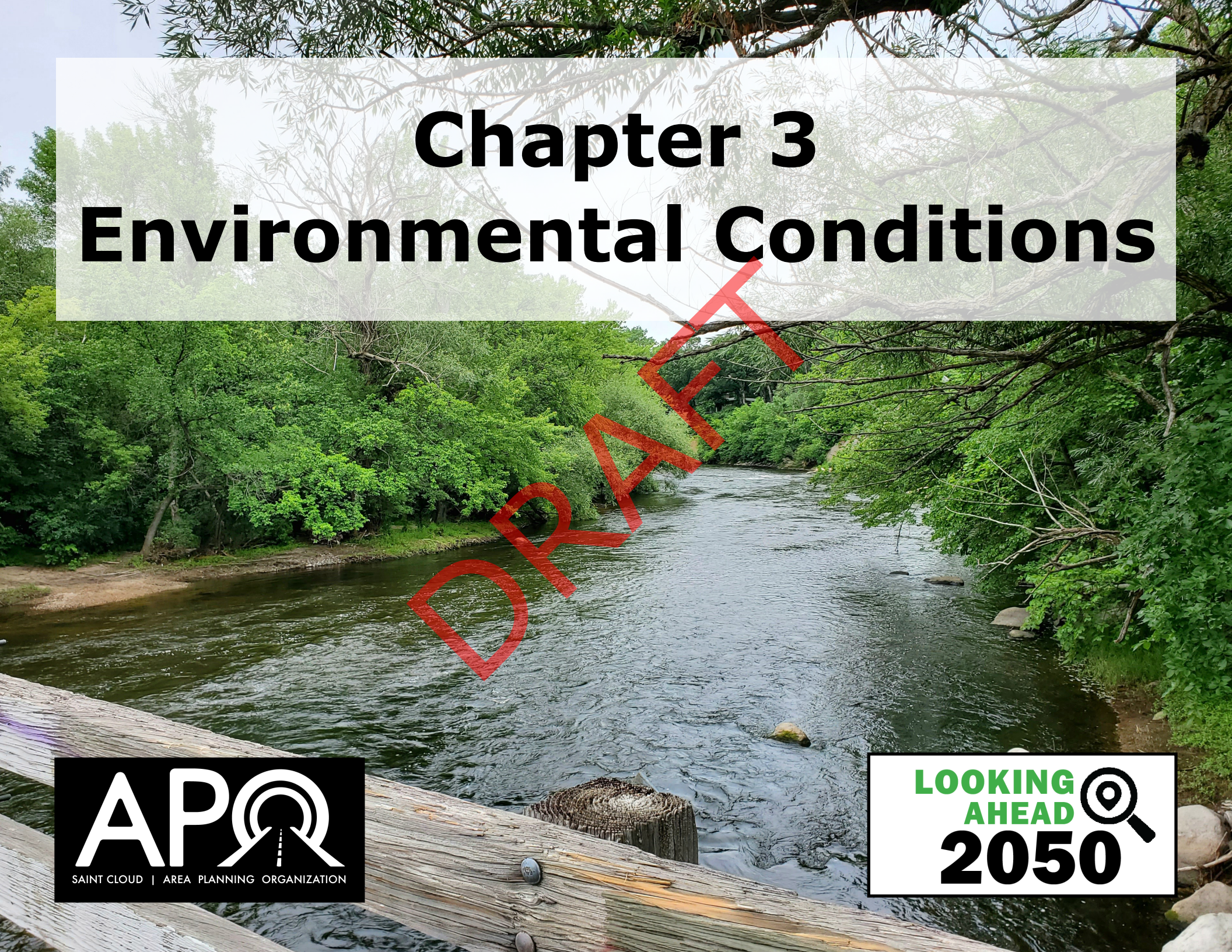
Chapter 3
Environmental Conditions



APO
SAINT CLOUD | AREA PLANNING ORGANIZATION

LOOKING AHEAD 2050

Chapter 3: Environmental Conditions Contents

Introduction

Transportation has a direct impact on the environment. From the significant role the transportation sector plays in greenhouse gas (GHG) emissions – which have been known to cause detrimental effects on air quality and human health – to the indirect connections it has on the deterioration of water quality and wildlife habitats, the relationship between transportation and the environment is one transportation planners must be mindful of when considering future infrastructure needs.

This chapter aims to investigate the relationship between the existing environment and transportation within the Saint Cloud MPA. Through the review of air quality, water quality, wildlife and habitat, and soil health within the MPA, we have a baseline understanding of the existing conditions of the natural environment. From there, we are able to look directly at the impact transportation has had on the natural environment.

Coupled with the natural environment, this chapter also contains a look at the cultural and historic properties found within the planning area. Similar to the natural environment, transportation planners must be mindful to minimize adverse effects infrastructure might have on cultural and/or historically significant areas.

Lastly, this section examines the projected impacts of climate change in the Saint Cloud region, including warmer temperatures, increased precipitation, challenges to the transportation network, and environmental consequences such as air and water pollution.

Air Quality

Air pollution has a significant effect on just about everything, from human health to changes in the earth's climate. And with nearly a quarter of all GHG emissions in Minnesota stemming from transportation, understanding this relationship is critical to developing an environmentally responsible and sustainable transportation network.

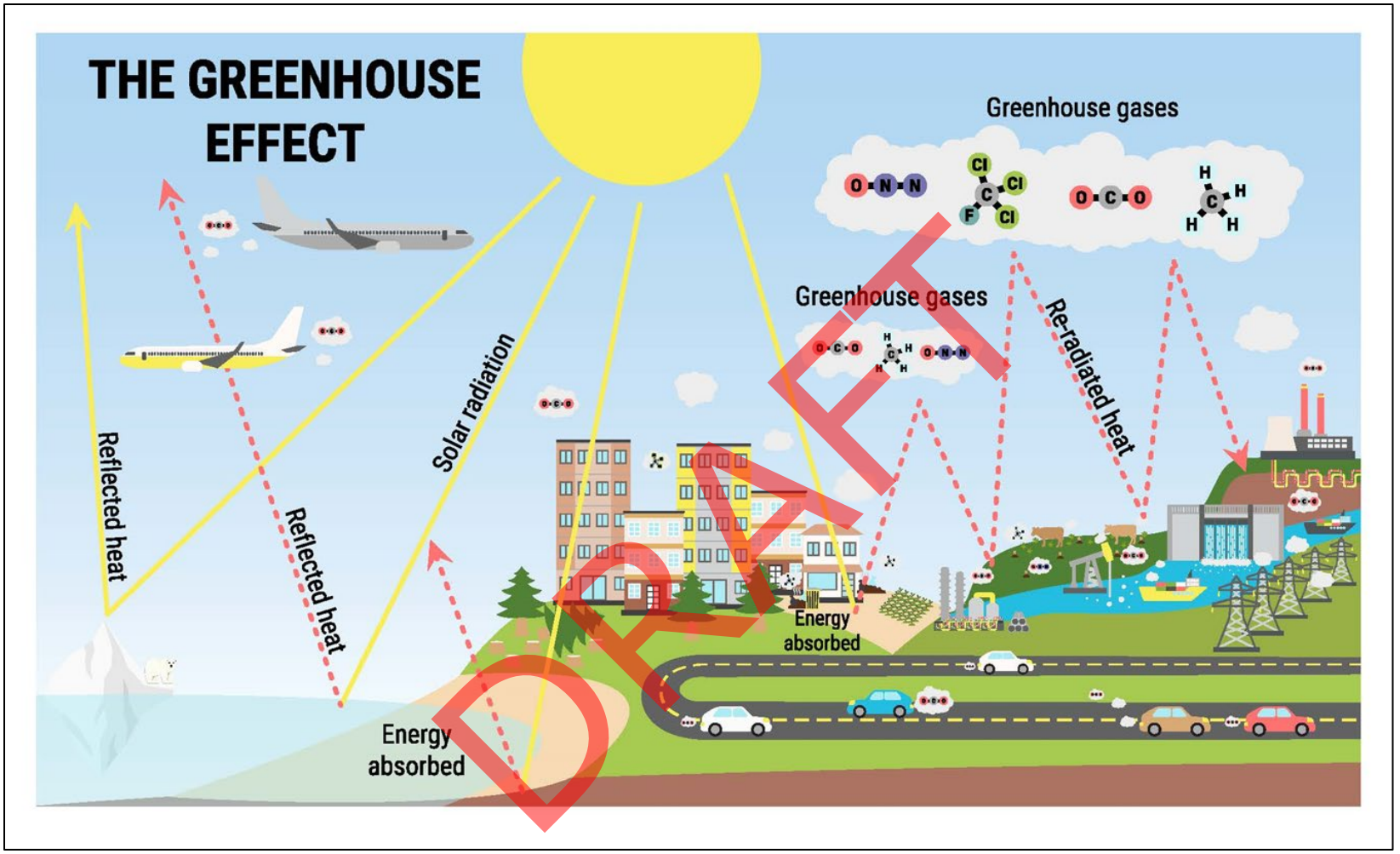


Figure 3.1: *The Greenhouse Effect.*
Photo courtesy of the Alamy.

GHG Emissions

In Minnesota, the transportation sector is the state's third biggest source of GHG emissions – following agriculture/forestry/land use and electricity generation (see Figure 3.4).

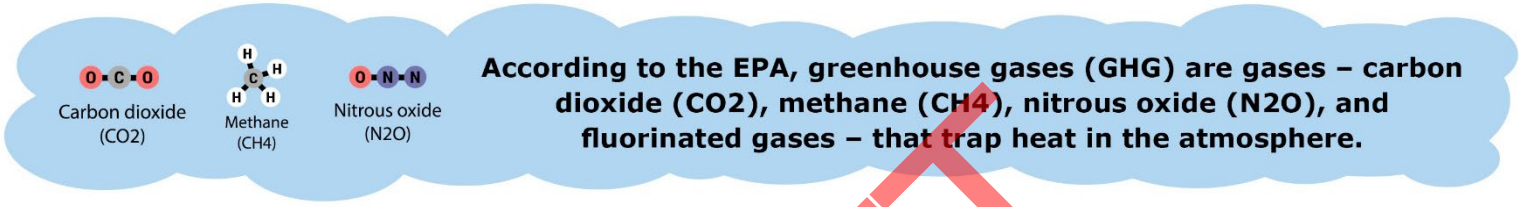


Figure 3.2: *Components of greenhouse gases.*

Statewide emissions from the transportation sector have decreased by 7% since 2005. However, since 2016, emissions have essentially plateaued in the state. One reason for the plateau appears to be an increase in people driving larger vehicles, such as light-duty trucks, SUVs, vans, etc., which on average, tend to release more emissions. These larger vehicles surpassed passenger cars as the largest transportation emitter of emissions in the early 2000s. Despite stringent vehicle tailpipe emissions standards implemented at the national level – impacting vehicles manufactured between 2012 and 2020 – the consumer trend of owning larger vehicles and driving them more miles has prevented a more significant reduction in transportation-related emissions.

Figure 3.3: *Example of an SUV.*
Photo courtesy of the APO.

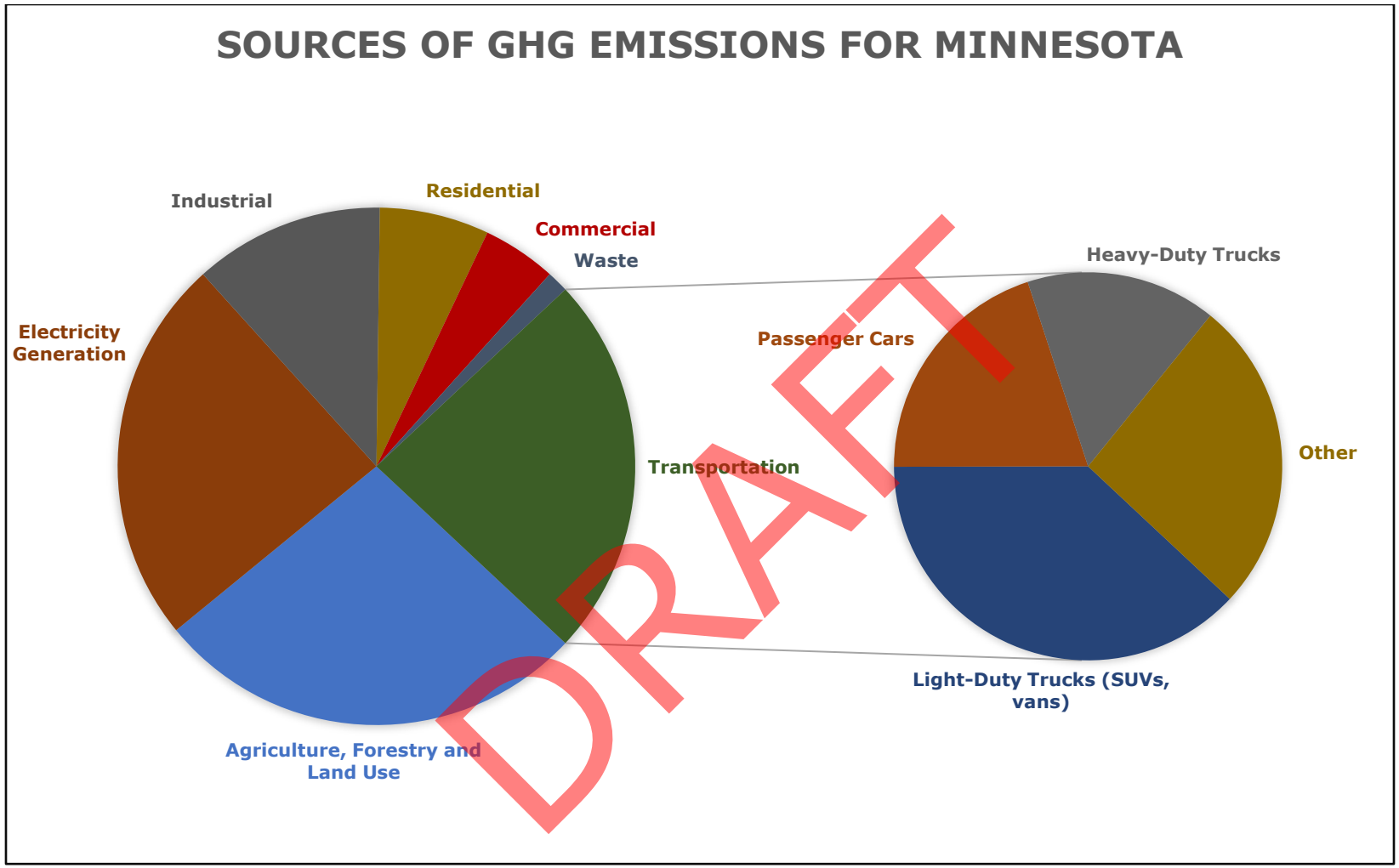
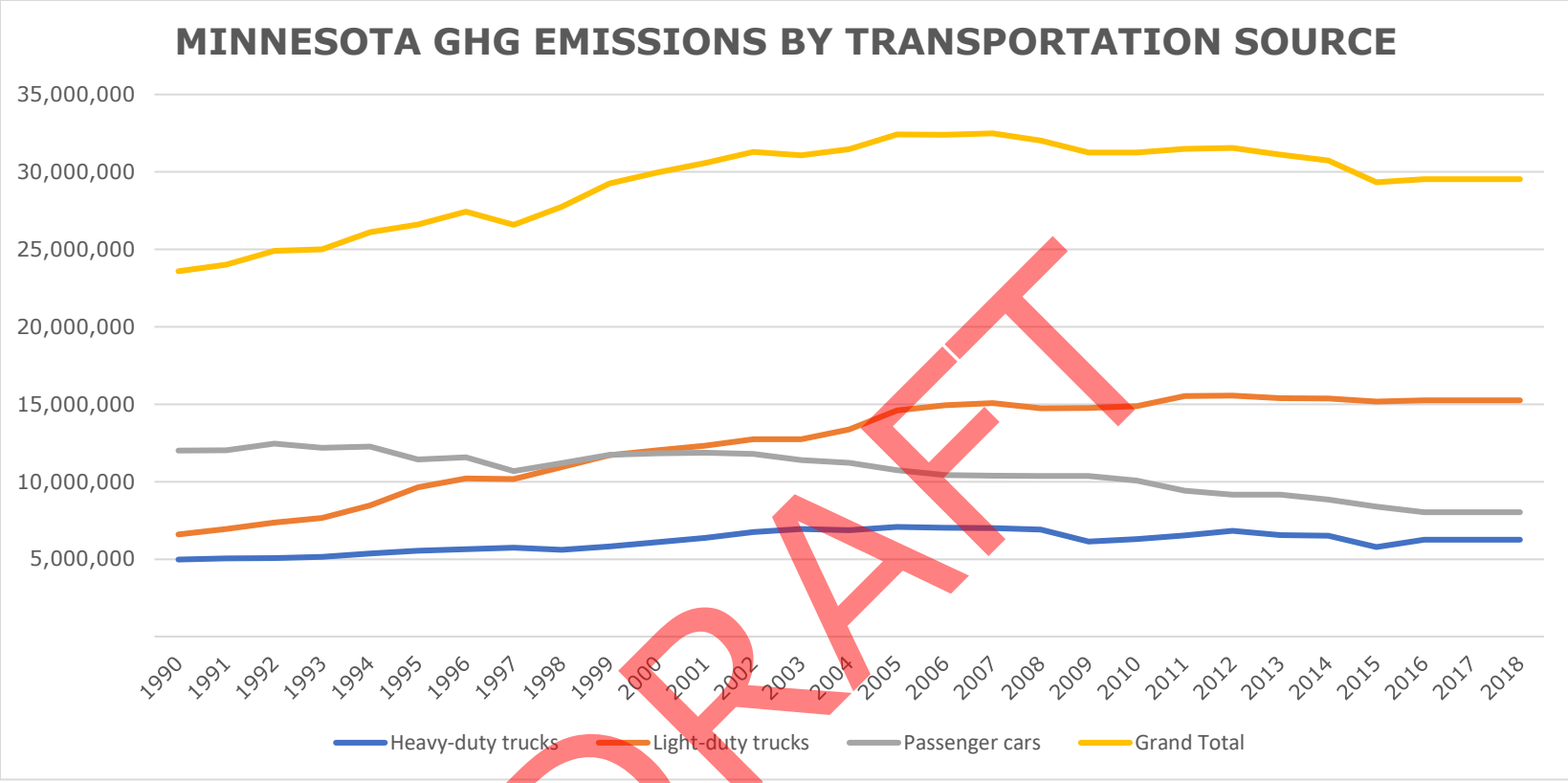


Figure 3.4: *Sources of Emissions (2018). *Other includes air conditioning, aviation, buses, marine, motorcycle, natural gas transmission, off-highway, railroad, and recreational vehicles.*
Data courtesy of Minnesota Pollution Control Agency (MPCA).



**GHG Emission measured in CO2 e-tones.*
Figure 3.5: *Emissions by Transportation Source in Minnesota. Data courtesy of MPCA.*

The effects of increased exposure to GHG emissions are known to have adverse impacts on human health. While all Minnesotans are susceptible to the health impacts of air pollution, including GHG emissions, not all these impacts are equal. People who live close to heavily used roads have increased exposure to air pollution because of structural inequities (institutional systems comprising city design, infrastructure, and regulations that have contributed to disparities in local source pollution). Because of these factors, in 2015, air pollution played a role in 8.2% of all deaths in the City of Saint Cloud according to the MPCA's and Minnesota Department of Health's (MDH's) Life and Breath: Greater Minnesota Cities Report (https://bit.ly/3Sd5sgW).

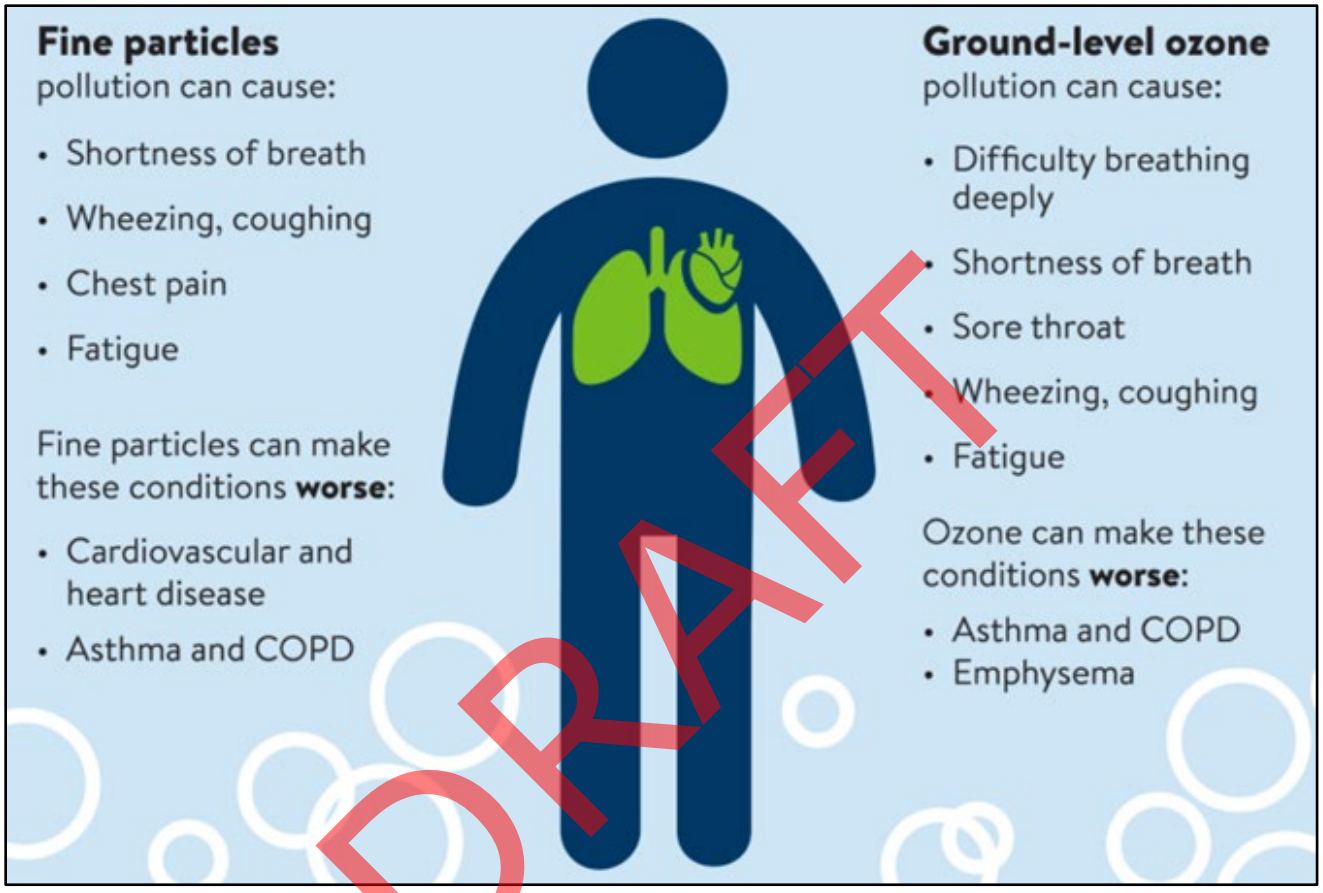


Figure 3.6: *Air Quality and Health.*
Data courtesy of Minnesota Pollution Control Agency (MPCA).

How is the Air?

To gauge air quality across the United States, The National Ambient Air Quality Standard (NAAQS) - was developed by the Federal Environmental Protection Agency (EPA).

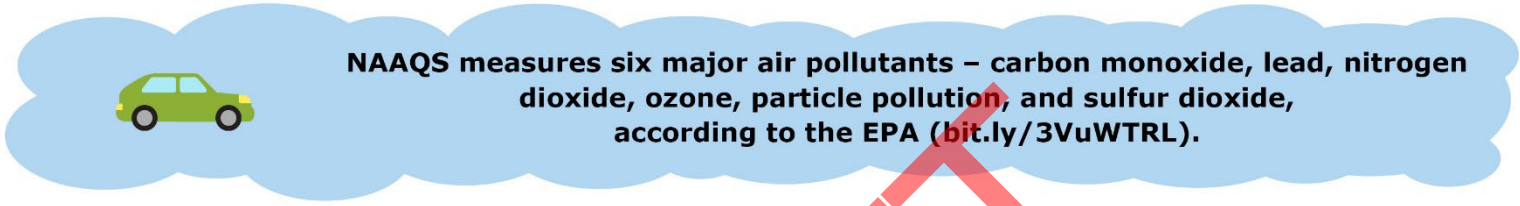


Figure 3.7: *The components measured under the National Ambient Air Quality Standard (NAAQS).*

In Minnesota, the MPCA is responsible for ensuring statewide compliance with NAAQS. Pollution levels are monitored daily at 50 locations around the state, including one near Talahi Community School – 1321 University Drive SE – in Saint Cloud. When pollutants exceed NAAQS standards, an air quality alert is issued based on a metric known as the Air Quality Index (AQI). The AQI gauges associated health effects that might be of concern, as shown in Figure 3.8.

Level of Concern	Description of Air Quality
Good	Air quality is satisfactory and air pollution poses little or no risk.
Moderate	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Unhealthy	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	Health alert: The risk of health effects is increased for everyone.
Hazardous	Health warning of emergency conditions: Everyone is more likely to be affected.

Figure 3.8: *Air Quality Index.*
Data courtesy of MPCA.

Air quality within the Saint Cloud region has been gradually improving since 2005. As noted in Figure 3.9, there has been an 18-percentage point increase in the percentage of days with good air quality over the last 15 years.

The improving air quality has resulted in Saint Cloud MPA achieving "attainment" status for air quality since 2013 after concluding a 20-year "maintenance" classification status.

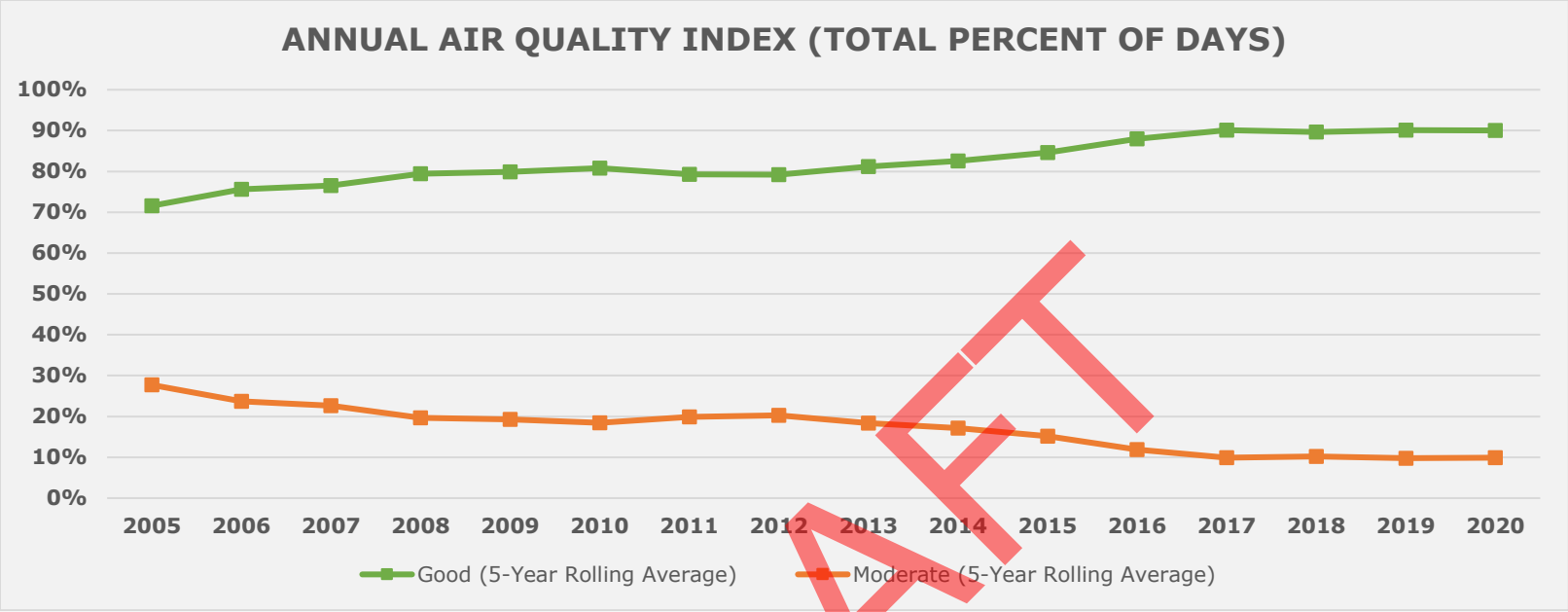


Figure 3.9: *Percent of Day with AQI of Good or Moderate in the MPA. Data courtesy of Minnesota Pollution Control Agency (MPCA).*

Figure 3.10: *Definition of attainment and nonattainment areas.*

Policy Timeline

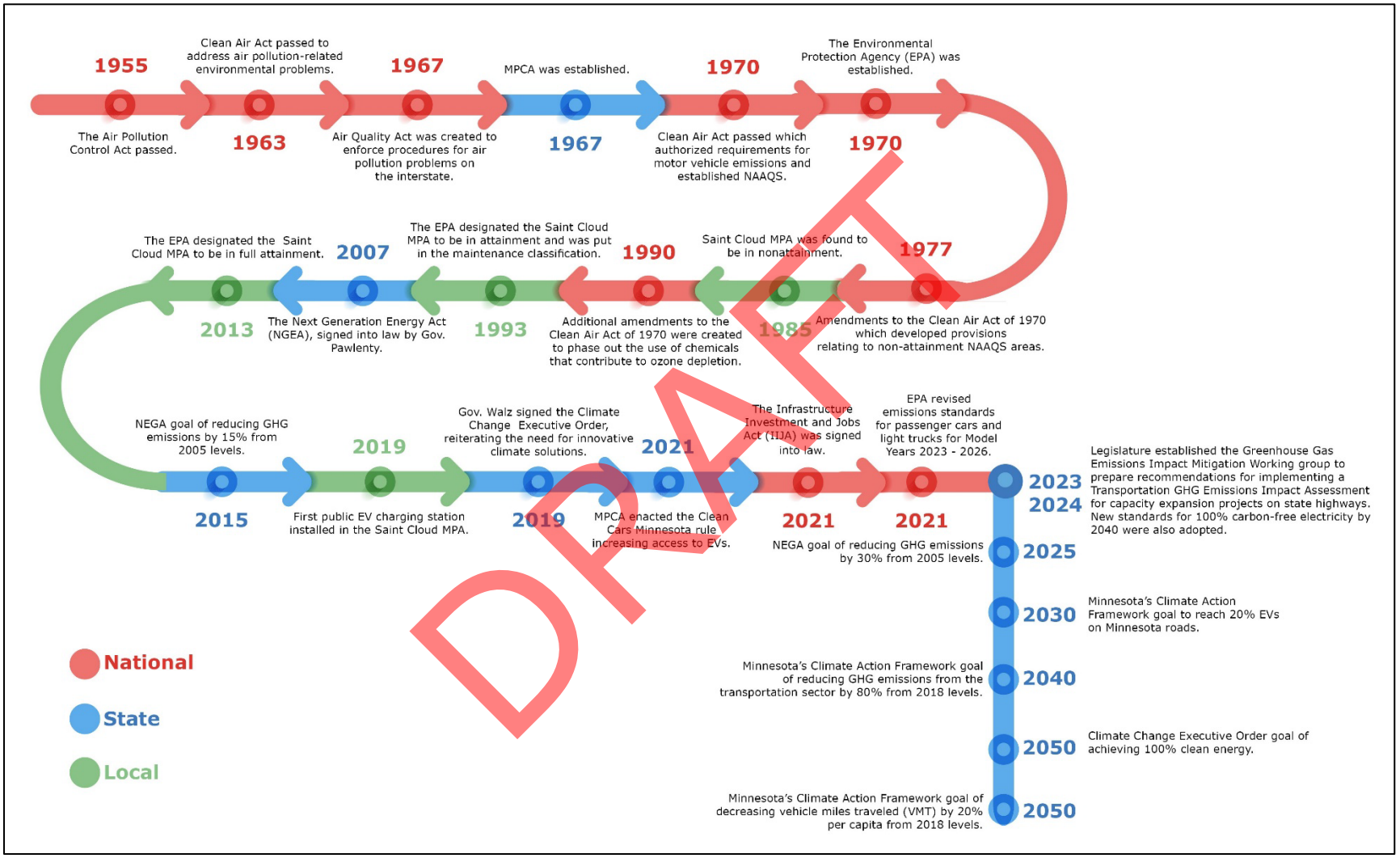


Figure 3.11: *A timeline of air quality policies developed at the national, state, and local level.*

Greenhouse Gas Emissions and Our Economy

Measuring the amount of GHG emissions compared to other economic indicators is one way to understand how GHG emissions relate to our economy. Minnesota's Gross State Product (GSP) – the sum of value added from all industries within the state – has grown since 2005, while GHG emissions have generally decreased. As shown in Figure 3.12, this demonstrates the state's economy can grow without increasing GHG emissions. During this same time frame, Minnesota's population has grown. Like the relationship between GSP and GHG emissions, Minnesota's GHG emissions have gone down despite a growth in population.

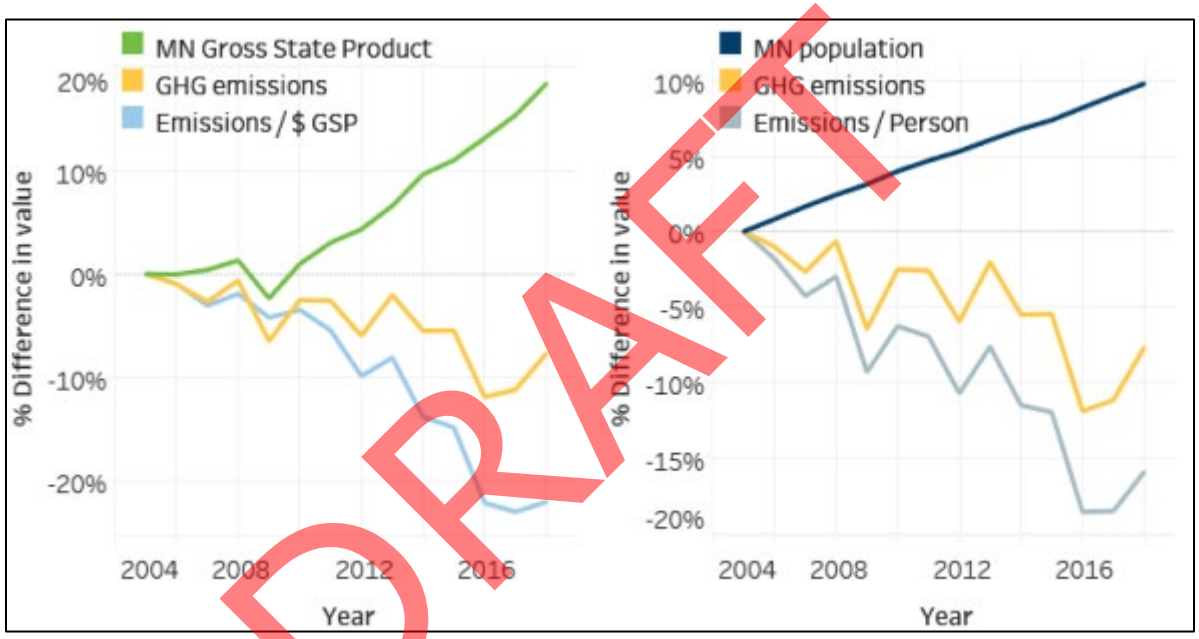


Figure 3.12: *(Left) - Minnesota's Emissions per Dollar Gross State Product (GSP), 2005-2018. (Right) – Minnesota's GHG Emissions Per Capita, 2005-2018 Data courtesy from MPCA's Greenhouse Gas Emissions Inventory 2005-2018 Report.*

Electrification of the Vehicle Fleet

New vehicle technology – particularly electric vehicles (EVs) – has been embraced by governments and corporations alike as one way to help future GHG emissions.

Despite being charged with electricity from the grid, electric vehicles produce only a third of the GHGs that a gas vehicle would, primarily due to their high energy efficiency, according to the EPA.

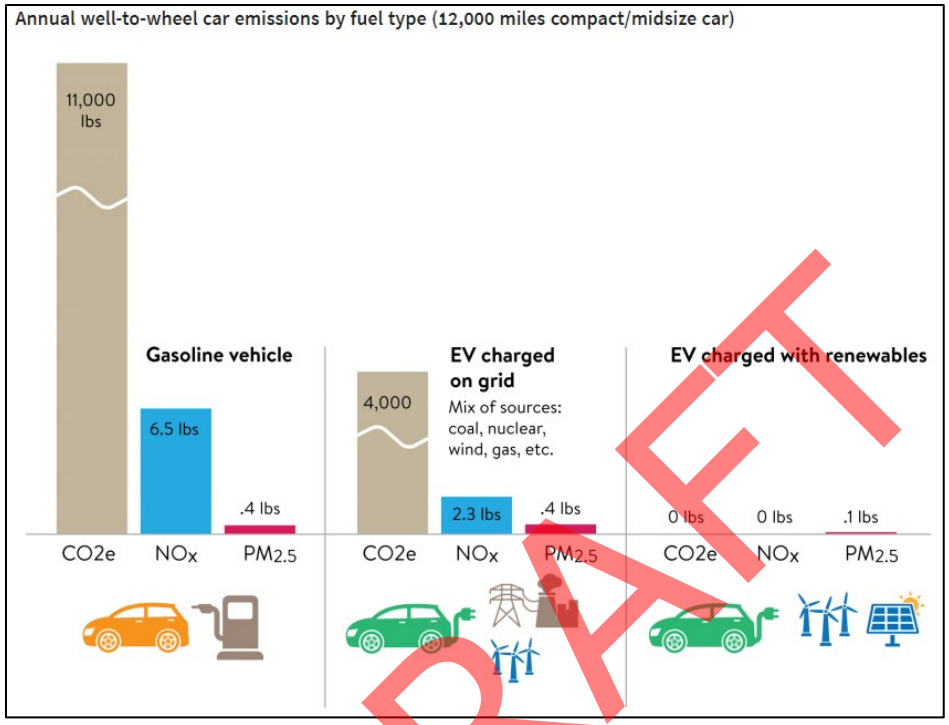


Figure 3.13: *Car Emissions by Fuel Type.*
Data courtesy from the MPCA's Accelerating Electric Vehicle Adoption: A Vision for Minnesota.

EVs only represent a small fraction of the total number of vehicles in the region. However, sales have been steadily increasing in Minnesota. There were 115 registered EVs in the Saint Cloud region as of 2020 according to the MPCA. In addition, publicly available EV charging stations have begun to spring up across the region; most notably, there are eight plugs in three locations – four plugs located near River's Edge Convention Center, two at Riverside Park, and two plugs located at Miller Nissan. In 2023, the City of Saint Cloud was awarded Carbon Reduction Program (CRP) funds to install an EV charging stations and the City of Sartell intends to add 16 publicly available EV charging stations.

Additionally, thanks in part to the IIJA, the National Electric Vehicle Infrastructure (NEVI) Formula Program was developed to provide funding for states to install fast charging stations. Minnesota has committed to installing these stations along the state's existing Alternatives Fuel Corridors – including I-94 within the Saint Cloud MPA. The Minnesota Electric Vehicle Infrastructure Plan (https://bit.ly/3uu1YgT) identifies four potential intersection locations (MN 23, MN 15, Roosevelt Road, and Opportunity Drive) to install charging stations in the Saint Cloud area.

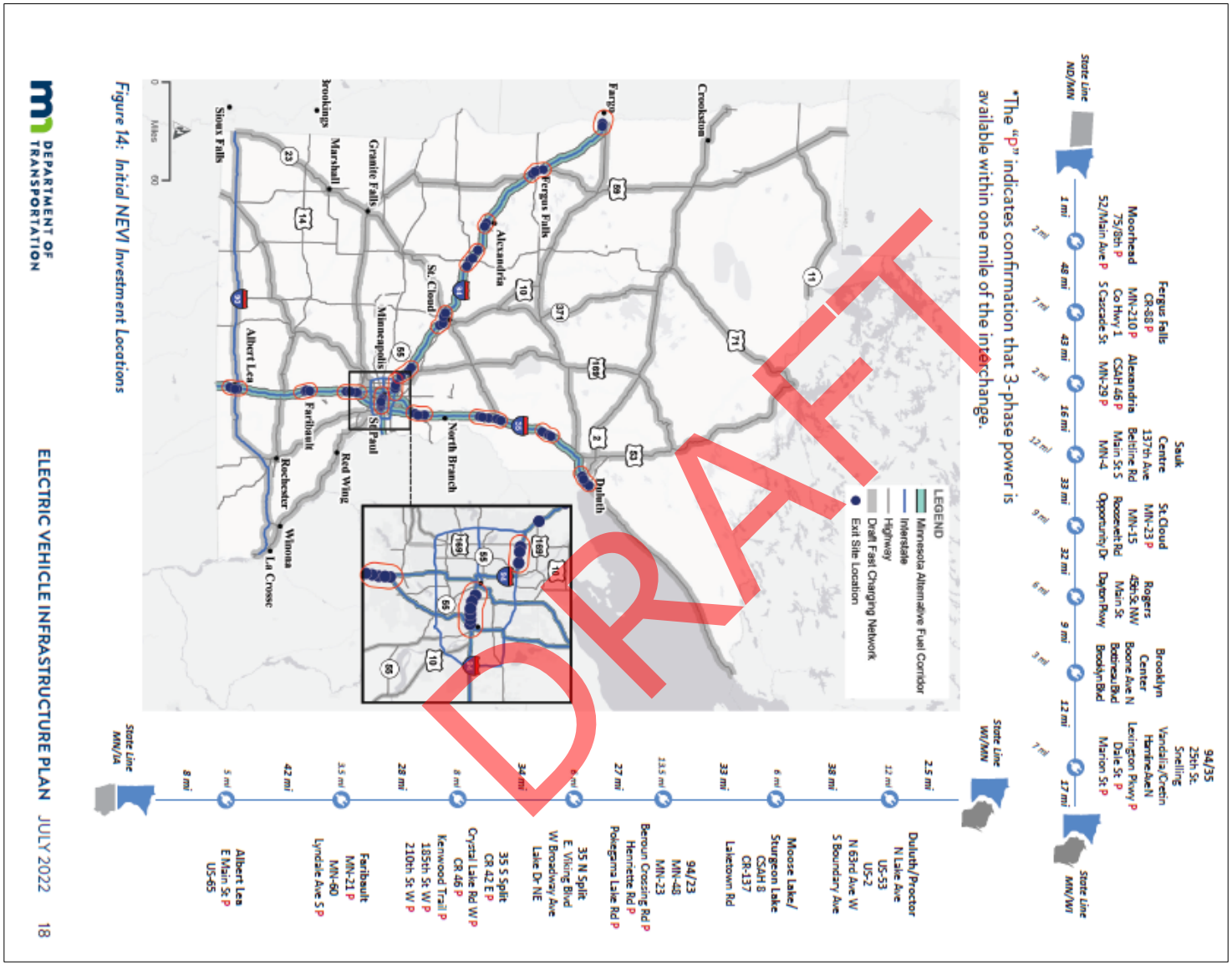


Figure 14: Initial NEVI Investment Locations

Figure 3.14: *Initial NEVI Investment Locations.*
Data courtesy from the Minnesota Department of Transportation (MnDOT) Electric Vehicle Infrastructure Plan.

Water Quality

In addition to air quality, transportation and transportation-related pollutants have a direct impact on the health of the area's lakes, rivers, wetlands, and other bodies of water. Runoff from streets, parking lots, and sidewalks lead to contaminated surface and groundwater (including drinking water), increased flooding, wildlife habitat harm, reduced fish stock, damage to unique natural features, and other aesthetic losses. According to the MPCA's report Minnesota's Water Quality Monitoring Strategy 2021-2031 (https://bit.ly/3OYhHzB), water recreation, such as fishing, canoeing and kayaking, swimming, and other pursuits, makes up $16 billion of the state's yearly tourism revenue. Minnesota is home to over 10,000 lakes and countless other bodies of water; protecting these waterways protects the Minnesota economy.

Figure 3.15: *Sources of water pollution from transportation sources.*

According to the Victoria Transport Institute, in 2015, an estimated 46% of vehicles in the United States leaked hazardous fluids, including crankcase oil; transmission, hydraulic and brake fluid; and antifreeze, as indicated by oil spots on roads and parking lots. This has a significant impact on our environment and economy, with estimates that leaking motor-fuel storage tanks, large oil spills, and urban runoff by oil from motor vehicles impose environmental water pollution costs of about 0.01 cents per vehicle mile. Based upon this estimate and VMT within the APO's planning area, water quality impacts for the region can be estimated to run approximately $14 million per year.

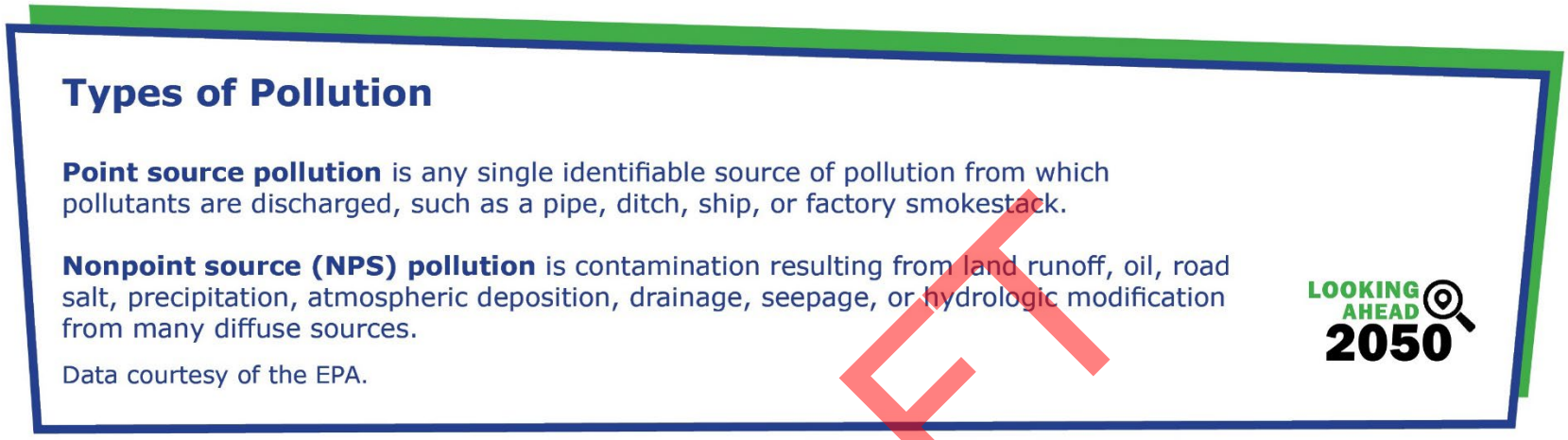


Figure 3.16: *Types of pollution.*

Water and Wetland Resources

Watersheds

Every lake, river, and place in Minnesota is part of a watershed – often physically separated from other watersheds based on gravity or topography.

The State of Minnesota is divided into eight major basins: Red River of the North Basin, Rainy River Basin, Great Lakes Basin, Saint Croix River Basin, Upper Mississippi River Basin, Lower Mississippi River Basin, Minnesota River Basin, and the Missouri River Basin. Those eight basins are further subdivided into 81 major surface water watersheds and approximately 5,600 minor watersheds.

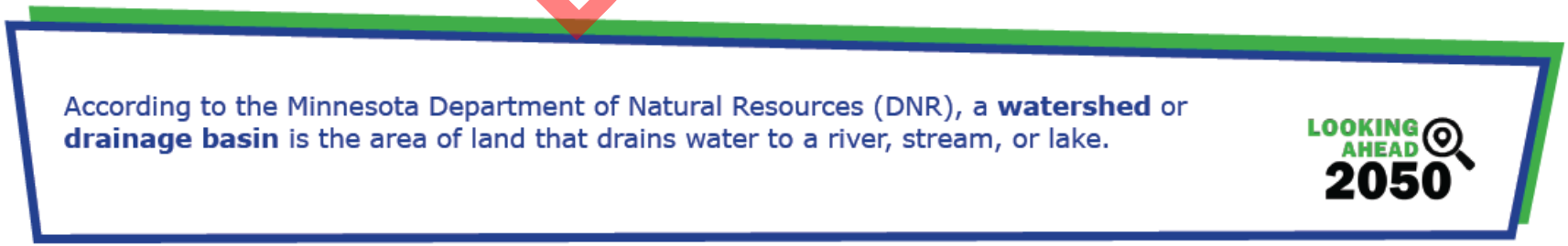


Figure 3.17: *Definition of a watershed.*

The Saint Cloud MPA is part of the Upper Mississippi River Basin and contains three major surface water watersheds – Mississippi River-Saint Cloud, Mississippi River Sartell, and Sauk River.

Figure 3.18: *Mississippi River in Sauk Rapids.*
Photo courtesy of APO.

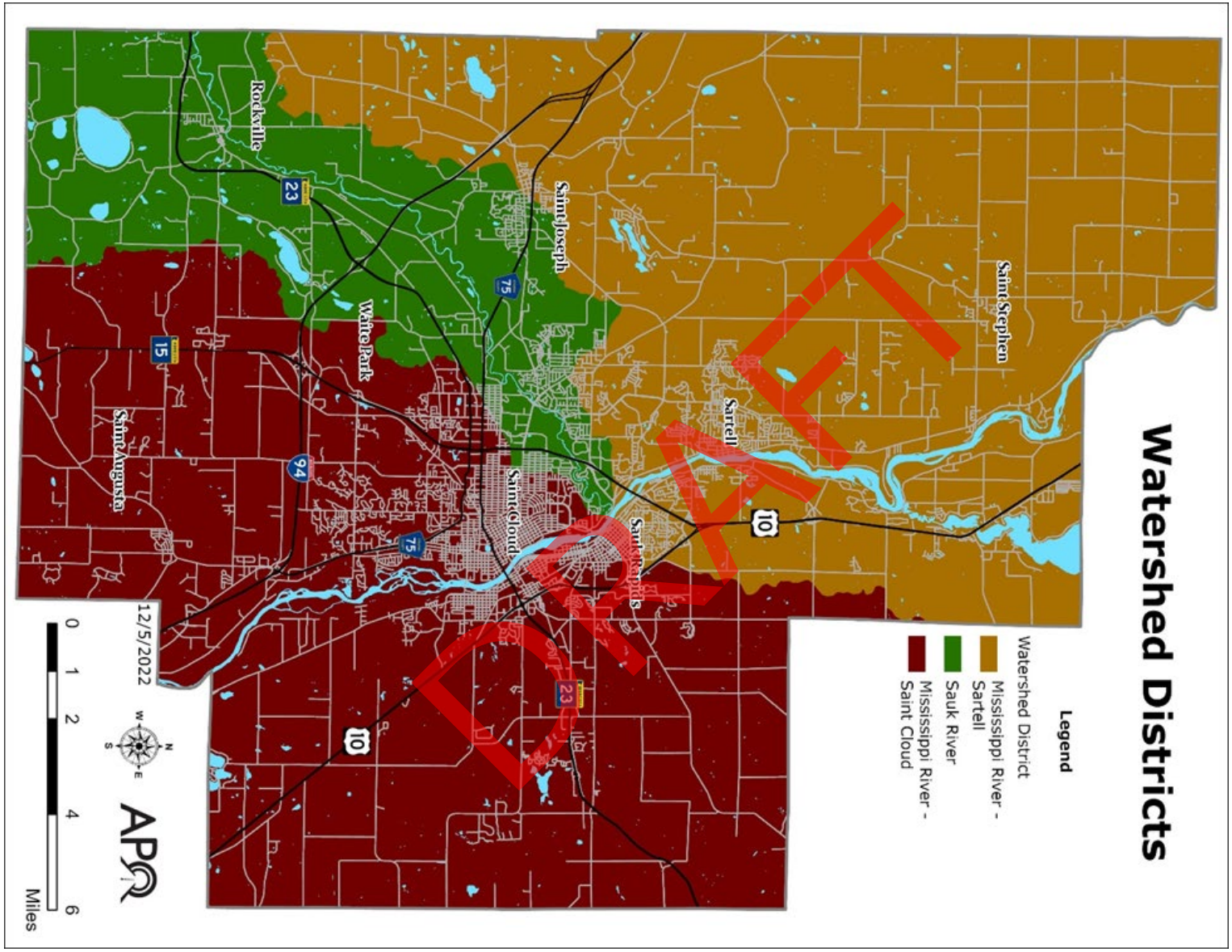


Figure 3.19: *Watershed Districts.*
Data courtesy of MPCA.

Mississippi River—Saint Cloud Watershed District

Facts:

- Covers 691,200 acres (1,080 square miles).
- Includes all or parts of the counties of Benton, Meeker, Mille Lacs, Morrison, Sherburne, Stearns, and Wright.
- Major communities located in the watershed include Sauk Rapids, Saint Cloud, Elk River, Big Lake, and Monticello.
- It has 907 total river miles and 374 lakes, with a total acreage covering 23,728 acres.
- Saint Cloud is the first city along the Mississippi River to obtain its drinking water from this resource.
- Two of Minnesota's most important power plants (Becker and Monticello) use the river as a non-contact cooling water source.
- Part of this stretch of the Mississippi River has been designated as a wild and scenic river.

Major Threats to the Watershed include:

- Loss of shoreline buffers and habitat due to development.
- Introduction of large amounts of phosphorus, sediment, and bacteria to surface waters.
- The combination of long, moderately steep slopes and easily erodible sandy loam soil that is inherently high in phosphorus.
- Increased nutrient, contaminant, and sedimentation loading from stormwater runoff from development and other nonpoint sources.
- Protecting drinking water supplies from bacteria impairments.
- Loss of biodiversity due to competition from invasive species.
- Relatively high percentage of agricultural and urban/residential land uses within the watershed.

Figure 3.20: *Infographic on the Mississippi River Saint Cloud Watershed District.*

Mississippi River—Sartell Watershed District

Facts:

- Covers 652,800 acres (1,020 square miles).
- Includes parts of Benton, Crow Wing, Mille Lacs, Morrison, Stearns, and Todd counties.
- Major communities located in the watershed include Saint Joseph, Sartell, Lastrup, Pierz, Buckman, Royalton, Upsala, Bowlus, Rice, Holdingford, and Avon.
- It has 879 total river miles and 232 lakes that cover 13,319 acres.
- It is primarily located in agricultural areas, with approximately 96% of the land in this watershed under private ownership.

Major Threats to the Watershed include:

- Loss of shoreline buffers and habitat due to development.
- Introduction of large amounts of phosphorus, sediment, and bacteria to surface waters.
- Increased nutrient, contaminant, and sedimentation loading from stormwater runoff from development and other nonpoint sources.
- Loss of biodiversity due to competition from invasive species.
- A relatively high percentage of agricultural and urban/residential land uses within the riparian or sensitive areas of the watershed.
- Protecting drinking water supplies from bacteria impairments.

Figure 3.21: *Infographic on the Mississippi River Sartell Watershed District.*

Sauk River Watershed District

Facts:

- Covers 667,200 acres (1,043 square miles).
- It encompasses portions of Todd, Douglas and Meeker Counties but predominately occupies a significant area of Stearns County.
- Major communities located in the watershed include Saint Cloud, Waite Park, Saint Joseph, Rockville, Osakis, Sauk Centre, Saint Martin, and Cold Spring.
- 57,092 people reside within the Sauk River Watershed.
- It is comprised of 374 lakes and 79 streams.
- Extends from the Mississippi River near Saint Cloud to within three miles of Alexandria.
- It is about 75 miles in length.
- The Sauk River itself meanders for 120 miles in a northwest-to-southeast direction.

Major Threats to the Watershed include:

- Low dissolved oxygen concentrations.
- Loss of habitat due to excess bedded sediment.
- Increased nutrients.
- Altered hydrology/channelization.
- Loss of woody habitat.
- Loss of connectivity (impoundments/improper placement of culverts).
- Elevated concentration of total suspended solids.

Figure 3.22: *Infographic on the Sauk River Watershed District.*

Figure 3.23: *Quick facts on the commercial navigation industry in the Upper and Lower Mississippi River Watershed Basins.*

Shoreland

Shoreland plays a vital role in maintaining the health of water bodies, according to the DNR. It acts as a buffer between land and water, protecting water quality by filtering pollutants and sediment that might otherwise enter the water. For example, if polluted water (from roads, parking lots, roofs, and lawns) infiltrates into shoreland, the soil and plants can assist in the purification process before the water ultimately enters a body of water.

Shorelands also provide habitat for a wide range of plant and animal species, including migratory birds and fish.

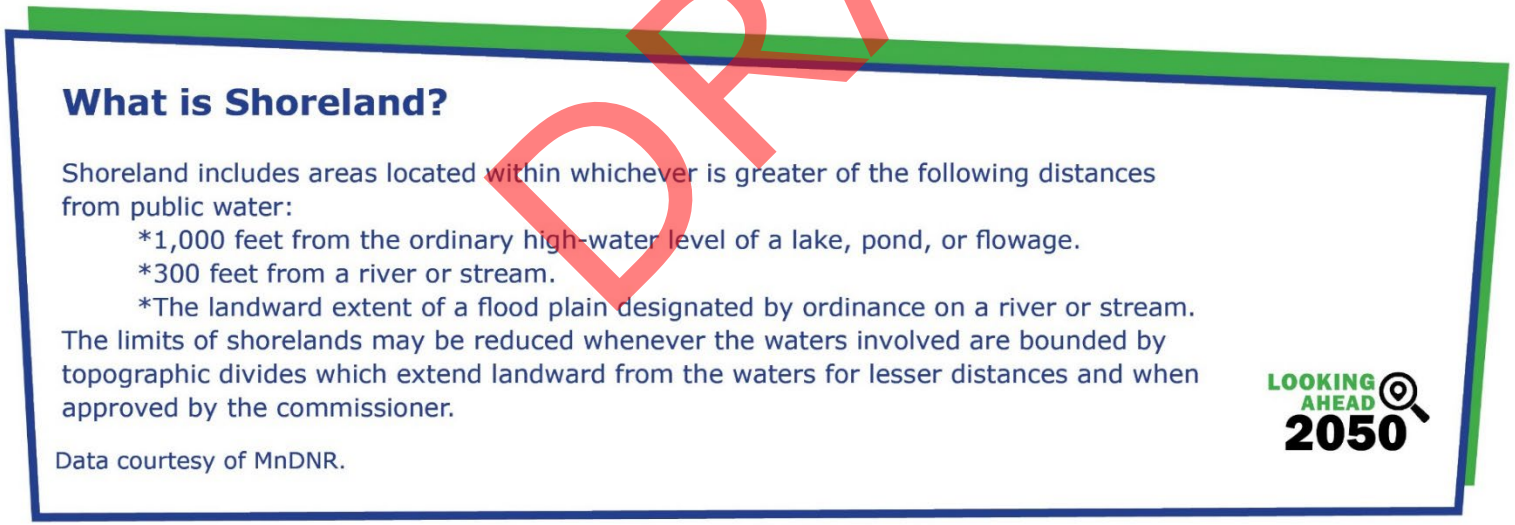


Figure 3.24: *Definition of shoreland.*

Stormwater

Runoff from stormwater continues to be a major cause of water pollution in urban areas. Rain and snow melt run over the many hard surfaces in urbanized areas — roads, sidewalks, driveways, parking lots, rooftops, etc. and carries trash, bacteria, heavy metals, oils, road salt, and other pollutants through storm sewers into local waterways. Heavy rainstorms can cause flooding that damages property and infrastructure.

A **municipal separate storm sewer system (MS4)** is a conveyance or system of conveyances such as roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains, etc.

Figure 3.25: *Definition of a municipal separate storm sewer system (MS4).*

Figure 3.26: *Example of a rain garden in the Lake George neighborhood.*
Photo courtesy of Saint Cloud APO.

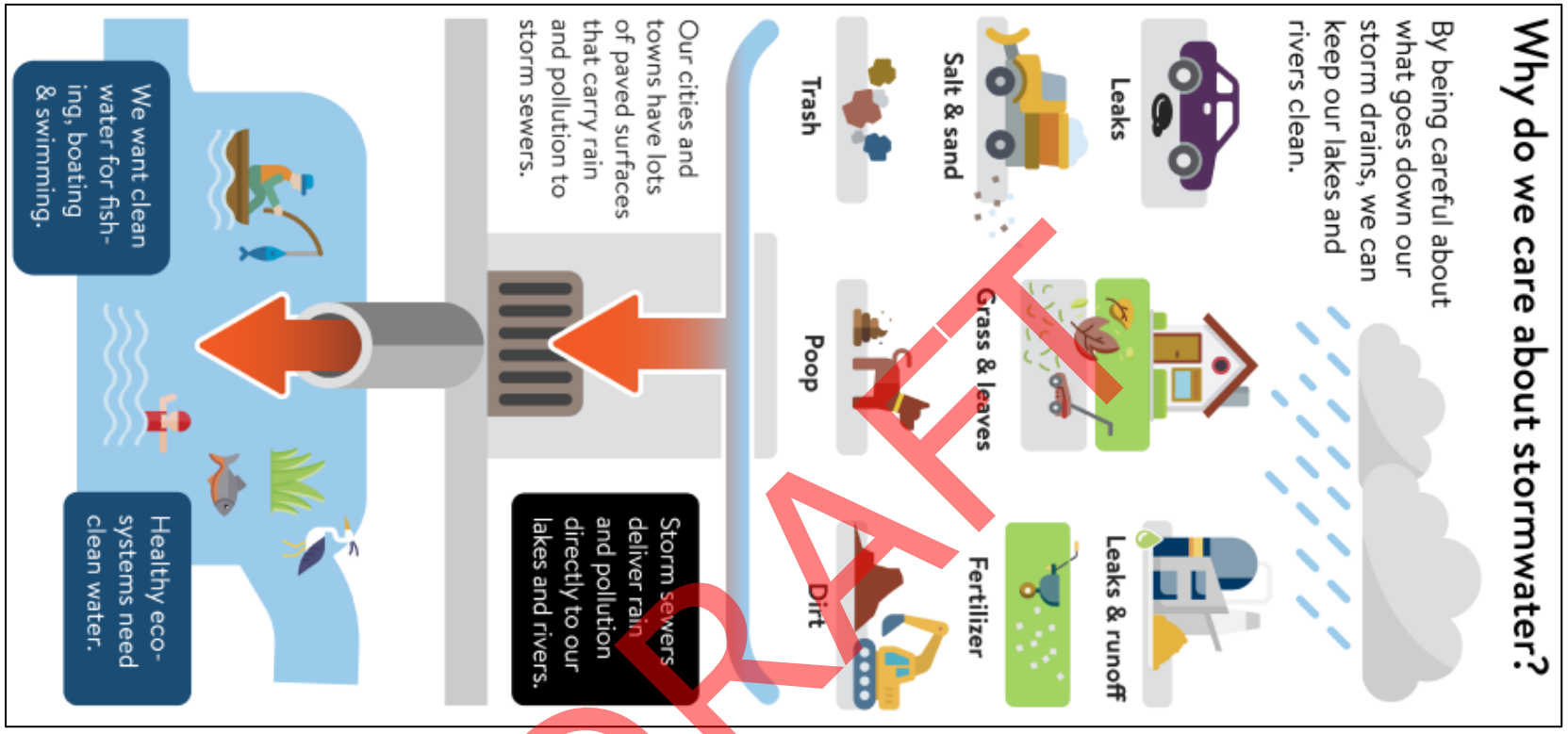


Figure 3.27: *Graphic on why people should care about stormwater. Data courtesy of MPCA.*

Wetlands

In Minnesota, there are several different kinds of wetlands, each with a wide range of characteristics. Some wetlands are primarily dry throughout the year, while others are almost always covered by several feet of water. Although wetlands can absorb pollutants from the surface water, there is a limit to their capacity to do so. The primary pollutants causing wetland degradation are sediment, fertilizer, human sewage, animal waste, road salts, pesticides, heavy metals, and selenium.

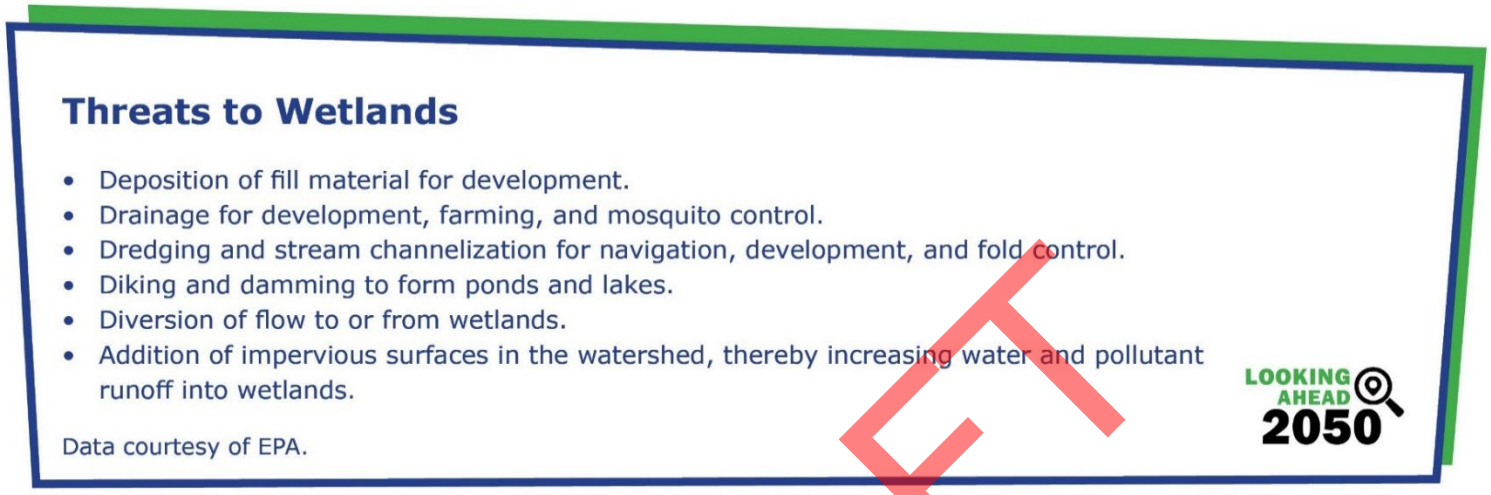


Figure 3.28: *Different threats to wetlands according to the Environmental Protection Agency (EPA).*

Swamps are the most prevalent type of wetland in the Saint Cloud MPA, with over 13,000 acres. They either have shrubs or are wooded and can be found along the edges of lakes, rivers, streams, and in glacial lake basins.

Seasonally flooded wetlands come in second with nearly 13,000 acres. These wetlands generally contain water for relatively short periods, primarily in spring or after heavy rains. They include small, shallow basins supporting annual plants and floodplain forests. Because they are dry for much of the year, seasonally flooded wetlands are often farmed. When left intact, these wetlands provide breeding habitats for amphibians, are valuable food sources for migrating waterfowl and shorebirds, and help protect and maintain the water quality of their associated rivers and streams.

Marshes, bogs (or peatlands), and shallow open water make up the remaining types of wetlands commonly found within the MPA. Ranging from shallow to deep, marshes are water-filled basins with a mix of open water and emergent and submerged vegetation. Marshes provide food and resting areas for migratory birds and many species of wildlife. The MPA has over 8,000 acres of marshes.

Bogs, or peatlands, are wetlands with soils made of peat – the partially decomposed remains of plants. The MPA has over 2,000 acres of bogs.

Shallow open water is classified as shallow ponds, lakes, or reservoirs. The MPA has over 1,000 acres of shallow open water.

Wetlands can also include non-vegetated aquatic communities and artificially flooded areas.

Non-vegetated aquatic communities do not have a layer of plants growing in or around them. These types of aquatic communities can be found in a variety of environments, including natural bodies of water such as lakes, ponds, and streams, as well as artificially created aquatic habitats like man-made lakes, reservoirs, and wetland restoration projects. Various factors, including physical, chemical, and biological factors, can form non-vegetated aquatic communities.

Lastly, artificially flooded areas – created or modified by humans – typically provide habitat for aquatic species, flood control, or recreational opportunities. They include damming a natural watercourse to create an artificial lake or pond or constructing a wetland in a previously dry land area.

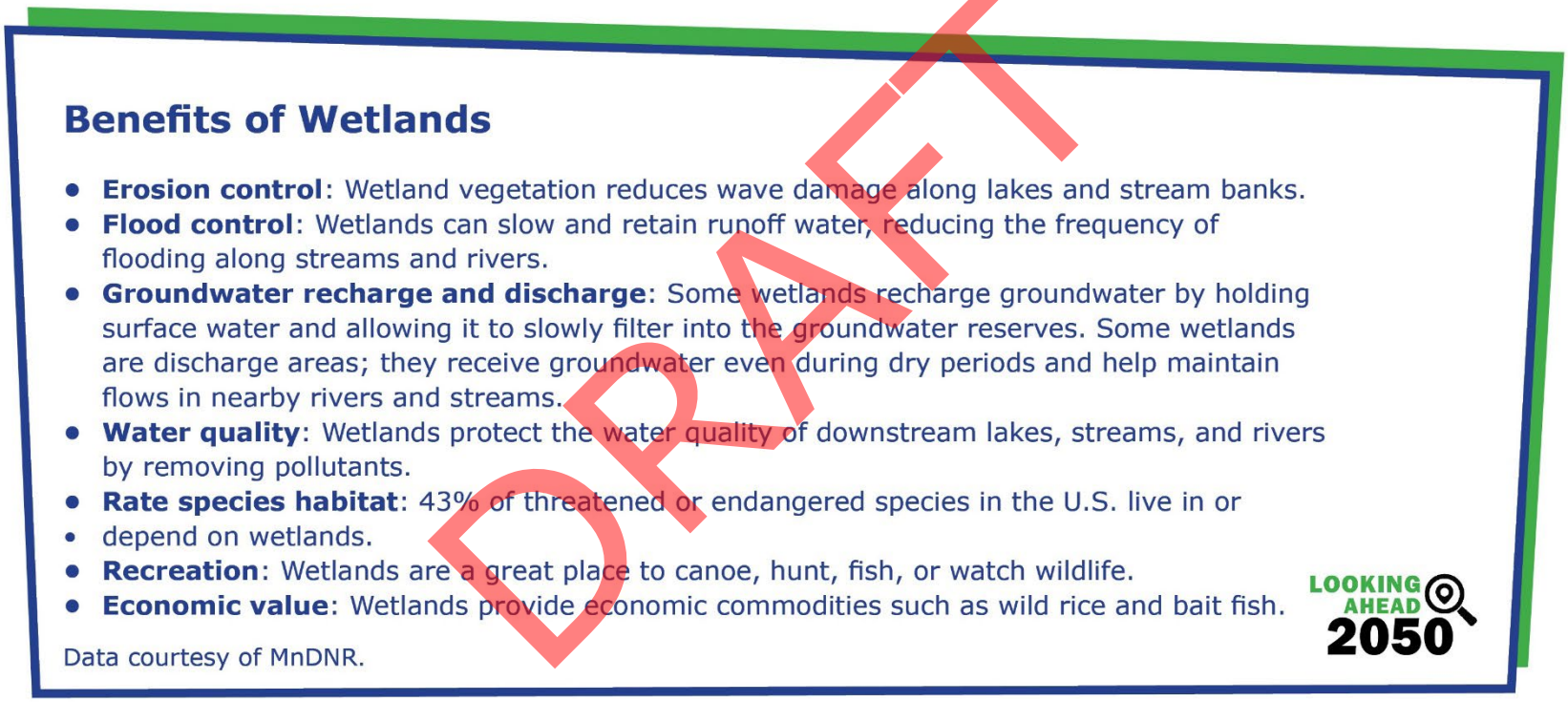


Figure 3.29: *Benefits of wetlands according to the Minnesota Department of Natural Resources (MnDNR).*

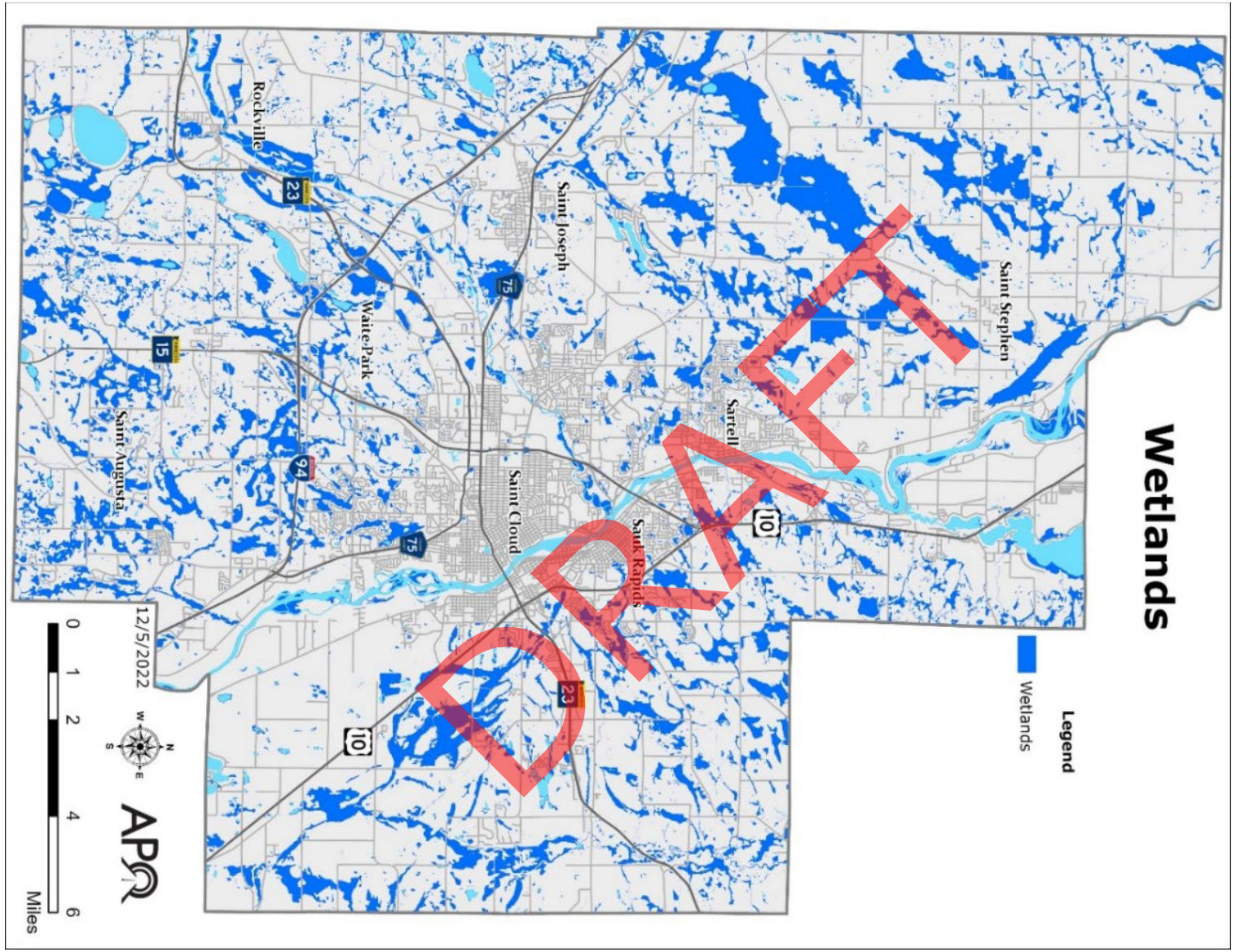


Figure 3.30: *Wetlands in the MPA.*
Data courtesy of DNR.

Groundwater

Groundwater is the source of drinking water for about 75% of all Minnesotans and 90% of all water used to irrigate crops according to the MPCA.

A groundwater province is a region characterized by a distinct set of geologic and hydrologic conditions that influence groundwater's occurrence, distribution, and movement. Groundwater provinces are typically defined by the type of geologic materials present in the region, including rocks, soils, and sediments, as well as the physical and chemical properties of these materials. There are two groundwater provinces in the MPA. The Central and Arrowhead/Shallow Bedrock Province.

Figure 3.31: *Sauk Rapids water tower. Photo courtesy of Saint Cloud APO.*

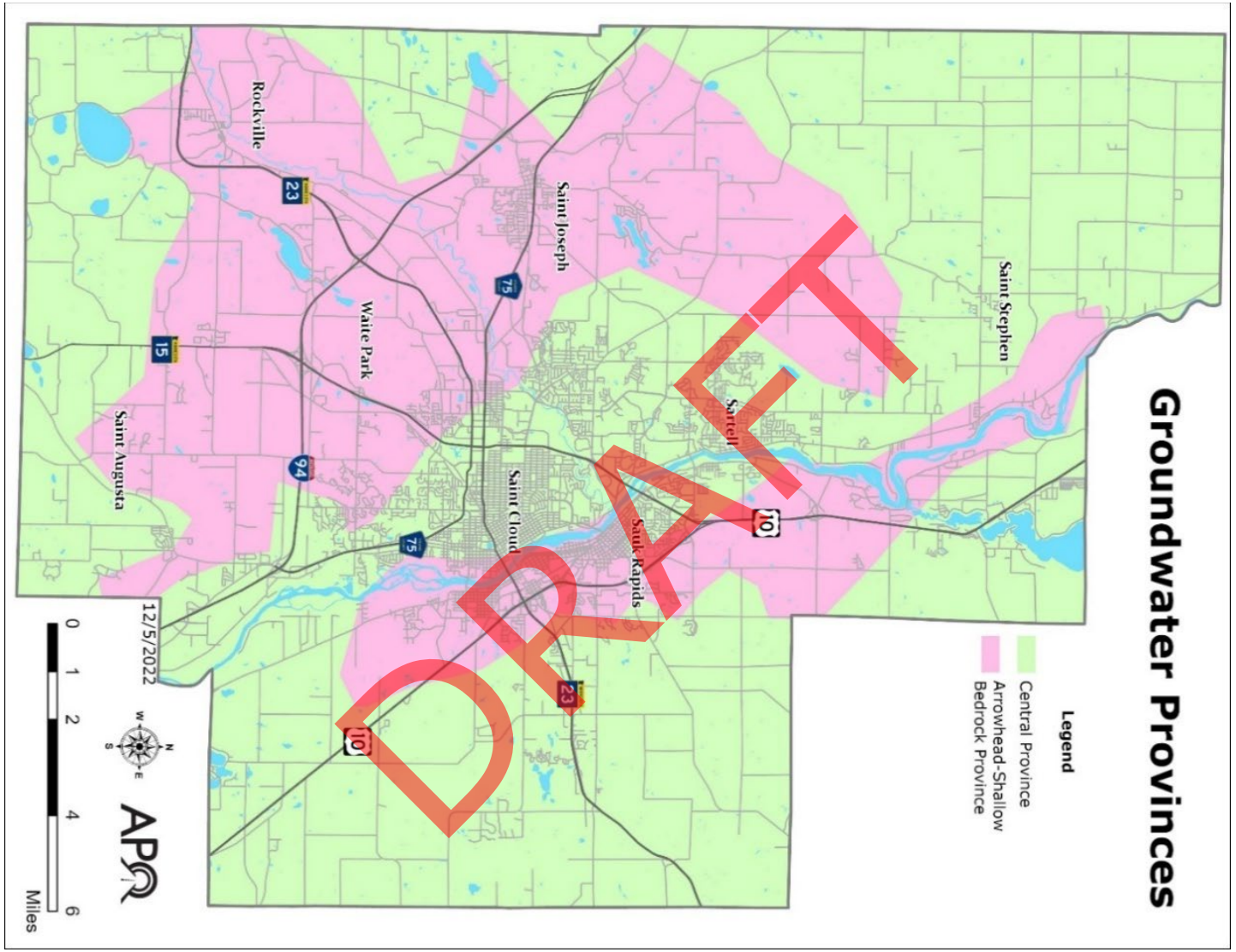


Figure 3.32: *Groundwater Provinces.*
Data courtesy of DNR.

In order to protect the quality and safety of groundwater – particularly since it is used as a primary source for consumption – wellhead protection areas (WHPAs) have been developed. WHPAs are areas surrounding public water supply wells that contribute groundwater to the well. In these areas, contamination on the land surface or in water can affect the drinking water supply. Within each WHPA, the likelihood that contamination could reach the public water supply intake is measured through a metric known as the Drinking Water Supply Management Area (DWSMA) vulnerability index. The higher the vulnerability index, the higher the risk the well could become contaminated.

There are 18 unique WHPAs in the MPA covering over 51,000 acres.

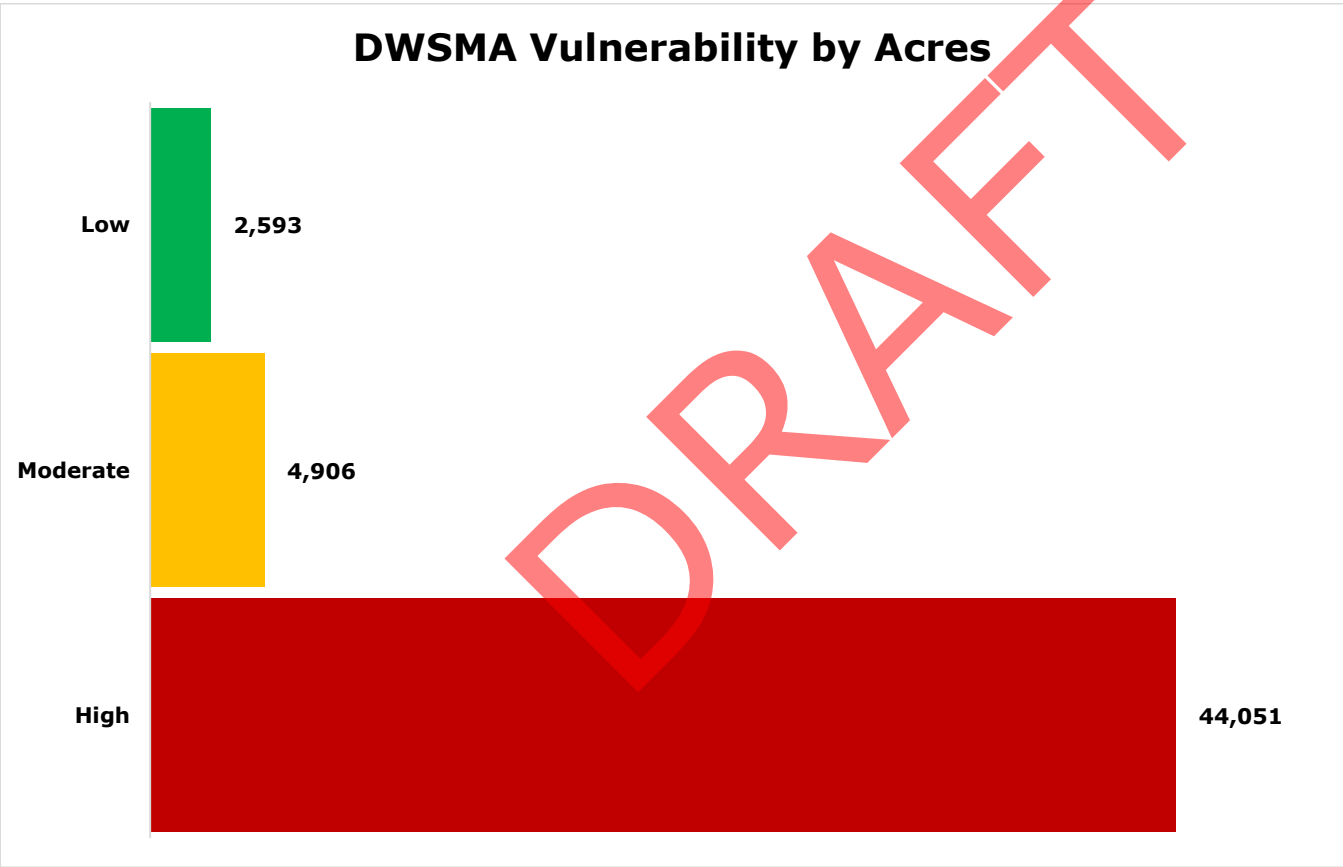


Figure 3.33: *DWSMA Vulnerability by Acres in the MPA.*
Data courtesy of DNR.

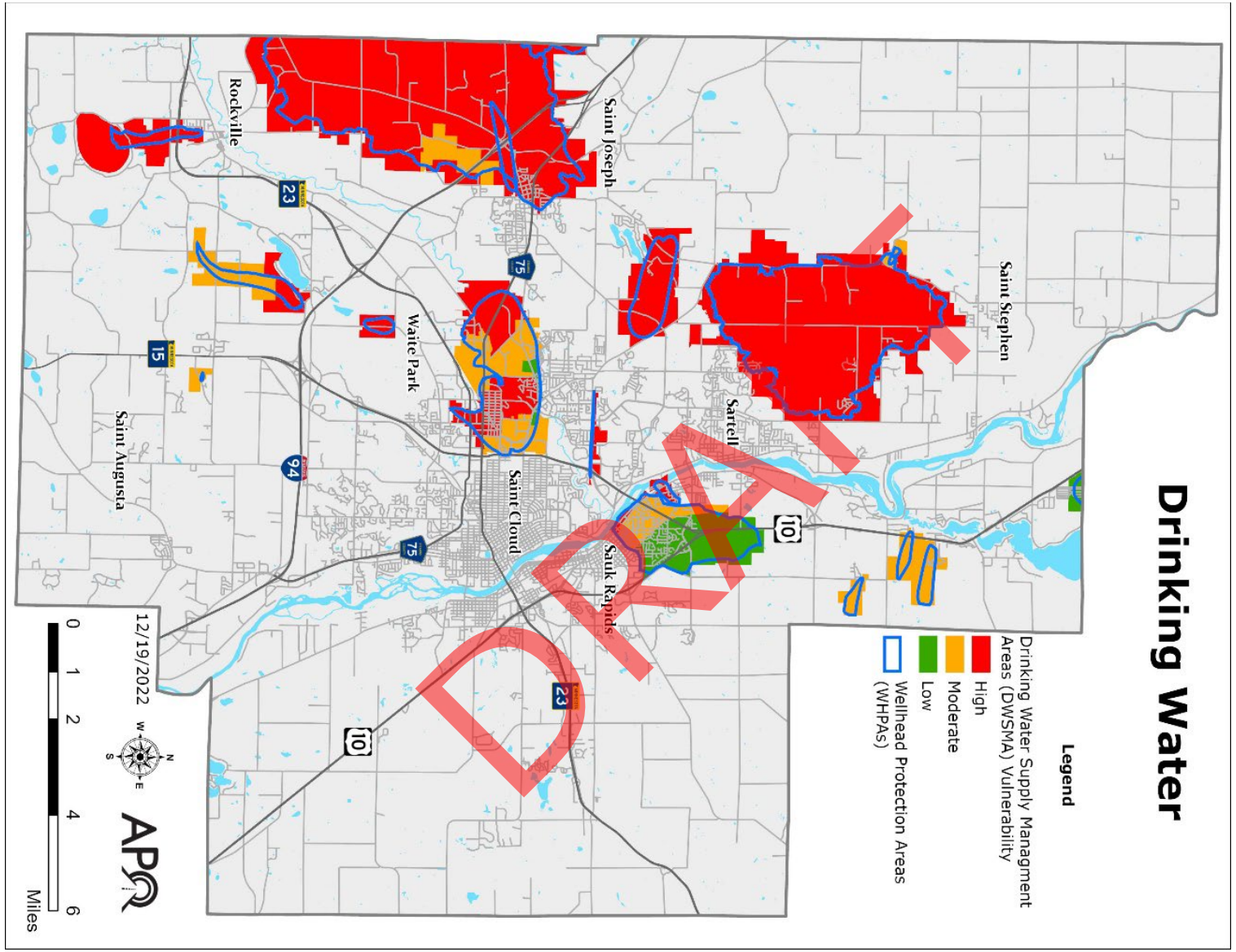


Figure 3.34: *Drinking Water.*
Data courtesy of MDH.

Transportation Impacts to Water Quality

Water Monitoring Sites

Several conditions put stress on the area's lakes, rivers, streams, and other bodies of water.

- **Too much sediment.** Soil and other matter in water can make it hard for fish and other aquatic life to breathe, feed, and reproduce. Sediment can also cover spawning areas and fill in parts of streams.
- **Low oxygen.** Aquatic life needs oxygen dissolved in the water to breathe and survive.
- **Temperature.** Water temperature affects metabolism and the ability to get oxygen, especially for species such as trout.
- **Lack of habitat.** Habitat affects all aspects of survival for fish and other aquatic life. Habitat encompasses places to live, food to eat, places to reproduce, and means of protection.
- **Too many nutrients.** Excess nutrients, such as phosphorus and nitrates, can be toxic to aquatic life and cause algal blooms.

Protecting our waters begins with consistent monitoring for pollutants. MPCA monitors aquatic life and recreation uses by collecting water chemistry as well as biological and physical data on lakes, wetlands, streams, and large rivers. There are over 170 active surface monitoring sites within the MPA observing the following features since 2010:

- **Biology Stations:** These types of monitoring sites collect fish, invertebrate communities, and aquatic plant data to protect aquatic ecosystems and manage fisheries.
- **Discharge Stations:** These monitoring sites collect specific facility discharge from a point source. These facilities must have a National Pollutant Discharge Elimination System (NPDES) permit. The permit will contain limits on what the industry can discharge, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or people's health.
- **Lake and Stream Chemistry Stations:** These sites collect water chemistry, bacteria, and physical measurements.

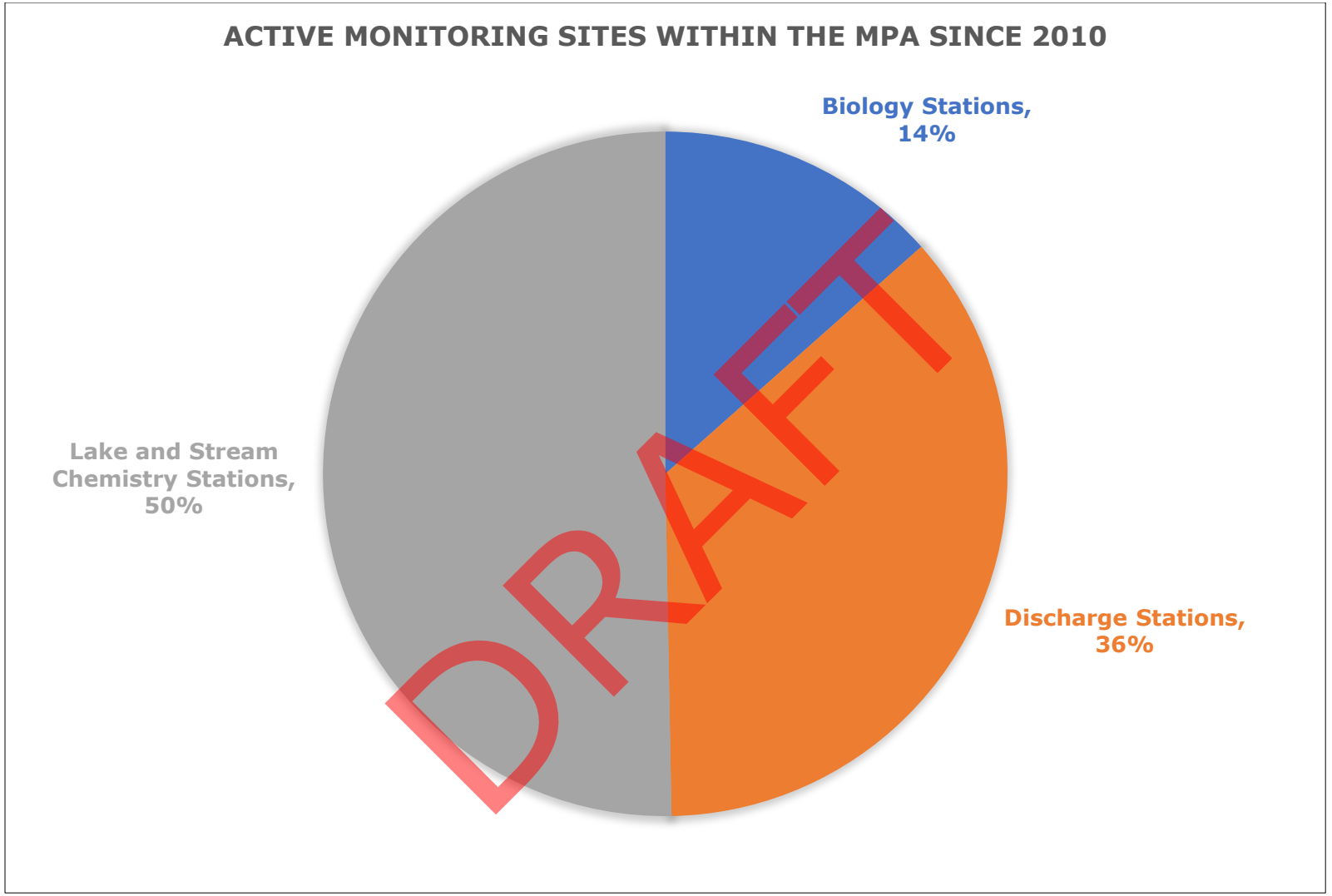


Figure 3.35: *Active Monitoring Sites Within the MPA Since 2010. Data courtesy of the MPCA.*

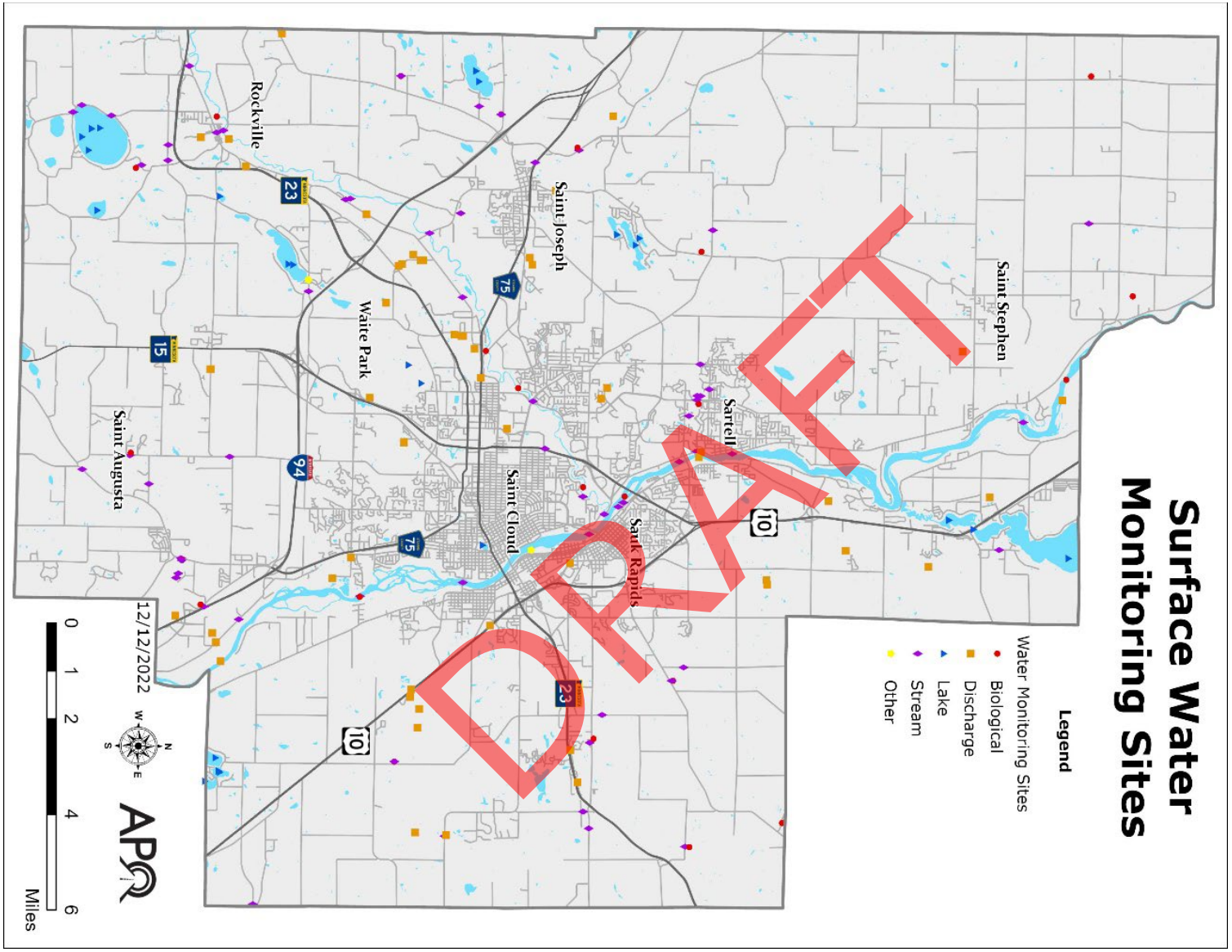


Figure 3.36: *Surface Water Monitoring Sites from 2010 to 2022.*
Data courtesy of MPCA.

Transportation-related pollutants such as chloride enter lakes, streams, wetlands, and groundwater from various sources but are not readily monitored through water quality stations. The Minnesota Statewide Chloride Management Plan (https://bit.ly/3HS4rJR) states nearly half (42%) of chloride comes from salt applied to roads, parking lots, trails, and sidewalks for winter maintenance.

Once chloride is in the water, reverse osmosis is the only way to remove it. This is not economically feasible at a large scale, according to the MPCA. Without being removed from the water, chloride will continue to accumulate in the environment over time. High chloride concentrations harm wildlife and kill fish, invertebrates, and plant species.

In addition to the environmental harm, chloride also can damage roads and bridges, increasing maintenance and repair costs. Chloride has also been known to corrode vehicle parts such as brake linings, frames, and bumpers. Estimates of damage to infrastructure, automobiles, vegetation, human health, and the environment due to road salt range from $803 to $3,341 per ton of road salt used, according to the MPCA. MnDOT used an estimated 354 million pounds of salt during the 2020-2021 winter, which comes out to between $284 million to $1.18 billion worth of damage.

A key challenge in reducing road salt use is balancing the need for safety with the public's growing expectation for clear, dry roads, parking lots, trails, and sidewalks throughout the mix, severity, and duration of Minnesota winters. The impact of climate change on salt use is uncertain. Shorter snowfall and freezing seasons may result in reduced salt use. Yet, more frequent snow events, more extreme events, and potentially more frequent ice storms may result in greater needs for deicing roads, particularly in the more populated parts of the state.

Impaired Waters

According to the MPCA, a body of water is considered "impaired" if it fails to meet one or more water quality standards.

Impairment includes:

- Mercury levels that lead to limits on fish consumption.
- Phosphorus and other nutrients that grow algae.
- Sediment that clouds the water.
- Bacteria that can make water unsafe for swimming.
- Unhealthy conditions for fish and bugs.
- Perfluorooctane sulfonic acid (PFOS) found in fish tissue.
- Sulfate impairments that may hinder the production of wild rice.

A unique water body segment can have multiple pollutants/stressors, such as E. coli and mercury, in the fish. Since 2010, 30 pollutants/stressors have been added to 21 unique water body segments in the MPA. The three most common types of pollutants in the MPA area include E. coli, mercury in fish tissue, and fish bioassessments (poor biological conditions). On the

other hand, five unique water body segments have been delisted since 2012. They include two sections of the Mississippi River, the Sauk River, Lake George, and an unnamed creek. A delisted body of water has met the water quality standard threshold for that specific pollutant/stressor. A body of water can be delisted for one pollutant but still be listed as impaired for another. For example, the Sauk River was delisted for fecal coliform but is still impaired with mercury in fish tissue, PCBs in fish tissue, and nutrients.

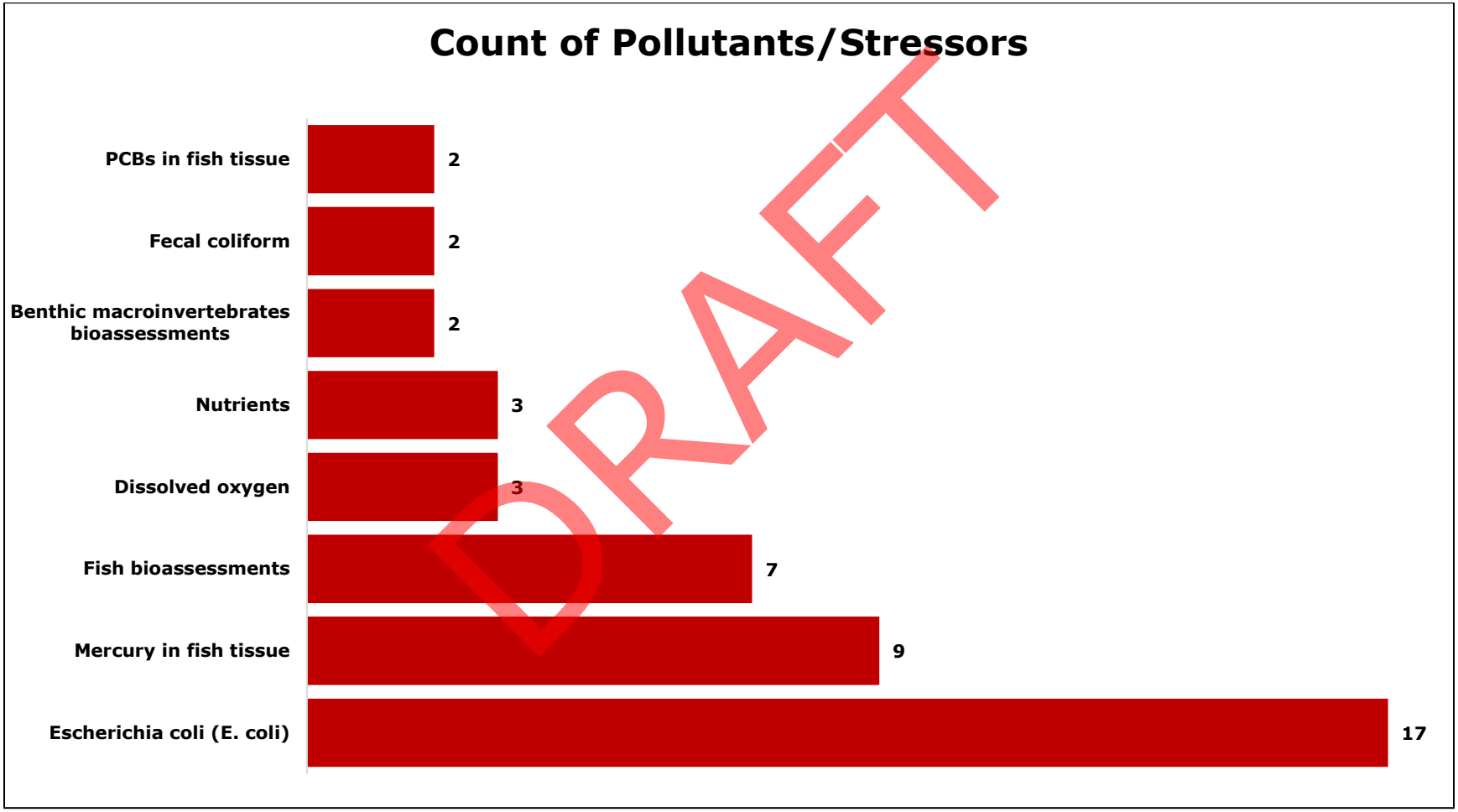


Figure 3.37: *Count of Pollutants or Stressors.*
Data courtesy of MPCA.

Lake George Success Story

Lake George was listed for excessive nutrients in 2012 by MPCA. An approved action plan was adopted in 2017 by the City of Saint Cloud and MPCA to combat the lake's contaminants. Starting in 2018, a stormwater treatment pond used to capture sediment and pollutants just south of Lake George, known as Little George, was dredged for the first time. More than 900 tons of sediment – about 50 semi-truck loads – were removed from the pond. The City of Saint Cloud, in cooperation with the Minnesota Conservation Corps and the University of Minnesota then completed in-lake alum treatments and an underground stormwater treatment upgrade. These efforts and residential rain gardens have helped lower the seasonal concentrations of nutrients in the lake to the point of earning a delisting.

LOOKING AHEAD 2050

Figure 3.38: *Infographic on the delisting of Lake George in Saint Cloud.*

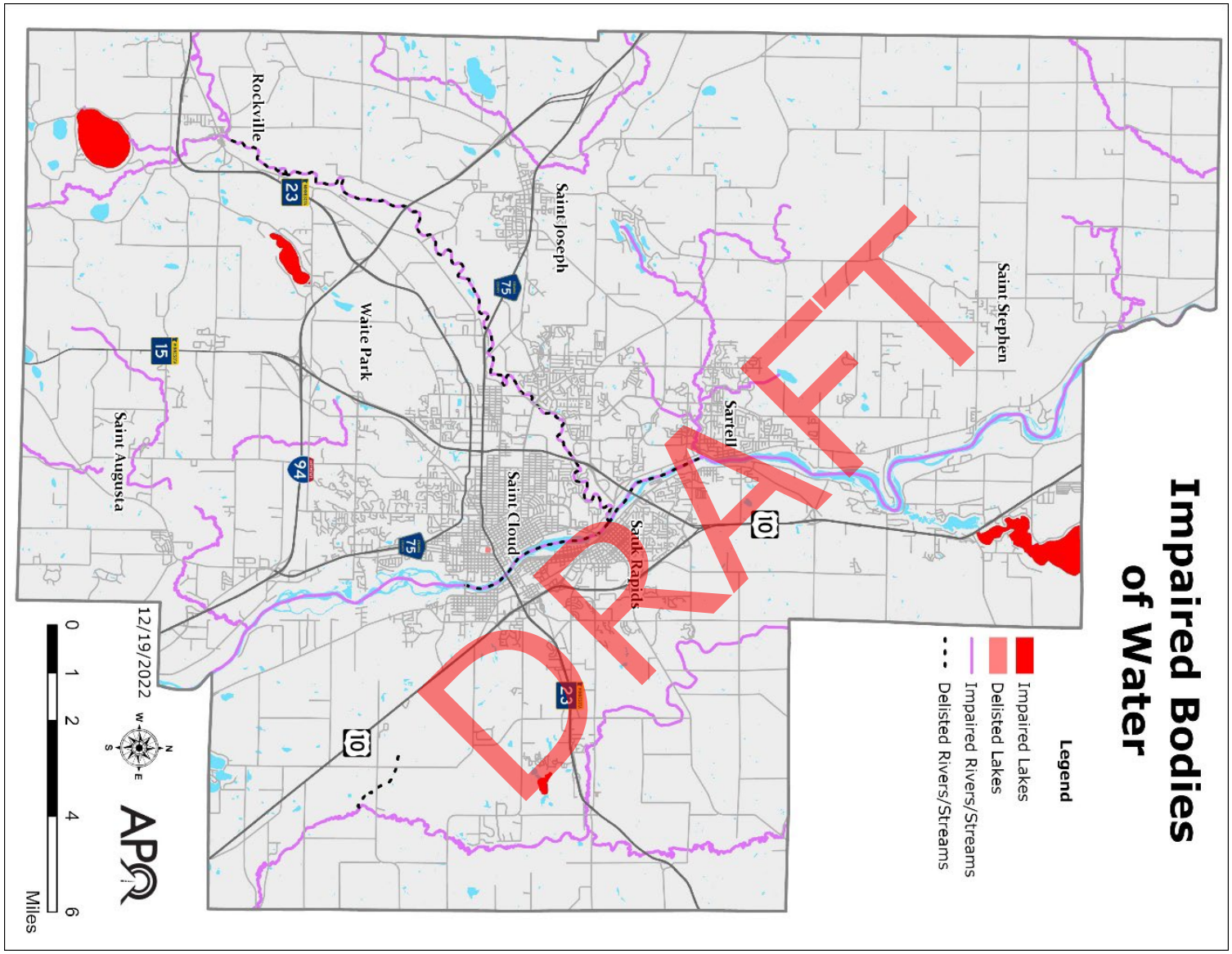


Figure 3.39: *Impaired Bodies of Water.*
Data courtesy of MPCA.

History of Water Protection Acts

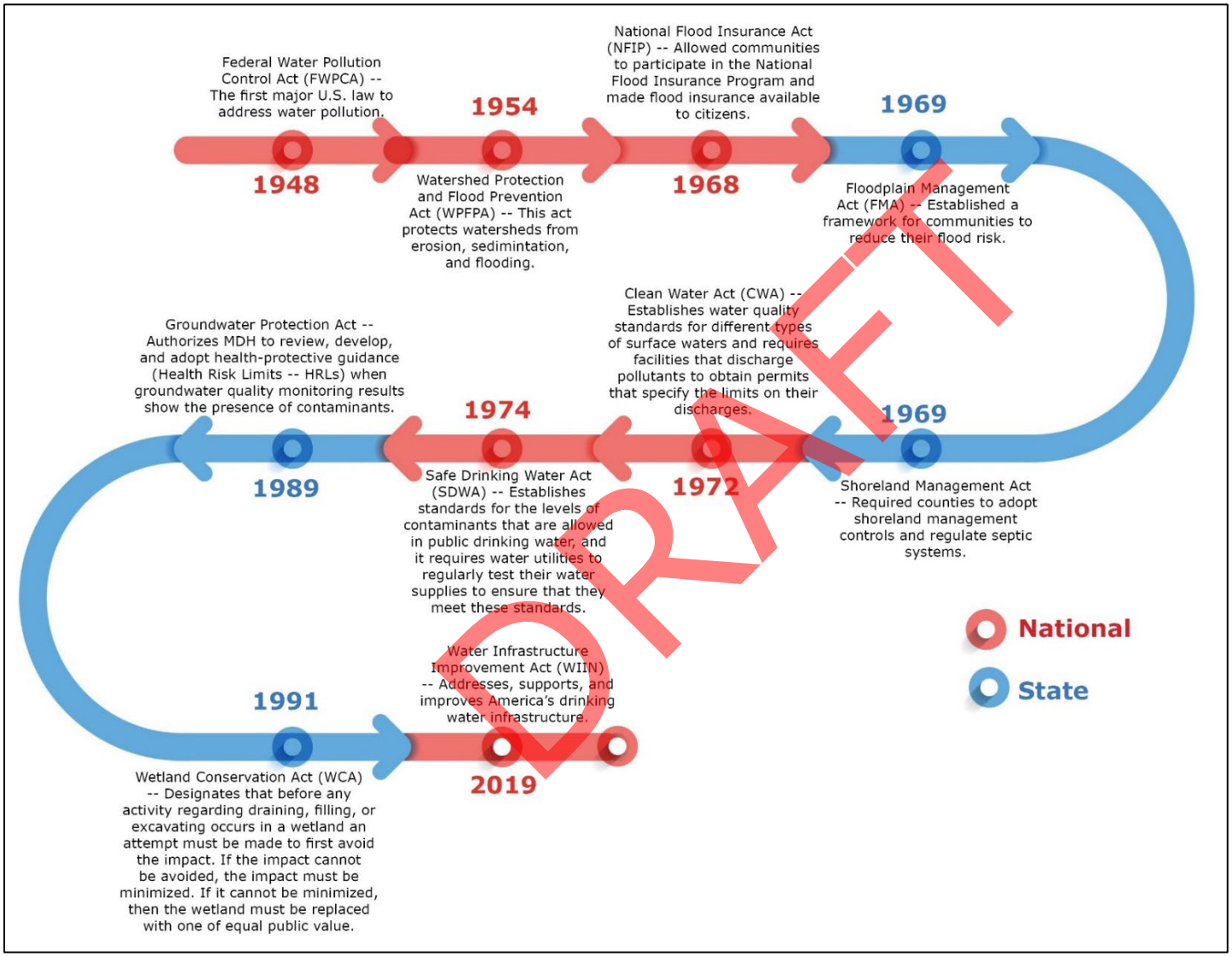


Figure 3.40: *Timeline of water protection acts passed at both the national and state levels.*

Floodplains

Flooding can strain transportation networks as well as the local economy in the short- and long-term through delays and damage to infrastructure. Roads being flooded, closed, or unsafe to travel negatively impact the transportation network and its connectivity by reducing, deviating, or canceling travel for passengers, products, and services. According to the DNR, rainfall events of more than 3 inches have increased by 65% since 2000 – with widespread rains of more than 6 inches occurring four times as frequently than in the previous three decades. And with the increase of extreme rainfall events across the state, it is more likely to anticipate significant damage to roads, bridges, sewers, utilities, and other facilities in the coming years.

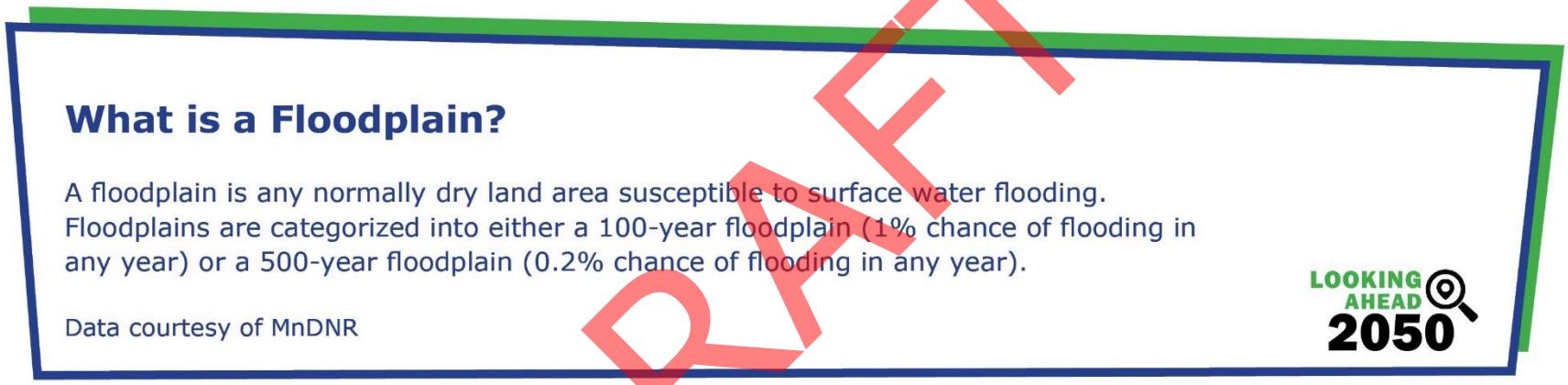


Figure 3.41: *Definition of a floodplain.*

If a proposed project is located within a floodplain, a detailed analysis should be included in the environmental document, as specified by the U.S. Department of Transportation. The analysis should discuss any risk to or resulting from the action, the impacts on natural and beneficial floodplain values, the degree to which the action provides direct or indirect support for development in the floodplain, and measures to minimize harm or to restore or preserve the natural and beneficial floodplain values affected by the project.

Figure 3.42: *Signage for Ninth Avenue S/10th Avenue S roadway prone to flooding. Photo courtesy of the APO.*

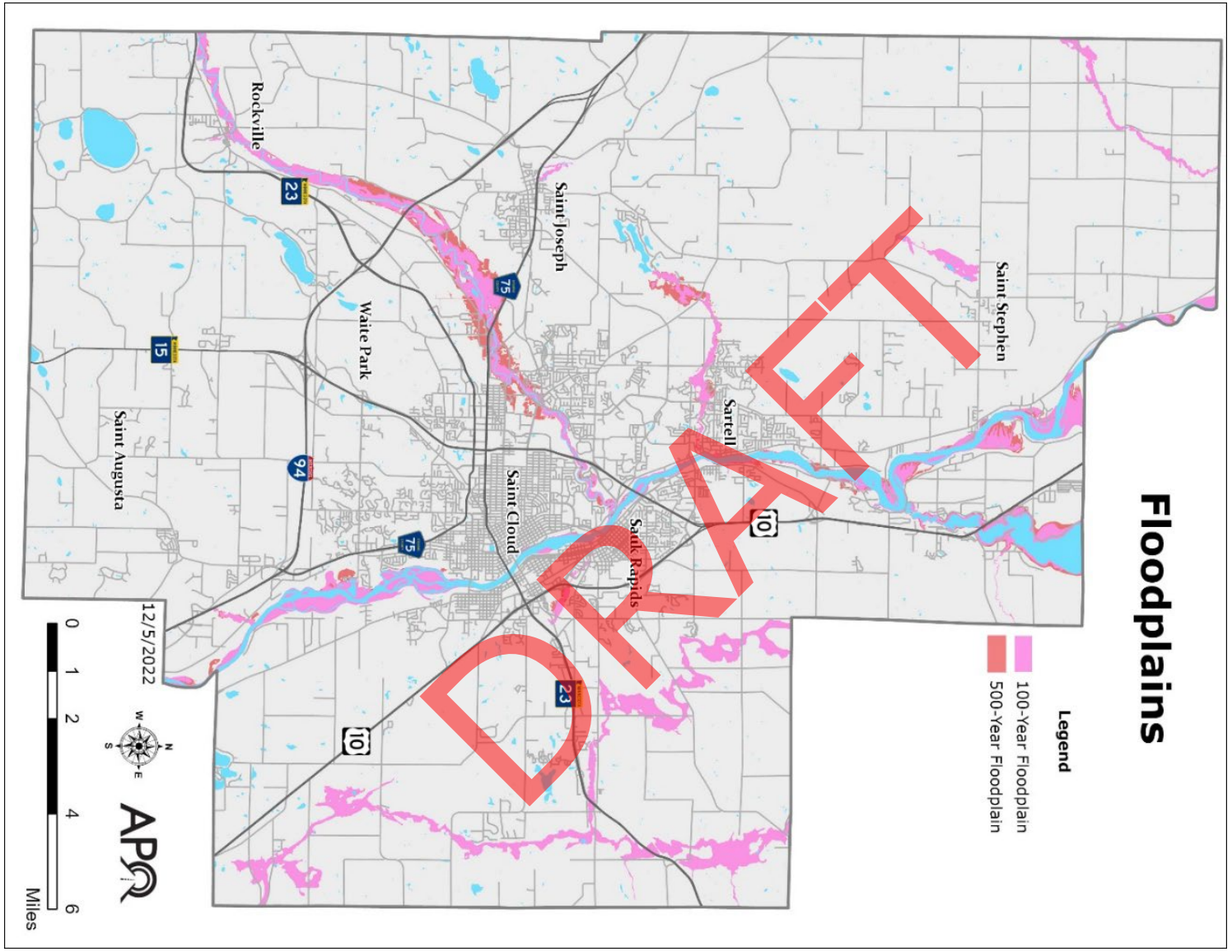


Figure 3.43: *Floodplains located within the MPA.*
Data courtesy of Federal Emergency Management Agency (FEMA).

Wildlife and Habitat

We've seen the impacts transportation infrastructure has on both air and water quality. However, that is not where the impacts stop when it comes to the environment. Transportation-related development plays a primary role in the degradation (or destruction) of native ecosystems. These effects can be seen through events such as the loss of prairie land, the fragmentation of habitats, and the introduction of invasive species. All of these impacts have major consequences to our environment, which have included the loss (or dangerously low populations) of vitally important species like pollinators and native wildlife.

Native Plant Communities

The DNR defines native plant communities as "a group of native plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms."

These plant communities are grouped together by vegetation that generally has uniform soil texture, soil moisture, soil nutrients, topography, and disturbance regimes.

Native plant communities provide several valuable functions including water filtration, flood moderation, carbon storage, moderation of water tables, local temperature moderation, erosion control, and the development and enrichment of soil. In addition, these communities provide a natural habitat for several thousand plant and animal species.

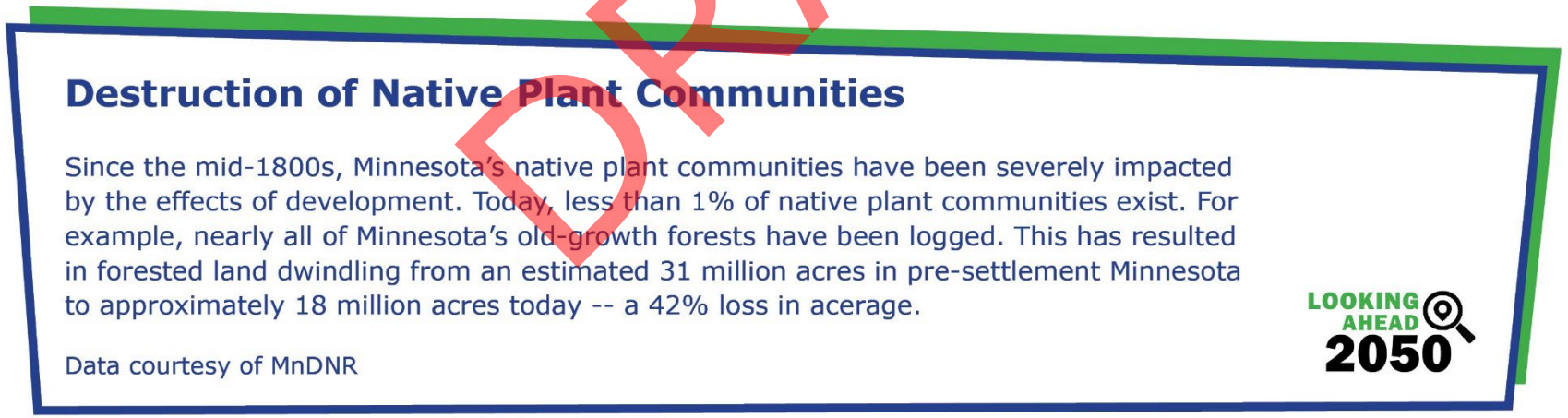


Figure 3.44: *Infographic on the destruction of native plant communities within Minnesota.*

However, finding true native plant communities in Minnesota is becoming more difficult. Since the mid-1800s, native plant communities have been key sources for food, shelter, clothing, fuel, and medicine. Products and byproducts of native plant communities have contributed substantially to the state's economy. But thanks to significant land development – including transportation infrastructure – a vast majority of native plant communities have been either destroyed or substantially altered.

Figure 3.45: *Infographic on rare or endangered plant species in the MPA.*

Native Animals

Minnesota is home to a wide variety of birds, fish, insects, arthropods, mammals, mussels, reptiles, and amphibians. Several of these native animals have been placed on the Rare Species Guide (RSG).

Data and photos courtesy of MnDNR

Greater prairie chicken

Heather vole

Wood turtle

Animals on the RSG

(not an all-inclusive list)

- Blanding's turtle.
- Bullsnake.
- Burrowing owl.
- Cougar.
- Eastern pipistrelle bat.
- Eastern spotted skunk.
- Four-toed salamander.
- Gray wolf (timber wolf).
- Greater prairie chicken.
- Heather vole.
- Lake sturgeon.
- Least shrew.
- Least weasel.
- Massasuaga snake.
- North American racer snake.
- Northern bog lemming.
- Northern myotis bat.
- Peregrine falcon.
- Plains hog-nosed snake.
- Plains pocket mouse.
- Prairie vole.
- Ratsnake.
- Short-eared owl.
- Smoky shrew.
- Smooth softshell turtle.
- Timber rattlesnake.
- Trumpeter swan.
- Wood turtle.
- Woodland vole

Approximately 70 insects are also included on the RSG list.

Figure 3.46: *Infographic on native animals found within the MPA.*

Monitoring Wildlife and Habitat

Existing habitats for native plants and animals are important to the ecosystem and need to be preserved before they are gone. One way to assist this preservation is through close monitoring. Numerous programs to both promote and maintain the biodiversity of these ecosystems have been put into place thanks to volunteers and that of the DNR. This is why the DNR conducts the Minnesota Biological Survey (MBS) to understand where conservation is needed most.

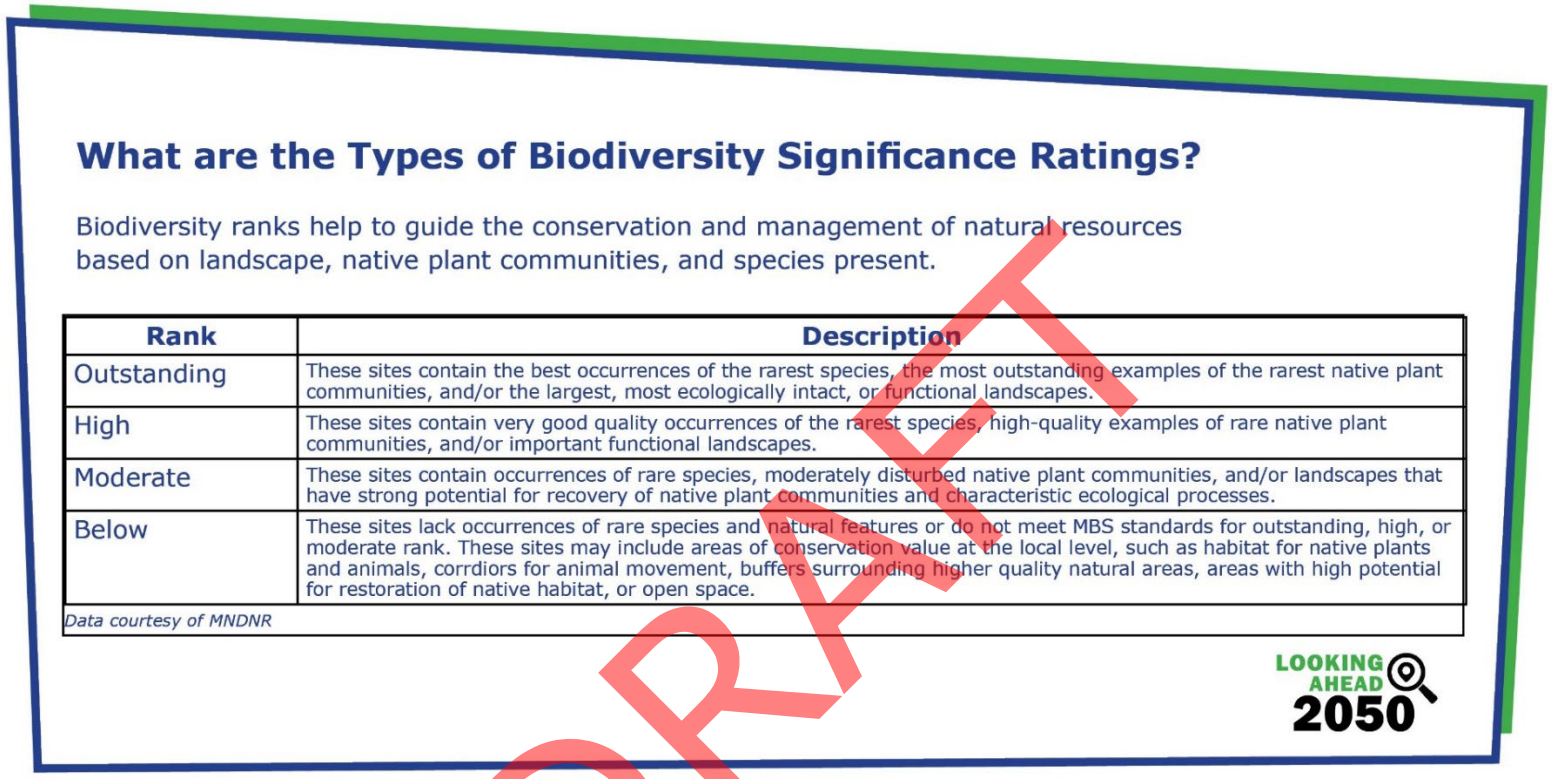
Regionally Significant Ecological Areas (RSEA)

The MBS collects, interprets, monitors, and delivers data on plant and animal distribution as well as the ecology of native plant communities and functional landscapes.

Once the data has been analyzed, MBS ecologists assign a biodiversity significance ranking. These ranks are used to communicate the statewide native biological diversity of each site to natural resource professionals, state and local government officials, and the public.

According to MBS, a site's biodiversity significance rank is based upon the presence of rare species populations, the size and condition of native plant communities within the site, and the landscape context of the site. Figure 3.49 contains a map of the sites of biodiversity significance found within the APO's MPA. Currently, there are over 20,000 acres in the MPA that contain biodiversity significance, of which nearly 80% of those acres are ranked moderate, high, or outstanding. To help protect these areas, the DNR creates wildlife management areas.

Figure 3.47: *Bob Cross Nature Preserve in Sauk Rapids.*
Photo courtesy of Saint Cloud APO.



What are the Types of Biodiversity Significance Ratings?

Biodiversity ranks help to guide the conservation and management of natural resources based on landscape, native plant communities, and species present.

Rank	Description
Outstanding	These sites contain the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact, or functional landscapes.
High	These sites contain very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes.
Moderate	These sites contain occurrences of rare species, moderately disturbed native plant communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.
Below	These sites lack occurrences of rare species and natural features or do not meet MBS standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corrdiors for animal movement, buffers surrounding higher quality natural areas, areas with high potential for restoration of native habitat, or open space.

Data courtesy of MNDNR

Figure 3.48: *Infographic on the types of biodiversity significance ratings.*

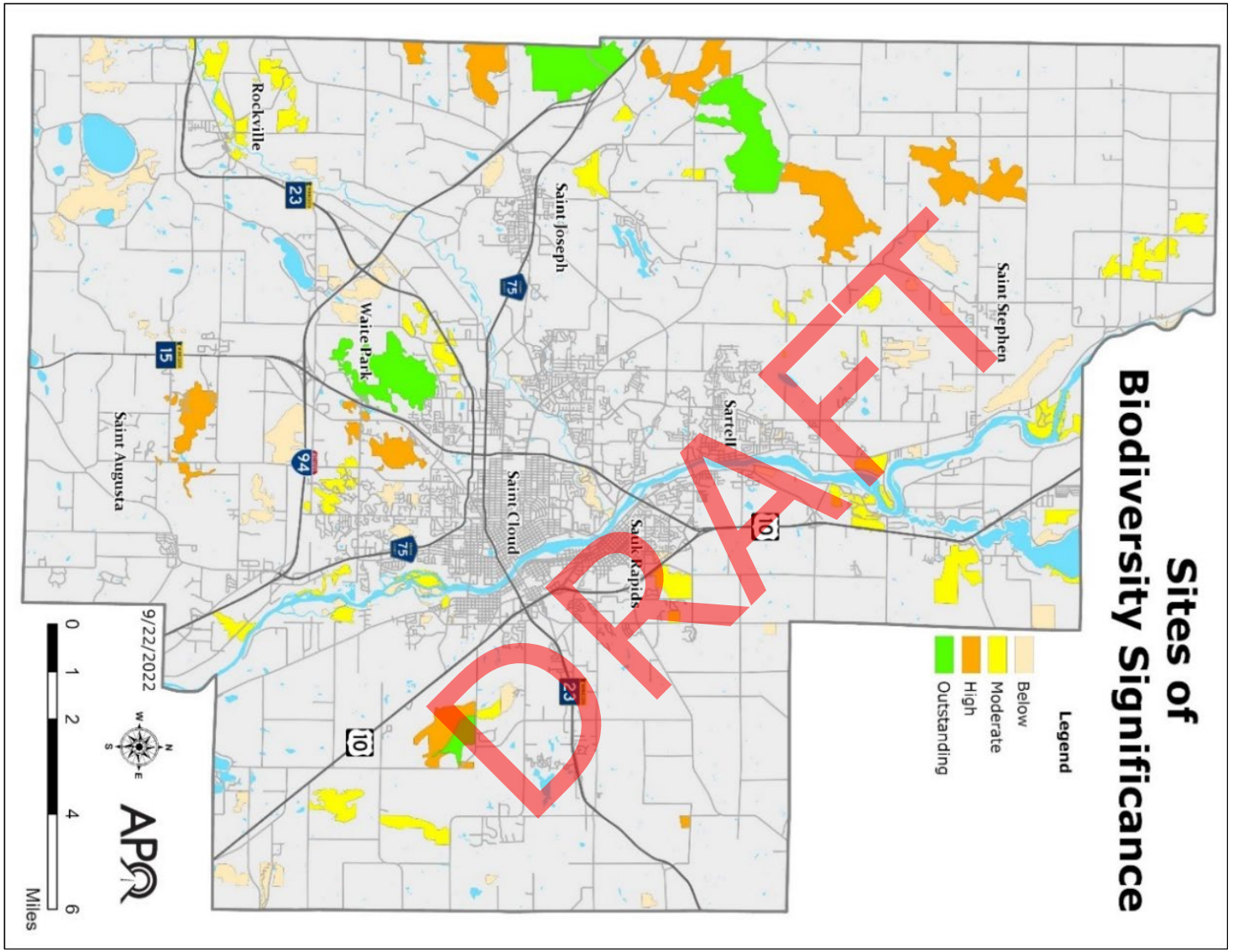


Figure 3.49: *Site of Biodiversity Significance.*
Data courtesy of DNR.

DNR Management Areas

As a function of its duties to conserve and manage the state's natural resources, such as areas of biodiversity significance, the DNR maintains three types of management areas: aquatic, wildlife, and scientific and natural areas.

Figure 3.50: *The Mississippi River.*
Photo courtesy of Saint Cloud APO.

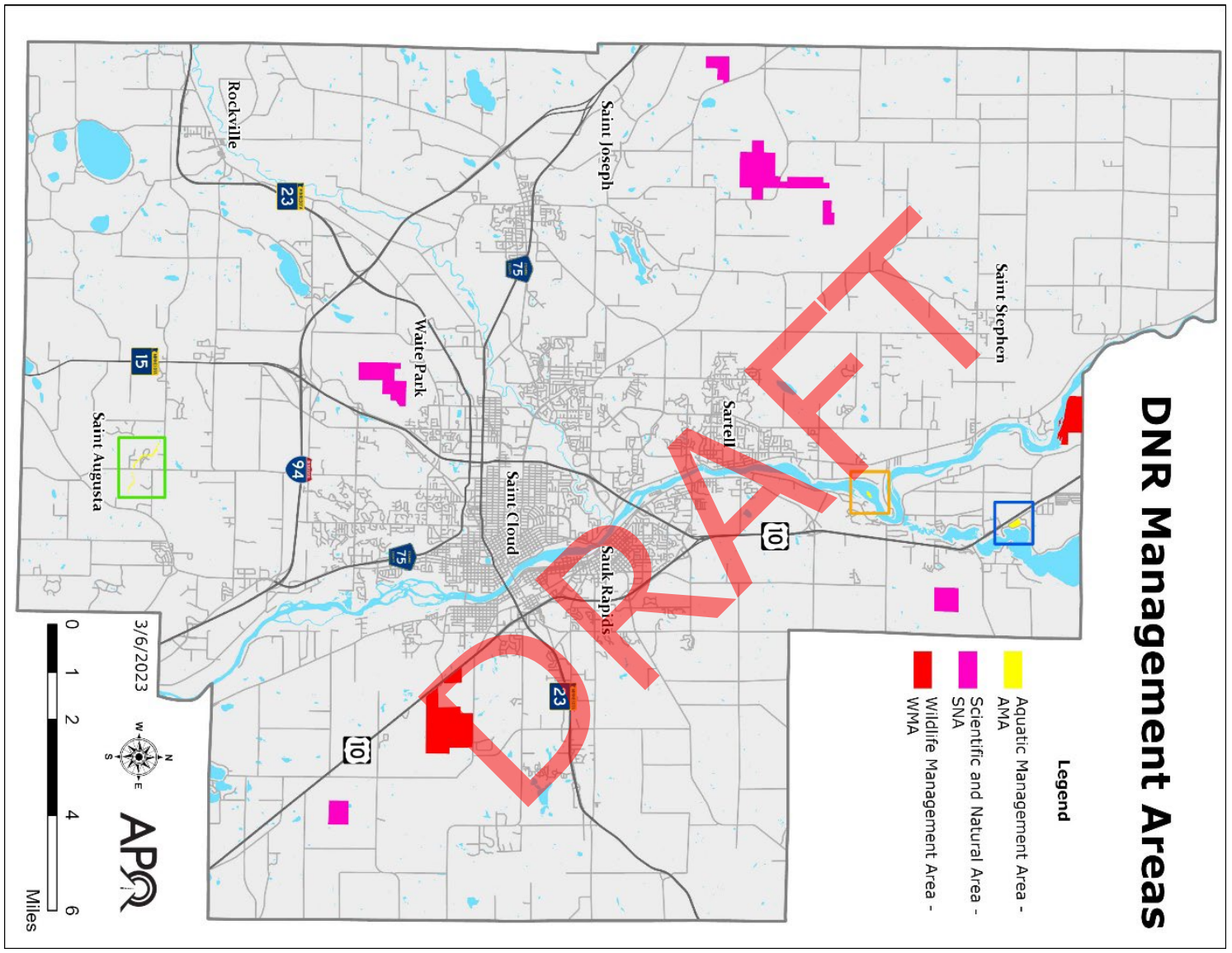


Figure 3.51: *DNR Management Areas.*
Data courtesy of DNR.

Aquatic Management Areas

The Aquatic Management Area (AMA) program provides angler and management access, protects critical shore land habitat, and provides areas for education and research.

The AMA program was created in 1992 as part of the state's Outdoor Recreation Act. AMAs are established to protect, develop, and manage lakes, rivers, streams, and wetlands critical for fish and aquatic life. AMAs also assist in protecting water quality standards.

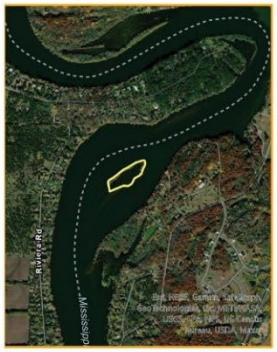
According to the DNR, as of the drafting of this plan, there were approximately 700 AMAs found in 73 of Minnesota's 87 counties totaling 770 shore land miles.

Three AMAs are found within the MPA: Luxemburg Creek, Baert Island, and Little Rock Lake. Local AMAs can be found on the map in Figure 3.51 (highlighted in different colored boxes for better visibility).

Figure 3.52: *The Mississippi River.*
Data courtesy of Saint Cloud APO.

Aquatic Management Areas in the MPA

Baert Island



Baert Island: Acquired in 2008, this 5.3-acre AMA is an island located in the Mississippi River. Brockway and LeSauk Townships reside to the west and Watab Township to the east. The island can only be reached by boat, with non-motorized travel allowed. Wildlife observation and angling are permitted around the island.

Little Rock Lake

Little Rock Lake: Acquired in 1977, this 1.7-acre AMA is located adjacent to the larger Little Rock Lake in northern Watab Township. Angling, non-motorized travel, and wildlife observation are allowed in this AMA.

Luxemburg Creek

Luxemburg Creek: This 0.57-acre AMA is Saint Augusta was acquired in 2005 and is part of a trout stream that allows angling access.

LOOKING AHEAD 2050

Data courtesy of MnDNR

Figure 3.53: *Infographic on the Aquatic Management Areas located within the MPA.*

Wildlife Management Areas

To curb the growing trend of wildlife habitat destruction, the State of Minnesota developed its Wildlife Management Area (WMA) system in 1951. According to the DNR, WMAs protect those lands and waters that have a high potential for wildlife production, public hunting, trapping, fishing, and other compatible recreational uses.

Across Minnesota, there are approximately 1,440 public wildlife areas – totaling about 1.29 million acres, according to the DNR.

There are two WMAs within the MPA: Michaelson Farm and Sand Prairie. Local WMAs can be found on the map (see Figure 3.51).

Figure 3.54: *The Sauk River.*
Photo courtesy of Saint Cloud APO.

Wildlife Management Areas in the MPA

Michaelson Farm

Michaelson Farm: This 258-acre WMA is within Watab Township and adjacent to both Bend in the River Regional Park and Mississippi River County Park. Recreational opportunities including hunting, trapping, hiking, cross-country skiing, snowshoeing, and wildlife watching/photography exist throughout the year.

Sand Prairie

Sand Prairie: This 650-acre WMA is situated in Haven Township. Sand Prairie WMA was the first to be designated as an Environmental Education Area. Local public schools, college students, and teachers routinely visit and study the Sand Prairie ecosystem. There are many excellent wildlife viewing, nature study, and hiking opportunities.

Data courtesy of MnDNR

LOOKING AHEAD 2050

Figure 3.55: *Infographic on the Wildlife Management Areas located within the MPA.*

Scientific and Natural Areas

Scientific and Natural Areas (SNAs) are public lands in which native plants and animals are minimally disturbed.

According to the DNR, characteristics of SNAs include undisturbed plant communities, rare or endangered species habitats, seasonal habitats for birds or animal concentrations, natural geologic formations and features, and plant communities undergoing succession as a result of natural processes.

There are over 160 SNAs within Minnesota as of the drafting of this plan. The APO's MPA contains five SNAs: Quarry Park, Englund Ecotone, Harry W. Cater Homestead Prairie, Partch Woods, and Saint Wendel Tamarack Bog. Local SNAs can be located on the map (again, see Figure 3.51).

Figure 3.56: *A bee on a flower.*
Photo courtesy of Saint Cloud APO.

Scientific and Natural Areas in the MPA

Quarry Park

Quarry Park: The 323 acres of Quarry Park SNA in Waite Park is situated on land formerly used for granite mining in the first half of the 20th century and is now part of the 684-acre Stearns County Park. This southern portion of Quarry Park offers a less altered setting, preserving what has been described as central Minnesota's best example of a granite bedrock outcrop community. In addition to the vegetation associated with the granite outcrops, this SNA protects large expanses of high-quality wet meadow, wet prairie, oak woodland, and oak forest. These varied habitats host species such as the tubercled rein orchid (threatened in Minnesota) and birds such as the Red-Shoulderd Hawk and Acadian Flycatcher (both Minnesota special concern).

Englund Ecotone: This 160-acre site protects one of the few remaining natural ares in developing Watab Township. The DNR defines an "ecotone" as a place of transition between two biological communities or biomes. This area is vital due to the habitat it provides for animals on the Species of Greatest Conservation Need (SGCN) list. They include the Red-Headed Woodpecker, Eastern Meadowlark, Loggerhead Shrike, and Grasshopper Sparrow.

Englund Ecotone

Data courtesy of MnDNR

LOOKING AHEAD 2050

Figure 3.57: *An infographic on the Quarry Park and Englund Ecotone Scientific and Natural Areas located within the MPA.*

Scientific and Natural Areas in the MPA

Harry W. Cater Homestead Prairie

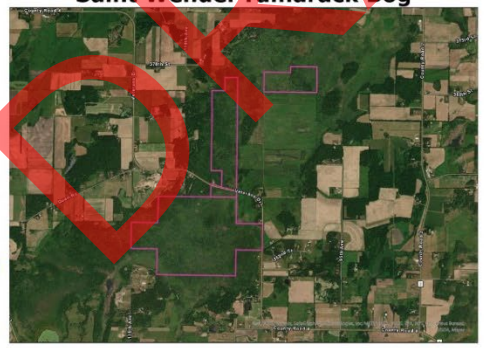
Harry W. Cater Homestead Prairie: Accessible only by water via the Elk River, "Cater Prairie" is in southern Haven Township. Much of the prairie that once existed in this area has been developed for residential or agricultural uses. This SNA contains many bees and other pollinators and offers habitat for birds such as the Red-Shouldered Hawk and Golden-Winged Warbler.

Partch Woods

Partch Woods: This 124-acre SNA is located in western Saint Wendel Township. Partch Woods contains forest maple, basswood, red oak, ash, birch, and elm trees and is one of the few "Big Woods" forest types that remain in this part of the state. In the spring, wildflowers such as hepatica, wood anemone, and bloodroot bloom which are then follwed in the summer by various ferns.

Saint Wendel Tamarack Bog:
This 650-acre SNA in Saint Wendel Township is roughly a quarter of the surrounding wetland complex. This SNA is known for the calcareous fen, a globally rare plant community of which 10 acres exists here. This site, which is technically not a bog, is a haven of biodiversity. The dominant plant community here is the tamarack swamp (80%) along with smaller areas of black ash (red maple) seepage swamp, willow-dogwood shrub swamp, and sedge meadow.

Saint Wendel Tamarack Bog



Data courtesy of MnDNR

LOOKING AHEAD 2050

Figure 3.58: *Infographic on the Harry W. Cater Homestead Prairie, Saint Wendel Tamarack Bog, and Partch Woods Scientific and Natural Areas located within the MPA.*

Invasive Species

Invasive species are non-native plants, animals, or other living organisms whose introduction into an ecosystem causes or is likely to cause economic or environmental harm. The DNR relies on preventative measures, early detection, and management strategies to avert the introduction and spread of invasive species. These strategies vary widely depending on the terrestrial or aquatic plants and animals being eradicated.

Invasive Terrestrial Plants

Proper land management not only improves ecosystems for native plants and pollinators, but also eliminates invasive and harmful roadside weeds. Many foreign plants are introduced to Minnesota ecosystems without their natural enemies. These weeds are called either invasive species or noxious weeds. Improperly managed roadsides facilitate the spread of invasive species across the landscape. This allows species to invade adjacent land and degrade the habitat and biodiversity that the land contains. With effective management, however, roadsides become an important venue for early detection and rapid control of new invasive species. This reduces the long-term impacts that invasive species could otherwise have on adjacent lands.

As of the drafting of this plan, the DNR has reported well over 100 types of invasive plants or diseases located within the MPA.

Invasive Terrestrial and Aquatic Animals

The impacts of aquatic and terrestrial invasive species are wide and varied. Invasive species outcompeting native species have caused the extinction of some native plants and animals elsewhere in the world, and the same could happen in Minnesota. According to the DNR, invasive species are transported through commercial trade, travel, and personal recreational activities. Terrestrial invasive species can be transported from activities such as backpacking, biking, gardening, hunting, or off-highway vehicle riding. On the other hand, invasive aquatic species travel between bodies of water in equipment such as tanks, pumps, hoses, silt curtains, and water-retaining components of boats.

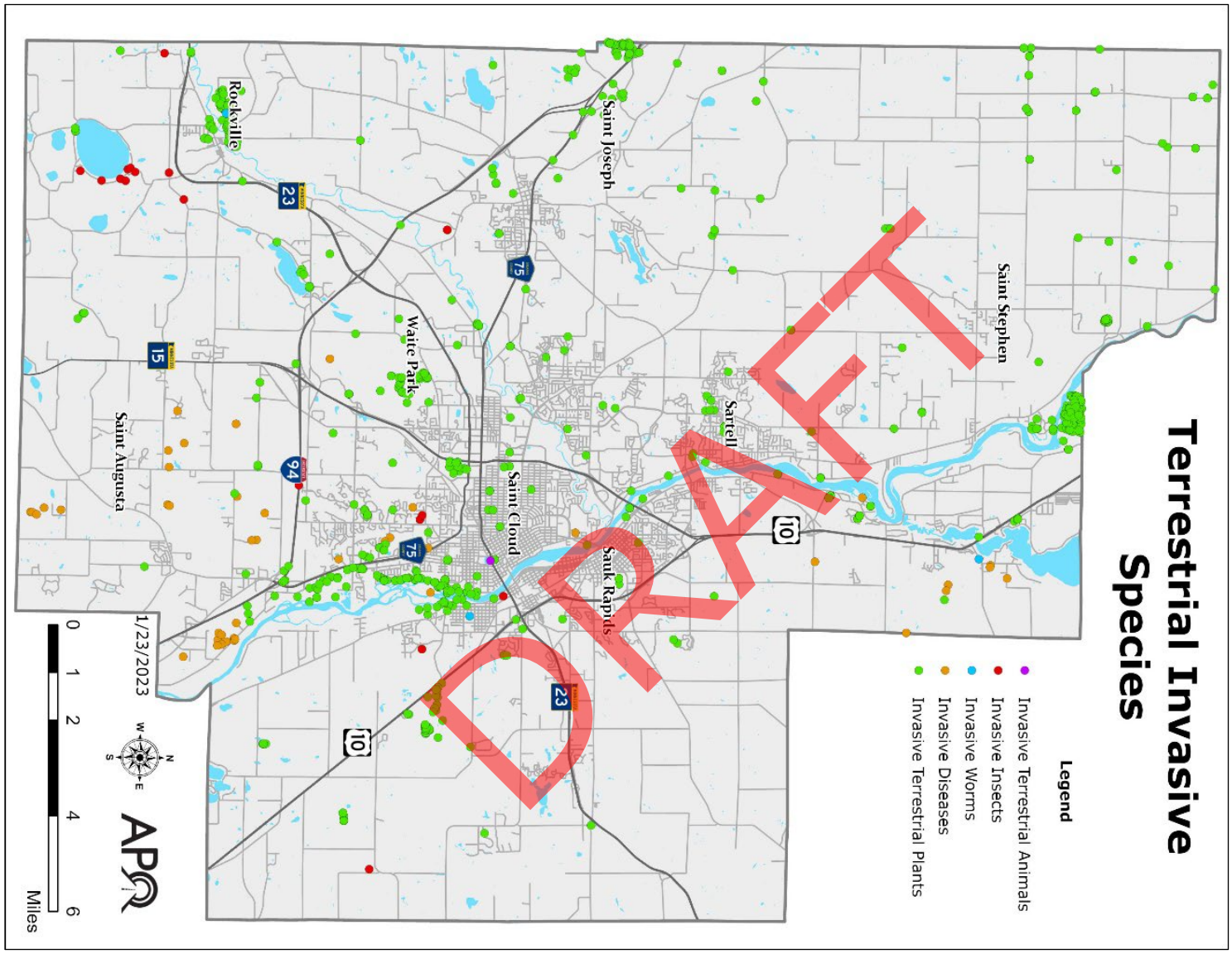


Figure 3.59: *Terrestrial Invasive Species.*
Data courtesy of DNR.

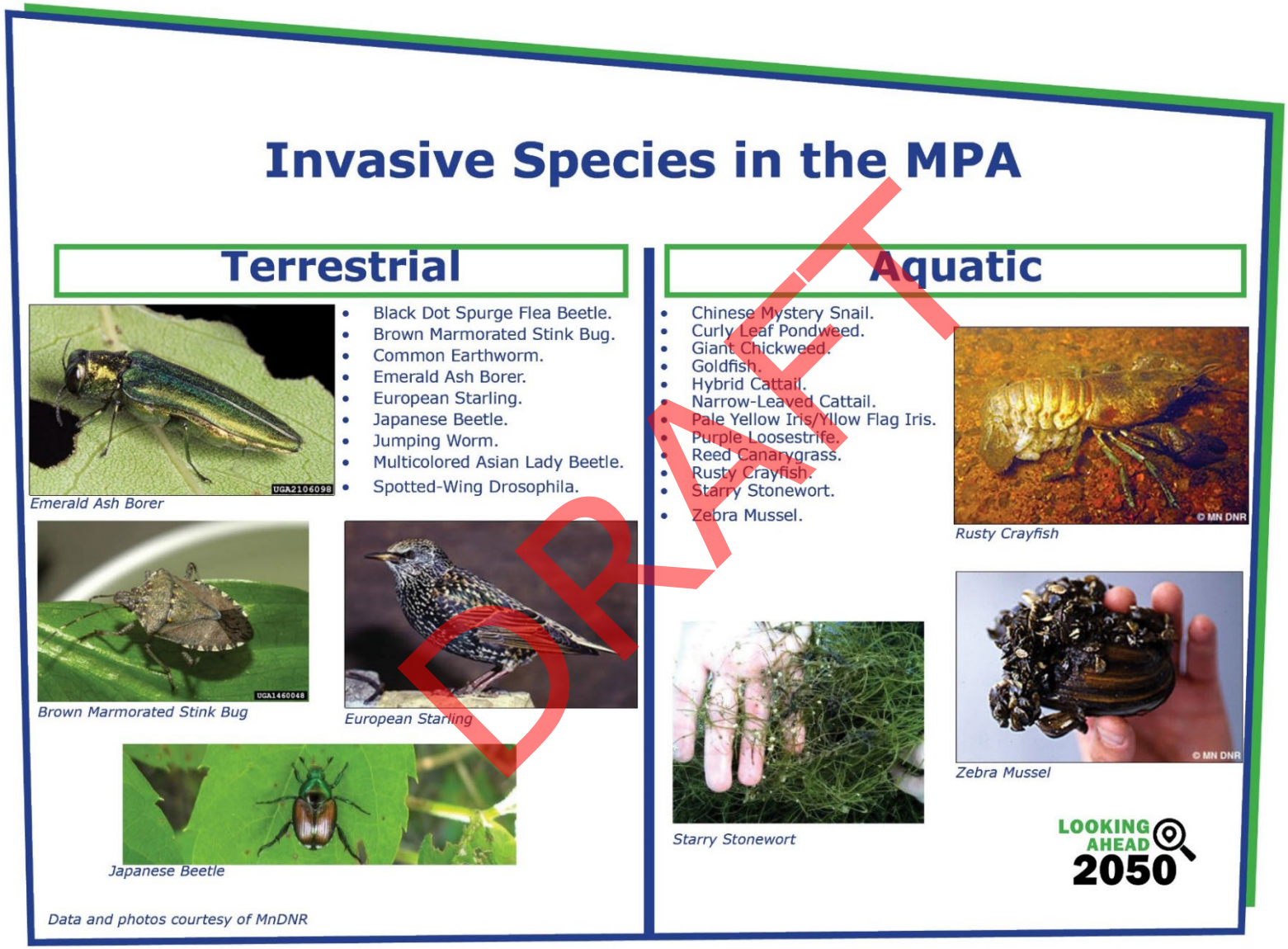


Figure 3.60: *Infographic on terrestrial and aquatic invasive species found within the Saint Cloud MPA.*

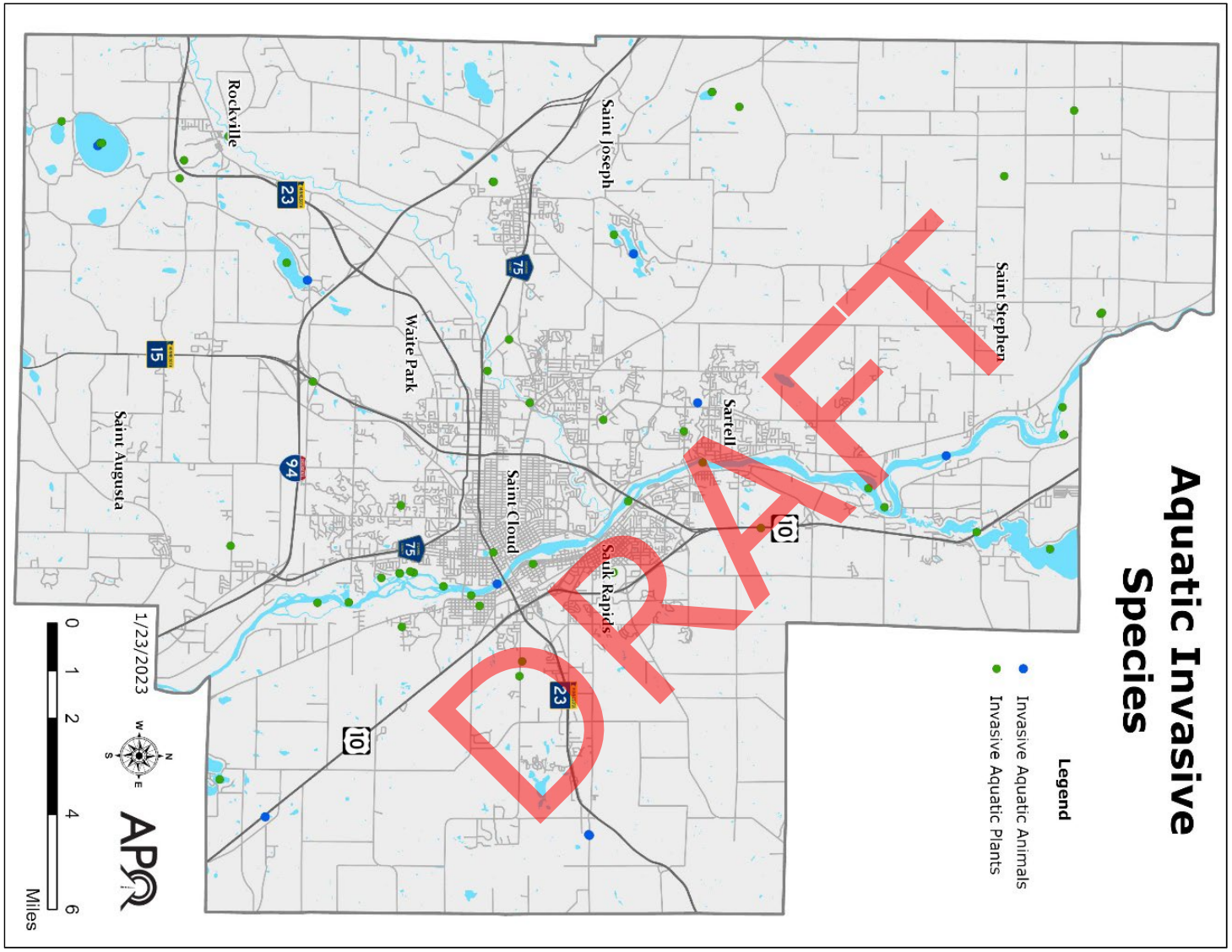


Figure 3.61: *Aquatic Invasive Species.*
Data courtesy of DNR.

Transportation's Impact on Wildlife and Habitat

As transportation planners, it is critical to have an understanding of the existing natural habitats and ecosystems – particularly at-risk species – in order to mitigate undesirable impacts to these areas. Additionally, by learning how to manage roadsides better and cooperating with other agency partners to maintain and improve wildlife habitats, we can not only prevent further harm to our region's environmental resources but also, in some cases, reverse it.

Roadside Management

To help control invasive species and enhance habitat in transportation right-of-way, construction projects should use strategies to encourage planting native flora. Diverse roadside vegetation improves the overall health and resiliency of roadside infrastructure, enabling it to more effectively perform the critical functions it provides for safety, soil stabilization, drainage, and stormwater treatment. Roadside management can use the following strategies to combat invasive species: biological control, herbicide application, mowing, and prescribed fire.

Biological Control

One method to protect native roadside vegetation is through biological control. According to MnDOT, this is done by using natural plant enemies to reduce or mitigate the effect of unwanted vegetation. Since invasive plants tend not to have natural predators, insects are deployed to reduce the plant's ability to reproduce by feeding on foliage, flowers, seed, roots, and other plant parts. This has proven very cost-effective and provides adequate control of invasive plant species. Without biological control, MnDOT would rely further on herbicide or mowing to control unwanted vegetation.

Herbicides

Herbicides are used to manipulate or control undesirable vegetation and are not directly toxic to insects. Many invasive species degrade pollinator habitats by crowding out native wildflowers. Some of these plants even release a chemical to inhibit the growth of other species near them. Weed control efforts balance the short-term impacts on pollinator habitat with the long-term benefits of reduced invasive species infestations and improved wildflower populations. Though the downside of herbicides is that they can eliminate native wildflowers.

Mowing

Mowing roadsides is very expensive in terms of personnel hours, equipment hours, and fuel consumption and has the most negligible impact on improving native plants. If mowing is meant only to provide sight distance and room for a vehicle to pull off the road, then mowing the entire roadside is unnecessary. Improper mowing height and too frequent or poorly timed mowing can reduce root mass, plant vigor, and overall production potential. Operating heavy equipment on roadside slopes can tear up vegetation, weakening the plant community and making the roadside more susceptible to weeds and erosion. When seeding the roadside, agencies should choose native, low-maintenance vegetation that maintains public safety while reducing the need to mow while providing habitat for wildlife while combating invasive species.

Prescribed Fire

Fire is an important aspect of vegetation management because many plants need fire for ideal growth. Since herbicides and mowing do little to prevent re-infestation, fire aids in weed control. When fire is used, native plants can outcompete weeds, which helps the plants establish deep root systems to prevent erosion and filter stormwater runoff. Prescribed fire is also used for safety to control brush and small trees near the roadway.

Wildlife Conflicts and Crossings

Native plants aren't the only section of the ecosystem affected by transportation. High-volume highways represent the greatest impact on wildlife, presenting an almost impassable barrier for many smaller wildlife species. Roadways can cause the direct loss of habitat through road and roadside buildings and roadway mortality from vehicle impacts, but they also have many non-direct impacts, as listed in Figure 3.62.

Impact on Wildlife	Description
Habitat fragmentation	Many rural roadways are built through existing established wildlife habitats. These roadways reduce the amount of interior habitat while increasing edge habitat, which can increase the prevalence of predators and parasites.
Road avoidance	Some wildlife avoid roadways due to road noise and human activity, decreasing potential habitat size and creating greater fragmentation. Road avoidance has been documented in native Minnesota species like wolves, turkeys, bobcats, and moose.
Reduced access to vital habitats	Many roadways were not planned or built with wildlife habitats in mind. Many roadways separate wildlife populations from vital areas necessary for sustained survivability, like food sources, spawning grounds, nesting areas, or migration routes.
Population isolation and fragmentation	Wildlife populations may become isolated from one another and fragment. This can lead to a greater likelihood of local extinction of native species due to environmental variability, genetic diversity loss, and natural catastrophes.
Disruption of regional population maintenance	The geographic dispersal of populations has been shown to be important for the genetic variability and local population survival in the face of potential extinction events. The barriers to population dispersal that roadways represent present a major factor affecting the long-term persistence of wild populations.

Figure 3.62: *Impact on Wildlife.*
Data courtesy of MnDOT's Biodiversity Trend Analysis.

Aquatic animals such as fish are also affected when barriers are created. Examples include the interruption of the natural flow of a waterway. When culverts are installed, they can cause faster water flow and limit fish passage. Long-span bridges that avoid disturbing the natural waterway are the best solution for water crossing from an ecological perspective.

Local Environmentally Sensitive Areas (ESAs)

An ESA is a designation for specific geographic areas or locations that are recognized for their environmental significance, fragility, or vulnerability. These areas are typically subject to special regulations or protections aimed at preserving and safeguarding their natural characteristics. Within the APO's planning area, two jurisdictions, Saint Cloud and Sauk Rapids have local ESAs.

City of Saint Cloud

The majority of Saint Cloud's natural attributes are categorized as ESAs, comprising floodplains, wetlands, wooded zones, shorelines, and undeveloped open spaces, in accordance with the provisions outlined in the City's Land Development Code (LDC). The LDC oversees various aspects of land development, including zoning, land subdivision, landscaping, signage, parking, and land use. ESAs necessitate a more stringent site plan evaluation to ensure the protection of Saint Cloud's natural environments.

The City of Saint Cloud actively promotes the adoption of low-impact design and other conservation-oriented development approaches for properties located either partially or entirely within an ESA. While the City's Land Use Plan outlines the desired future land use for all parcels within its jurisdiction and planning area, the ESA designation should persist as a guiding principle for sustainable future development. Moreover, ESAs should serve as a blueprint for establishing an interconnected network of parks and open spaces throughout Saint Cloud's growing areas, achieved through the implementation of conservation easements and parkland dedication.

City of Sauk Rapids

The City of Sauk Rapids has established a prioritized list of natural resources aligning with the City's goals and objectives. This list encompasses several key elements, including rivers and streams, wetlands, wildlife corridors and habitat, native plant communities, bluffs and slopes, stormwater infiltration, recharge areas, natural recreation, granite and aggregate resources, and wellhead protection areas.

These elements collectively define an environmentally sensitive area overlay district. The creation of this district serves several essential purposes, such as maintaining the integrity of underlying zoning districts and their current development potential while allowing for alternative methods of development that best serve the community's interests. It also aims to safeguard open spaces, green areas, and the water quality of the flowage connected to the Mississippi River.

Moreover, the overlay district provides increased flexibility for subdivision planning and potential incentives in exchange for the protection of green spaces, open areas, and other resources identified by the city. It encourages development that conserves and leverages existing natural site features and vegetation, fostering a more efficient pattern of open spaces and recreational

areas. Additionally, it supports opportunities for more effective land utilization and development in harmony with transportation facilities, community amenities, and the objectives outlined in the comprehensive plan.

Soil

Wildlife and habitat can only flourish if the soil is healthy enough to support life. According to the U.S. Department of Agriculture (USDA), soil is a living and life-giving natural resource. It is teaming with billions of bacteria, fungi, and other microbes that are the foundation of an elegant symbiotic ecosystem.

What Is Soil?

Soil is a natural element comprised of a mixture of organic (dead plants and animals) and inorganic (rock, sand, clay, and silt) materials along with various gases and liquids. Soil can be categorized into three groups based on texture. Like how ingredients in cake batter unite to produce a cake, each of these groups – together with a mixture of organic materials – bind together in different consistencies to form soil. This composition of materials determines how the soil will function (drainage, nutrients, firmness) and what type of uses will be best suited (agriculture, wetland, construction).

Figure 3.63: *Soil being hauled by a dump truck during a road project in Sauk Rapids.*
Photo courtesy of Saint Cloud APO.

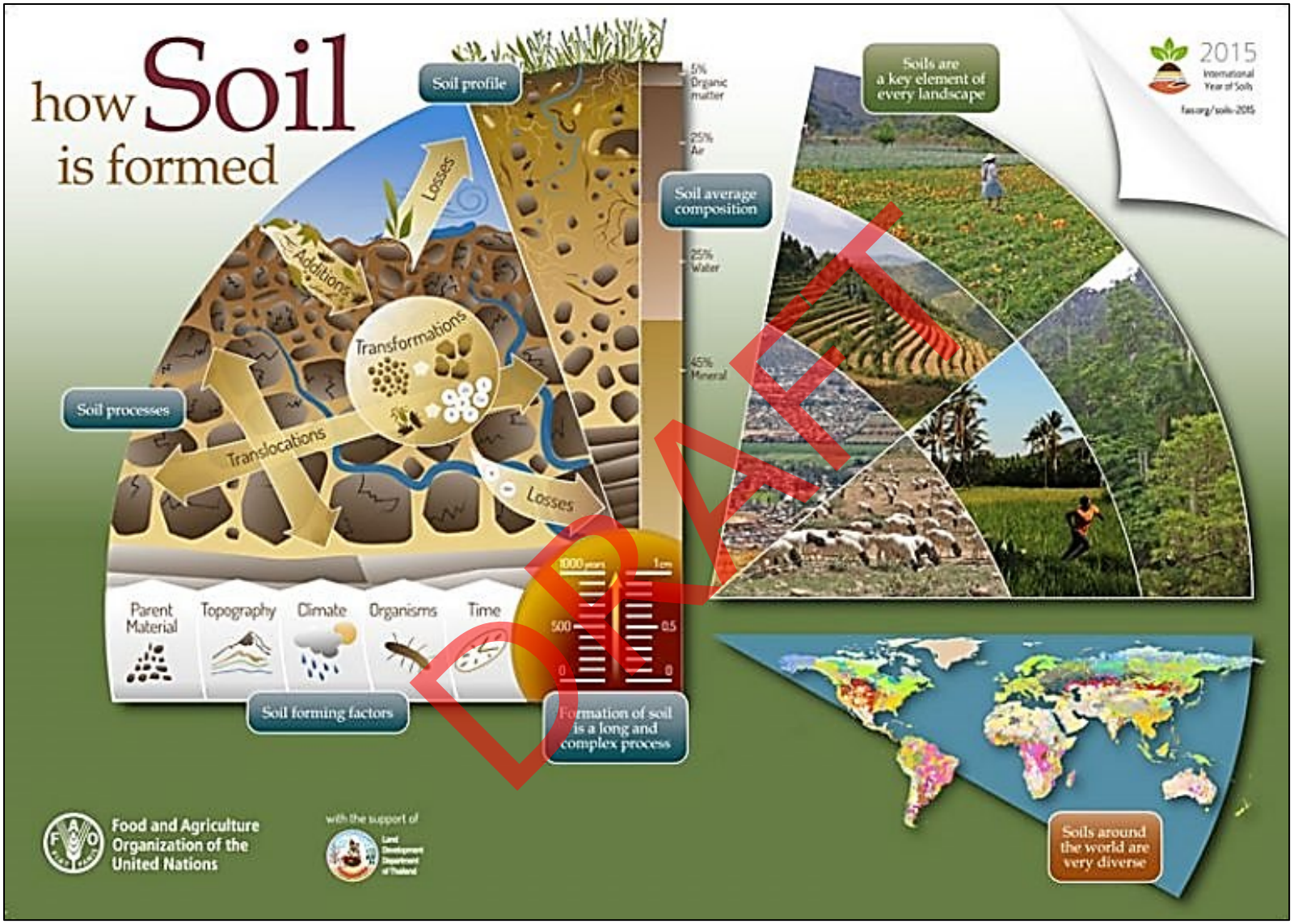


Figure 3.64: *How soil is formed.*
Data courtesy of the Food and Agriculture Organization of the United Nations.

Soil Health, Benefits, and Functions

Soil health, according to the USDA, is the "continued capacity of the soil to function as a vital, living ecosystem that sustains plants, animals, and humans." Assessing soil health can determine how well soil not only performs all of its functions now but how well those functions are being preserved for future use. This is especially important considering soil health can play a role in other environmental aspects, including clean air and water, bountiful crops and forests, productive grazing lands, diverse wildlife, and beautiful landscapes.

Figure 3.65: *Example of reconstruction of Stearns County Road 1/Riverside Avenue N in Sartell. Photo courtesy of Saint Cloud APO.*

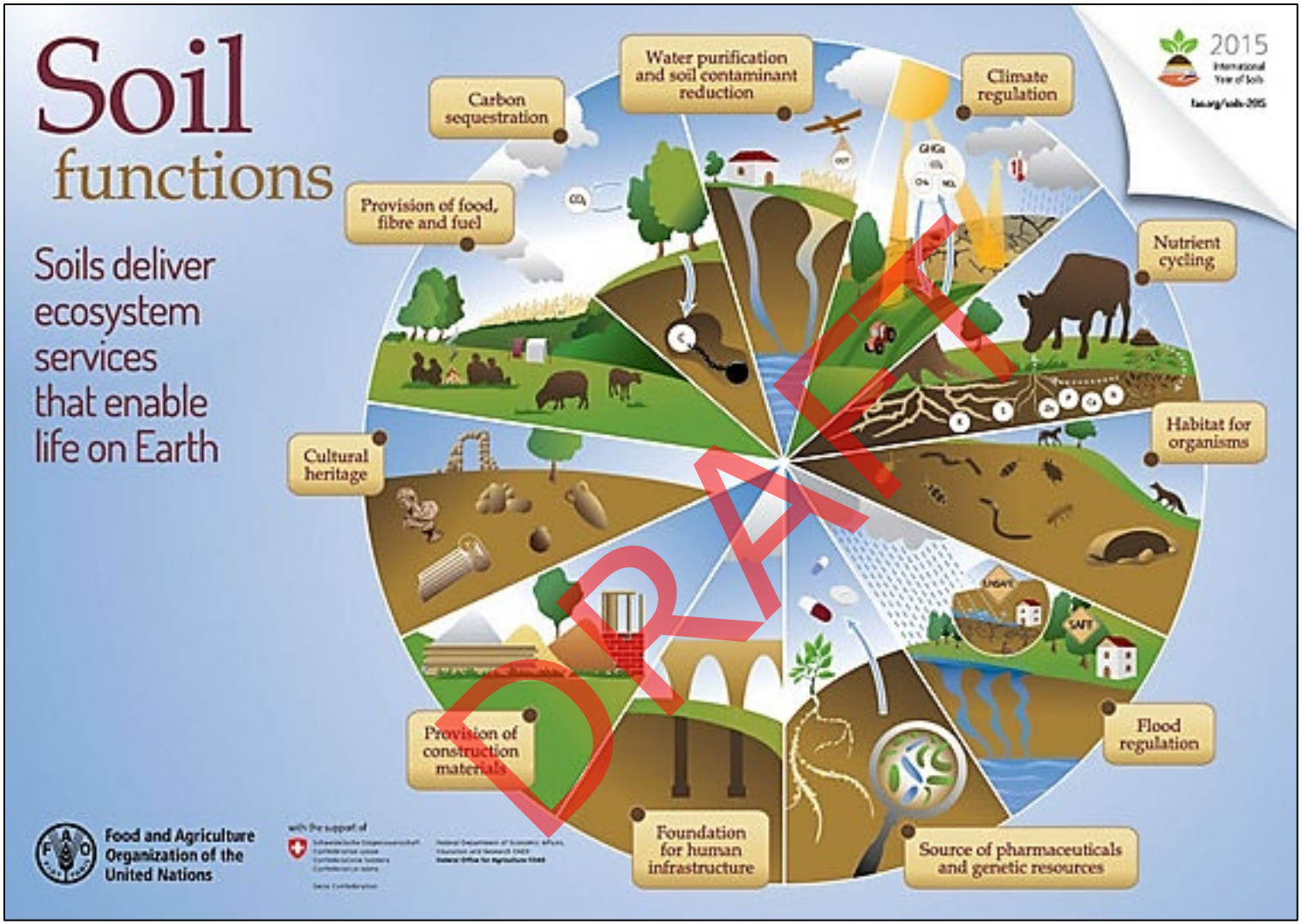


Figure 3.66: *Soil functions.*
Data courtesy of the Food and Agriculture Organization of the United Nations.

Transportation's Impact on Soil

As noted in a previous section, the transportation sector contributes nearly a quarter of GHG emissions to the state's air quality. In addition to the adverse impacts on human health, air pollution also can impact the health and quality of the soil. The release of particulate matter and other pollutants from vehicles can acidify the soil, making it more prone to erosion and less able to support vegetation.

Aside from these impacts, the actual construction and maintenance of transportation infrastructure – such as roads and highways – can also have a direct impact on soil quality and health.

Different types of soil are needed during the roadway construction process. The exact types of soil needed are dependent on the specific location and type of roadway being built. Generally, the soil beneath a roadway must be able to support the weight of the roadway and the vehicles traveling on it. If not, the cost to maintain those roadways – including underlying structures such as pipelines and conduits – over time potentially will be considerably more.

Soil Classification System

The American Association of State Highway and Transportation Officials (AASHTO) has developed a classification system used to group soils together that have similar properties and attributes that are conducive for highway construction purposes.

The relative amounts of gravel, coarse sand, fine sand, and silt-clay must first be determined to assign a soil's AASHTO classification. This is done by evaluating the following criteria: the grain size, plasticity, size of cobbles and boulders. These factors determine the best soils for each type of construction project.

For example, sandy or gravelly soils tend to have good drainage and stability, making them suitable for constructing roads and highways. On the other hand, clay soils are not as stable and tend to expand and contract with changes in moisture, making them less suitable for roadway construction without proper treatment.

If the soil is unsuitable for roadway construction, it may need to be removed and replaced with suitable soil or treated with a stabilizing agent such as lime or cement to make it strong enough to support the roadway. The soil may also need to be compacted to make it dense enough to support the roadway.

It's also important to note that during the construction process, the soil should not be compacted too much; otherwise, it will lose its ability to accept water and become impervious, which can lead to flooding.

Erosion

When doing any sort of development – including roadway construction and maintenance – careful consideration must be given to potential soil erosion. Removal of vegetation, grading of land, and excavation of soil all can increase the chances for the surrounding land to fall away which can impact the stability of roadway or building. For example, when vegetation is removed, it exposes the soil. Exposed soil is much more susceptible to erosion from wind and/or water. Coupled with grading – which can

change the soil's natural drainage patterns – water is more likely to flow over the soil instead of infiltrating it, leading to more soil being washed away as runoff and sedimentation.

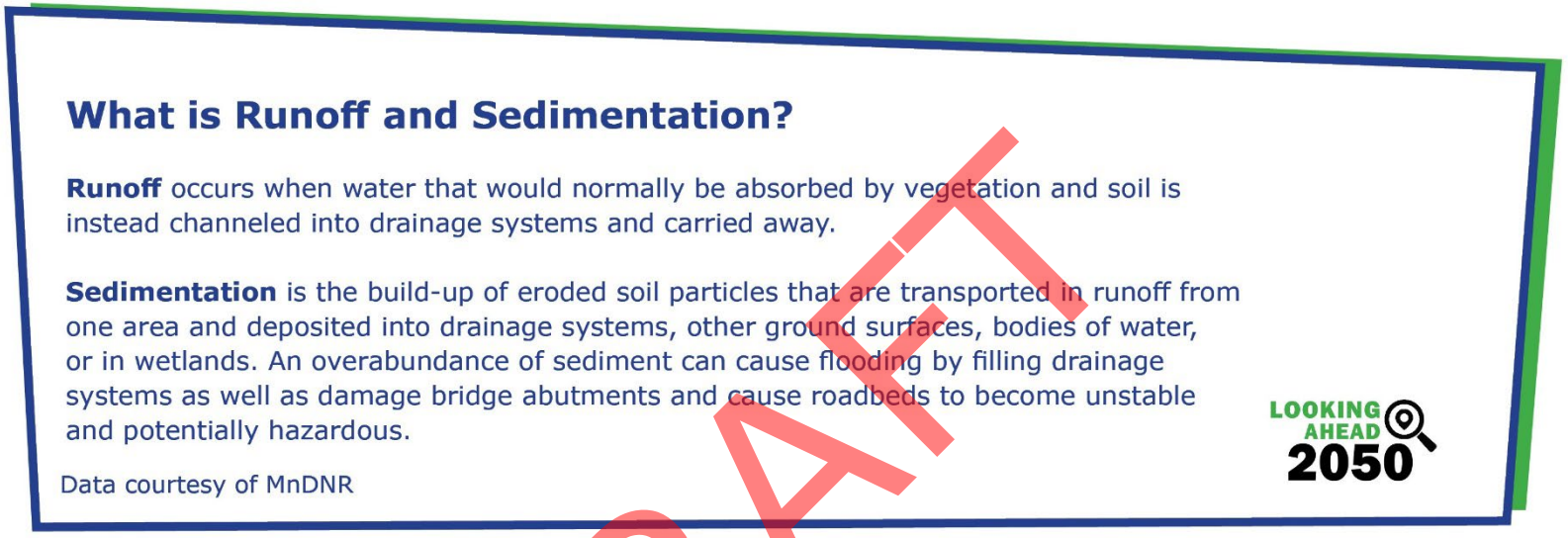


Figure 3.67: *Definition of runoff and sedimentation.*

To combat some of the negative impacts transportation infrastructure can have on soil, particularly pertaining to soil erosion, road construction crews often embrace some sort of soil stabilization measure.

Below is a list of some of the more commonly used practices:

- Soil stabilization: This involves treating the soil with a stabilizing agent such as lime, cement, or asphalt to increase its strength and stability.
- Soil compaction: This involves compacting the soil to increase its density and make it better able to support the roadway. This can be done using heavy equipment such as rollers and vibrating plates.
- Geogrids and geotextiles: These are materials that can be used to reinforce soil and improve its stability. Geogrids are made of plastic or metal and are used to hold soil in place, while geotextiles are made of fabric and are used to separate soil layers.
- Drainage systems: These systems can be installed to remove excess water from the soil and prevent erosion. This can include things like French drains, culverts, and retaining walls.

- Erosion control: Measures such as silt fences, sediment basins, and sediment ponds can be used to control erosion and sedimentation during and after construction.
- Reforestation and revegetation: After construction is complete, vegetation can be replanted to help stabilize the soil and prevent erosion.

By applying either a biological, physical, or a chemical stabilization technique (or a combination of techniques), construction crews hope to protect the existing soil against impacts from wind, rain, and/or stormwater runoff.

It's important to note that the most appropriate solution will depend on the specific location, the type of soil, and the type of roadway being constructed. The solutions may need to be adjusted or combined to achieve the best results.

Figure 3.68: *Construction of Scout Drive in Sartell.*
Photo courtesy of Saint Cloud APO.

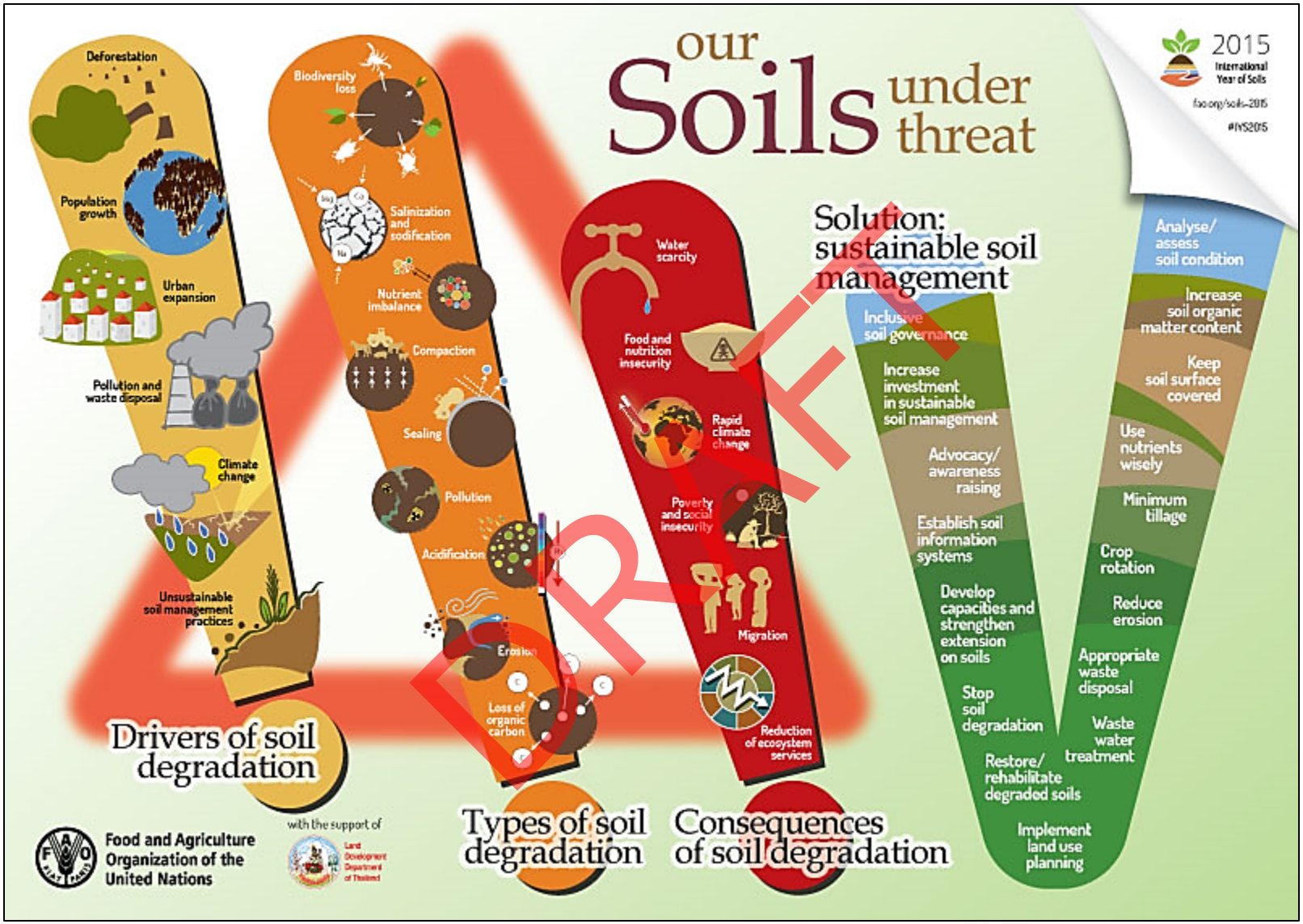


Figure 3.69: *Our soils under threat.*
Data courtesy of the Food and Agriculture Organization of the United Nations.

Cultural and Historic Properties

The natural environment is a very important aspect planners must be aware of when it comes to the development of transportation networks. In addition to air, water, wildlife/habitat, and soils, transportation planners must also account for the presence of cultural and historic properties – being mindful of the potential impact transportation development will have on them.

During the 1960s and through the 1980s, many historic and culturally significant downtowns and neighborhoods were destroyed by the powerful pressures of "progress" in an attempt to make the city center accessible to the suburban commuter. Since then, national and local movements have advocated for preservation planning. The Minnesota Statewide Historic Preservation Plan (https://bit.ly/45W7Ukj) refers to preservation planning as the rational, systematic process by which a community develops a vision, goals, and priorities for the preservation of its historic and cultural resources. Transportation is an essential aspect of our economy and culture however, it should be balanced with preserving what is important to a community.

Figure 3.70: *The historic Foley-Brower-Bohmer house. Photo courtesy of Saint Cloud APO.*

Benefits of Historic Preservation

Environment

Converting an existing building requires less energy to produce steel, glass, brick, wood, and plastic materials.

Community

Preservation can encourage smart growth and infill development by helping revitalize downtowns and residential neighborhoods.

Economy

Between 2011 and 2022 an estimated $5.9 billion of economic acitivty was created due to the benefits around the state's Historic Structure Rehabilitation Tax Credit. This generated 29,000 jobs and $2.2 billion in labor income.

Photo courtesy of Saint Cloud APO

LOOKING AHEAD 2050

Figure 3.71: *Benefits of Historic Preservation.*
Data courtesy of the University of Minnesota Extension.

National Register of Historic Places

The National Register of Historic Places (NRHP) is the official list of the nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Park Service's NRHP is part of a program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. To be eligible for the NRHP, certain criteria must be met including the integrity and historic significance of the place and/or property. As of the end of 2020, the National Register had more than 96,000 properties listed – representing 1.8 million contributing resources such as buildings, sites, districts, structures, and objects.

Designation of Historic Properties

A structure's significance for being listed on the NRHP is based on two primary factors: historical or cultural importance and architectural value. Occasionally historical and architectural aspects are contributing factors, in which case the overall significance is elevated. Historical significance can be determined based on any of the four criteria.

- The property is associated with events that have significantly contributed to American history.
- The property is associated with the life of a significant person in the American past.
- The property embodies distinctive features of a type, period, method of construction, or high artistic values.
- The property and its site may contain important information in history or prehistory.

Integrity is another factor in the designation of a historic property. This factor considers the period or theme for which it is being recognized. There are seven elements to determine the level of integrity necessary for historical significance.

- **Location:** The place where the historic property was constructed or the place where the historical event occurred.
- **Design:** The combination of elements that create the form, plan, space, structure, and style of a property.
- **Setting:** The physical environment of a historic property.
- **Materials:** The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- **Workmanship:** The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- **Feeling:** A property's expression of the aesthetic or historic sense of a particular period of time.
- **Association:** The direct link between an important historic event or person and historic property.

While several properties within the Saint Cloud MPA have made it on the NRHP, the region also maintains a record of historically and/or culturally significant properties to the region that are currently not included on the NRHP list. These properties include century homes and century and sesquicentennial farms.

Century Homes

The City of Saint Cloud established the Century Homes Recognition Program in 1998. To qualify for the program, homes must have been initially built for residential use, be documented to be 100 years or older, be located within the city limits of Saint Cloud, and demonstrate the homes' original architecture. Most of these homes are in the Southside-University neighborhood, where SCSU and many of its students reside. In this neighborhood, over 200 houses were built before 1920, though not all the homes are in this program. The Southside-University neighborhood contains some of the oldest remaining structures in the city.

Century homes within Saint Cloud are also found in the Saint John Cantius/Edelbrock neighborhood. Located north of MN 23 and west of 10th Avenue N, this neighborhood contains some of the oldest subdivisions in the city, dating back to 1853.

Century and Sesquicentennial Farms

The Minnesota Farm Bureau Federation and the Minnesota State Fair work in conjunction to honor Minnesota families that have owned their farms for at least 100 years (century farms) or at least 150 years (sesquicentennial farms). To qualify for this program, these farms must meet the age requirement of being owned by the family for at least 100 years and currently be involved in farming at least 50 acres. These farms are scattered throughout the Saint Cloud region and contributed to the region's growth and development during the late 19th to early 20th Century. Today, Stearns County has more century farms than any other county in Minnesota and continues to create jobs in agriculture-related sales, shipping, and processing in the region.

Figure 3.72: *An older style barn located in Saint Cloud.*
Photo courtesy of Saint Cloud APO.

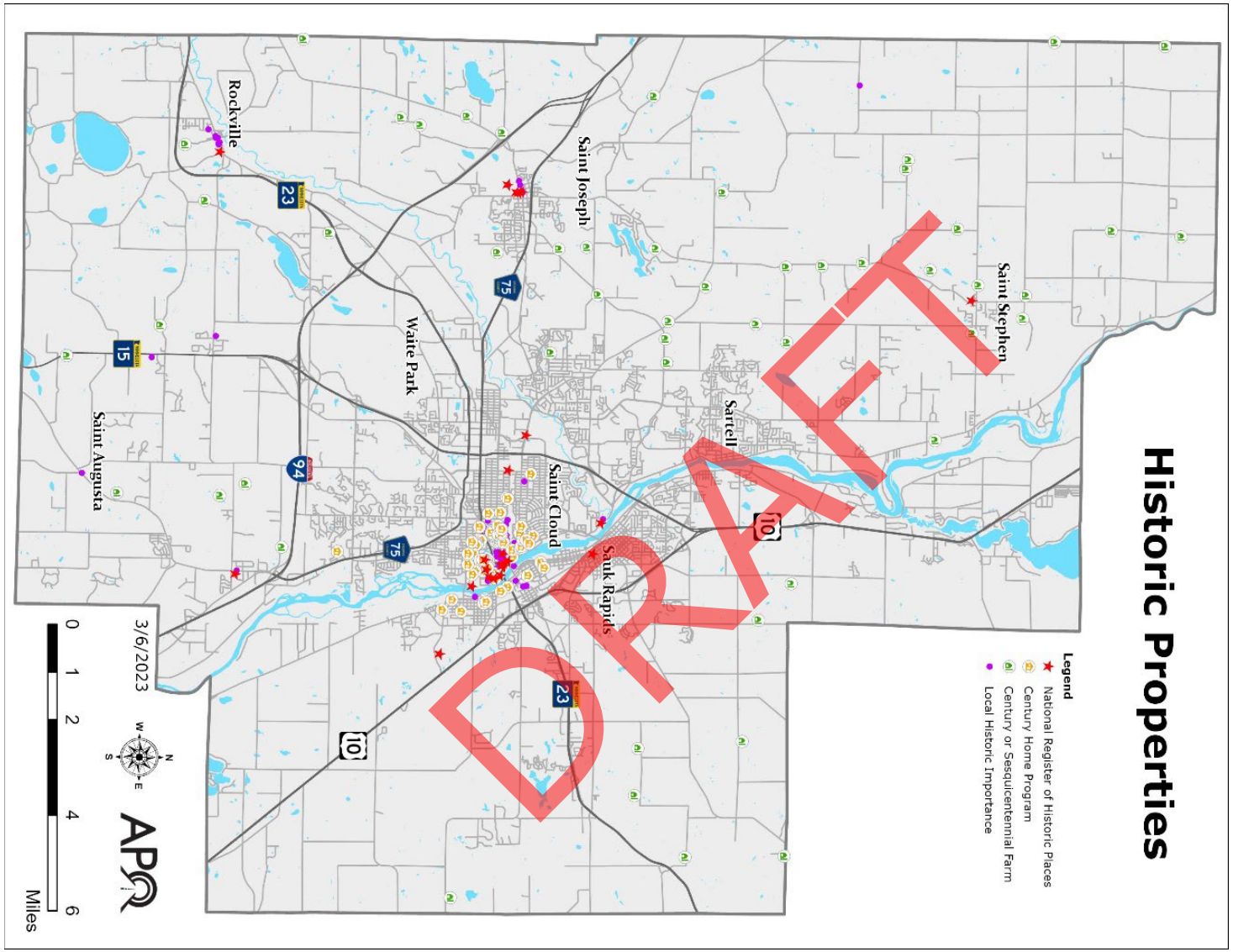


Figure 3.73: *Historic Properties.*
Data courtesy of the Stearns History Museum, City of Saint Cloud, U.S National Park Service, and Minnesota Farm Bureau.

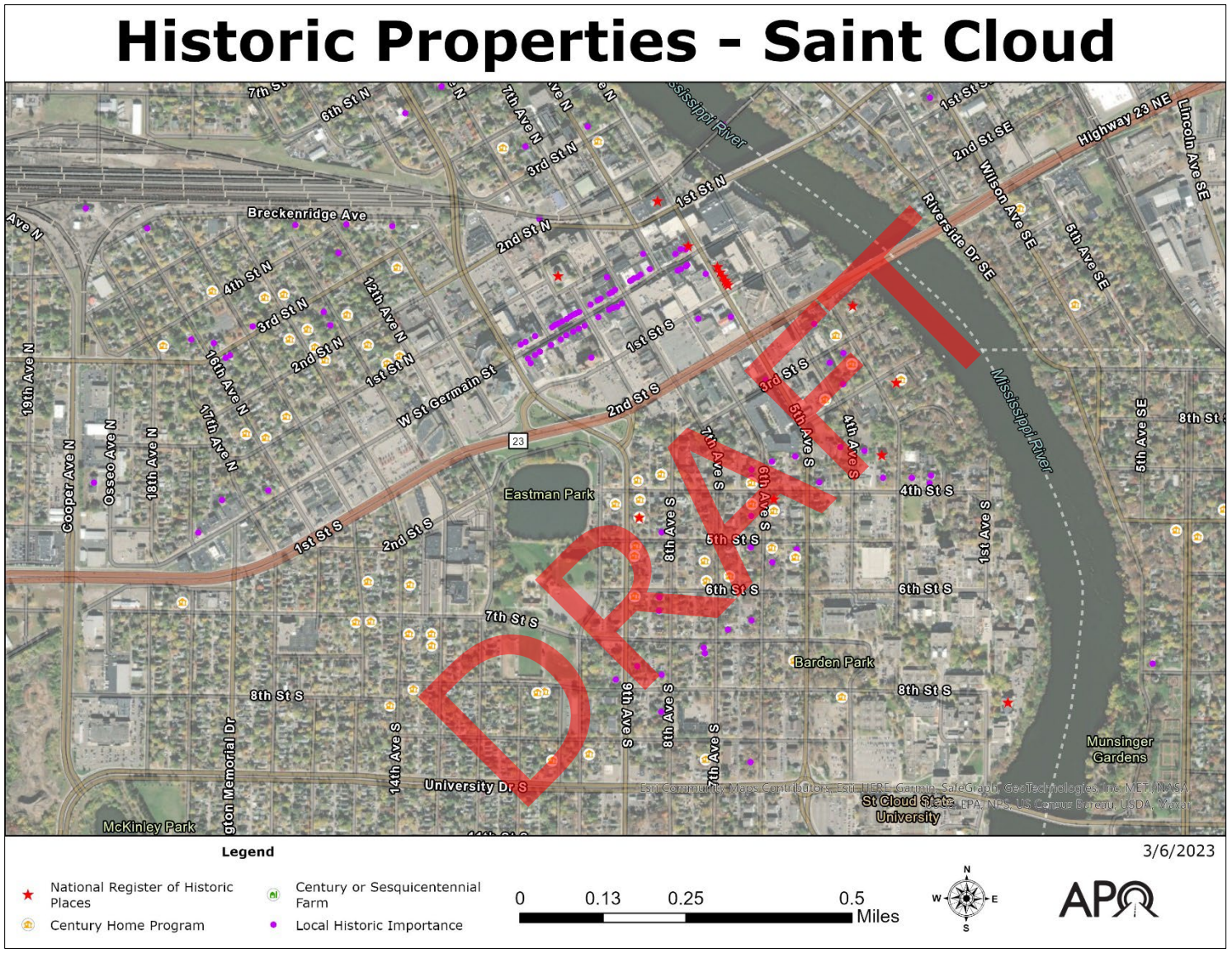


Figure 3.74: *Historic Properties – Saint Cloud.*
Data courtesy of the Stearns History Museum, City of Saint Cloud, U.S National Park Service, and Minnesota Farm Bureau.

Historical Districts

Historic Districts are a collection of assets, such as a grouping of commercial, industrial, or residential buildings; archaeological sites; or a combination of different resource types that reflect cohesion and continuity. As a group, the buildings should retain the integrity of location, design, setting, materials, workmanship, feeling, and association to be considered a historic district. Individual buildings may also be listed on the NRHP and included in a district.

There are four NRHP historic districts with the MPA.

Minnesota State Reformatory for Men Historic District (Minnesota Correctional Facility): This historic district in Saint Cloud covers approximately 65 acres and includes 26 buildings, six structures, and two sites constructed between 1887 and 1933. These buildings are in the Romanesque-revival and Tudor-revival designs.

Saint Cloud Commercial Historic District: This Saint Cloud district spans the core of the central business district of downtown, mainly along West Saint Germain Street. There are 61 properties in the district, of which 41 are considered historic, and seven are listed individually on the NRHP. Most of the buildings in the district were built between the early 1880s and 1936 and display architectural styles such as Late Victorian, Italianate, Queen Anne, and Romanesque Revival.

Figure 3.75: *The historic Breen Hotel building in downtown Saint Cloud.*
Photo courtesy of Saint Cloud APO.

Saint Benedict's Convent and College Historic District (College of Saint Benedict): This district in Saint Joseph comprises a series of religious and educational buildings built from 1882 to the late 1920s. There are 21 buildings, with 14 being of historical significance. These buildings display architectural styles such as Romanesque, Renaissance, and Beaux-Arts.

Veterans Administration Hospital: This district in western Saint Cloud comprises of 176 acres within the historic district. Of the 69 buildings on the campus, 31 were built between 1923 and 1950. Many of the buildings display architectural styles such as late 19th and 20th Century Revivals, Colonial Revival, and Classical Revival.

Figure 3.76: *The Veterans Administration (VA) Hospital in Saint Cloud.*
Photo courtesy of Saint Cloud APO.

In addition to the three NRHP historic districts, the City of Saint Cloud has designated local historic districts. These districts contain a concentration of older buildings, structures, sites, and spaces that reflect the history and culture of the city.

Barden Park Historic District: This district includes Saint Cloud's oldest park and one of the oldest neighborhoods. The homes were built between the 1880s and 1945 and include unique architectural styles such as Gothic Revival and Neo-Classical.

Figure 3.77: *Barden Park in Saint Cloud.*
Photo courtesy of Saint Cloud APO.

Pantown Neighborhood: This neighborhood was built to house the Pan Motor Company employees, a rare type of company-built housing arrangement in Minnesota. These homes were built between 1917 and 1919 in the Craftsman and Colonial Revival styles.

Figure 3.78: *A Pantown-style home.*
Photo courtesy of Saint Cloud APO.

Southside Neighborhood: This district contains over 260 buildings, containing single-family residences, apartment buildings, churches, and many housing units for SCSU students. Homes were built between the early 1880s and 1950s and include many different architectural styles, such as Gothic Revival, Romanesque, Colonial Revival, Prairie, and Period Revival.

Figure 3.79: *Nehemiah P. Clarke House in the Southside Neighborhood. Photo courtesy of Saint Cloud APO.*

Southeast Side Historic District: The Southeast Side Historic District contains four distinct areas; Riverside Park and Munsinger Gardens, Kilian Boulevard, George A. Selke Field, and George W. Friedrich Park.

Figure 3.80: *Munsinger Gardens in Saint Cloud.*
Photo courtesy of Saint Cloud APO.

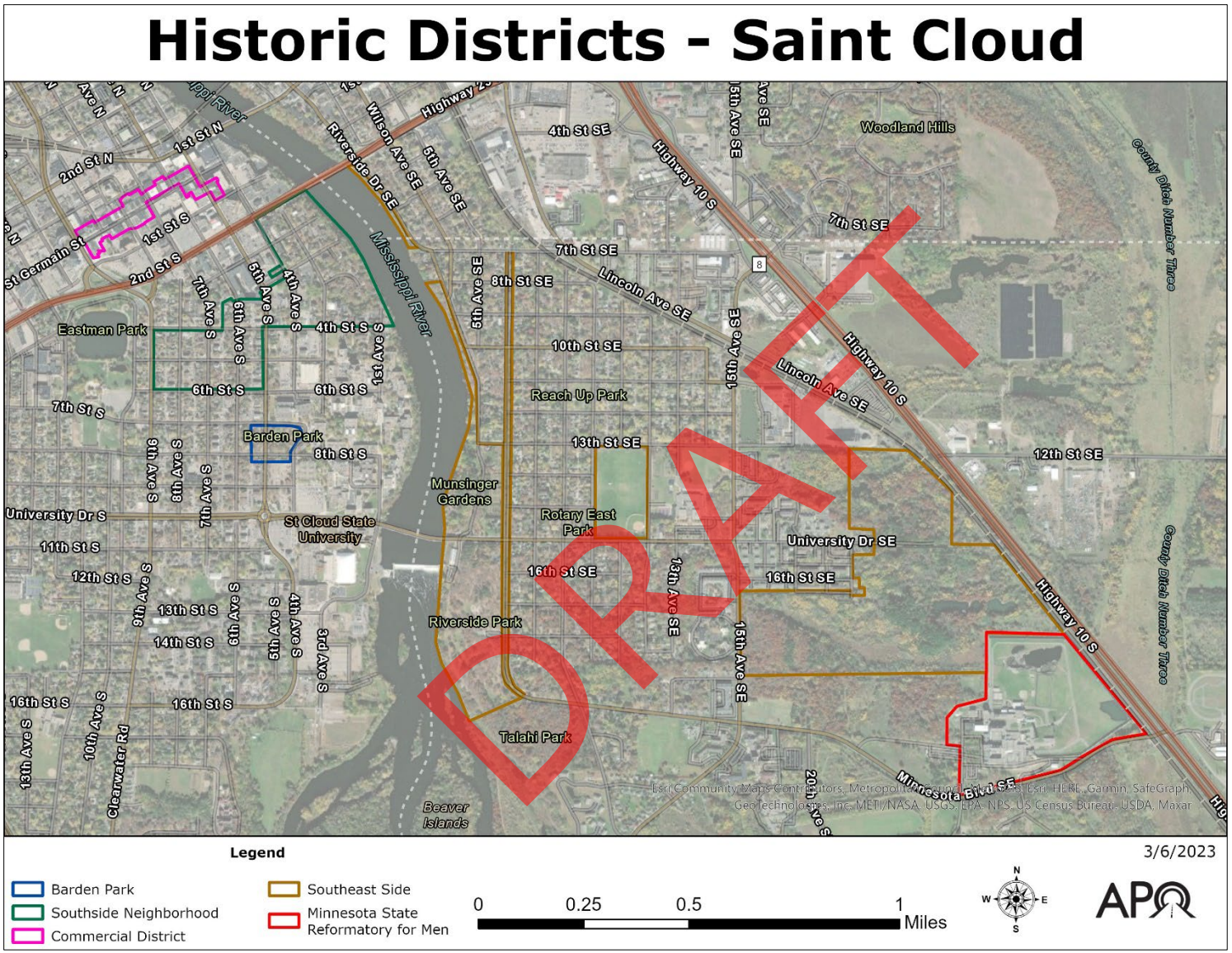


Figure 3.81: *Saint Cloud's Historic Districts.*
Data courtesy of the City of Saint Cloud and the U.S National Park Service.

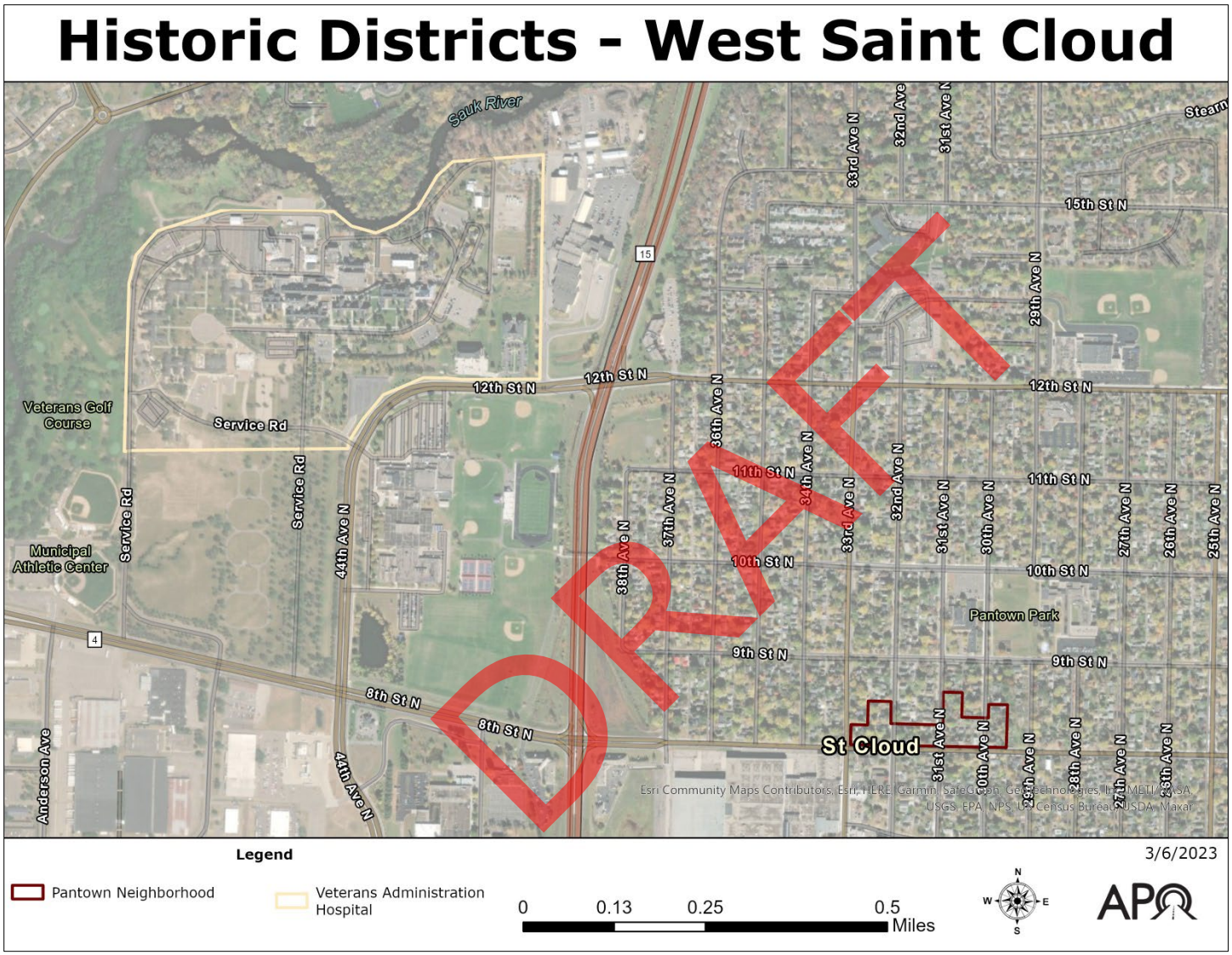


Figure 3.82: *Western Saint Cloud's Historic Districts.*
Data courtesy of the City of Saint Cloud and the U.S National Park Service.

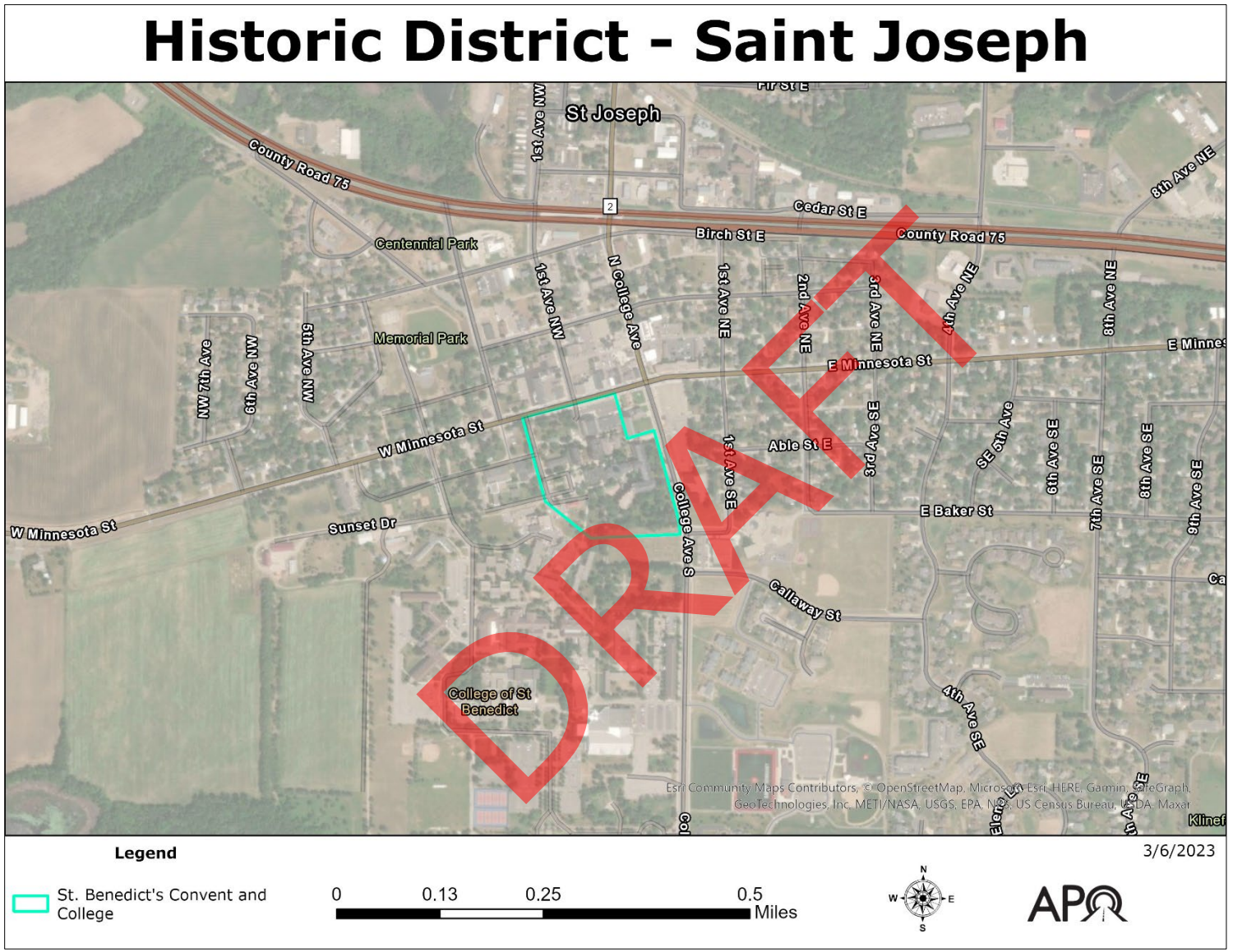


Figure 3.83: *Saint Joseph Historic District.*
Data courtesy of the U.S National Park Service.

Transportation and Historic Properties

Balancing the region's transportation needs alongside the needs and/or desires to preserve cultural and historical properties is a challenge that transportation planners and engineers face. Early and regular consultation with historic property stakeholders is crucial to understand possible impacts to these properties as well as assessing ways to avoid, reduce, or mitigate any adverse effects.

Climate and Resilience

Throughout this chapter we have discussed the importance of our environment – both from a natural and cultural/historical perspective. In addition, we have also touched on the impacts the transportation system has on our environment. However, what about the impacts the environment, particularly climate change, may have on the transportation system?

It is well documented the impacts climate change has on the natural environment – altering air, water, and soil quality as well as the negative effects on wildlife and habitats. But extreme weather events such as heat, flooding, and droughts also have negative impacts on the transportation network.

Severe conditions may reduce the life of infrastructure and increase operational disruptions. These impacts may result in changes to the design, construction, siting, and maintenance of infrastructure. Additionally, severe weather conditions have prompted the need for new infrastructure such as evacuation routes in order to circumvent potential issues that may arise due to flooding (for example) of existing emergency routes or infrastructure failure. Taken together, climate change has the real possibility of threatening investment in transportation infrastructure, weakening mobility and the economy, and compromising the safety of the traveling public.

According to the Climate Action Plan from the U.S. Department of Transportation (https://bit.ly/3MTUix1), the effects of climate change could have possible impacts on our regional transportation network, such as the ones listed below.

- Increased thermal expansion of paved surfaces, potentially causing degradation and reduced service life due to higher temperatures and increased duration of heat waves.
- Higher maintenance/construction costs for roads and bridges due to increased temperatures or exposure to storm surge.
- Asphalt degradation and shorter replacement cycles; leading to limited access, congestion, and higher costs, due to higher temperatures.
- More frequent/severe flooding of underground tunnels and low-lying infrastructure, requiring drainage and pumping, due to more intense precipitation and storm surge.
- Increased numbers and magnitude of storm surges potentially shortening infrastructure life.
- Culvert and drainage infrastructure damage, due to changes in precipitation intensity, or snow melt timing.
- Decreased driver/operator performance and decision-making skills, due to driver fatigue as a result of adverse weather.

- Increased risk of vehicle crashes in severe weather.

Climate change is a multifaceted and complex issue. The section below looks at two of the major components of climate change as they relate to transportation – temperature and precipitation.

Figure 3.84: *Concrete barrier buckling on Interstate 35.*
Photo courtesy of MnDOT.

Temperature

According to SCSU's Atmospheric and Hydrologic Sciences Department (https://bit.ly/3P2nzIS), Saint Cloud's 30-year (1991-2020) average temperature is 42.9 degrees Fahrenheit – something that has remained unchanged since the department's previous report 10 years earlier (1981-2010). However, while the average temperature has remained constant, how the temperature variations are spread throughout the year has not. According to SCSU, temps from November through January were 1.9 degrees warmer on average between 1991 and 2020 versus 1981-2010. February through May, on the other hand, experienced temps nearly full degree cooler. Data from the Atmospheric and Hydrologic Sciences Department also found a trend in the area for cooler high temperatures and warmer low temperatures resulting in "more humid conditions, which would tend to keep the overnight temperatures milder, but would also create hazy skies or more cloud cover during the days."

Figure 3.85: *Landscaping at Tech High School. Photo courtesy of Saint Cloud APO.*

To get a better understanding of the long-term impacts of temperature change, the U.S. Global Change Research Program developed the Climate Mapping for Resilience and Adaptation (CMRA) assessment tool. The CMRA assessment tool is a model used to project the climate conditions changes over the next several decades. The tool uses historical baseline data from 1976 to 2005. The model then projects the future into three-time bands, Early Century (2015-2044), Mid-Century (2035-2064), and Late Century (2070-2099). Each time band has two scenarios, low and high emissions indications, with low emissions referring

to concerted efforts being made now to cut GHG emissions and high emissions referring to the having no changes being done today to curb GHG emissions. Specific locations can be selected by County, Tribal Land, or U.S Census Tract level. We have chosen Stearns County for our purposes, as most of our MPA is within this area.

The historical data indicates an average of eight days with a maximum temperature above 90 degrees Fahrenheit. This increased to an average between 22 to 24 days in the early century (2015-2044). By 2050 there will be an average of 39 days per year above 90 degrees Fahrenheit days. The late century increases even more to 40 to 67 days, a 400% to 737% increase in 90-degree Fahrenheit days from current levels. This increase in temperature will result in the amount of energy required for cooling homes and businesses increasing by 105% in 2050. Overall, the region can expect the daily max temperature to be 5.3 degrees Fahrenheit warmer and the daily minimum temperature to be 5.7 degrees Fahrenheit warmer by 2050.

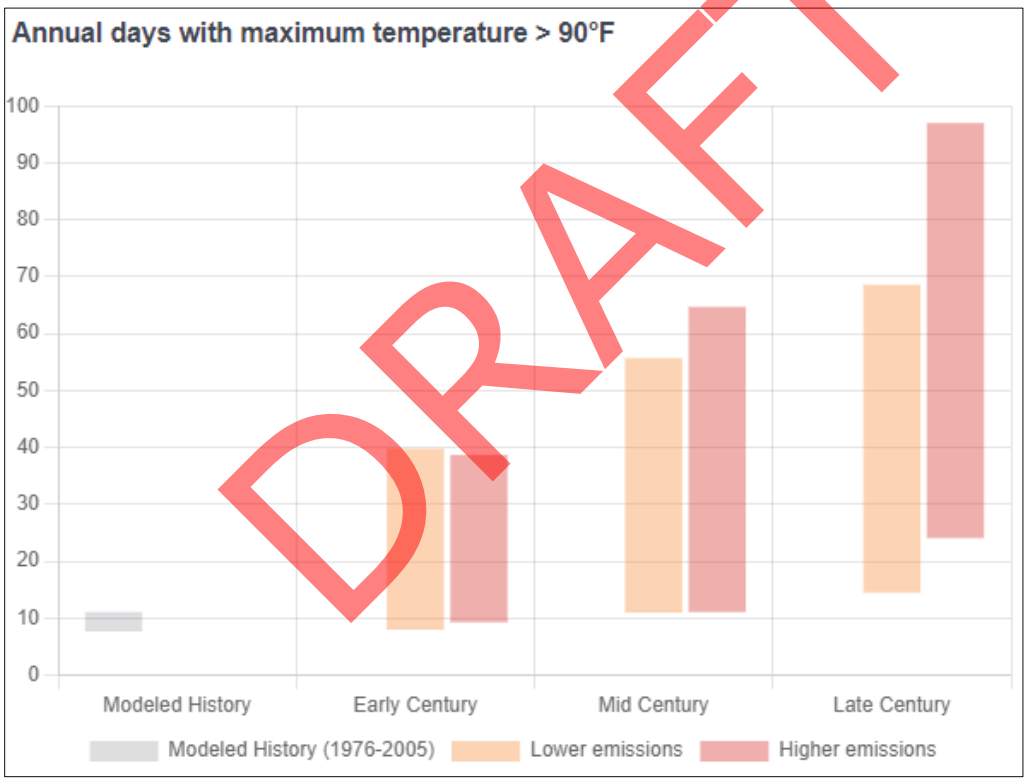


Figure 3.86: *Annual Days with Maximum Temperature Above 90 Degrees Fahrenheit in Stearns County. Data courtesy of CMRA.*

While CMRA indicates an increase in warmer temperatures for the entirety of Stearns County, urban areas like those found within the APO's planning area have the potential to see even higher temps. As the region develops, impervious surfaces tend to increase. These impervious surfaces trap heat and intensify the urban heat island effect, which makes a city warmer than its nearby undeveloped areas. High- and medium-intensity development areas—defined as those with more than 50% impervious surfaces—have 5 to 6 degrees hotter average temperatures.

Precipitation

The SCSU 1991-2020 climate report found the region has been experiencing more precipitation during this 30-year timeframe than the previous report (1981-2010) had noted. The average annual precipitation between 1991-2020 rose 2.7% -- to just shy of 28.5 inches. In fact, looking at historical data, this 30-year period experienced 1.3 more inches of rain per year than the average (27.2) dating back to 1893. While the region on a whole is experiencing more rainfall, it should be noted that June and September in particular are significantly drier (by at least 10%) in the reporting period of 1991-2020 compared to the 1981-2010 time period.

Figure 3.87: *Storm drain mural in Saint Cloud. Photo courtesy of Saint Cloud APO.*

Time Period	Average Annual Precipitation (Inches)	Percentage Difference from 1991-2020 Average Period
1991-2020	28.49	0.0%
1981-2010	27.73	-2.7%
1893-2020	27.15	-4.94%

Figure 3.88: *Average annual precipitation in inches by time period.*
Data courtesy SCSU Atmospheric and Hydrologic Sciences Department.

In terms of snowfall, the region experienced a 3.9% increase. According to the SCSU climate report, the 2010s saw three of the 10 snowiest seasons on record due to heavy late snowfalls occurring between February and April.

The CMRA tool indicates that the early century in Stearns County will see an average annual increase of 1 inch of precipitation, up from the historical 27 inches. This amount goes as high as an average of 30 inches in the late century, an overall 2-inch increase. The 2-inch increase in precipitation means there will be more annual days with total precipitation greater than 1 inch. This adds an average of 5.8 days per year with extreme precipitation events by 2050.

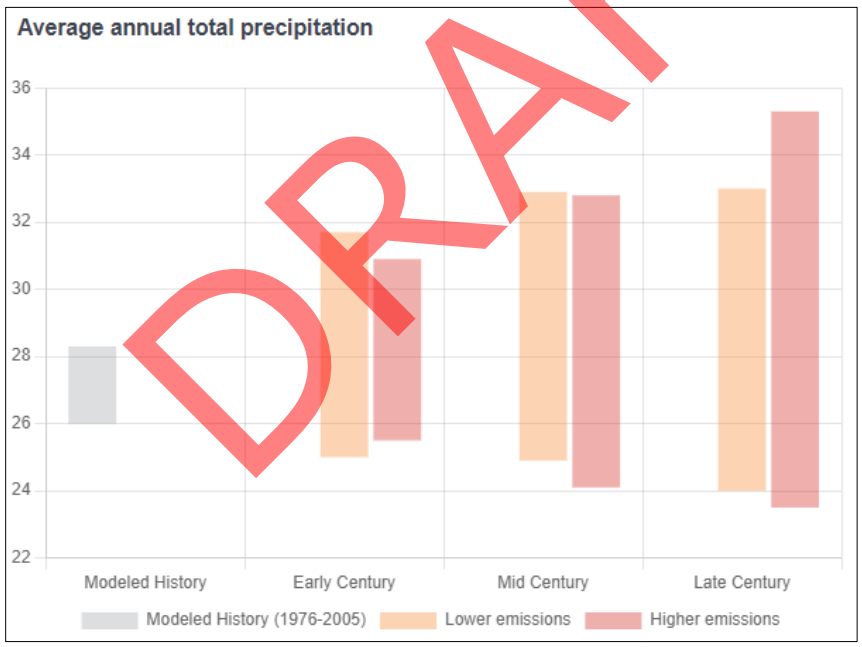


Figure 3.89: *Average Annual Total Precipitation in Stearns County.*
Data courtesy of CMRA.

Impacts on Transportation Networks

Temperature and precipitation increases have the potential to create new challenges to the existing transportation network. For example, temperature increases will require changes to transportation design standards. Infrastructure will now need to be able to withstand higher heat levels, longer durations of freeze-thaw cycles, and buckling pavement. In addition, with an increase in rain and snowfall, roadway flooding may become a more common occurrence as existing stormwater and sewer infrastructure may not be able to handle extreme precipitation events.

Figure 3.90: *Example of Graniteview Road. Photo courtesy of Saint Cloud APO.*

Climate Change and the Environment

Even before adverse impacts to the transportation network are observed, changes in weather conditions have already started to impact the natural environment. And those impacts are anticipated to worsen over time.

In terms of air quality, the increase in temperatures runs the risk of creating unhealthy levels of ozone. The American Lung Association (https://bit.ly/3oHW909) states hotter weather and stagnant air create conditions that make ozone more likely to form – including smog. In addition, hotter and drier weather increase the risk of drought and wildfires which lead to particle

pollution which the American Lung Association has linked to adverse human health conditions such as heart disease, lung cancer, and asthma.

As mentioned in the water quality section, when it rains, stormwater flows across rooftops, roadways, and other impervious surfaces, causing runoff and carrying many pollutants into the soil, lakes, rivers, streams, and wetlands. With the projected increase of impervious land area due to our growing region, severe storms and flooding are likely to increase non-point source pollution of the region's aquatic ecosystems and wetlands.

Even though the data indicated the current and future conditions will be wetter due to significant rain or snow events (there will be an overall increase in the annual days that exceed the 99th percentile of precipitation), CMRA states the region will experience a greater number of dry days per year as well. The expected increases in drought periods and increases in overall precipitation levels emphasize the need to balance water uses in various precipitation conditions that may fluctuate periodically, according to the EPA. These dry spells during the summer and early fall could lead to ecosystem stress, such as destroying crops, drying out forests, promoting wildfires, and reducing water available for agriculture, municipal use, hydropower, and ecosystem habitats. Drought leads to less food, water, and habitat available to wildlife. In addition, the lack of water can cause root damage in flora and create stress, making them more susceptible to pests and disease. Drought also restricts recreational and tourist activities such as boating, fishing, and camping, leading to financial stress for businesses and economies.

Figure 3.91: *Example of apartments next to agricultural fields in Sartell.*
Photo courtesy of Saint Cloud APO.

Climate change alters where species can thrive. Plant hardiness zones identify the regions in which plants and ecosystems can thrive based on temperatures, precipitation levels, and climates. Climate effects have already caused incremental changes to plant hardiness zones, and more drastic changes are expected by mid-century. When plant hardiness zones change, species that were once able to thrive in those areas may no longer be able to survive as the climate changes. Increased temperatures are expected to intensify the presence of invasive species and diseases in the region. Ecological changes can affect the migratory and reproductive cycles of the region's native aquatic, avian, and terrestrial wildlife.

Agricultural production is sensitive to changes in climate. Warmer winters may lead to longer growing seasons and higher agricultural economic returns. Other climate impacts like heat waves, droughts, and extreme precipitation events can have the opposite effect on agricultural resources, leading to significant crop failure and lost revenue. The extent to which these crop systems could adapt to changes through the use of resilient strains of crops, alternative farming techniques, and irrigation and land drainage systems is less certain.

The Human Cost of Climate Change

In addition to the current and future impacts of the changing climate on both the transportation system and the natural environment, rising temperatures, and increasing precipitation are also predicted to have implications on human health. According to the U.S. Department of Health and Human Services, social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters or disease outbreaks.

When discussing impacts related to a changing climate, Health and Human Services experts state changes in precipitation patterns have the possibility of creating extensive flooding. Flooding can ruin homes resulting in evacuations, health problems due to mold and mildew, and emotional distress. Economic factors due to flooding can decrease home values and increase insurance costs, as well as the need for additional infrastructure to address these problems. This, in turn, can put stress on the city and its residents.

For excessive heat, experts warn of a potential increase in heat-related illnesses and mortality. Elderly residents, people with chronic diseases, and low-income households without access to air conditioning due are particularly susceptible to heat waves.

What is being done?

As highlighted in the preceding sections on air quality, water quality, wildlife and habitat, soils, historic properties, and climate and resilience, there are effective strategies to mitigate the environmental impact of transportation. It is crucial to recognize that federal and state policies play a vital role in addressing this issue. One example is the Infrastructure Investment and Jobs Act (IIJA) passed by the United States Congress in 2021, which includes programs and funding to combat climate change. The Carbon Reduction Program (CRP) under IIJA supports projects aimed at reducing transportation emissions, while the National Electric Vehicle Infrastructure (NEVI) Program facilitates the deployment of EV charging infrastructure nationwide. Both initiatives contribute to improved air quality across the country.

Additionally, the Promoting Resilient Operations for Transformative Efficient and Cost-Saving Transportation (PROTECT) Program, also part of IIJA, helps enhance the resilience of surface transportation to natural hazards, including climate change, flooding, extreme weather events, and other disasters. In 2023, MnDOT will work with a consultant to develop a Resilience Improvement Plan (RIP). The Plan will document program priorities and program processes to invest PROTECT funds. The RIP was completed in February 2024.

At the federal level, increasing emission standards for passenger cars and light trucks in 2021 further contributes to efforts to improve air quality.

At the state level, Minnesota has outlined goals in its Climate Action Framework Plan (https://bit.ly/3NSCPFT) for 2050, including a 20% per capita reduction in VMT from 2018 levels, reducing GHG emission from the transportation sector by 80% by 2040, reach 20% EVs on Minnesota roads by 2030 and achieving 100% clean energy. These targets will significantly enhance air quality. In fact, achieving MnDOT's goal of carbon-neutral surface transportation by 2050, according to the Rocky Mountain Institute (RMI), could prevent an additional $81 billion in damages to industries ranging from agriculture to real estate. These goals could be accomplished by a series of priority actions such as increasing funding for non-motorized transportation, increasing transit services, planning land use and transportation together, exploring opportunities for a clean fuel standard, and expanding regional charging.

Additionally, Minnesota's Statewide Multimodal Transportation Plan (SMTP) (https://bit.ly/3rqKTGk) – a long-range plan that looks 20 years into the future and provides policy direction for the entire transportation system statewide – has identified climate as one of the six priority focus areas. The stated climate goal in the SMTP is to advance a sustainable and resilient transportation system, enhance transportation options and technology to reduce greenhouse gas emissions and adapt Minnesota's transportation system to a changing climate. The strategies listed in the SMTP to achieve the goal include:

- Transitioning the transportation sector away from dependence on fossil-based fuels.
- Making transportation and land use decisions that reduce total GHG emissions.
- Protecting people and communities through regional approaches to mitigate risk from the changing climate and extreme weather.

- Increasing resiliency of people and communities by adapting infrastructure to withstand the changing climate.

Another Minnesota GO plan, Pathways to Decarbonizing Transportation in Minnesota (https://bit.ly/44KJFE8), aims to investigate possibilities for reducing GHG emissions originating from surface transportation. The plan is comprised of three interconnected components:

1. Collaborating with state and national specialists to devise model inputs and assumptions rooted in their expertise.
2. Developing future GHG emission scenarios through modeling techniques.
3. Actively engaging with individuals across Minnesota's communities to gather their perspectives on the challenges and prospects related to reducing GHG emissions from transportation.

The plan recommends finding integrated solutions such as building an EV market and providing more EV options; promoting biofuels; funding EV infrastructure; providing incentives for EVs; and providing more alternative transportation options on various roadway projects.

Finally, at the conclusion of both the 2023 and 2024 state legislative sessions (https://tinyurl.com/9us4psw7), Minnesota lawmakers made additional strides to address greenhouse gas emissions within the transportation sector.

As part of these changes, updates were made to the state statute surrounding GHG emissions reduction. These updates included establishing a goal to reach net zero GHG emissions by 2050 as well as requiring the commissioner of transportation to set emission reduction targets specifically for the transportation sector. Additionally, lawmakers tasked MnDOT with the following:

1. Mitigate the GNG emissions impacts of all capacity expansion projects on Interstate, US highway, state highway, and business highway routes.
2. Establish interim targets to meet the state GHG emissions reduction goal. MnDOT is also required to specify a target for the Metropolitan Council's seven-county area. Additional regional targets can also be established.

To assist in achieving the outcomes outlined in the first task, the state convened the Transportation Greenhouse Gas Emissions Impact Mitigation Working Group. This group's primary focus was to prepare recommendations for implementing a Transportation Greenhouse Gas Emissions Impact Assessment for capacity expansion projects. While this effort is still a work in progress as of the drafting of this plan, it is anticipated the outcome of this working group's impact assessment will require future capacity expansion projects programmed in the APO's short-term Transportation Improvement Program (TIP) be assessed to ensure compliance with the updated state GHG emissions reduction statute. A methodology outlining how this effort will be completed is still on-going.

As of the drafting of this plan, work is currently underway to develop GHG emission reduction targets at the state level. In addition to establishing the specific target for the Metropolitan Council (the MPO for the Minneapolis-Saint Paul area), MnDOT is also working with other MPOs across the state to develop regional GHG emissions targets – including the Saint Cloud APO. Progress on this initiative as well as the end results of an APO-specific regional target were at the beginning stages of development as of the

drafting of this plan. However, these statutory changes will be closely monitored in the short term and will be something the APO will continue to plan for in the near future.

By implementing these plans, policies, and strategies, Minnesota is actively working towards a more sustainable and environmentally friendly transportation system.

Environmental Conversations at the Local Level

It is not enough for transportation planners to simply be aware of the natural environment. A critical and ongoing connection must be cultivated between the transportation and environmental sectors throughout the transportation planning and implementation process. During the development of this MTP, APO staffers coordinated a discussion among several environmental stakeholders to address this issue in early January 2024. Agencies represented in this coordination meeting included:

- Stearns County Soil and Water Conservation District.
- Stearns County Parks Department.
- Minnesota Department of Transportation (MnDOT), Air and Noise.
- City of Saint Cloud Heritage Preservation Planning.
- MnDOT, Air and Water.
- Minnesota Department of Natural Resources (DNR) Benton/Stearns Hydrology.
- Sauk River Watershed District.
- Stearns County Environmental Specialists.
- Benton County Soil and Water Conservation District.
- CentraCare Community Health Improvement Team.
- Benton County Wetlands/Solid Waste.
- DNR Regional Environmental Assessment Ecology.
- Sherburne County Parks Department.
- Minnesota Pollution Control Agency (MPCA).
- City of Saint Cloud Planning Department.
- Benton County Public Health.

The results of this conversation provided some overarching guidance on how local transportation planners and engineers can work together to construct an infrastructure network that is both beneficial for moving people and goods as well as demonstrating responsible environmental stewardship practices.

Air Quality

As demonstrated in this chapter, the transportation sector has a sizeable impact on air quality. During this discussion, it was noted by MPCA representatives that the EPA standards for air quality have been strengthened which has the potential to place many areas in the state currently in attainment (including the Saint Cloud MPA) to fall into nonattainment status. Additionally, MPCA staffers informed APO planning staff of changes issued by the state legislature regarding GHG mitigation. Per this discussion, any new capacity expanding project will be required to have a GHG mitigation analysis conducted using the Minnesota Infrastructure Carbon Estimator (MICE) Tool shortly after this plan is adopted. For those capacity expansion projects occurring within an air quality maintenance area, there will need to be a microscale analysis to help determine the impact the proposed project will have on air quality.

MPCA staff also stated the state legislature is also requiring their agency to develop rules pertaining to the impact of air quality and noise pollution on areas with high concentrations of Black, Indigenous, and People-of-Color (BIPOC) and other historically disadvantaged communities. Overall, Minnesota reports relatively good air quality,

however, it was noted in a recent study that there were elevated air and noise pollution levels in historically disadvantaged communities. Strategies are currently under development to determine possible ways to mitigate some of these impacts within the Twin Cities region. It is unclear if something like this will eventually make its way to the Saint Cloud area.

Water Quality

Local environmental planners stressed the importance of early communication and coordination for any transportation project to ensure the project is compliant with various environmental protection processes. When it comes to wetlands specifically, environmental and transportation planners must follow the Wetland Conservation Act (WCA) process which includes:

1. Avoiding the wetland. What steps are being taken to avoid disturbing wetlands?
2. Minimizing/mitigating impacts to the wetland. If avoidance is not possible, what steps are being taken to reduce significant impact to the wetland.
3. Replacement. If there are any permanent wetland impacts, there may be a process in which obtaining an approved wetland replacement and/or purchasing wetland credits to mitigate wetland impacts could be available.

Additional concerns raised by local environmental planners included stormwater management as well as possible impacts to water quality due to road salt or sanding of additional roadways during the winter.

Wildlife and Habitat

The environmental planners present at the stakeholder engagement meeting stated impacts on plants or animals on the state-listed threatened and endangered species lists are prohibited by law. For transportation planners and engineers, this means coordination involving environmental planners needs to happen early in the process.

When it comes to tree removal associated with a roadway construction project, environmental planners indicated there may be restrictions on the time of year trees can be removed. Transportation planners and engineers should also focus on preserving trees, especially prioritizing oak trees since oaks are resilient to climate change and an important species for pollinators.

The group also asked transportation planners to consider incorporating wildlife passage areas (critter crossings) to allow wildlife to cross roadways which have segmented habitats. This could be installed through the use of culverts or fencing to help route animals to use the proposed critter crossings.

Wildlife and habitat specialists also strongly advised transportation planners to safeguard the Minnesota Biological Survey (MBS) Sites of Biodiversity Significance and DNR Native Plant Communities. These specialists also encouraged incorporating native vegetation whenever possible.

Soil Health

Environmental planners stated the biggest impact transportation has on soil is compaction. They stated healthy soil allows air and water to penetrate between the soil particles allowing for a healthy environment for

microbes. Compaction not only can kill these microbes, but also inhibits plants (including trees) from establishing healthy root systems. In addition, local wells can be impacted by soil compaction, especially if a transportation project is located within a recharge area.

To help minimize the impacts of soil compaction in project area, environmental planners encourage a physical barrier (fence) to prevent unnecessary vehicles (large equipment and construction worker vehicles) from traveling outside the project area.

Cultural and Historic Properties

Environmental planners encourage engaging with owners of historic properties when doing any sort of road construction project. This is due to the potential to restoration components and plantings that will be needed to maintain the character or resource of the properties.

Additionally, environmental planners stated that as part of the wetland process, jurisdictions and/or agencies implementing a transportation infrastructure project are required to conduct a review to determine if archeological sites are present. Most commonly, local environmental planners have stated archeological sites are typically found near the Mississippi River or other bodies of water.

Climate and Resilience

Local conversations surrounding climate change and resiliency addressed two main questions:

1. How does climate change factor into long-term infrastructure planning in the region?
2. What mitigation strategies are currently being implemented or considered in the region to address the impacts of climate change on the environment?

Environmental planners agree that the changes in the local climate will require special consideration when it comes to the transportation sector. Examples include paying closer attention to stormwater runoff given the increase in precipitation events and understanding the relationship between adding more impervious surfaces (i.e., roadways) can lead to heat island issues – increasing temperatures within the urban core. Additionally, these planners also encouraged the transportation sector to explore more forms of alternative transportation including walking, biking, public transportation, or alternative fuels such as electric vehicles all to reduce carbon emissions.

Currently, the focus for several environmental planners is to ensure our region can adapt to the changing climate. For local planners, this includes a focus on ensuring vegetation planted after a roadway project are climate resilient species and implementing two-stage drainage ditch systems to improve water flow and control flooding.

Key Takeaways from the Local Perspective

Environmental planning is a vast and complex field full of various specialties and nuances. As such, local environmental planners have strongly recommended coordination on transportation infrastructure projects occurs early and often – prior to investing significant time and resources on an infrastructure project. Ensuring environmental regulation compliance as well as working to obtain the necessary permits, according to local environmental planners, would help streamline an infrastructure project and ensure good stewardship of the environment, resources, and taxpayer dollars.

Transportation Planning for our Future Environment

As climate change poses substantial risks to ecosystems, communities, and infrastructure, transportation planners bear a crucial responsibility to mitigate the environmental impact of the transportation sector. By implementing measures that promote sustainable transportation options, such as active modes of transportation and EVs, transportation planners can contribute to improved air quality and reduced health risks for the public. Furthermore, they can help preserve natural resources and biodiversity by designing transportation networks that conserve resources and protect natural ecosystems.

To foster more sustainable urban environments, transportation planners can reduce the need for long-distance travel, preserve open spaces, and support compact and mixed-use development patterns. Incorporating climate resilience techniques into infrastructure design is also essential to ensure that transportation systems can withstand and adapt to changing climate conditions. At all levels of government, policies and plans are being implemented and resources are being allocated to promote environmentally friendly transportation.

By including environmental factors in their planning procedures, transportation planners can ensure compliance with regulations and access financing opportunities that support low-carbon and environmentally friendly transportation options. In summary, transportation planning plays a significant role in developing sustainable and environmentally friendly transportation networks. Through careful selection of measures that reduce emissions, conserve resources, and enhance resilience, transportation planners can contribute to a cleaner, healthier, and more sustainable future while considering the environmental consequences of their decisions.