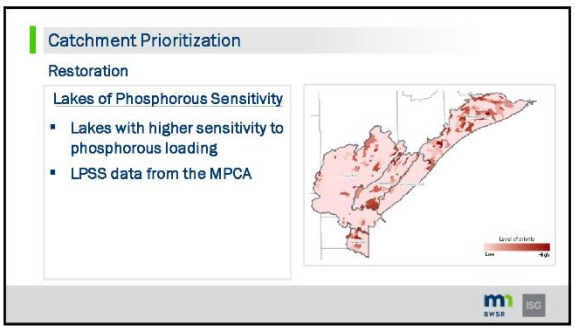

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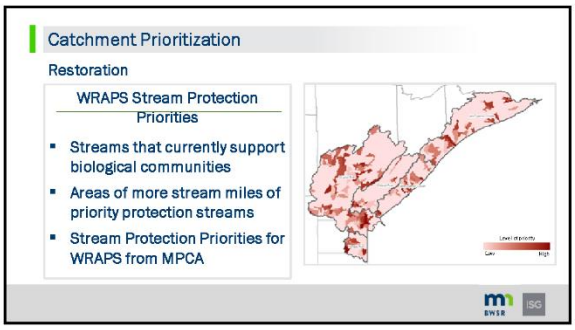

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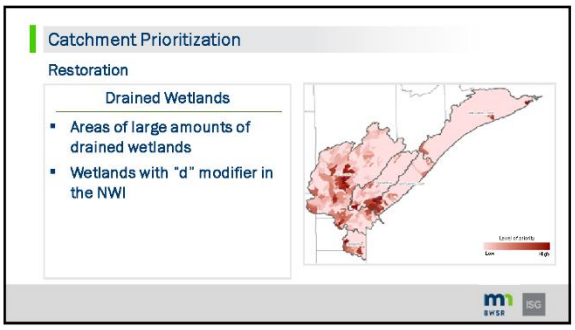

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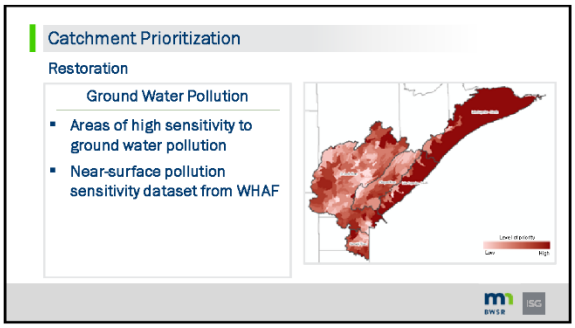

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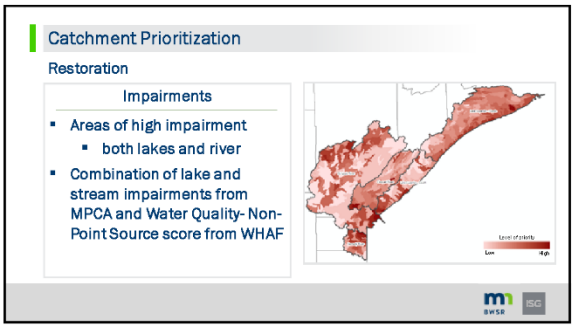

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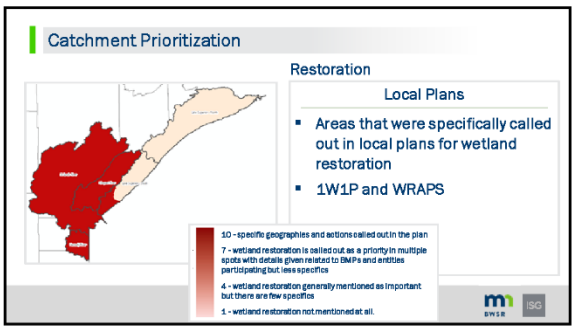

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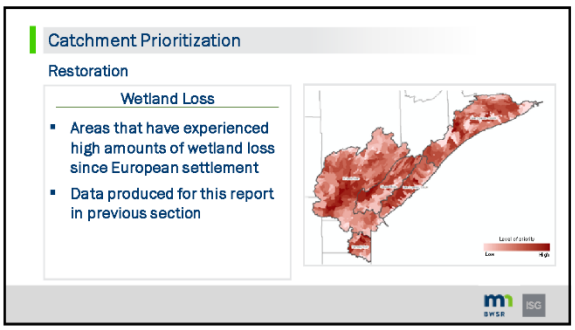

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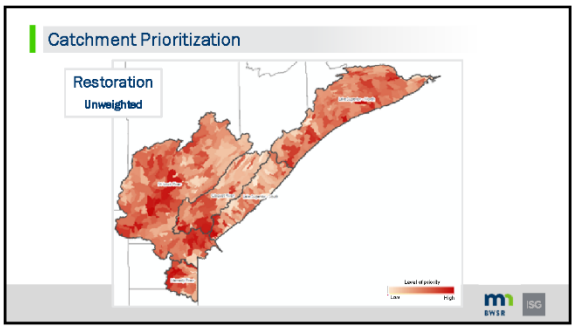

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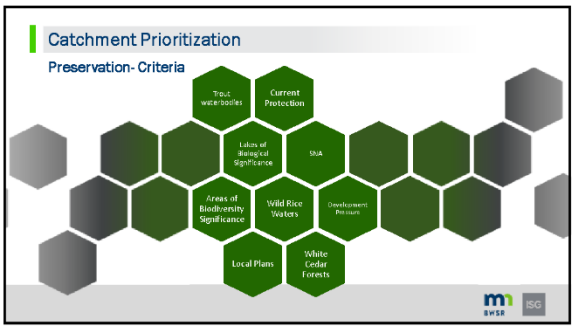

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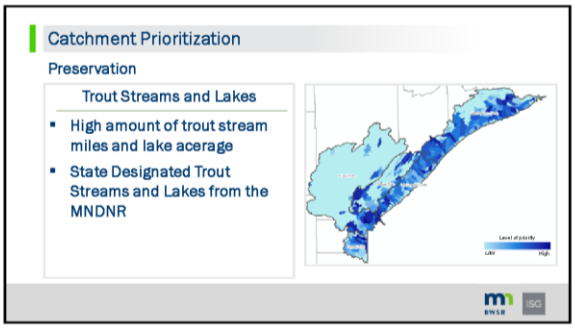

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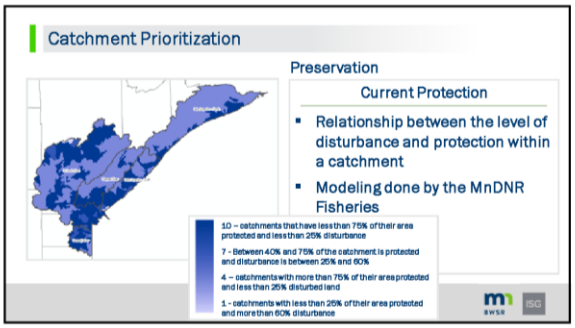

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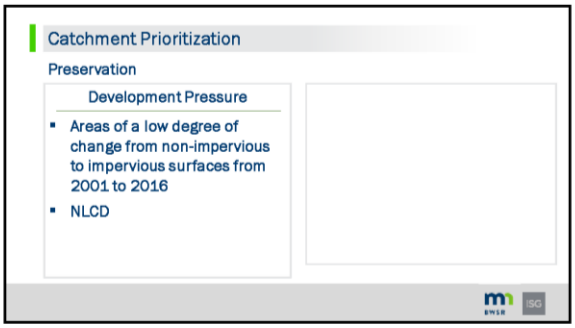

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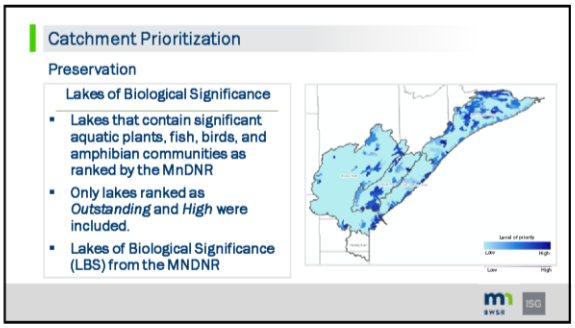

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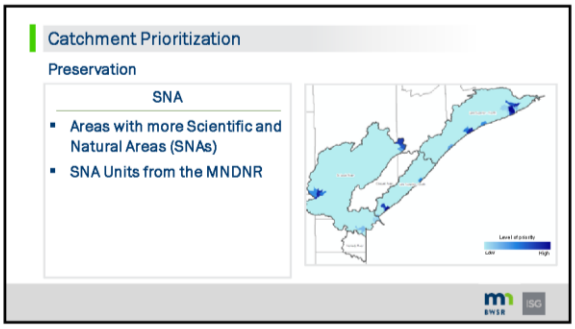

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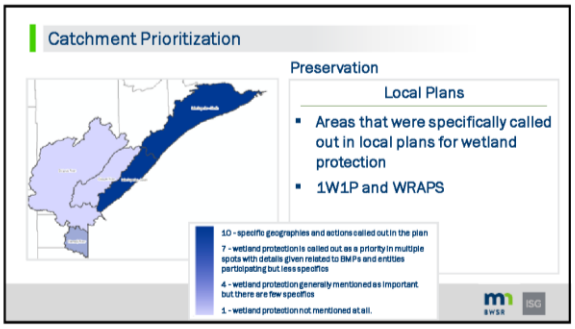

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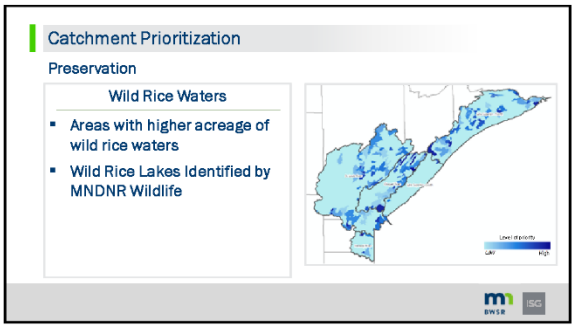

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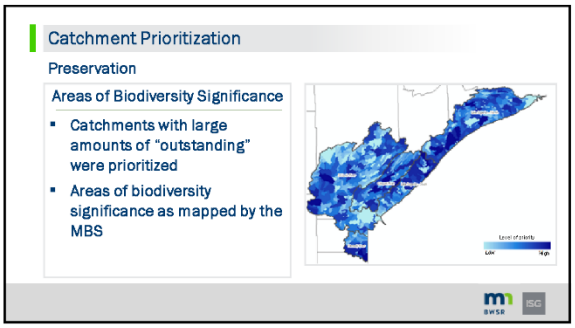

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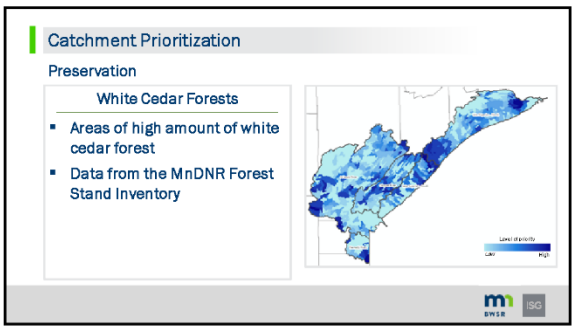

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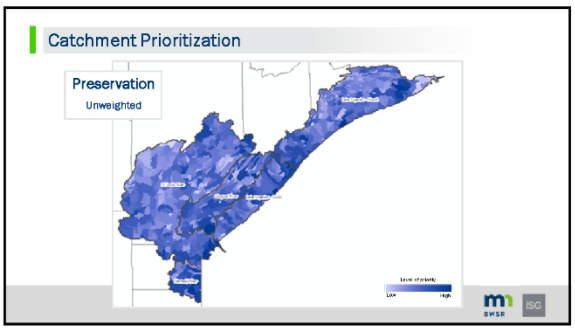

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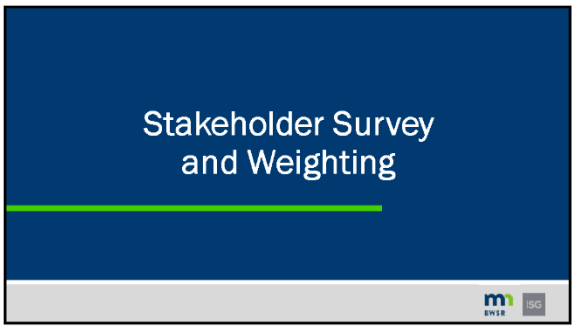

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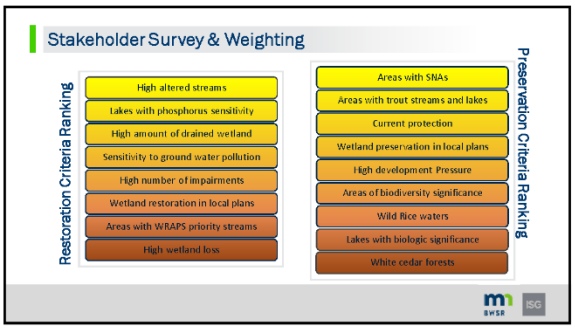

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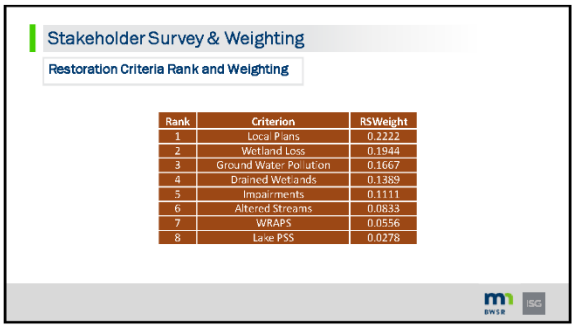

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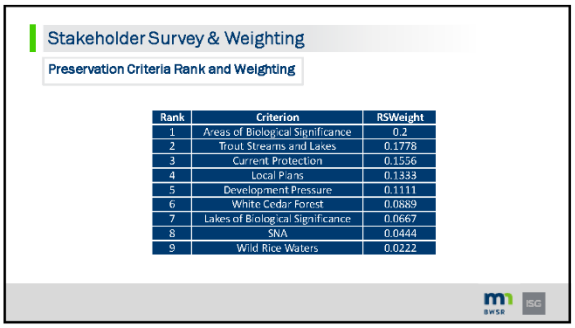

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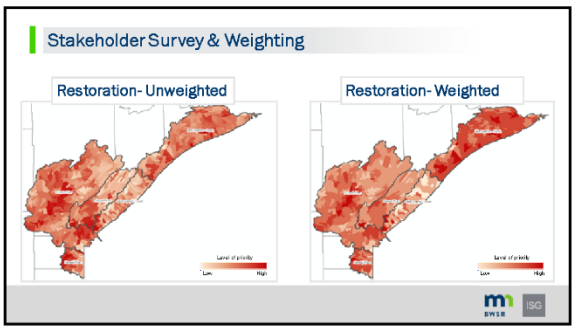

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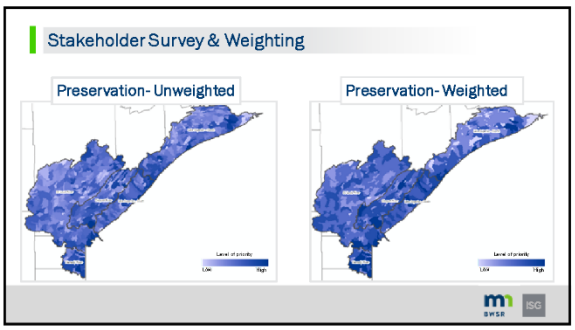

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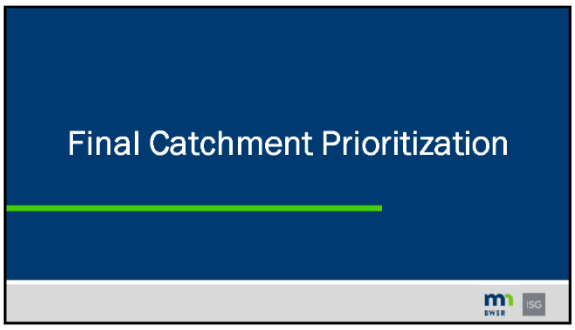

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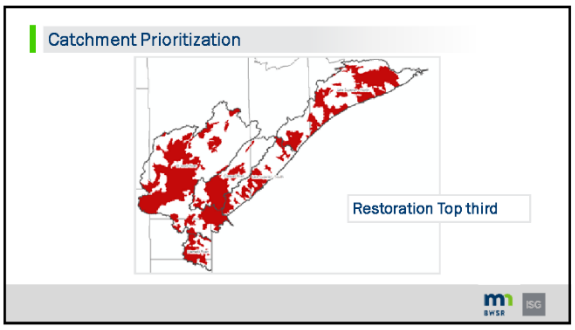

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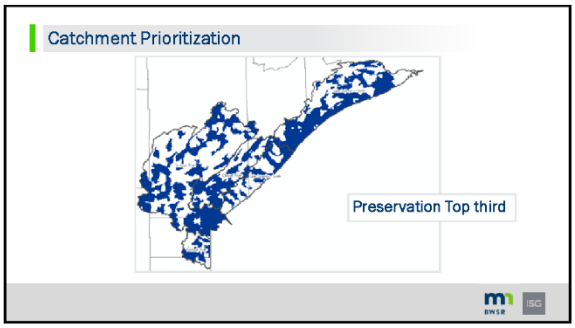

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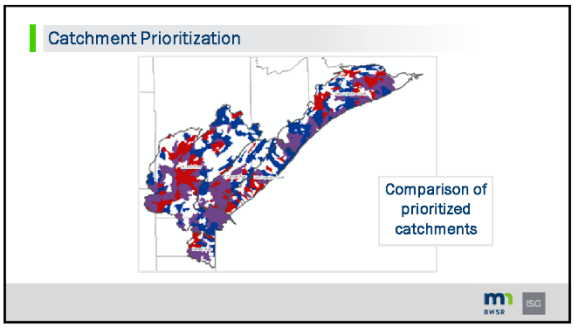

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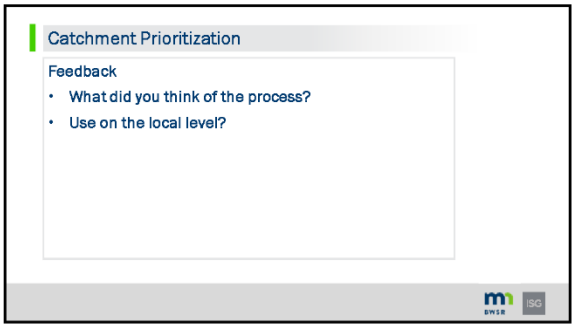

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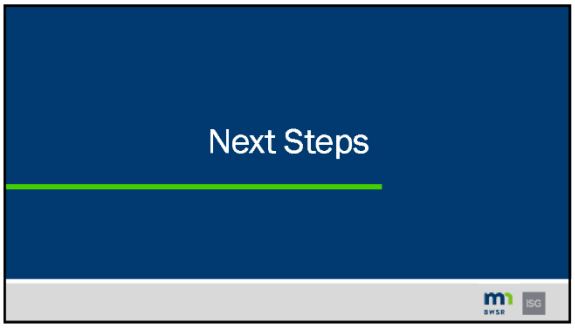

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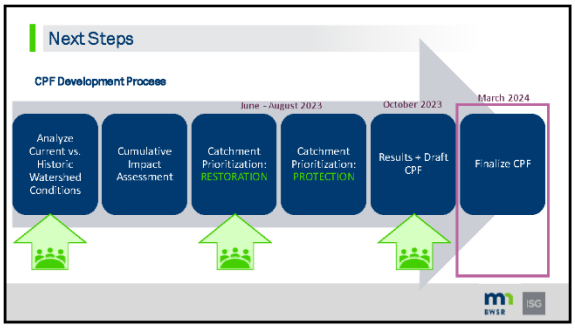

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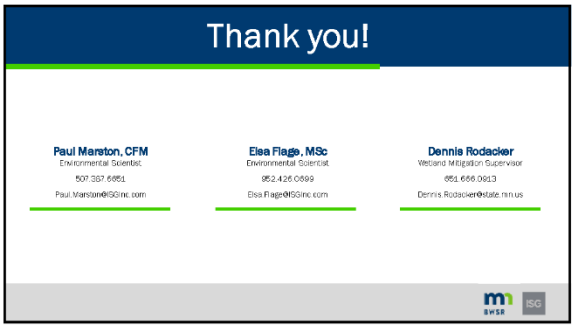

54

Appendix D: Catchment Prioritization Maps

Figure D-1. Catchment Prioritization Comparison

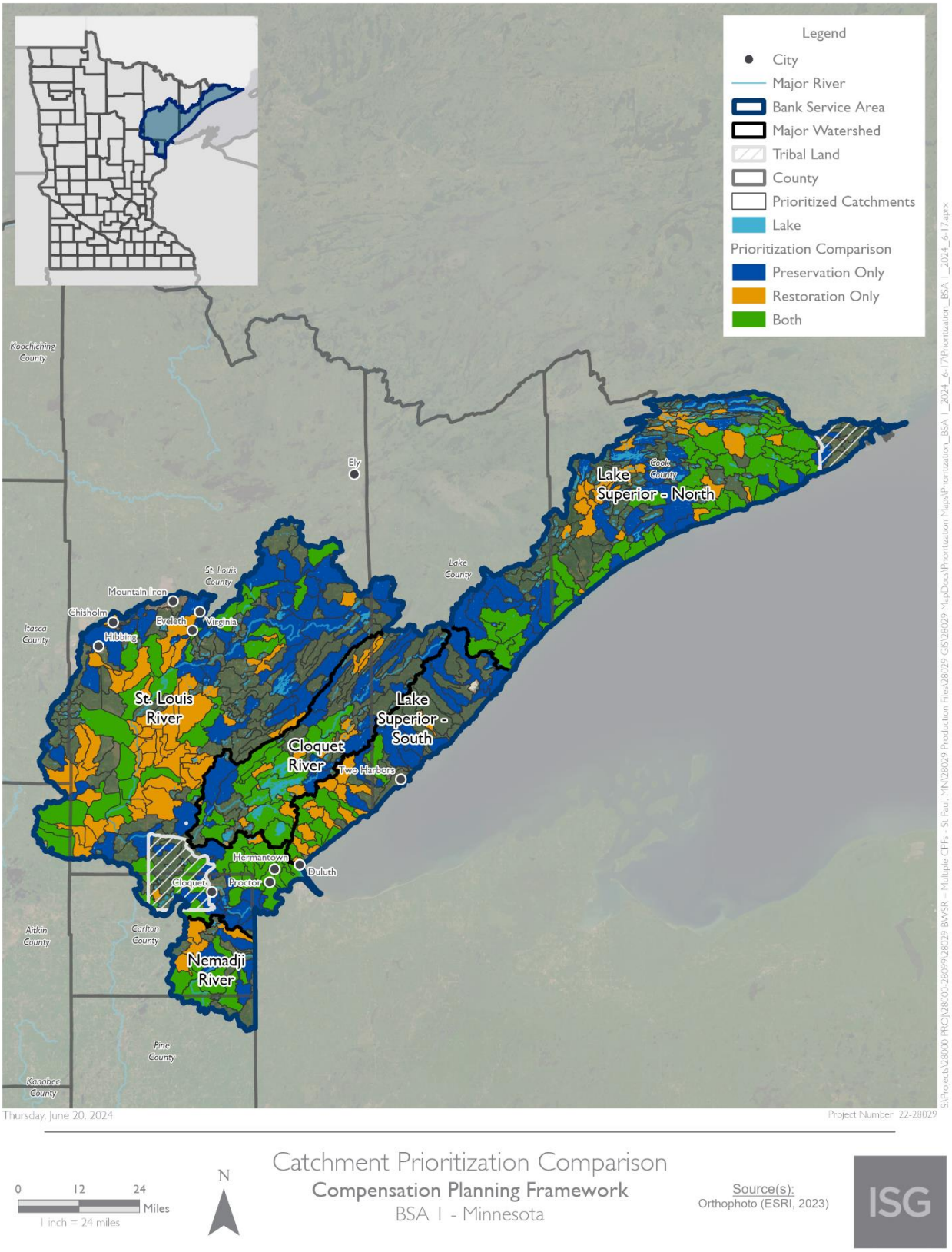

Figure D-2. Unweighted Restoration Catchment Prioritization

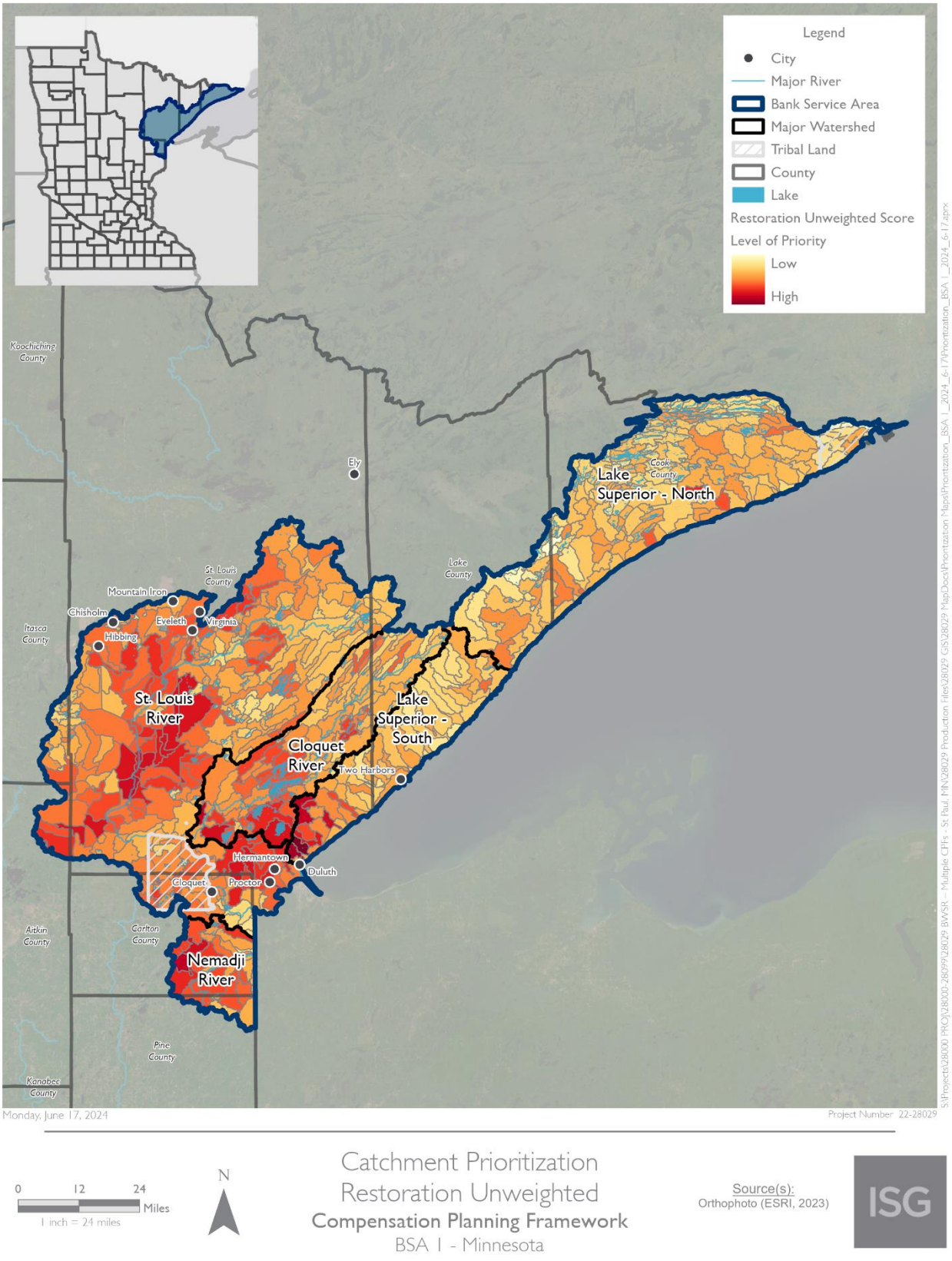

Figure D-3. Unweighted Preservation Catchment Prioritization

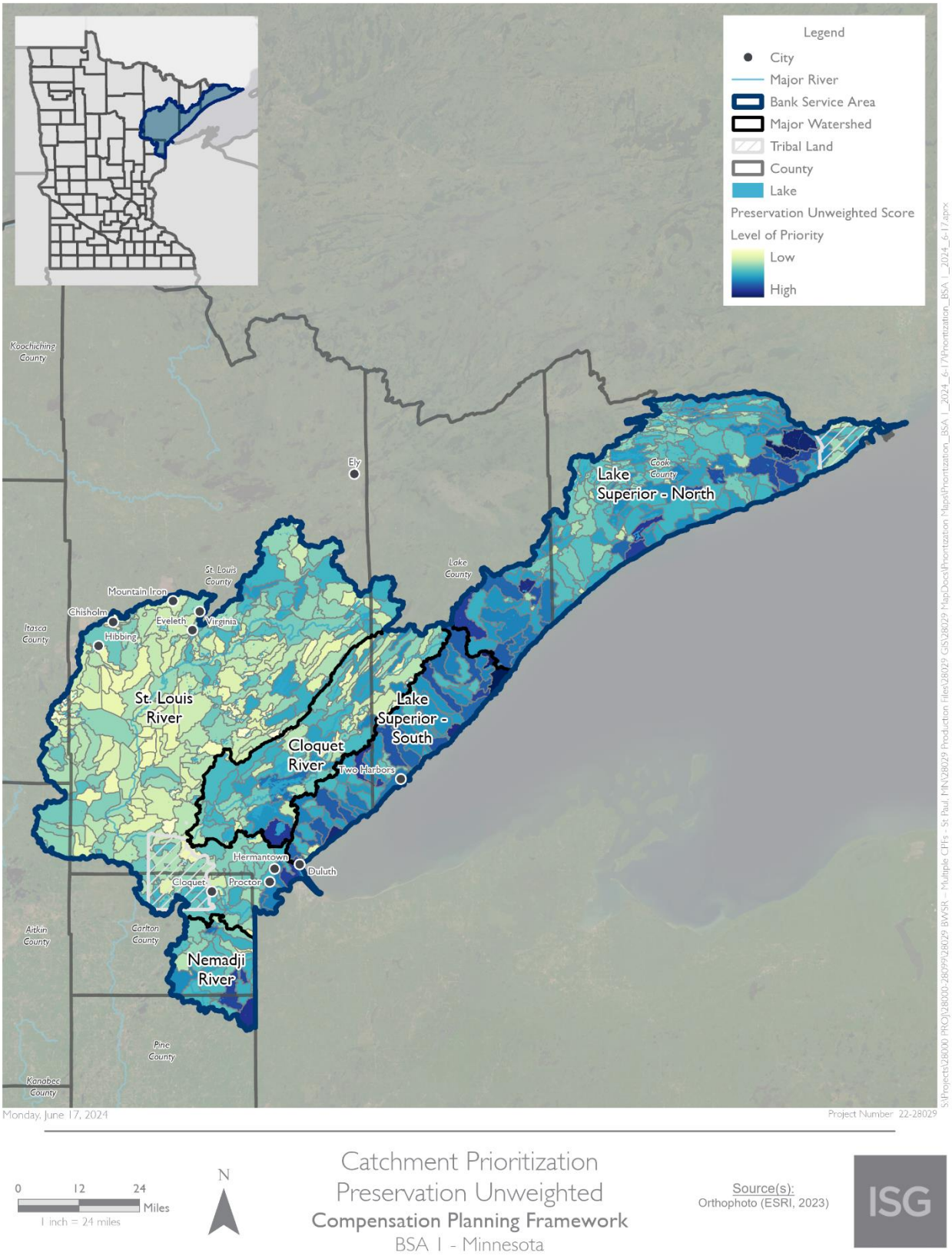

Figure D-4. Weighted Restoration Catchment Prioritization

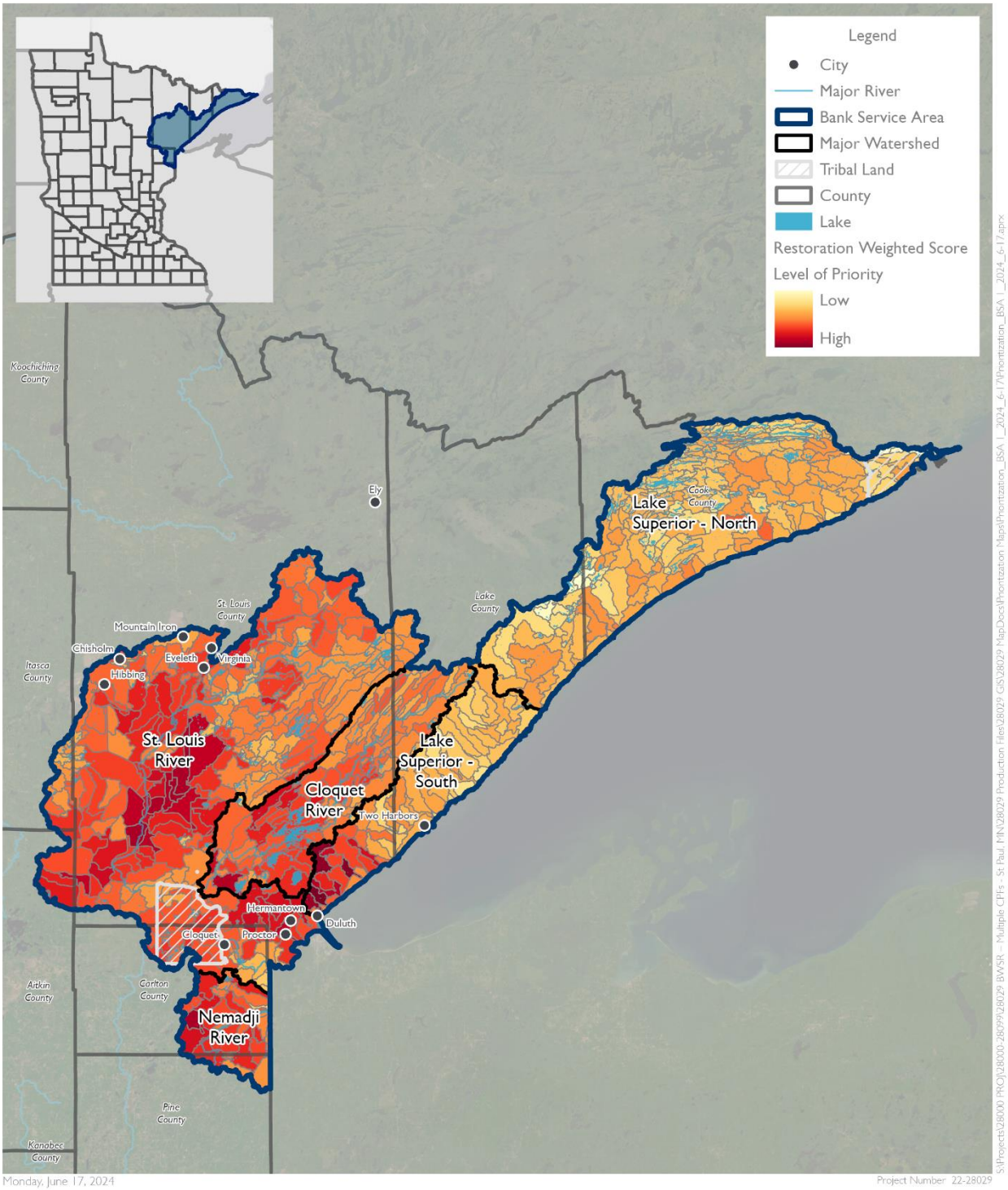

Figure D-5. Weighted Preservation Catchment Prioritization

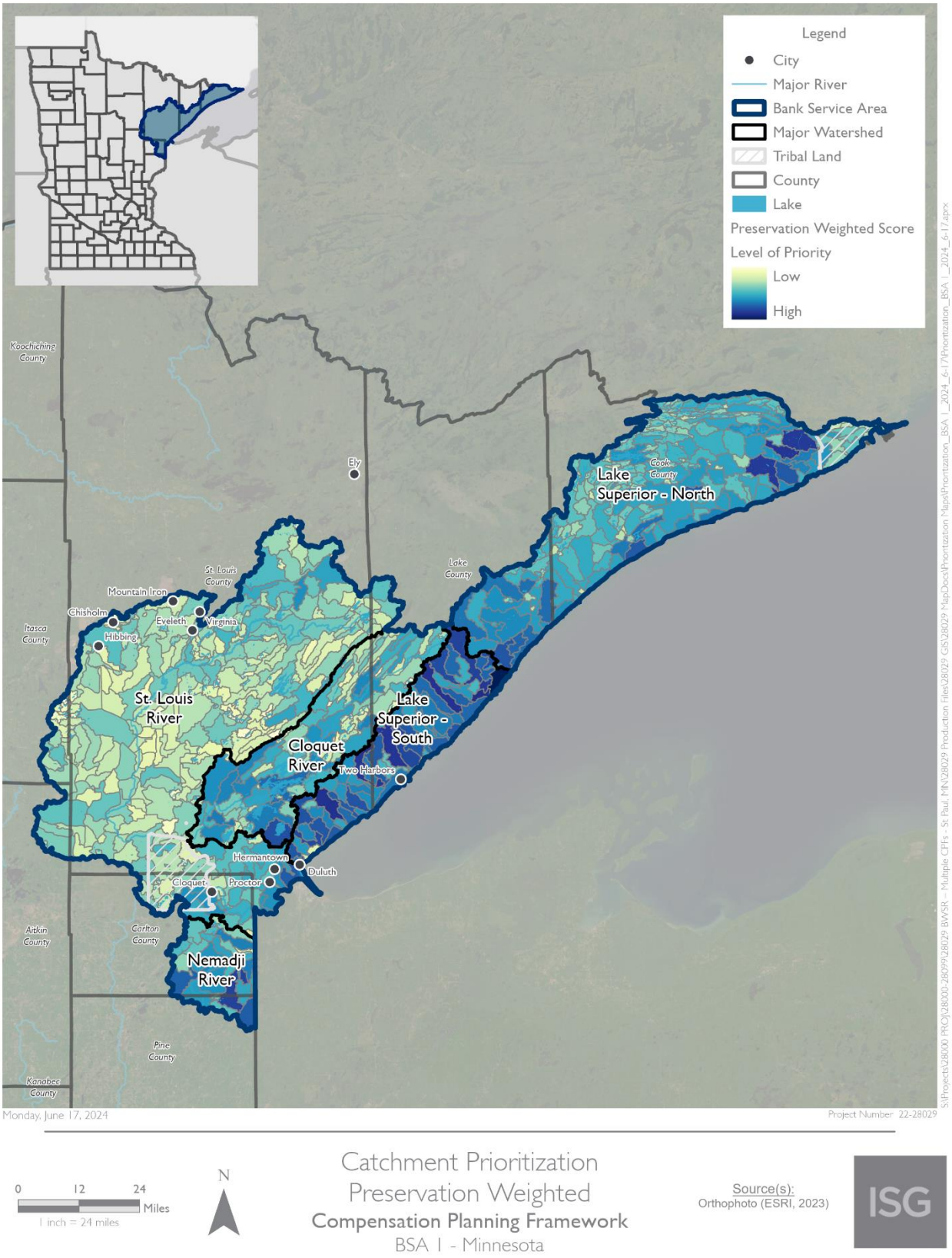

Figure D-6. Final Restoration Catchment Prioritization

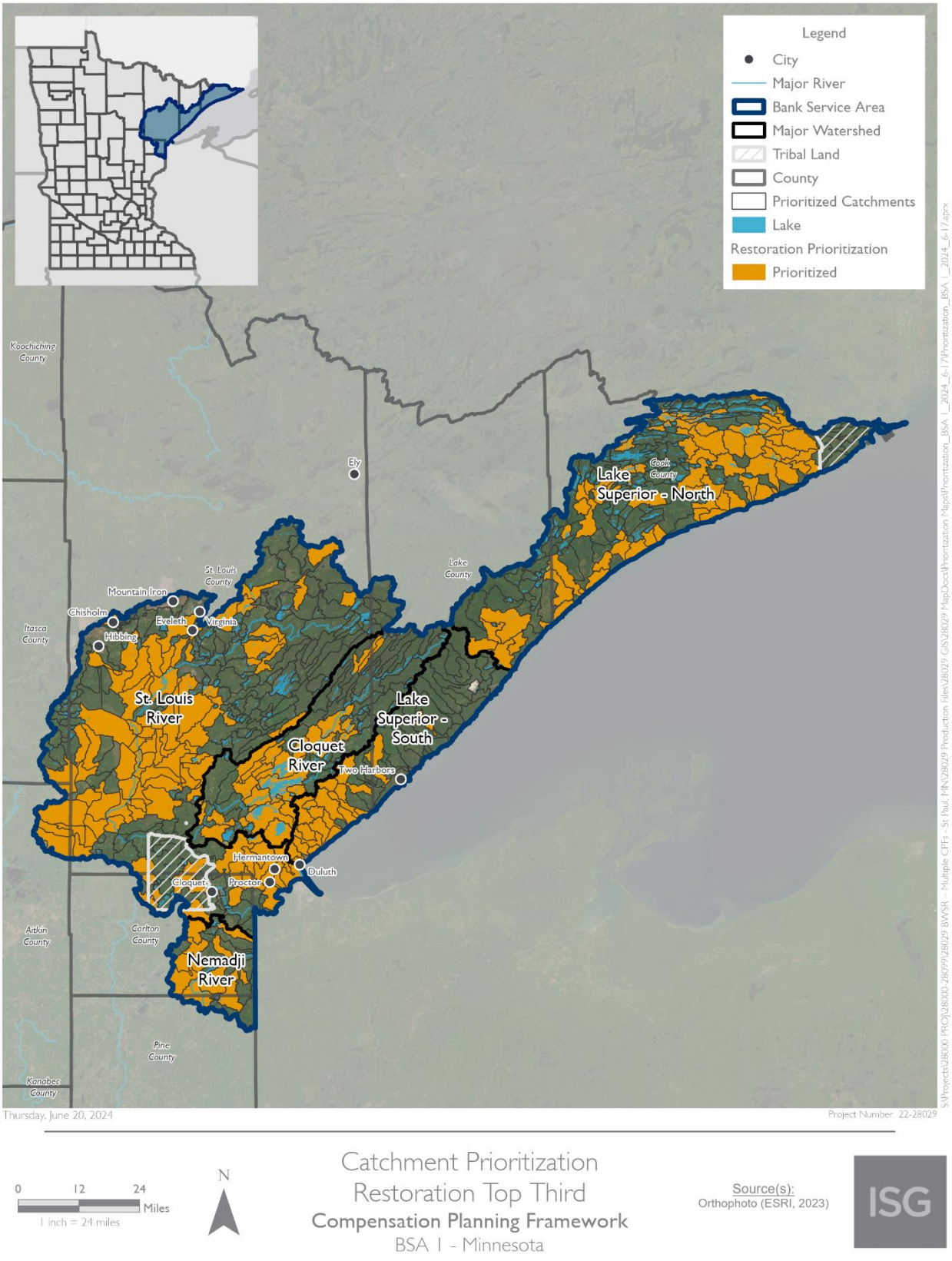

Figure D-7. Final Preservation Catchment Prioritization

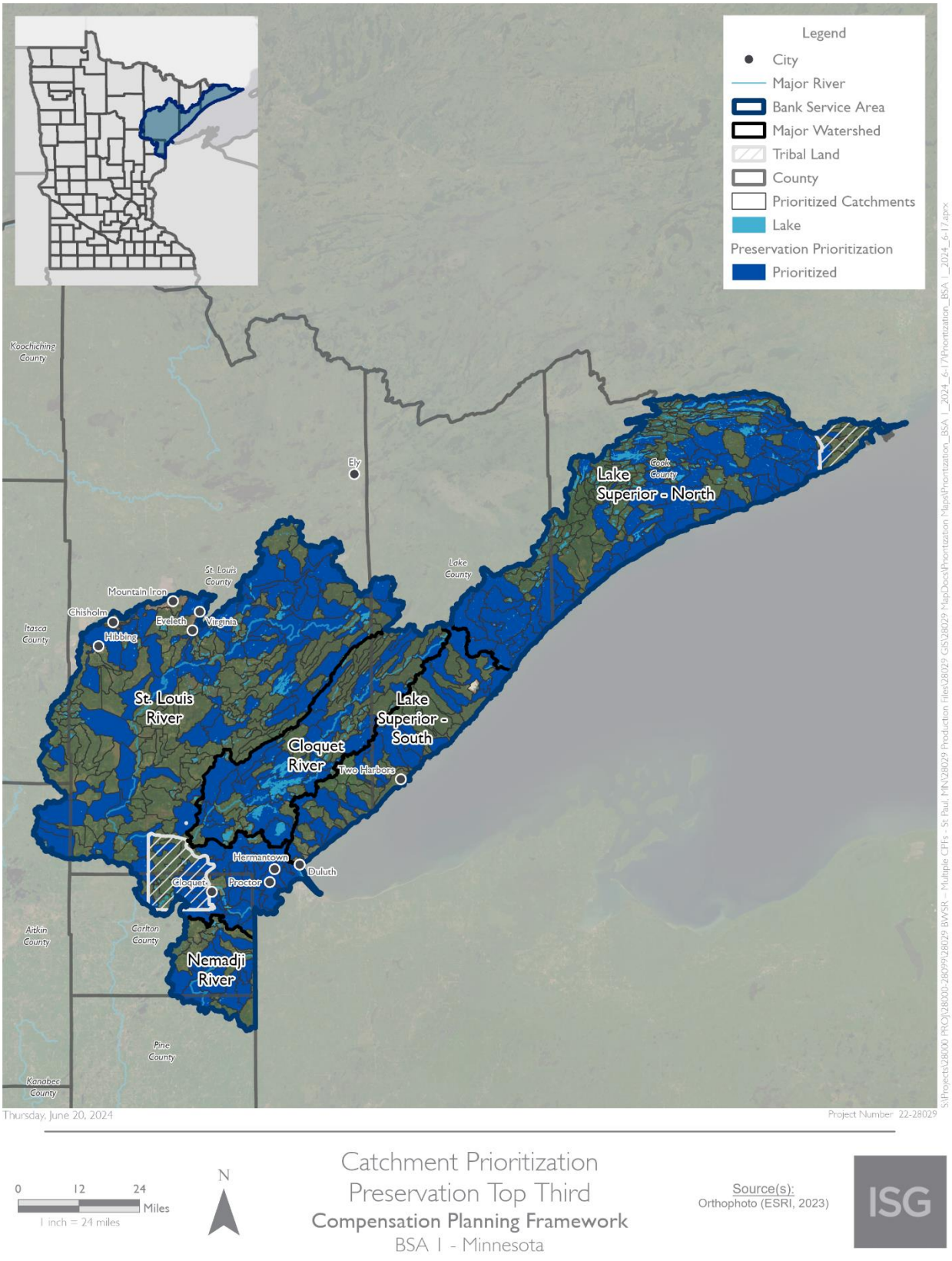

Figure D-8. Final Restoration Catchment Prioritization – Cloquet River Watershed

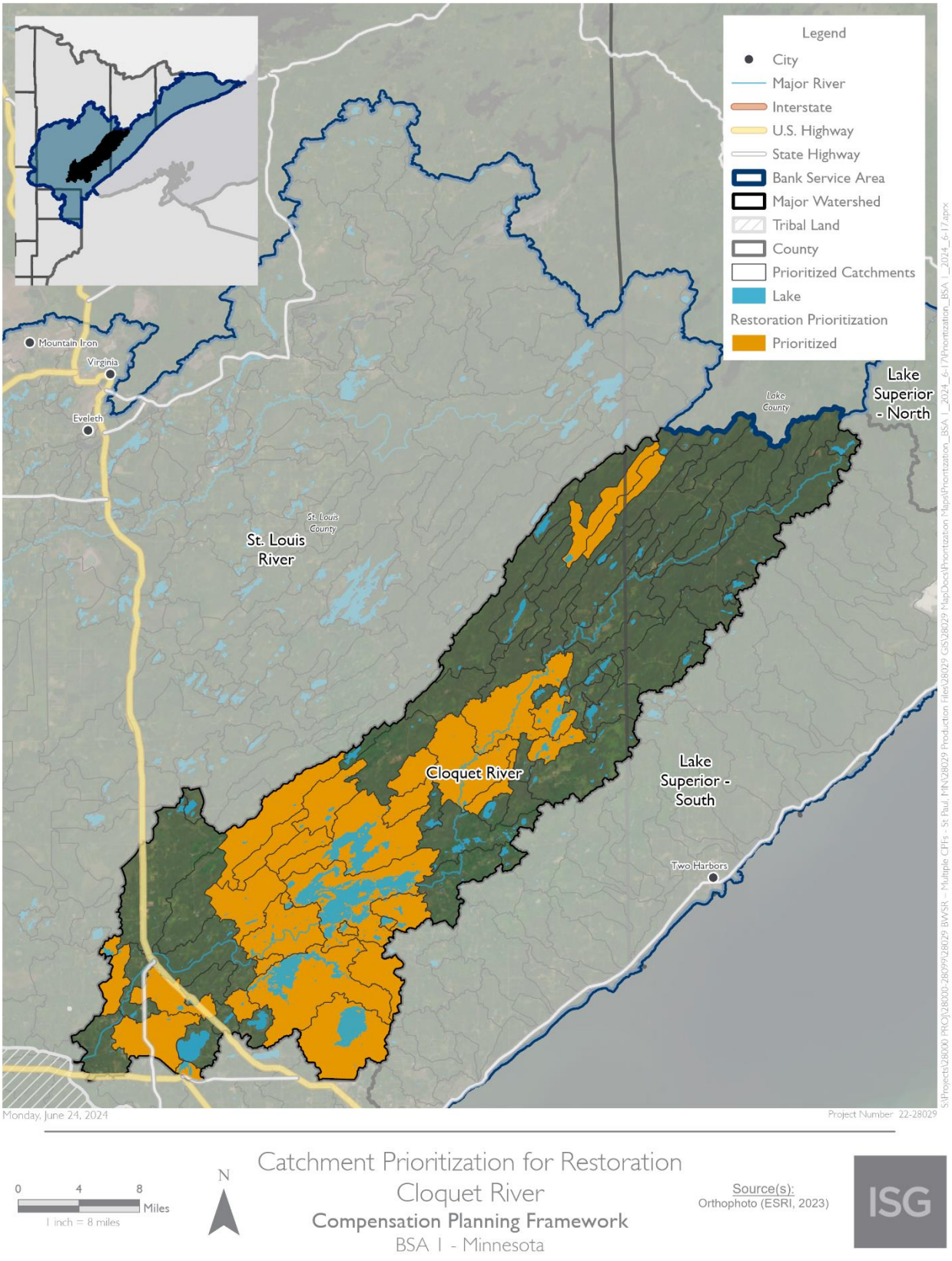

Figure D-9. Final Restoration Catchment Prioritization – Lake Superior – North Watershed

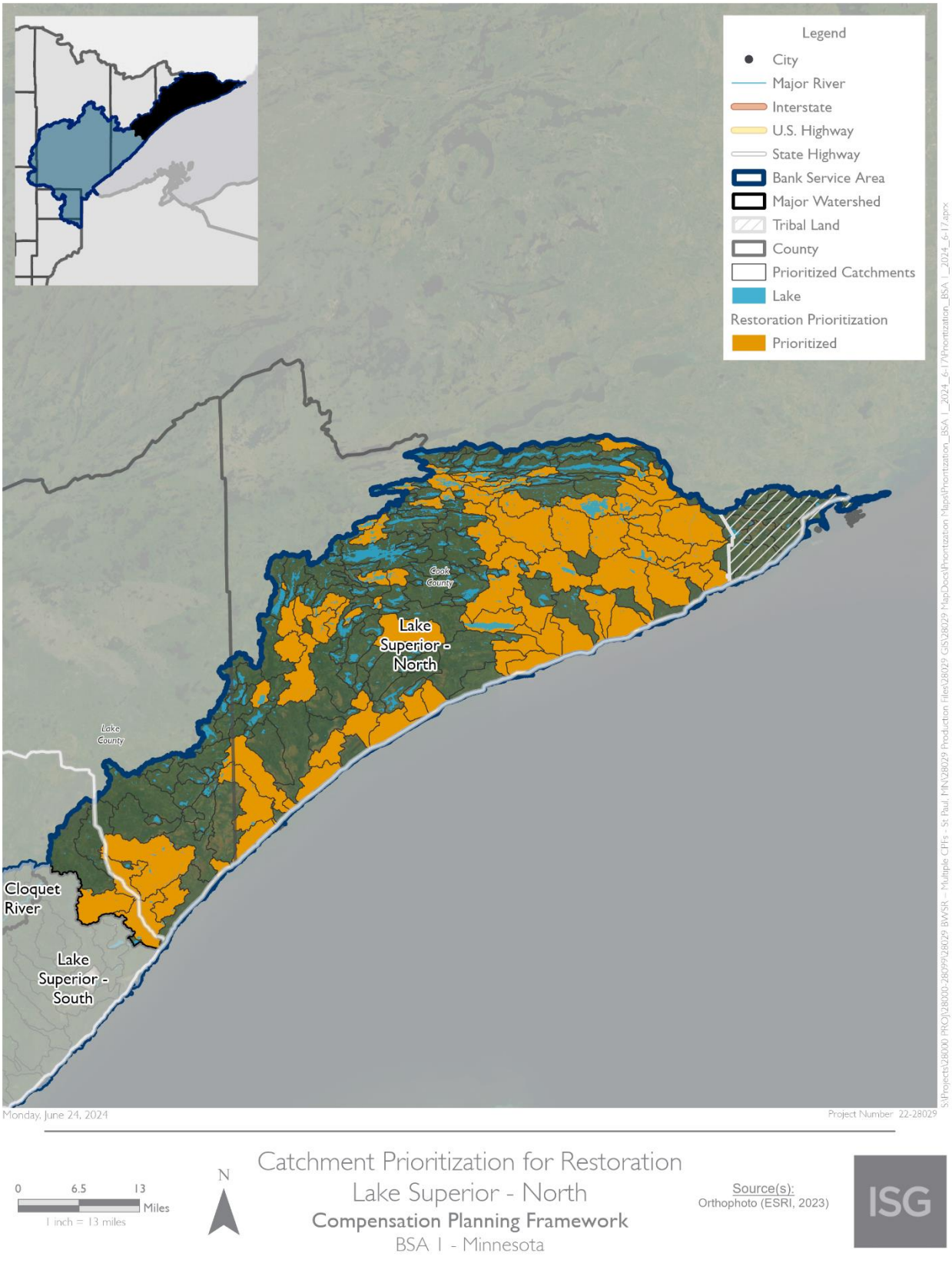

Figure D-10. Final Restoration Catchment Prioritization – Lake Superior – South Watershed

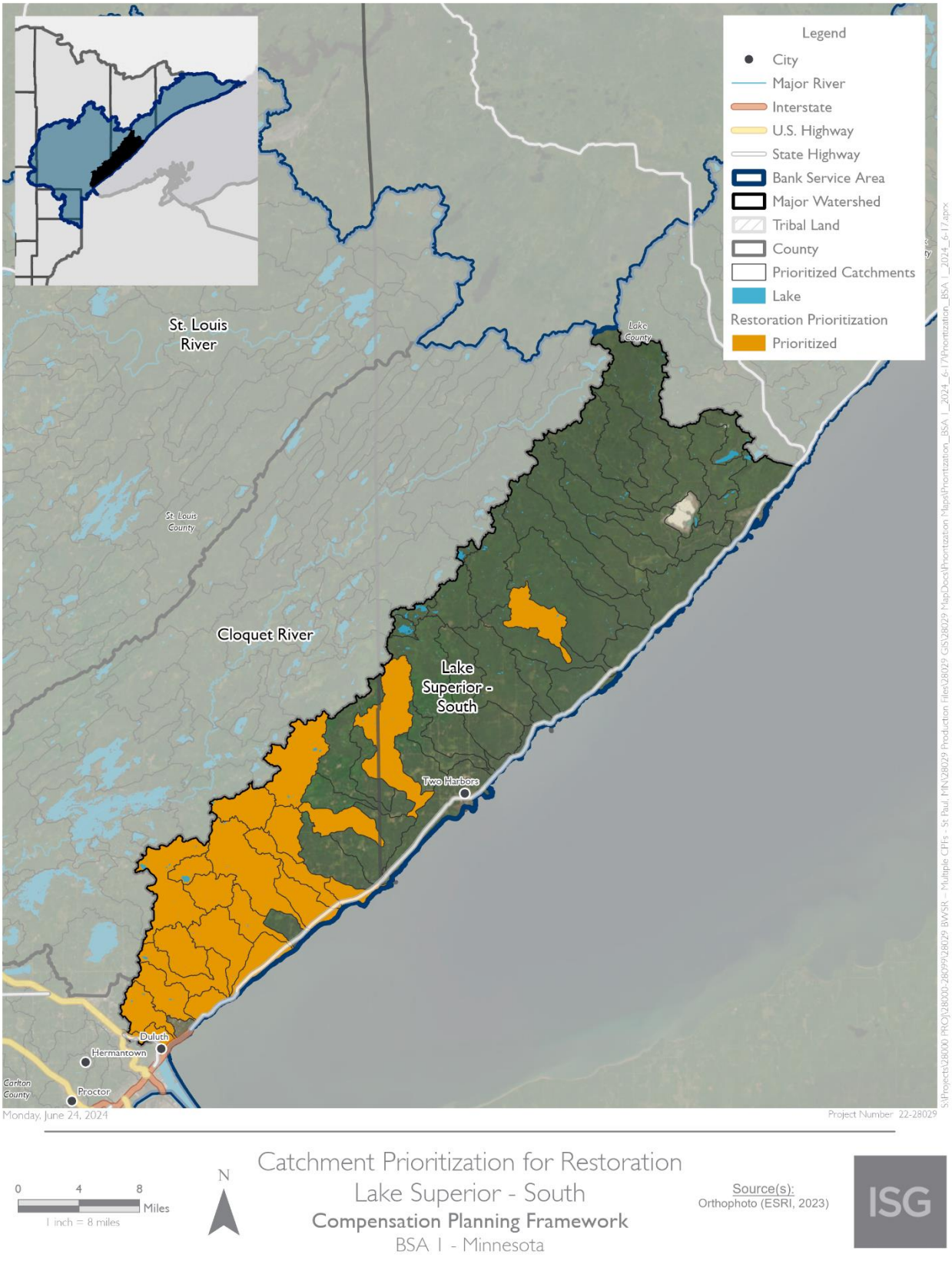

Figure D-11. Final Restoration Catchment Prioritization – Nemadji River Watershed

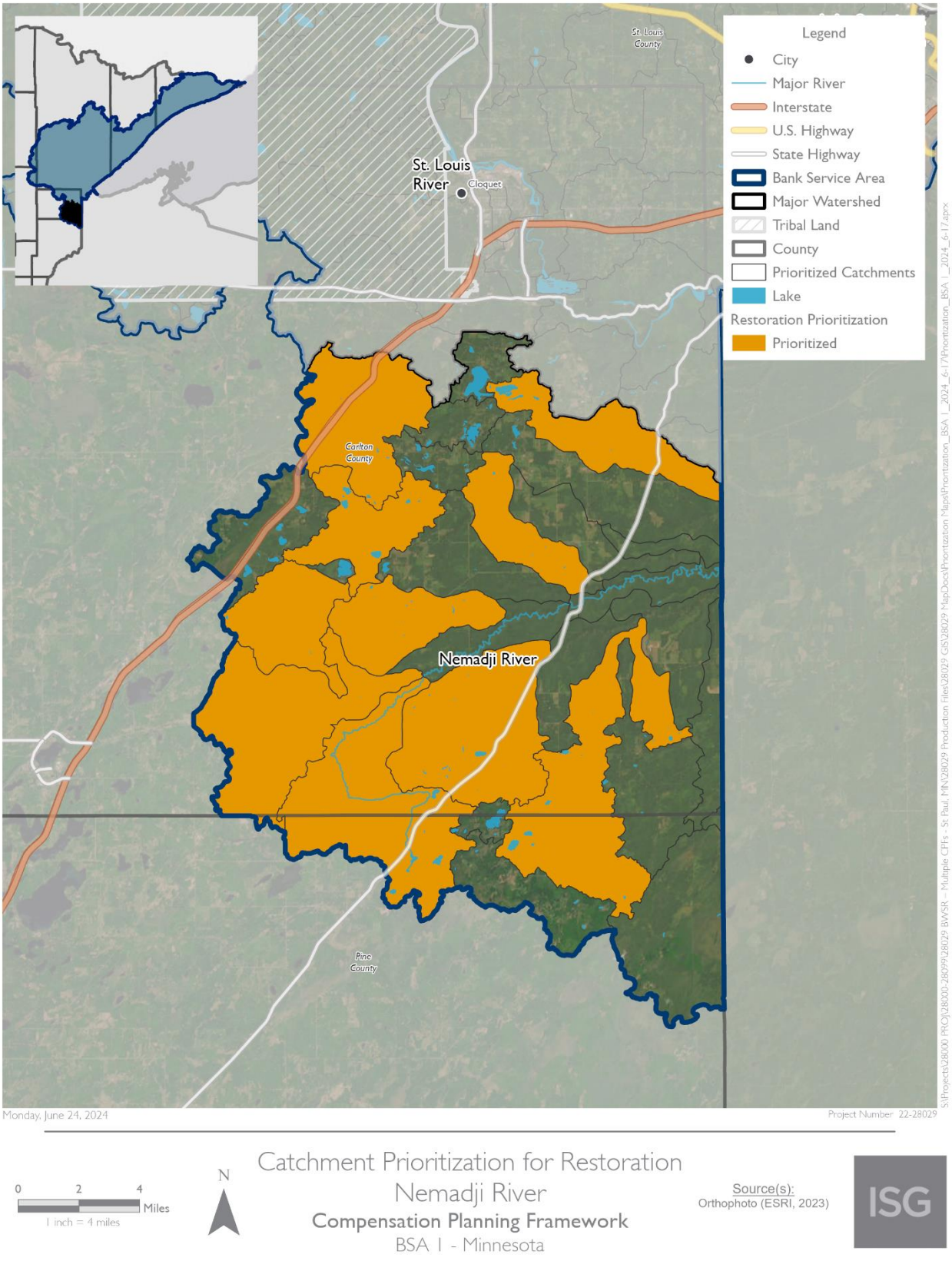

Figure D-12. Final Restoration Catchment Prioritization – St. Louis River Watershed

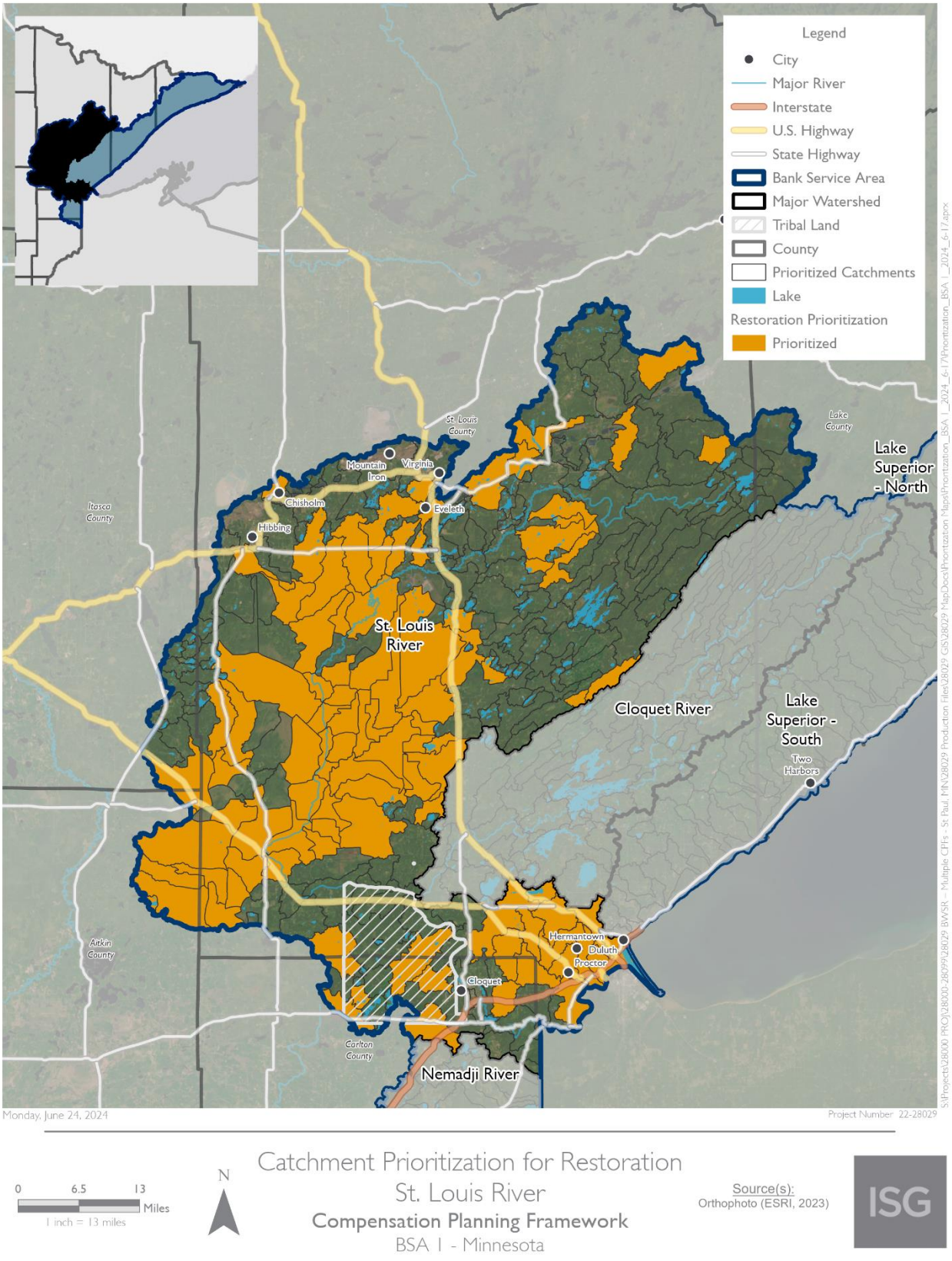

Figure D-13. Final Preservation Catchment Prioritization – Cloquet River Watershed

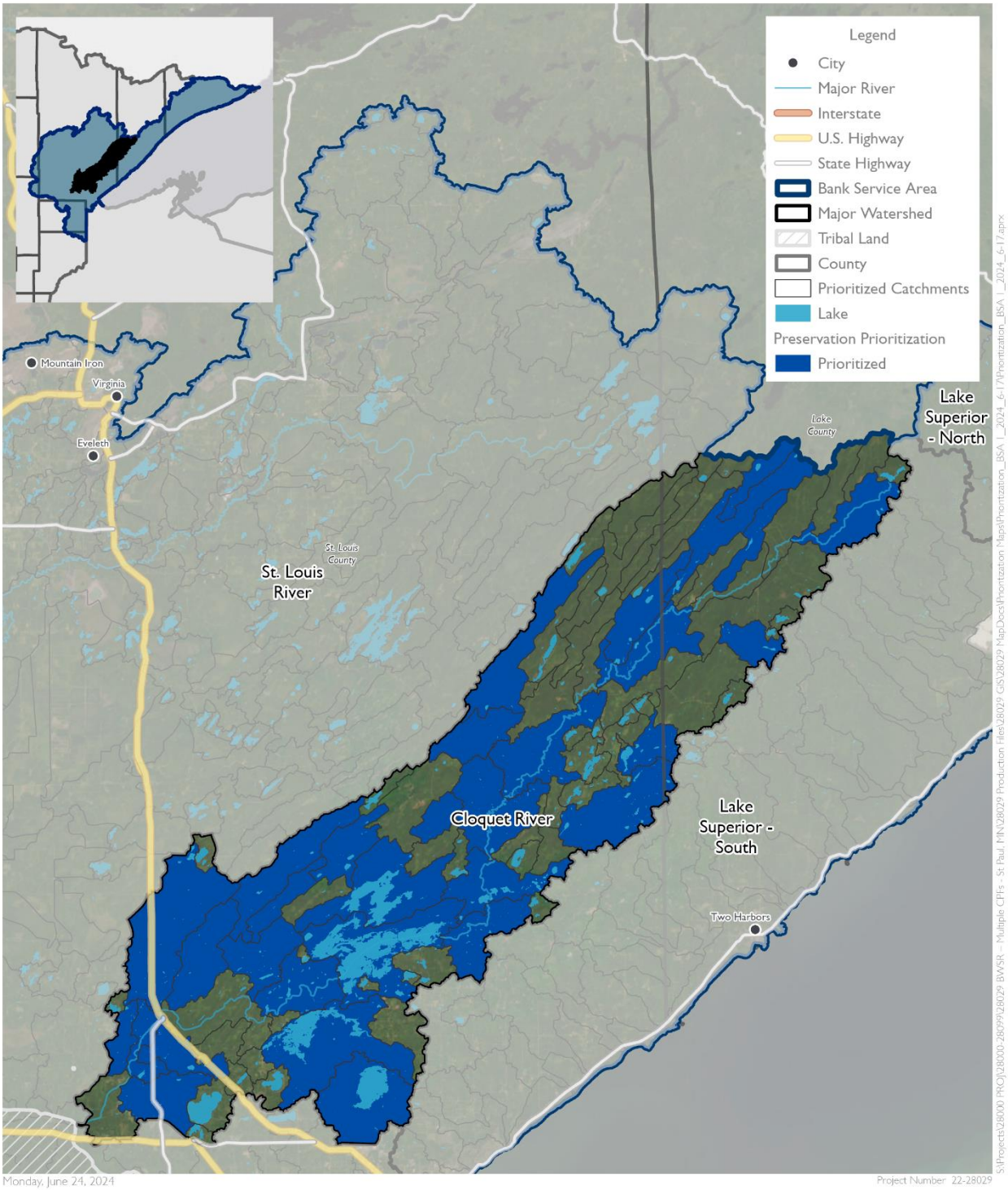

Figure D-14. Final Preservation Catchment Prioritization – Lake Superior – North Watershed

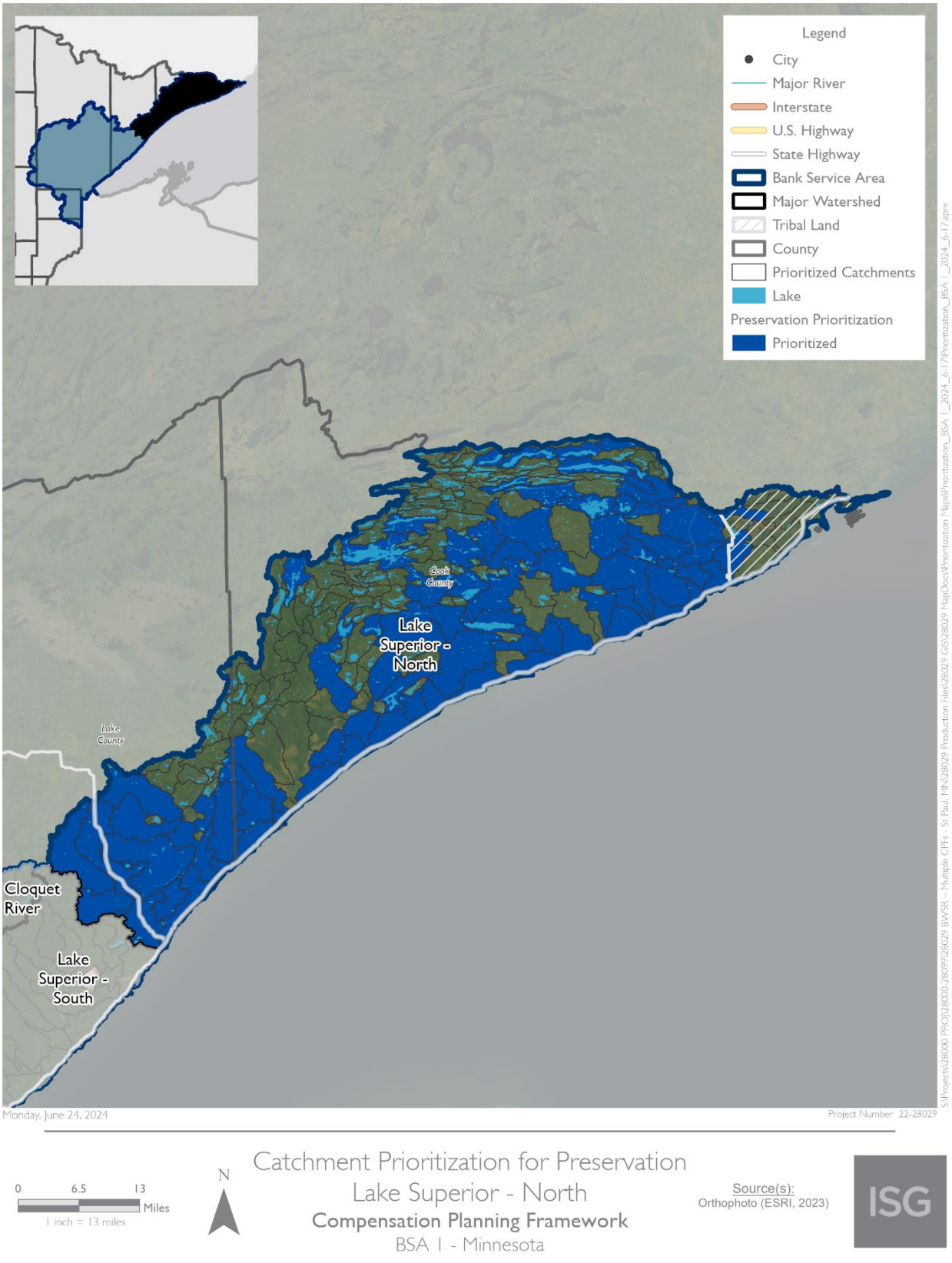

Figure D-15. Final Preservation Catchment Prioritization – Lake Superior – South Watershed

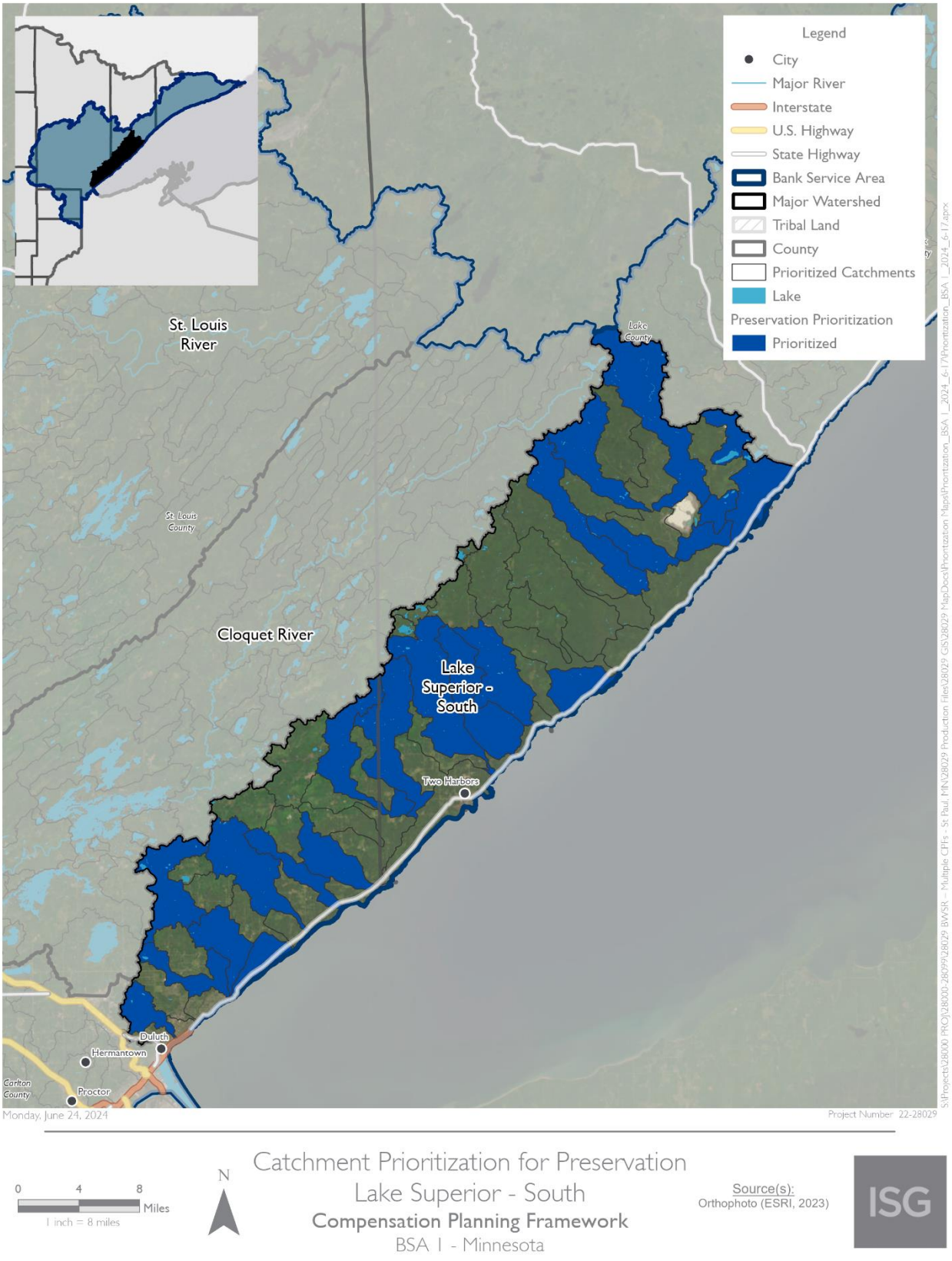

Figure D-16. Final Preservation Catchment Prioritization – Nemadji River Watershed

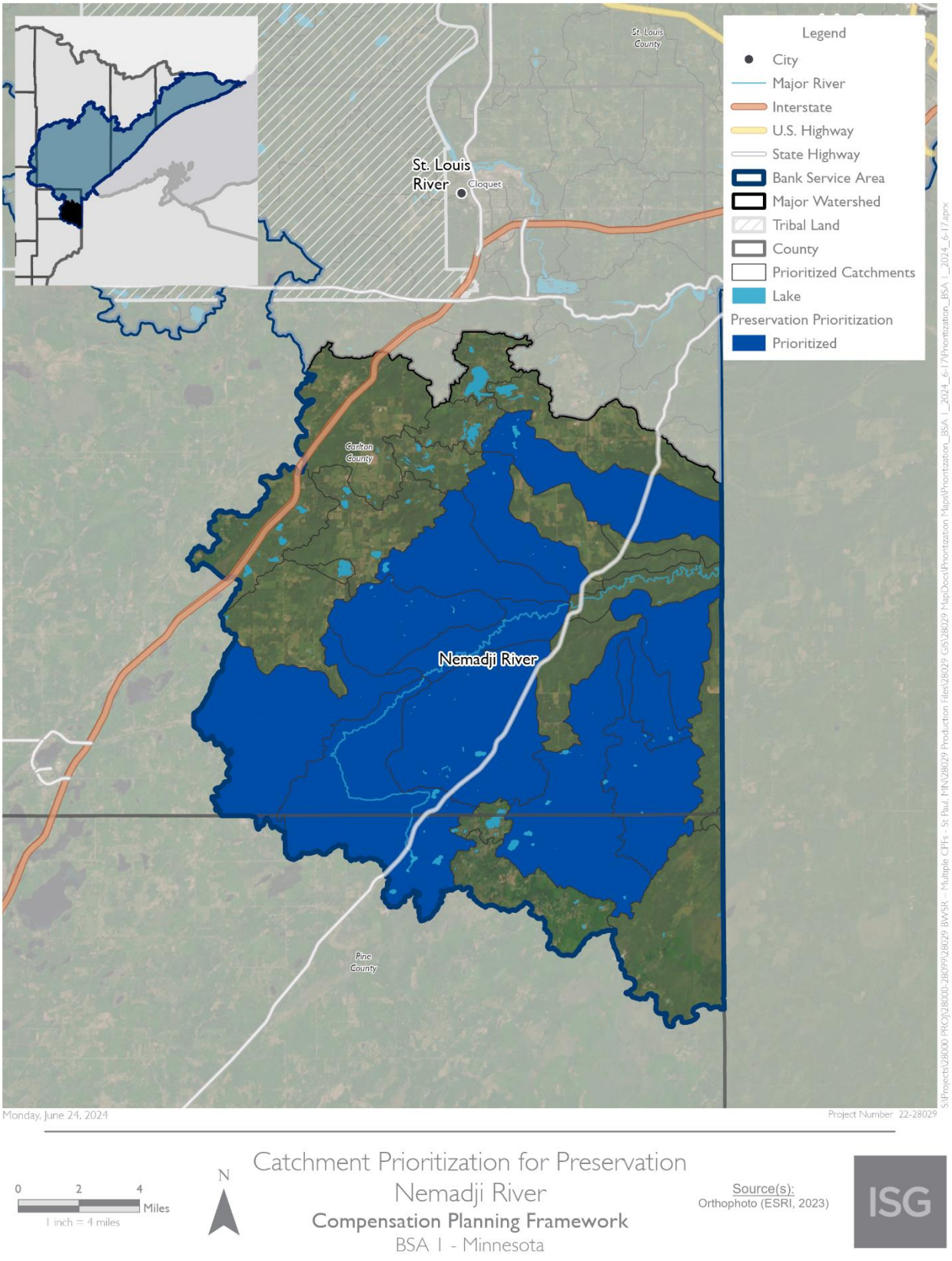

Figure D-17. Final Preservation Catchment Prioritization – St. Louis River Watershed