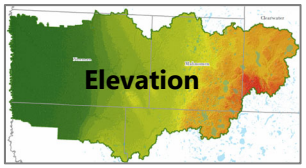
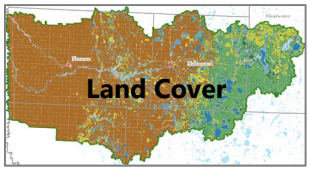
Land and Water Resource Narrative

The story of the Wild Rice - Marsh River Watershed is a story of transitions. From high ground to low ground, forested to cultivated, lakes to streams, natural to altered water courses, this slice of geography is ecologically and economically diverse on an east-west axis.





Positioned in the middle of Minnesota's side of the Red River Basin, the Wild Rice – Marsh River Watershed drains approximately 1,998 square miles (1,278,720 acres) across six counties - Becker, Clay, Clearwater, Mahnomen, Norman, and Polk - before it joins the Red River of the North. Primary towns include Ada, Mahnomen, Twin Valley, White Earth, Waubun, and Zerkel (Figure 1).

The area defined for this planning effort is comprised of two distinct watersheds, the Wild Rice and the Marsh River – Upper Red River of the North. The Marsh River includes areas of direct drainage to the Red River South and North of the Wild Rice River confluence with the Red River (Figure 1).

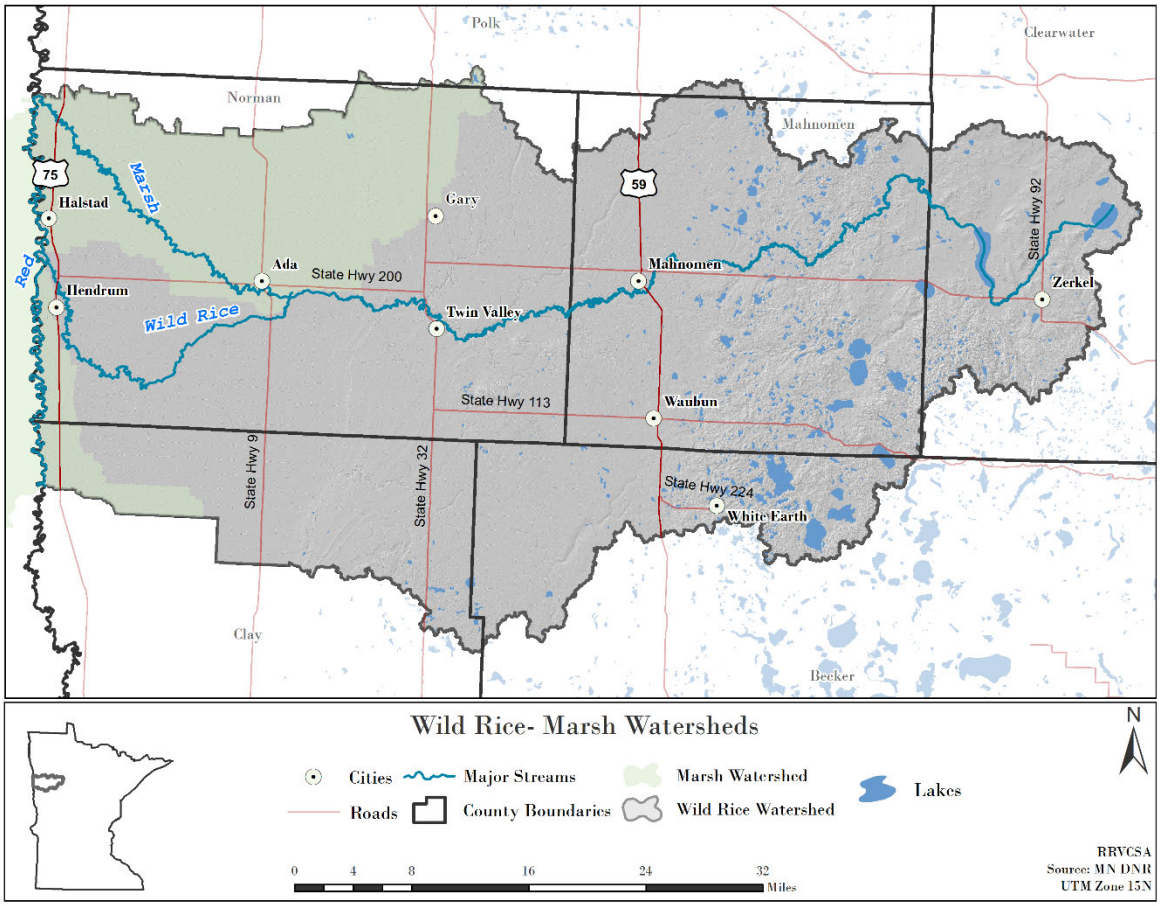


Figure 1. Wild Rice and Marsh River Watersheds.

Past

This east to west transition in the Wild Rice – Marsh River Watershed is a result of **glacial activity** in the area. Glaciers scoured Minnesota and North Dakota during the last ice age, leaving lakes, outwash and till in their wakes. Around 10,000 years ago the glaciers began to melt back, but an ice sheet still covering Canada blocked water drainage north to Hudson Bay. As a result, the melt water backed up, forming the 700-mile-long x 200-mile-wide Lake Agassiz covering what is now the Red River Valley (Figure 2). As the northern ice sheet retreated, Lake Agassiz drained north to Hudson Bay, but left behind Lake of the Woods and Lakes Winnipeg and Manitoba as remnants (NDGS).

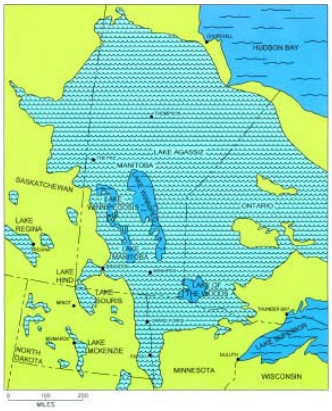


Figure 2. Glacial Lake Agassiz (North Dakota Geological Survey).

The **soils** in the watershed bear the mark of glacial activity as well. The fine claylike silt that accumulated on the bottom of Lake Agassiz (Lacustrine) is responsible for the fertility of the Red River Valley today. The beaches of Lake Agassiz can still be seen as north/south transects of sandy soil in the middle of the transitional zone of the watershed (Till Plain, Figure 3). The makeup of soils determines what type of land uses are amenable to that landscape and also the rates of infiltration and erosion. Sandy soils are well drained and therefore runoff is minimal, whereas fine particles such as silt erode more easily.

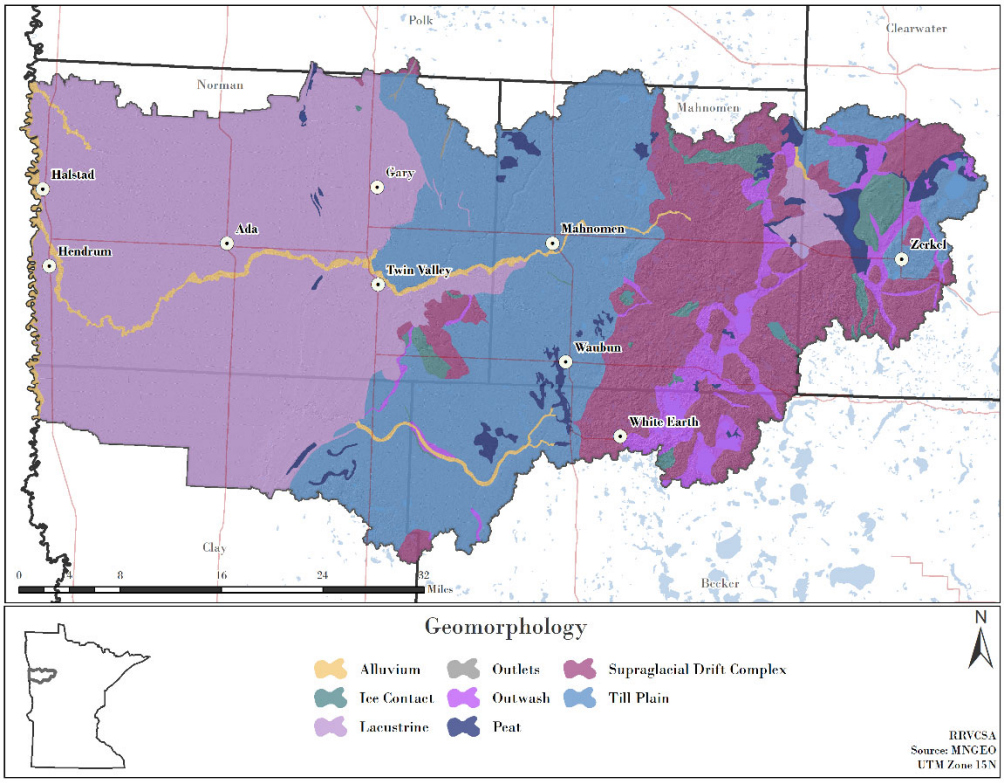


Figure 3. Soils in the Wild Rice - Marsh Watersheds.

Before humans settled the area, the land cover in the Wild Rice – Marsh Watershed transitioned from mixed forests in the east to prairie to the west. There were also numerous wetlands dotting as much as 40% the landscape (DNR WHAF). These wetlands are part of the Prairie Pothole Region, which has glacial depressions that fill with water in spring and form wetlands. The Prairie Pothole Region is important ecologically to North America because it is vital for migratory waterfowl and other wildlife, supporting breeding populations of numerous waterfowl species.

Present

The **climate** in the Wild Rice – Marsh Watershed is a temperate continental climate with cold winters and warm summers. The cold winters affect the surface water and the growing season. The lakes are ice-covered in the winter, and plants and cultivated crops can only grow from approximately May through October. Average annual precipitation is 25.2 inches and average temperature is 40.7 F. (DNR WHAF)

The Wild Rice River cuts a generally east to west course from its headwaters at Upper Rice Lake 168 miles to its confluence with the Red River of the North. The headwaters start in the Northern Lakes and Forests Ecoregion, and consists of forests and hilly terrain, with many lakes and wetlands scattered on the landscape. These lakes are characterized by good water quality and habitat, and the landscape generally remains in its natural state. Major tributaries in this Ecoregion include Heir Creek, Buckboard Creek, Auganash Creek, Mosquito Creek and Roy Creek. The Wild Rice River also passes through Lower Rice Lake, a 2,000-acre lake abundant with Wild Rice.

As the Wild Rice River flows west it enters a transitional zone in the North Central Hardwoods Ecoregion. Here the elevation begins to drop and land use transitions from forests to cultivated crops. Some large lakes are present in this mosaic of land uses, and more alteration of the natural landscape has occurred, along with lakeshore development. The White Earth River is a major tributary that flows north from White Earth Lake to meet the Wild Rice River.

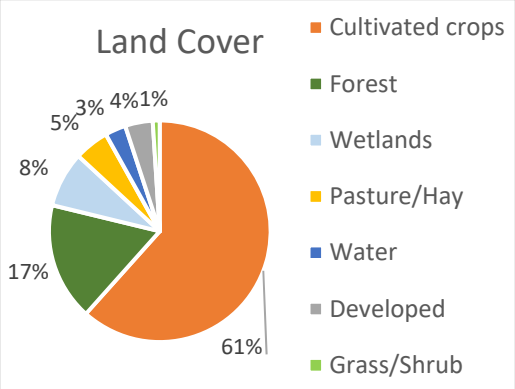


Figure 4. Land cover in the Wild Rice Watershed

As the Wild Rice River leaves this transitional zone, the elevation levels out into the flat Lake Agassiz Plain. Here, the land use is dominated by cultivated crops (Figures 4, 5). The crops grown are mainly corn, soybeans and small grains, with some sugarbeets in the northwest. Just east of Ada, the Marsh River breaks away on a northerly course and joins the Red River near Shelly, MN. The Wild Rice River continues on its westerly course and joins the Red River south of Halstad, MN.

There are nine permitted wastewater treatment facilities in the Wild Rice - Marsh Watershed (see map in Appendix X). None of the cities in the watershed require a Municipal Separation Storm Sewer System (MS4 permit).

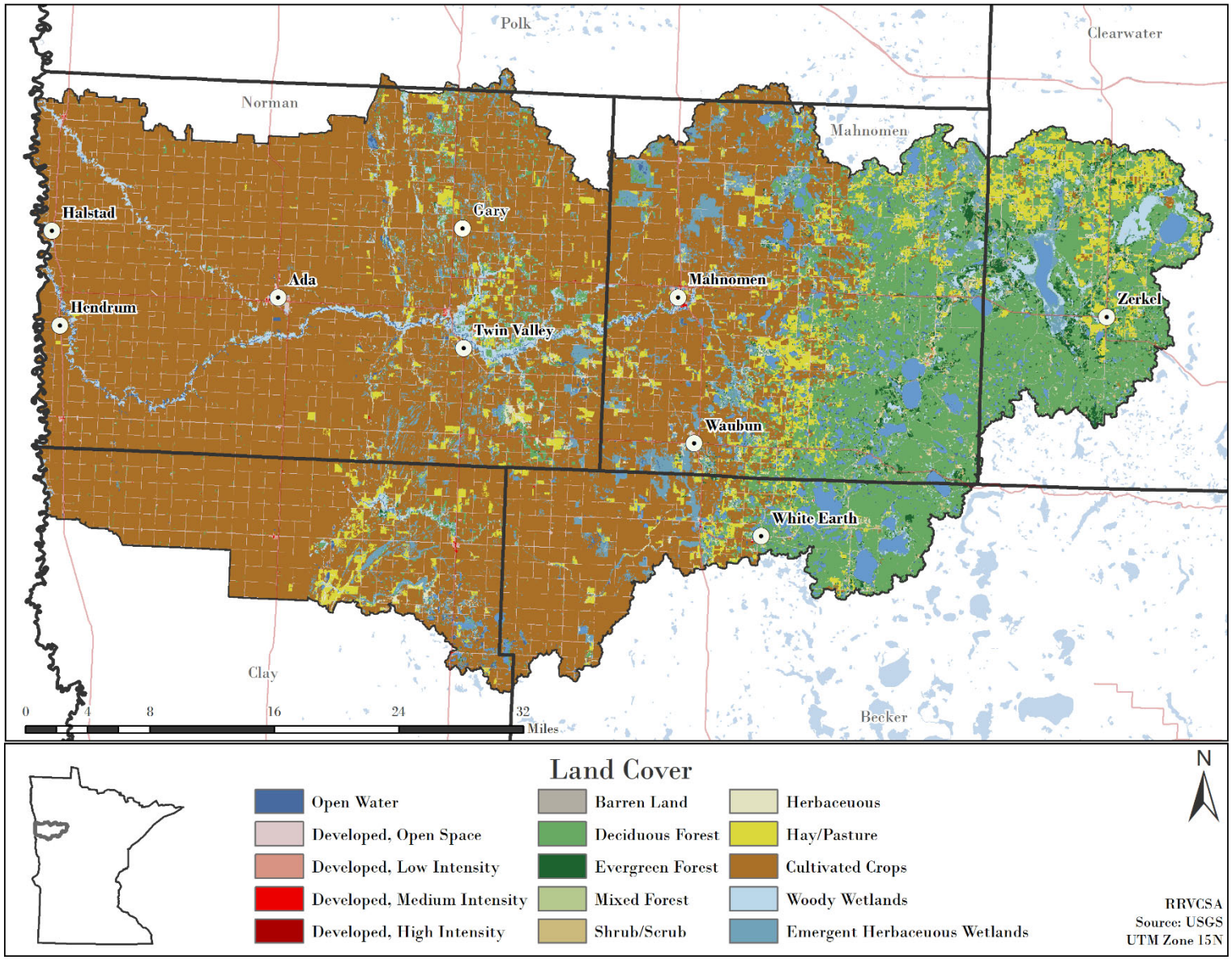


Figure 5. Land cover in the Wild Rice - Marsh Watershed.

The Wild Rice – Marsh Watershed has abundant surface water resources, including lakes, streams and wetlands. There are some **lakes** with outstanding water quality in the Wild Rice River Watershed (Table 1). The DNR has developed lake classifications to help describe and prioritize lakes with unique qualities:

- **Lakes with Outstanding Biological Significance:** The presence of unique species of aquatic plants, fish, birds, or amphibians.
- **Phosphorus Sensitivity**: The lake's sensitivity to phosphorus as determined by the DNR. Sensitivity means that added phosphorus would affect the clarity in these lakes the most (Radomski 2018).
- **Cisco Refuge Lake**: Lakes with cold-water fisheries and the presence of Cisco (tullibee). These lakes are classified as deep and clear enough that they will still provide suitable cold-water fish habitat even after climate change.
- **Wild Rice Priority Lakes**: Lakes where wild rice management and protection is a priority.

Of the lakes tested, only Roy and Tulaby are showing a declining trend in transparency and only Tulaby is impaired for eutrophication. The remaining lakes can be prioritized for protection strategies to maintain the excellent water quality.

Table 1. Selected large lakes in the Wild Rice River Watershed with outstanding qualities.

Lake	Surface Area (acres)	Depth Classification	Water Quality Trend	Trophic State	Outstanding Qualities
Upper Rice	1,338	Shallow Lake	Insufficient data	48 - Mesotrophic	Outstanding Biological Significance Wild Rice Lake
Roy	679	Deep Lake	Declining	53 - Eutrophic	Highest Phosphorus Sensitivity Wild Rice Lake
South Twin	1,101	Deep Lake	Stable	45 - Mesotrophic	Cisco Refuge Lake, Higher Phosphorus Sensitivity
Strawberry	1,445	Deep Lake	Stable	41 - Mesotrophic	Higher Phosphorus Sensitivity
White Earth	1,980	Deep Lake	Improving	38 - Oligotrophic	Cisco Refuge Lake, Outstanding Biological Significance; Lake Sturgeon reintroduced
Lower Rice	2,018	Shallow Lake	Insufficient data	58 - Eutrophic	Outstanding Biological Significance Wild Rice Lake

Lake Sturgeon once inhabited the Red River and its tributaries and lakes, but their populations. were decimated as a result of habitat alterations, dam construction and sediment. In the 2000s, sturgeon were introduced to White Earth Lake and other surrounding lakes by the White Earth Department of Natural Resources and are now thriving again.

Figure 6. Upper Rice Lake.

Forests, wetlands and lake-rich areas are also quality **habitat** for fish and wildlife and enjoyable terrain for recreation. Boating, fishing, and waterfowl, small game and deer hunting are regular pastimes in the area. There are many designated wildlife management areas and to protect these riches (Figure 11). The Minnesota Biological Survey has designated 31.8 square miles as outstanding (areas that contain the rarest species of plants and animals and the most ecologically intact or functional landscape) and 115.9 square miles of high biological significance (good occurrences of rare species of plants and animals and important functional landscapes).

The Wild Rice – Marsh Watershed has a large **stream** network that weaves through the landscape as it makes its way to the Red River. There are twice the number of intermittent streams as there are perennial streams.

Stream Miles in the Wild Rice – Marsh River Watershed

- 876 miles of intermittent stream
- 637 miles of intermittent drainage ditch
- 476 miles of perennial stream
- 50 miles of perennial drainage ditch
- Source: DNR 2003

Rivers and streams have seasonally variable patterns in their flows of water, nutrients and sediments. Mother Nature has its own built in methods for storing water (wetlands) and draining excess rainwater from the landscape (intermittent streams). When humans began farming in the Red River Valley, they began draining the water of the landscape more quickly to increase acreage for farming. These practices include ditches, culverts and dams, and are referred to as altered watercourses (Figure 7). When water is drained more quickly it also causes more nutrients and sediment to move into the streams and rivers. This sediment can affect habitat quality for fish and wildlife, including covering habitat structure such as rubble and woody debris and causing decreased dissolved oxygen and increased turbidity. Monitoring data illustrates these changes in the many listed stream impairments (Figure 8).

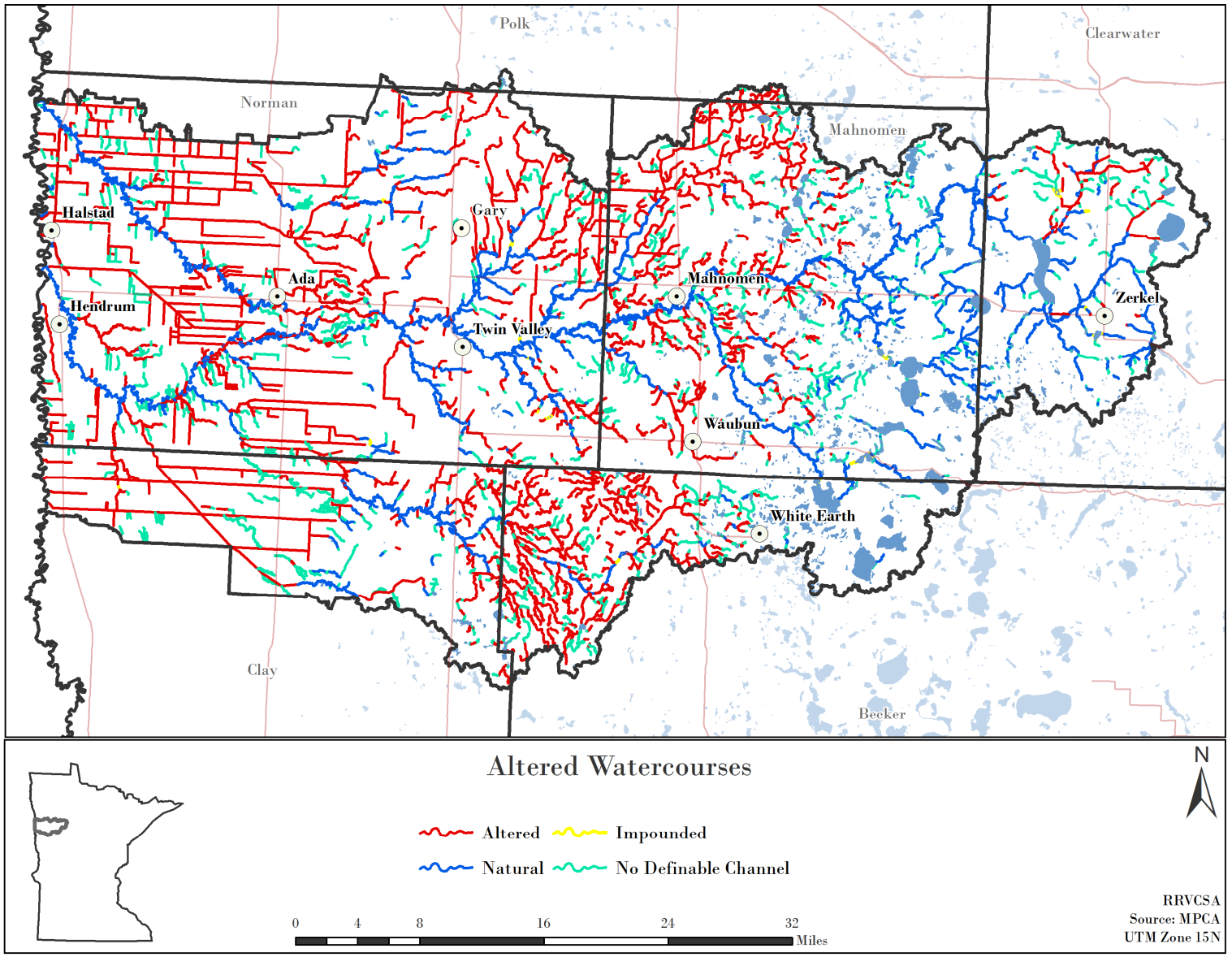


Figure 7. Altered watercourses in the Wild Rice - Marsh Watershed.

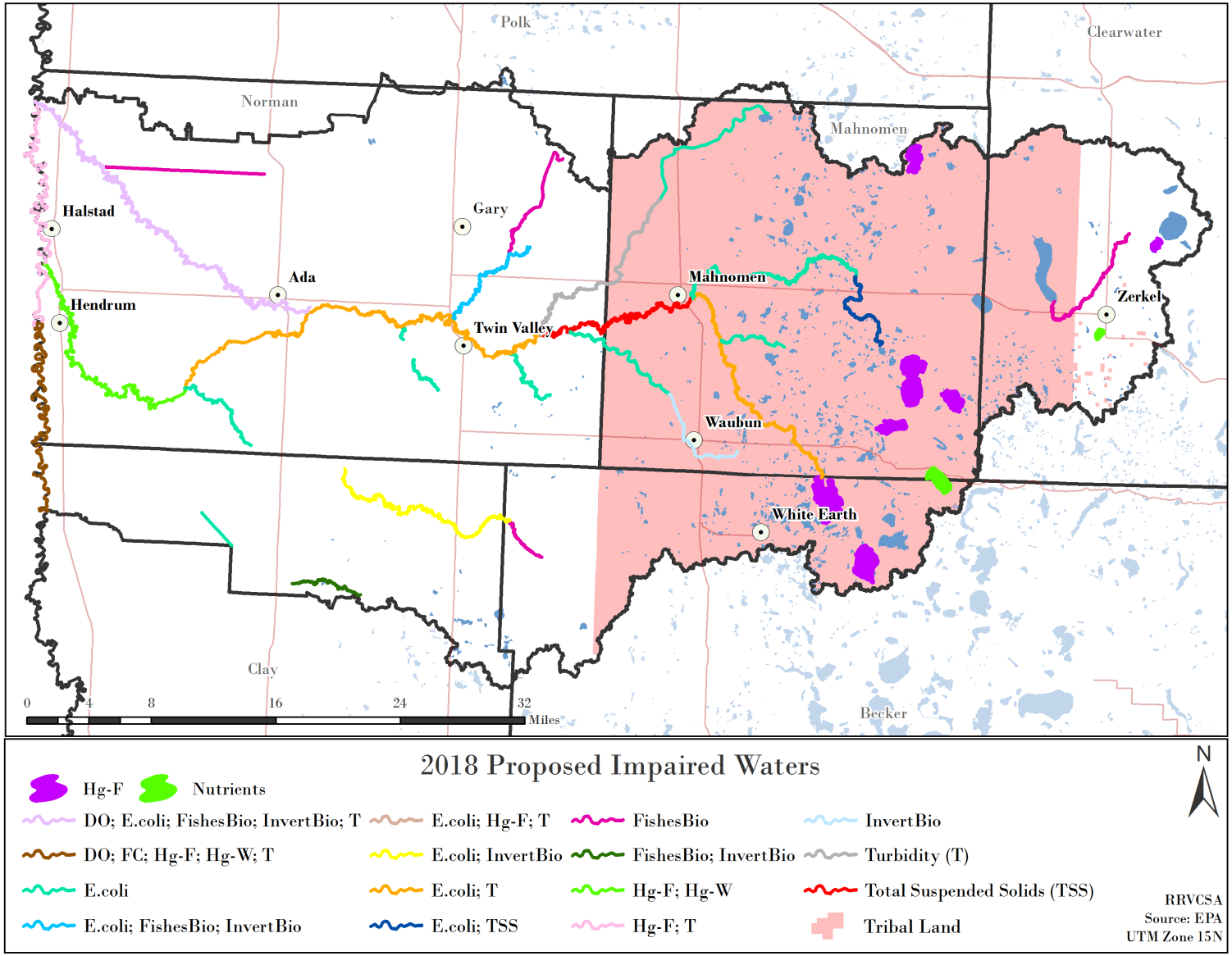


Figure 8. Impaired waters in the Wild Rice - Marsh River Watershed (WRAPS, 2019).

In 2014, the Minnesota Pollution Control Agency (MPCA) embarked on the Intensive Watershed Monitoring effort for the Wild Rice River Watershed, which resulted in the **Watershed Restoration and Protection Strategy (WRAPS)**. This monitoring effort consisted of analyzing existing data and collecting new data, including biological data (fish and aquatic macroinvertebrates). This study resulted in many new impairments in the watershed, which are waterbodies that do not meet state standards for water quality (Figure 8, Table 2).

Table 2. Impairment descriptions in the Wild Rice - Marsh River Watershed (Figure 8, WRAPS 2019).

Impairment	Description
M-IBI	Shows if the stream is healthy for invertebrates (insects, crayfish, etc)
F-IBI	Shows if the stream is healthy for fish.
Dissolved Oxygen (DO)	Fish and aquatic invertebrates need oxygen to survive. Low levels of dissolved oxygen affect the suability of the stream for these organisms.
E.coli	*E.coli* bacteria come from warm-blooded animals such as cattle and humans. It can contaminate the water for swimming.
Turbidity/Total Suspended Solids (TSS)	Turbidity and TSS are measures of how cloudy the water is from sediment. Sediment can come from land and streambank erosion.

Stressors are sources that are impacting or threatening the fish and aquatic macroinvertebrate communities. In the Wild Rice WRAPS, the greatest stressor was altered flow regime, in which periods of high flow contribute to high turbidity and sediment loading and low flow contributes to elevated water temperatures and resulting low dissolved oxygen. The majority of these impairments occur in the western half of the basin within the Lake Agassiz Plain that has been heavily drained to facilitate row crop agriculture. This planning process can work to find ways to improve these impaired water bodies.

Groundwater dynamics in the Wild Rice – Marsh River Watershed are also a relic of glacial activity. The Lake Agassiz plain has very low groundwater pollution sensitivity, while the far eastern side of the watershed is highly sensitive. Since the eastern side of this watershed is mainly forested, groundwater quality is not a priority concern. There are six Drinking Water Supply

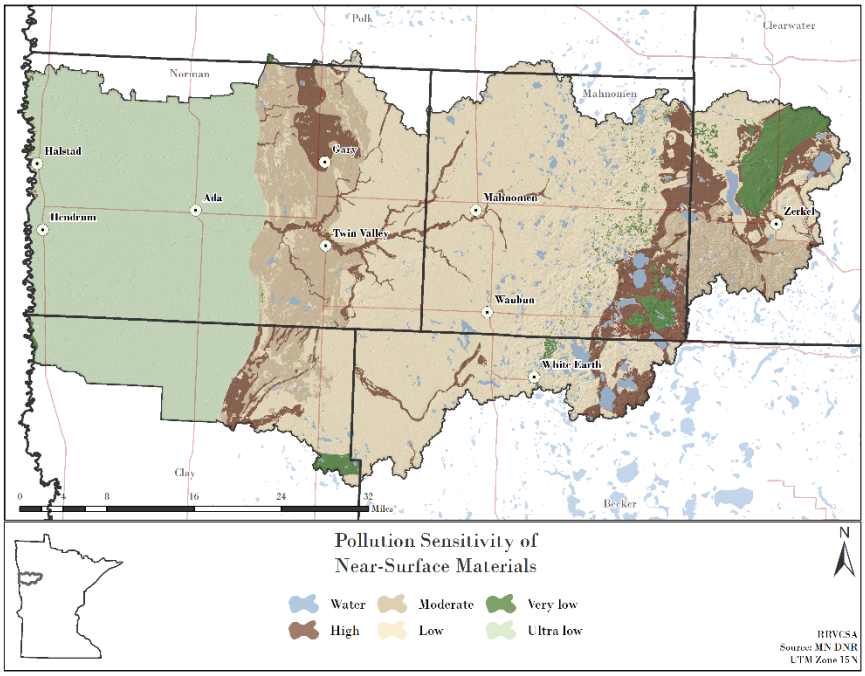


Figure 9. Groundwater sensitivity to pollution in the Wild Rice River Watershed (DNR WHAF).

Areas (DWSMAs) in the watershed but they are all classified as having low vulnerability (DNR WHAF).

From 1994-2013 ground water withdrawals have been increasing, largely driven by agricultural irrigation, so groundwater quantity could be an emerging concern.

Land ownership in the Wild Rice – Marsh Watershed is a mixture of private, public and tribal land (Figure 10). The White Earth Reservation, established in 1867 by treaty, covers a large portion of the eastern half of the watershed (Figure 8). The state land consists of numerous wildlife management areas scattered throughout the watershed (Figure 11).

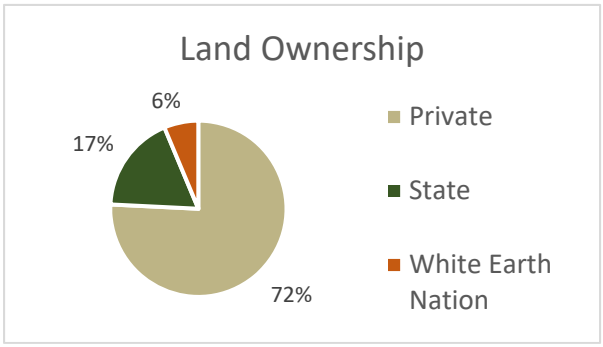


Figure 10. Land ownership in the Wild Rice Watershed.

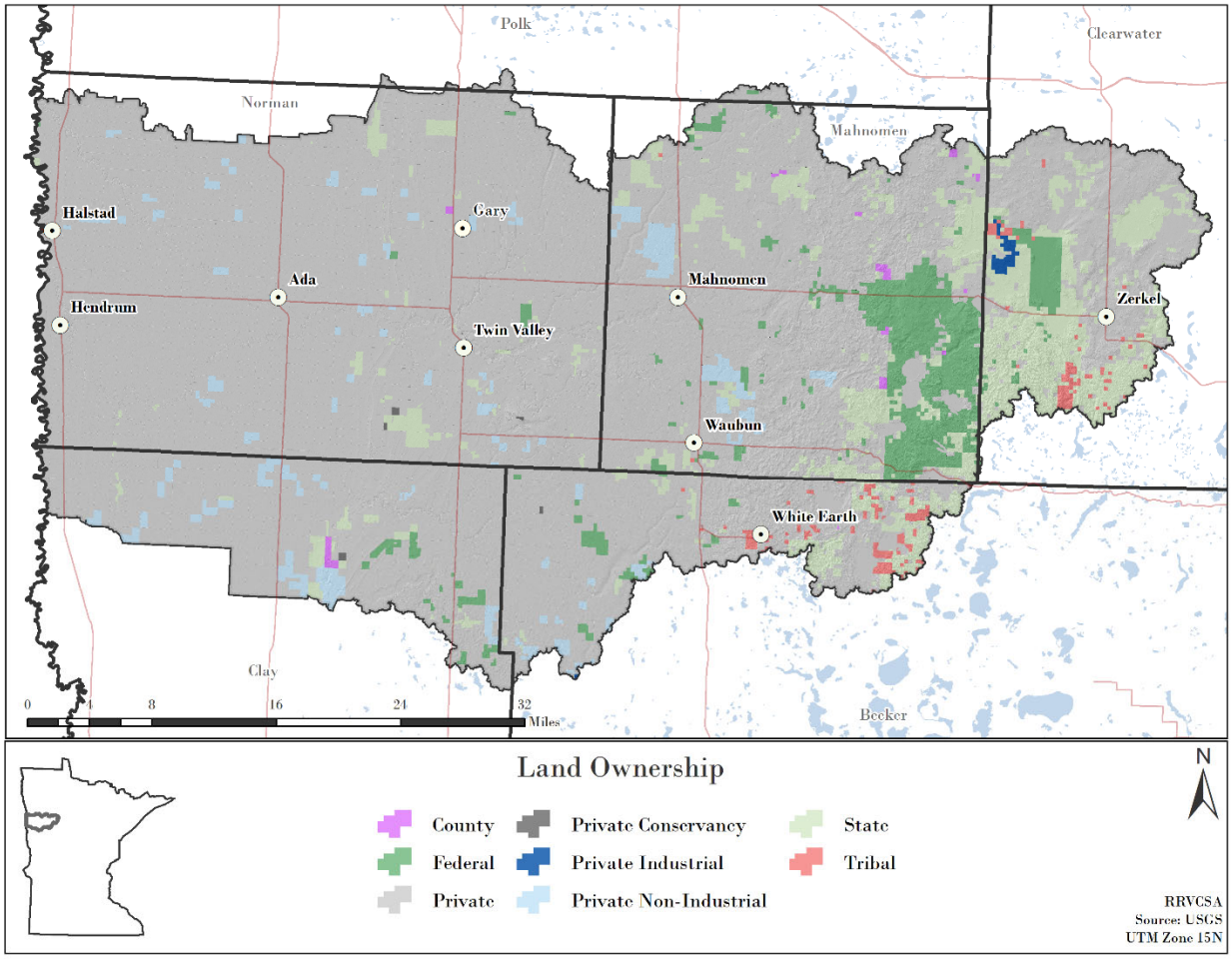


Figure 11. Map of land ownership in the Wild Rice - Marsh River Watershed.

Historical increases in altered watercourses and drainage of wetlands has also contributed to more frequent and more severe **flooding** in the watershed and downstream in the Red River, which can have negative economic and environmental consequences.

Figure 12. Flooded farm field.

Because of its history of flooding, the Red River Basin has worked to coordinate flood damage reduction on a basin-wide scale.

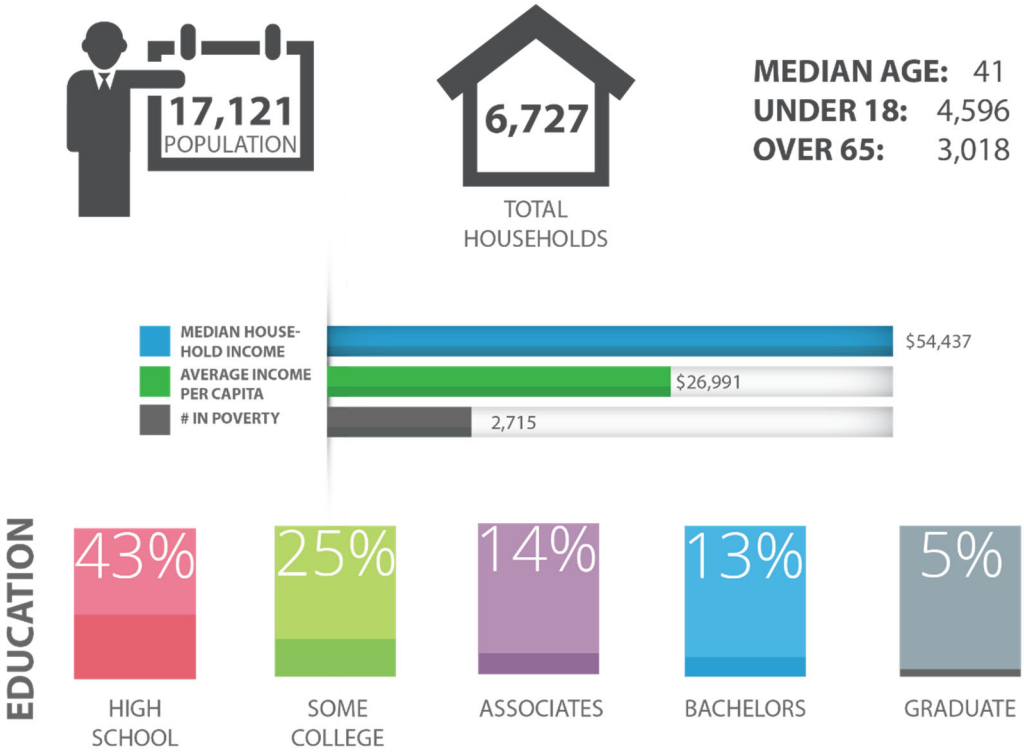
The main options for reducing runoff and flooding described in the Red River Basin Flood Damage Reduction Framework (Technical Paper No 11) include the following projects. Depending on the situation and location, nearly all methods have been deployed to some extent in the Wild Rice – Marsh Watershed.

1. **Reduce flood volume** – includes practices such as wetland restoration, cropland best management practices and conversion of land use to perennial grassland or forest (increases evapotranspiration).
2. **Increase conveyance capacity** – includes practices such as channelization, agricultural drainage, diversions, setting back existing levees and increasing road crossing capacity.
3. **Increase temporary flood storage** – includes practices such as impoundments, wetland restoration, culvert sizing and levees.
4. **Protection/avoidance** – includes practices such as urban, farmstead and agricultural levees, evacuation of the floodplain and flood-proofing.

The Wild Rice Watershed District was originally formed to reduce flood damage in the watershed, and now also manages water quality and natural resources. Flood damage reduction and protection projects have primarily included ring dikes around rural residences, community flood protection, improving public infrastructure and drainage systems, urban stormwater management, and increasing temporary flood storage. The Watershed District works together with the White Earth Band of Ojibwe and Soil and Water Conservation Districts to manage the abundant water resources in the watershed.

The main **economy** in the watershed is cultivated crops, with corn, soybeans and sugar beets most common. These crops are important to the nation's food source. The population in the watershed has not changed much over time and is currently 17,121 people (Figure 13) (See map in Appendix X). Most of the new development pressure is focused around the lakeshore in the eastern half of the watershed.

2017 US CENSUS AMERICAN COMMUNITY SURVEY WEIGHTED BY % BLOCK GROUP IN PLANNING REGION



2017 CENSUS OF AGRICULTURE WEIGHTED BY % OF EACH COUNTY IN PLANNING REGION

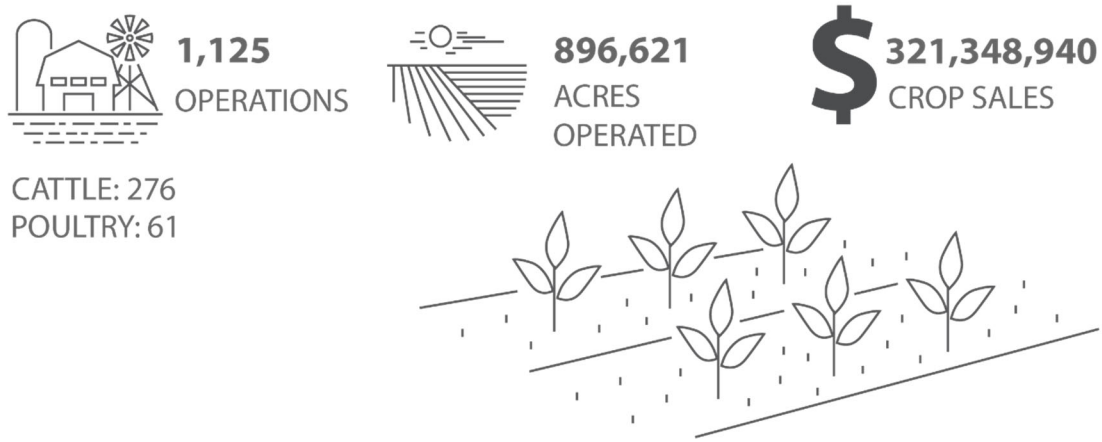


Figure 13. Socioeconomic information for the Wild Rice Marsh Watershed.

Future

Along with the story of the transitions over the landscape, there have also been transitions occurring over time in the Wild Rice – Marsh Watershed. The main changes that have occurred since pre-settlement times include:

- **Loss of wetlands**- In a comparison of hydric soils (soils that were historically saturated with water) and current wetlands, the wetlands have decreased from 881.4 sq. miles to 222.6 square miles (WHAF DNR), which amount to a 25% decrease in wetland coverage. A decrease in wetlands can contribute to flooding as there is less water being stored on the landscape.
- **Altered hydrology** – With row crop agriculture comes a tendency to drain water off the landscape more quickly than it does naturally, which has resulted in severe physical alteration (channelization, ditching, and impoundments) of the original waterbodies. This altered hydrology can increase the frequency and severity of flooding, increase the sediment and nutrients in streams and decrease habitat quality for aquatic organisms.
- **Lakeshore development** – Humans love water, and beautiful lakes are an attraction for human settlement. With increased settlement can come a tendency to alter the shoreline and build impervious surfaces. These changes can increase the nutrient and sediment runoff into the lake, affecting water quality and habitat for fish and aquatic organisms.

With an eye on the past and a foot in the future, the Wild Rice – Marsh River Watershed can be managed in a fashion that produces abundant crops, fosters soil health, reduces seasonal flooding, and protects the abundant lakes and rivers within its boundaries for all to enjoy.

Figure 14. Aerial view of Twin Valley, MN.