2026 Source Water Assessment

MINNEAPOLIS PUBLIC WORKS WATER TREATMENT & DISTRIBUTION SERVICES

PWS ID # 1270024

DEPARTMENT OF HEALTH

CLEAN WATER LAND & LEGACY AMENDMENT

2026 Source Water Assessment – Minneapolis Water Works
Public Water Supply ID: 1270024

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Glossary

Ammoniation – A process that involves treating or combining something with ammonia.

Appropriations – The total amount of water approved for use from an aquifer, stream, lake, or reservoir by the Minnesota Department of Natural Resources.

Aquatic consumption – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that differentiates whether the water is safe for use via drinking, culinary, or food processing use, and whether or not fish caught in that waterbody can be consumed by people.

Aquatic life use – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that describes whether the waterbody supports a healthy aquatic ecosystem or not.

Aquatic recreation use – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that describes whether the waterbody supports or is impaired for recreational (i.e. swimming, boating, fishing, etc.) purposes.

Buffer – An area of equal width on either side of a stream.

Centerline – The center of a stream.

Concentrations – The abundance of an element or compound within a volume of water.

Contaminant – A chemical or pollutant, either natural or man-made, that degrades water quality.

Cyanobacteria – A type of microorganism that obtains its energy through photosynthesis. Also known as Blue-Green Algae, they produce toxins that can be harmful if pets and humans come in contact with them.

Cyanotoxins – A toxin that is produced by cyanobacteria.

Delineated area – A watershed area that has been outlined as contributing to a downstream waterbody that serves as a public water supply source. The ERA, SMA, and DWSMA-SW are all delineated areas.

Dilution – The action in which a chemical, biological, or contaminant concentration is reduced in water by increasing the amount of water present.

Disinfectant – Any oxidant, including but not limited to chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

Disinfection byproduct – A chemical that is formed from a reaction between a disinfectant and organic matter that is present in water.

Drinking Water Supply Management Area - Surface Water – The larger delineated protection area that encompasses the HUC12 subwatersheds that drain directly to the ERA and SMA and where nonpoint source management is considered.

Emergency Response Area – The delineated protection area that encompasses an 8-hour time of travel distance to the drinking water intake and where point and nonpoint source management is considered.

Environmental Justice – The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, concerning the development, implementation, and enforcement of environmental laws, regulations, and policies.

Fecal coliform – A type of bacteria that is found in animals and humans and is transmitted to the natural environment.

Fluoridation – The process of adding fluoride to a public water supply to reduce tooth decay.

Geography – Physical features of a described land area.

Gradient – The degree of slope of a surface, either of the land or water table.

Hazardous – A substance that poses a risk to human health by physical contact (via skin, breathing, or swallowing) and occurs frequently enough or in large enough quantities to cause harm.

Hydrologic Unit Code – A code assigned by the U.S. Geological Survey (USGS for each watershed. HUCs are nested values, with larger watershed basins having fewer digits and sub-basins of that watershed having more digits that are derived from the larger basin codes.

Infrastructure – The physical structures and facilities that are needed for a public water supply's operation.

Inorganic chemical – Metals, salts, or other compounds that typically do not contain carbon.

Intake – A pipe located in a waterbody from which a public water supplier pulls their raw water for treatment.

Lakeshed – The topographical area surrounding a lake that contributes water via overland flow, groundwater, or stream flow.

Microorganism – An organism that can only be seen with the use of a microscope.

Mitigate – Decrease in severity.

Organic chemical – A compound that contains carbon.

Perennial stream – A reoccurring or year-round stream flow.

Public Water Supply – A water system which provides drinking water to persons other than the supplier of the water.

Spill Management Area – The delineated protection area that encompasses a 24-hour time of travel distance to the drinking water intake and where point and nonpoint source management is considered.

Radionuclides – An element that decays radioactively, emitting radiation as a result.

Toxin – Poison from plant or animal origin.

Watershed – An area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.

Abbreviations

1W1P – One Watershed One Plan

AIS – Aquatic Invasive Species

BMPs – Best Management Practices

BNSF – Burlington Northern Santa Fe

CEC – Contaminants of Emerging Concern

cfs – Cubic feet per second

DBPs – Disinfection By-Products

DNR – Department of Natural Resources

DWAMP – Drinking Water Ambient Monitoring Program

DWSMA-SW – Drinking Water Source Management Area – Surface Water

EJ – Environmental Justice

EPA – U.S. Environmental Protection Agency

ERA – Emergency Response Area

FEMA – Federal Emergency Management Agency

FIS – Flood Insurance Study

GAC – Granular Activated Carbon

GIS – Geographic Information System

GRAPS – Groundwater Restoration and Protection Strategies

HAB – Harmful Algal Bloom

HBV – Health Based Values

HUC – Hydrologic Unit Code

HVL – Highly Volatile Liquid

IPCC – Intergovernmental Panel on Climate Change

KML – Keyhole Markup Language

LiDAR – Light Detection and Ranging

MCL – Maximum Contaminant Level

MDA – Minnesota Department of Agriculture

MDH – Minnesota Department of Health

mg/L – Milligrams per liter

MN – Minnesota

MGD – Millions of gallons per day

MNDWIS – Minnesota Drinking Water Information System

MnGEO – Minnesota Geospatial Information Office

MPARS – Minnesota Permitting and Reporting System

MPCA – Minnesota Pollution Control Agency

NDMA - N-Nitrosodimethylamine

NOAA - National Oceanic and Atmospheric Administration

NPDES – National Pollutant Discharge Elimination System

NRCS – Natural Resource Conservation Services

NTU – Nephelometric Turbidity Units

NWI – National Wetland Inventory

pCi/L – picoCuries per liter

PCSI – Potential Contaminant Source Inventory

ppb – Parts per billion

ppm – Parts per million

PWS – Public Water Supplier

RCP – Representative Concentration Pathway

SCADA – Supervisory Control and Data Acquisition

SDWA – Safe Drinking Water Act

SMA – Spill Management Area

SWA – Source Water Assessment

SWAA – Source Water Assessment Area

SWCD – Soil and Water Conservation District

SWIPP – Surface Water Intake Protection Plan

TN – Total Nitrogen

TP – Total Phosphorus

TSS – Total Suspended Solids

TTHM – Total trihalomethanes

µg/L – Micrograms per liter

UMRSWPP – Upper Mississippi River Source Water Protection Project

USGS – United State Geological Survey

VOC – Volatile organic compounds

Executive Summary

The 2026 Source Water Assessment (SWA) for Minneapolis Water Works evaluates the current condition, vulnerability, and protection needs for the City of Minneapolis' drinking water source, the Mississippi River, and its contributing watersheds. This assessment was prepared by the Minnesota Department of Health (MDH) in partnership with the city and regional stakeholder groups to support long-term source water protection planning and implementation efforts over the next decade.

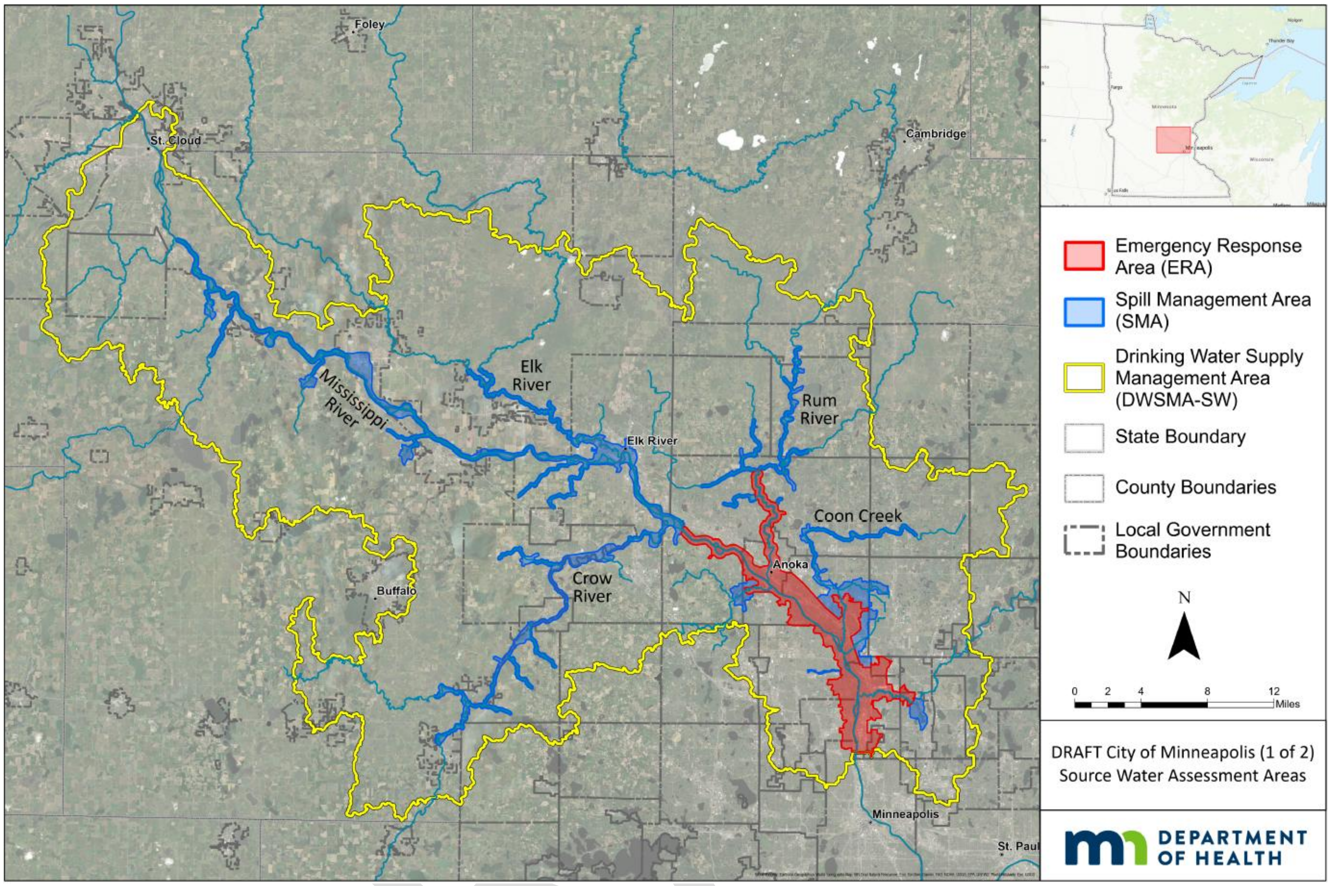
Minneapolis Water Works serves more than 547,000 residents and businesses in Minneapolis and the surrounding wholesale customer cities through treatment facilities located in Fridley and Columbia Heights, Minnesota. They withdraw water from the Mississippi River at Fridley and do not have an alternative source. The Mississippi River remains a stable and reliable source of drinking water, but the watershed faces increasing pressures from urban development, agricultural activities, aging infrastructure, altered hydrology, climate change, and emerging contaminants. The upstream drainage area contains a mixture of agriculture, development, wetlands, forests, and open water. These land uses contribute to increased erosion, nutrient loading, stormwater runoff, and habitat degradation. Climate change is expected to further intensify these impacts through increased precipitation variability, flooding potential, warmer temperatures, and changing hydrologic conditions.

The SWA delineates four nested source water protection areas upstream of the drinking water intake: the Emergency Response Area (ERA, 8 hour time of travel), Spill Management Area (SMA, 24 hour time of travel), Drinking Water Supply Management Area – Surface Water (DWSMA-SW, HUC12 watersheds upstream of ERA and SMA), and the broader Source Water Assessment Area (SWAA, entire HUC2 watershed upstream). Together, these areas identify locations where point source and nonpoint source pollution may impact drinking water quality (see figure ES 1 below for Minneapolis' DWSMA-SW map).

Water quality monitoring indicates that Minneapolis continues to produce drinking water that meets all federal and state drinking water standards. Current treatment processes effectively remove turbidity, pathogens, cyanotoxins, and other contaminants from the source water, but several ongoing and emerging risks were identified throughout the watershed including elevated nutrients, chloride, sediment, *E. coli*, cyanobacteria, and contaminants of emerging concern such as PFAS. Several point source locations upstream of Minneapolis' intake are highlighted as high priority such as the FMC Corp. Superfund site, the BNSF Northtown railyard, and several large City of Fridley and Coon Rapids storm interceptor outfalls. These sites have the potential to leak large quantities of potential containments directly into the Mississippi and are located close to the intake, creating a short response time. The Monticello Nuclear Power Plant is located further upstream. In addition, there is also heavy industrial land use directly upstream of the treatment plant, which contain many point sources such as aboveground and underground tanks, wastewater, and industrial stormwater outfalls.

To address these risks, the SWA recommends continued investment in source water monitoring, emergency preparedness, collaboration among local cities, counties, watersheds, and state agencies, contaminant source management, infrastructure improvements, and long-term protection planning. Key priorities include strengthening spill response capabilities, improving coordination with local and regional partners, supporting best management practices across the watershed, monitoring emerging contaminants, and evaluating alternative or backup water supply options.

This assessment provides the scientific and planning foundation for Minneapolis' future Surface Water Intake Protection Plan (SWIPP) and supports proactive protection of one of the region's most important public resources: safe and reliable drinking water from the Mississippi River.



ES 1. Minneapolis' Drinking Water Supply Management Area – Surface Water, Spill Management Area, and Emergency Response Area

Introduction to the Source Water Assessment

Background

The 1996 amendments to the federal Safe Drinking Water Act (SDWA) required the Minnesota Department of Health (MDH) to complete source water assessments for surface water public water suppliers (PWS). The first source water assessment (SWA) for Minneapolis was completed in May 2005.

Since the first SWAs were completed, much has changed in the processes used to develop source water protection plans as well as with the data and tools to support these efforts. For example, the data that is available now is much more detailed and uses a more sophisticated method to characterize water quality. The water resource management framework in Minnesota has also changed substantially, most notably with a shift towards watershed-based comprehensive local water planning.

MDH has dedicated resources to update the Minneapolis SWA and to work with the PWS, Minneapolis Public Works Water Treatment & Distribution Services Division (henceforth referred to as Minneapolis Water Works), to create a Surface Water Intake Protection Plan (SWIPP). These documents will be used to drive implementation of activities to protect the surface water-derived source water for the city of Minneapolis for the next ten years. After the 10 years have elapsed, MDH will reassess the PWS source water assessment area. This updated SWA will guide the amended SWIPP.

Contributors to the SWA

MDH, in partnership with Minneapolis Water Works, assembled a team of staff from Minnesota Pollution Control Agency, Minnesota Department of Natural Resources, Minnesota Board of Water and Soil Resources, Minnesota Department of Agriculture, Minnesota Rural Water Association, local city governments, the Metropolitan Council, watershed districts and management organizations, and county Soil and Water Conservation Districts to develop and review this SWA.

Purpose of the SWA

The information from this updated and enhanced assessment can be used to expand upon activities to prevent or mitigate contamination of Minneapolis' surface water-derived source of drinking water. The SWA provides information regarding drinking water sources for public water systems. A SWA includes information on the following: identification of the resource used as a drinking water source, watershed characterization, public water system intake and treatment, contaminants of concern, known threats, and recommended implementation actions to protect the source.

Source Water Characteristics

The city of Minneapolis lies within central/southeast Minnesota (MN) along the Mississippi River, from where they source their drinking water. Minneapolis is the second furthest city upstream in the country to source drinking water from the Mississippi River. The contributing drainage area to the Minneapolis Water Works drinking water treatment facility lies within the Upper Mississippi River Basin and intersects eight (8) counties (Stearns, Benton, Sherburne, Wright, Isanti, Anoka, Hennepin, and Ramsey) and five (5) major watersheds. The watersheds are listed below in Table 1.

Table 1. Minneapolis Drainage Area Intersecting Watersheds

	Watershed Name	HUC8 Code*	Total Watershed Area (sq. mi.)
1	Mississippi River – St. Cloud	07010203	1,121
2	Rum River	07010207	1,584
3	North Fork Crow River	07010204	1,485
4	South Fork Crow River	07010205	1,279
5	Mississippi River – Twin Cities	07010206	1,007

* United States Geologic Survey (USGS) Hydrologic Unit Code (HUC)

The Minneapolis Water Works drainage area encompasses portions of the Mississippi River – St. Cloud, Rum River, North Fork Crow River, and Mississippi River- Twin Cities watersheds. The South Fork Crow River watershed only overlaps a small portion of the drainage area. These areas are described below. See Figure 1 for a map of the Minneapolis drainage area and the HUC8 watersheds it overlaps. The HUC8 watersheds are described in detail in Appendix A.

Minneapolis Water Works Drainage Area Statistics

Mississippi River – St. Cloud Area: 337,220 acres

Mississippi River – Twin Cities Area: 187,062 acres

North Fork Crow River Area: 133,697 acres

Rum River Area: 128,441 acres

South Fork Crow River Area: 14,503 acres

Upstream Combined Stream Length: 584 miles

Upstream Lake Waterbody Area: 53,389 acres

Upstream Wetland Area: 138,584 acres[1]

[1]Wetland information is based on US Fish and Wildlife Service National Wetland Inventory (NWI) data

Four of the five major watersheds have similar characteristics due to lying within the Upper Mississippi River Basin (HUC4 - 0701). Sparsely populated but moderately developed, the Upper Mississippi River Basin exhibits a cold to mild climate, with average summer temperatures ranging between 65-70°F and average winter temperatures between 10-20°F. Average annual precipitation is about 28 inches, with peak rainfall occurring between June and August and average annual snowfall is around 48 inches (St. Cloud State University, 2025). These numbers vary within the densely populated and developed region of the Mississippi River – Twin Cities watershed to the southeast, which exhibits some effects of the urban "heat island". Summer high temperatures in the city tend to be around 10°F warmer than the surrounding region to the north, while winter low temperatures are roughly the same. Average annual precipitation and snowfall is a couple inches greater than the surrounding region, exhibiting a wetter climate than the north. More information about Minneapolis' climate is given in the section *Climate Change Impacts*.

Land Use and Geology

Land use plays an important role in water quality and directing implementation activities in the source water protection areas. Land use data was taken from the 2024 National Land Cover Database (NLCD) developed by the USGS (United States Geological Survey, 2025). The majority of the land within the Minneapolis drainage area is characterized as agricultural and developed, with large swaths of altered watercourses, row crops, rangeland, and impervious surfaces. In addition to these altered areas, there are some natural forested regions and open water, though less prominent.

Four of the five watersheds exhibit similar land use, water quality stressors, and waterbody impairments due to their location within central Minnesota. The primary stressors to water quality include extensive agriculture, excess streambank erosion and suspended solids, altered hydrology and manmade impoundments such as dams, low dissolved oxygen levels, increased nutrient runoff such as phosphorus and nitrogen, and high chloride levels. The Mississippi River – Twin Cities watershed is significantly more developed than the other watersheds, with more impervious surfaces and extensive altered watercourses. The waterbodies present in these watersheds are critical to aquatic habitat as well as playing an important role in recreation and tourism. Recommendations to combat these stressors are outlined in formal watershed restoration planning efforts, led by the MN Board of Soil and Water Resources (BWSR), the MN Pollution Control Agency (MPCA), and local watershed management organizations.

The five watersheds upstream of Minneapolis exhibit a wide variety of topographic features and parent soil textures, primarily due to past glacial depositions left behind during the last Ice Age. The primary deposit is glacial till, which is comprised of clay, silt, fine sand, and gravel. The area is characterized by flat plains and rolling hills which are created by till deposits in the form of moraines, drumlines, and glacial outwash (Minnesota Geological Survey, 2025). There are also numerous lakes present in the depressions left behind by the retreating glaciers.

The Mississippi River is incised into glacial deposits, creating large terraces and floodplains. Towards St. Cloud, some bedrock is exposed along the stream banks. Broad sand plains dominate much of the surface in Benton, Sherburne, Anoka, and Hennepin counties, supporting wetlands and pinelands. Buried sand and gravel aquifers provide drinking water to the north and west, where bedrock aquifers are unavailable or impractical. Bedrock aquifers that are used for drinking water in this region are the Prairie du Chein-Jordan, Tunnel City - Wonewoc, and the Mount Simon-Hinckley aquifers. Urban development, agriculture, and large infrastructure projects have heavily altered the surficial geology and their hydrologic functioning, affecting infiltration rates and groundwater flow pathways. Altered infiltration rates can have the potential to quickly introduce surface contaminants into the groundwater system or increase surface water runoff.

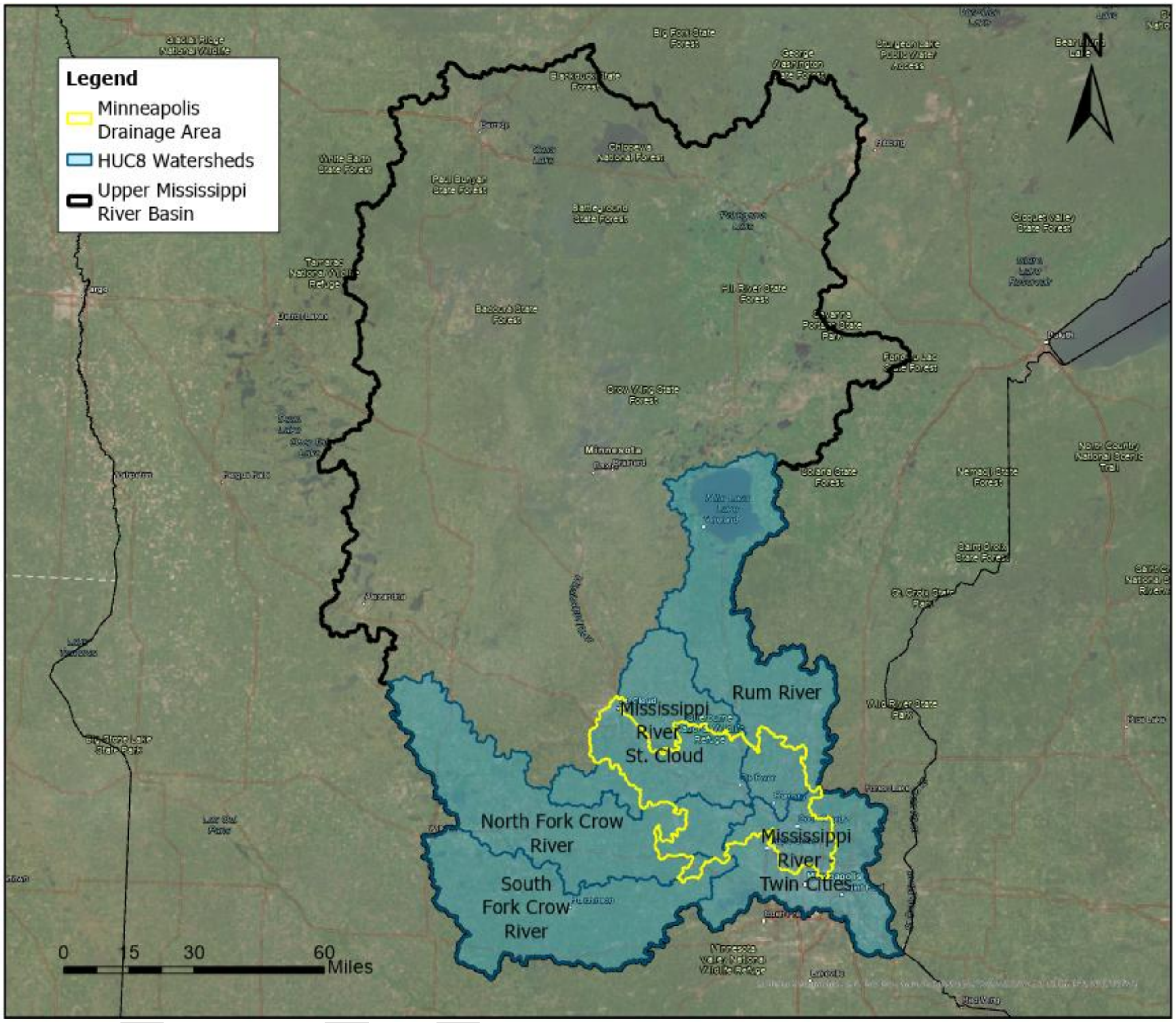


Figure 1. Upper Mississippi River Basin with Minneapolis Water Works Drainage Area, intersecting HUC8 Watersheds, and State Boundaries

Infrastructure Characteristics

Minneapolis Water Works operates two water treatment facilities adjacent to the east bank of the Mississippi River in Fridley and Columbia Heights, MN, and operates over 1,000 miles of water mains. They provide water to over 547,000 customers in the cities of Minneapolis, Columbia Heights, Crystal, Edina – Morningside neighborhood, Golden Valley, Hilltop, New Hope, and Bloomington (partially), as well as the Metropolitan Airport Commission and the University of Minnesota Twin Cities campus. The city operates one drinking water intake located on the Mississippi River which is located less than five miles downstream of the St. Paul Regional Water Services drinking water river intake.

The following list describes the key infrastructure components and permit capacity to provide safe and reliable water for residents and businesses in Minneapolis and the surrounding cities.

Public Water System Characteristics	
Intake Location:	Mississippi River
Treatment Facility:	Two treatment facilities (filter plants), approximately 25 yards east of the intake. One softening plant and one dewatering plant, and various pump stations
Treatment Methods:	**Lime softening, particulate removal** by gravity filtration (rapid sand and dual media), ultrafiltration, alum, ferric chloride coagulation, baffled basin sedimentation, cationic polyelectrolytes coagulation; **Disinfection** via ammoniation and chlorine gas**; Lead and copper corrosion control** by caustic soda and blended phosphate stabilization; **Taste and odor control** via GAC, PAC sodium permanganate oxidation (seasonal); and **Fluoridation**
Production:	Max daily production of (up to) 104.0 million gallons per day (MGD), design capacity of 220.0 MGD, average daily production of 53.92 MGD (Minnesota Department of Health, 2025)
Storage Capacity:	0.0 million gallons elevated; 141.0 million gallons ground
Interconnects:	One small emergency interconnect with St. Paul Regional Water Services (located at University Avenue). Some wholesale customer cities have emergency interconnects with other cities (e.g. Columbia Heights and New Brighton).
Backup Water Sources:	None
DNR Appropriations Permit:	Surface water (Permit #1978-6216): 240,000 gallons per minute and 125,000 million gallons per year permitted

Table 2 shows the water volumes pumped from the surface water intake, as reported for the past five (5) years to the Department of Natural Resources (DNR) Minnesota Permitting and Reporting System (MPARS). The intake system consists of a diversion wall, bar racks, sluice gates and low-service pumps. The pumps are controlled in SCADA by 24/7 on-site operator, while the sluice gates are currently controlled manually. In the case of emergencies, the low-service pumps can be shutdown via SCADA immediately. If the sluice gates need to be closed, they must be manually closed by staff. At the time of this assessment, Minneapolis is installing automated intake actuators that will prevent the need for manual gate operation. Project completion is anticipated for the end of 2026. Minneapolis does not operate any emergency supply wells onsite, nor do they have any alternative water supply sources.

Table 2. Annual Volume of Water Pumped from Mississippi River

Intake	MPARS No.	2021	2022	2023	2024	2025
Mississippi River	1978-6216	19,661	19,680	**20,967**	19,428	20,008

* Expressed as millions of gallons. Bolding indicates the greatest annual pumping volume reported in the five-year span for the system.

As Minneapolis currently does not operate any backup water supply, there have been past feasibility studies to evaluate alternative options. Minneapolis completed a detailed evaluation of an alternative well field as part of its 2016 Vulnerability Assessment in compliance with the 2018 Federal America's Water Infrastructure Act. The analysis demonstrated that a well field would mitigate some of the risks to source water, some of the time. However, the consequences are much higher for a regulatory drought scenario where this mitigation measure does not reduce risk. Based on a cost-benefit analysis, the huge costs of the well field did not favorably compare to the comparative amount of risk that would be "bought down", and a well field was not recommended as a cost-effective risk reduction measure. More effective measures include added operation resiliency of the existing drinking water intake and additional finished water storage.

Projected Water Demand

Currently, Minneapolis provides water to just over 547,000 customers in the city and some surrounding suburbs. Below, Figure 2 shows the historical and maximum daily water demand in relation to the population served from 2010 to 2025. Figure 3 shows the same for the future projected population through the year 2040. This data is taken from the City of Minneapolis Water Supply Plan, dated November 2017 (Minneapolis Department of Public Works, 2017). As this plan was developed eight (8) years ago at the time of this assessment, several of the future predicted years have now passed. This report includes the actual recorded daily water demand as reported to MPARS alongside the "predicted" values for comparison. These plans are updated once every ten years and Minneapolis anticipates updating their Water Supply Plan in 2027.

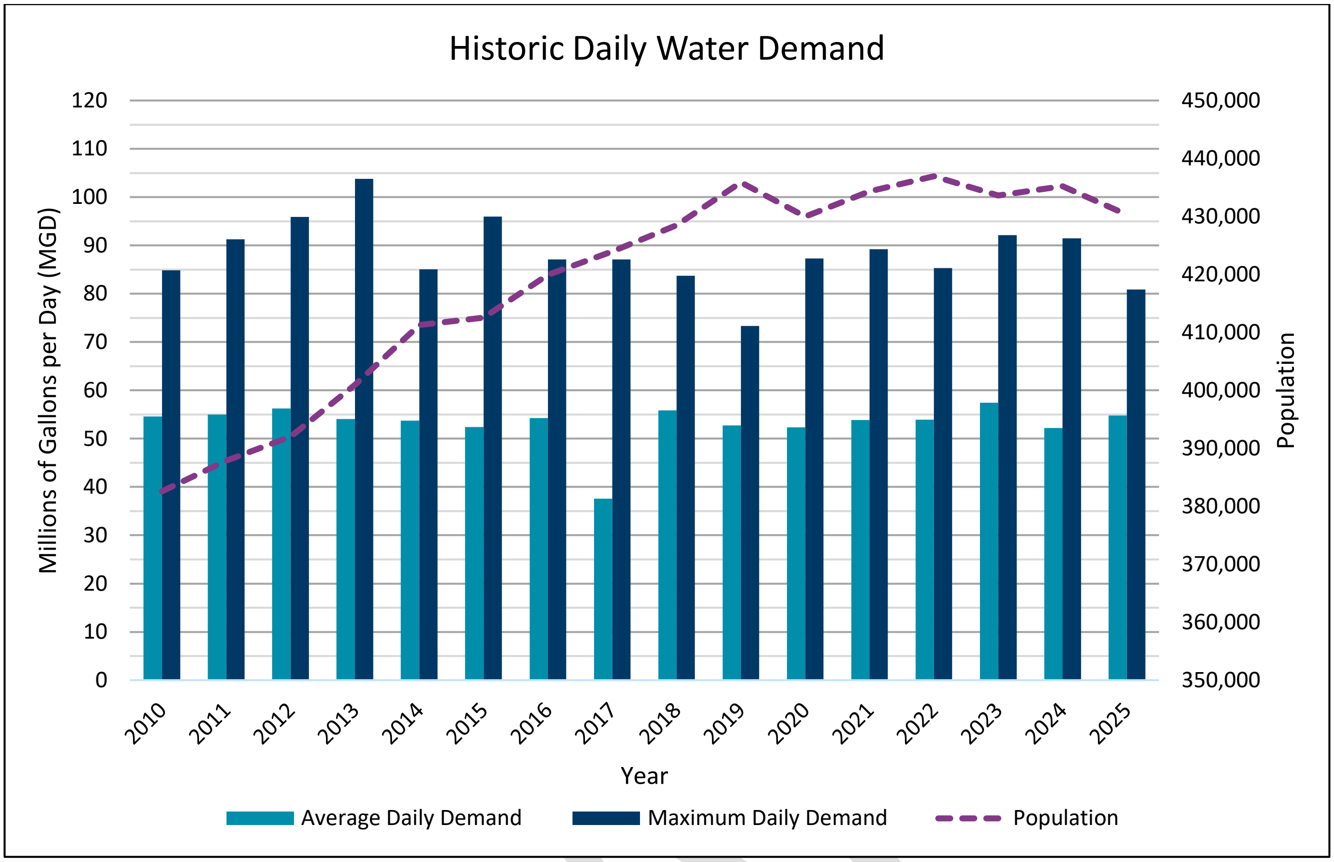


Figure 2. Historic Average Daily Water Demand and Population for the City of Minneapolis

It is expected that average daily water usage for the public water system will decrease slightly throughout the next decade, while population projections for the city of Minneapolis are expected to grow roughly 1.5% to 4.5% per decade. These growth rates were taken from the regional forecast completed by the Metropolitan Council. The projections factor in the rise in water conservation awareness, sustainable water use measures, natural population growth, and immigration migration rebounding post-COVID (Metropolitan Council, 2023).

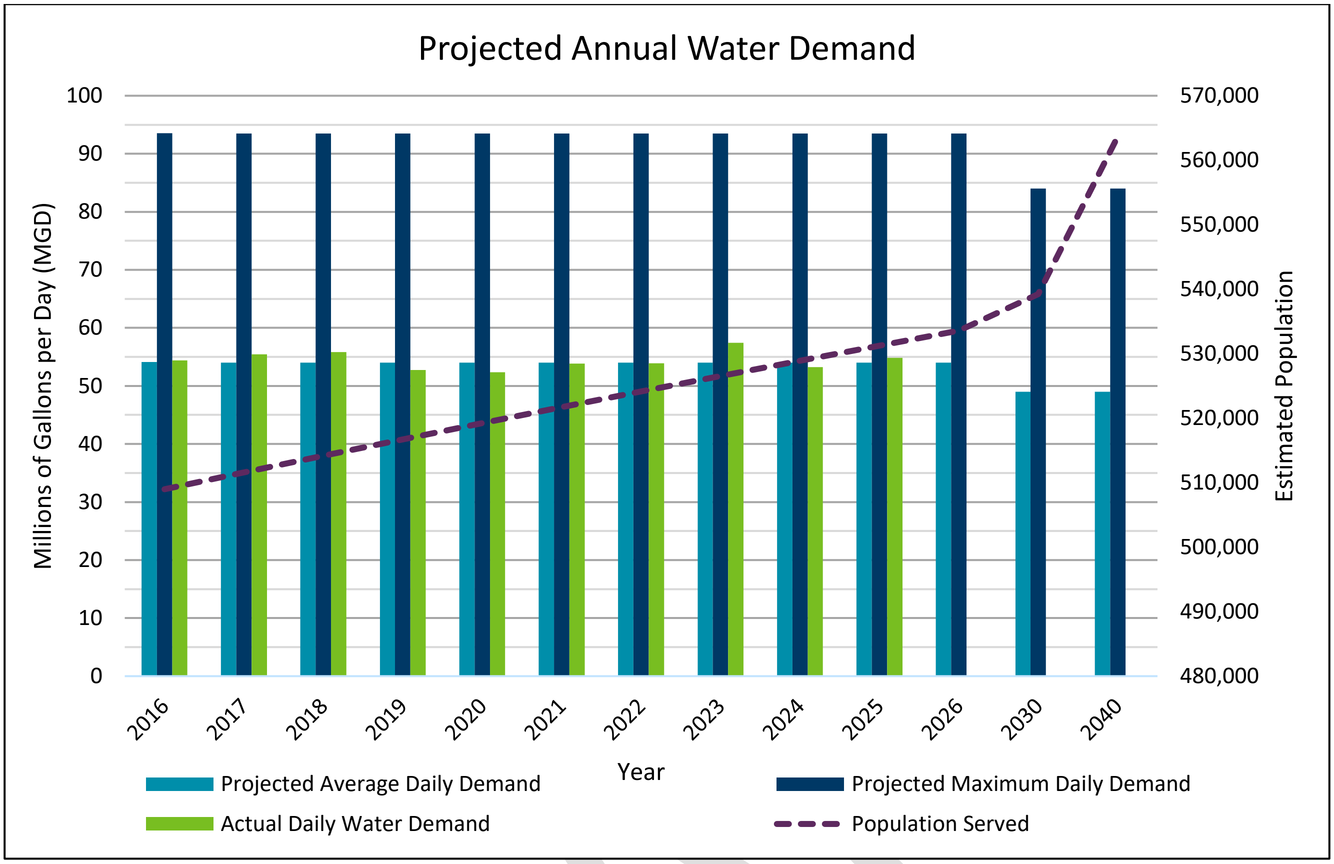


Figure 3. Future Projected Average Daily Water Demand and Population Served by the City of Minneapolis

The Mississippi River is considered a stable and reliable source of drinking water. The historic water demand was compared to average annual flow rates within the Mississippi River, recorded by the USGS at their stream gauge sites located near the Minneapolis intake (United States Geological Survey, 2025), and it was found that there is no correlation between maximum daily demand and seasonal high or low flow rates. USGS also recorded the percentile data drop for drought conditions sustained longer than five days for 10-year periods and found that there is minimal probability of low water levels or flow rates occurring in the future (Minneapolis Department of Public Works, 2017). The state also maintains a Statewide Drought Plan that "provides a framework for preparing for and responding to droughts to minimize conflicts and negative impacts on Minnesota's natural resources and economy", which may help water levels during sustained periods of severe drought (Minnesota Department of Natural Resources, 2026).

Source Water Protection Areas

There are four (4) delineated nested protection areas upstream of the Minneapolis drinking water intake. These areas are called the: 1) Emergency Response Area, 2) Spill Management Area, 3) Drinking Water Supply Management Area – Surface Water, and 4) Source Water Assessment Area.

The purpose of these areas is to indicate the level of risk associated with the presence of contaminants near or upstream of drinking waterbodies. The water flow data used to delineate source water protection areas along the rivers and streams was collected from a combination of the MN DNR, MPCA, USGS, and the Federal Emergency Management Agency (FEMA). Historical aerial photos dating back several decades were reviewed for changes (e.g. river meandering, ditch reconstruction, constructed ponds, wetland extents etc.) to surface water features in the region. The review showed minor river centerline meanders have occurred which were corrected during this assessment.

Emergency Response Area

The Emergency Response Area (ERA) is designed to help the PWS address potential contaminant sources that could present an immediate health concern to water users. It encompasses the drainage area that would contribute water to the intake within an eight-hour (8) travel time period. This is the amount of time it would take to inform the PWS of a spill event and the time needed to turn off the intake to minimize immediate contaminant exposure to those drinking the water. The ERA includes a quarter mile buffer on either side of the main stem of the river source and its tributaries, up to an 8-hour time of travel distance upstream, as well as lakes and their immediate sub-catchments. The buffer width was chosen based on rough estimates of petroleum remediation plume distances in the subsurface (Minnesota Department of Health, 2023).

To determine the ERA for Minneapolis, various data sources were used and combined to estimate the delineated area. First, topographical and water flow data taken in the Mississippi River and other major waterbodies were assessed to estimate a general 8-hour time of travel distance upstream from the intake location. This was done by using a combination of FEMA's floodplain model outputs (generated using the US Army Corps of Engineers' HEC-RAS hydraulic modeling software (https://www.hec.usace.army.mil/software/hec-ras/), USGS annual stream gauge flow measurements, the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency estimates, and various past MPCA surface water monitoring studies in which flow grab samples were taken. All these data sources provided a flow volume at various points within the rivers, which was then used to estimate travel time distances upstream. To remain conservative and to ensure dataset congruency, all values were assessed at the 100-year storm interval.

MDH SWA guidance recommends, where possible, prioritizing the use of available hydraulic models to estimate travel time. The FEMA Flood Insurance Studies (FIS) listed below in Table 3 includes results from the associated FEMA effective hydraulic models and was used to assist with ERA delineation (Federal Emergency Management Administration, 2025). These models broke up the rivers into segments at inconsistent cross-sectional intervals, where flow velocity could be calculated at each point. The lengths between each FEMA cross section were divided by the associated 100-year velocities in the FIS report to calculate the time of travel between cross sections. This calculation was repeated upstream between cross sections until an 8-hour travel time was reached. Figure 4 below highlights the extents of the available FEMA effective model boundaries and associated 100-year velocity data available in the FIS's. Past MPCA monitoring results were used to supplement stream reaches outside of the FIS model extents.

Table 3. FEMA Flood Insurance Studies Used in Delineation Calculations

Flood Insurance Study No.	County	Source*
27003CV001A	Anoka	FEMA FIS: Anoka
27009CV000A	Benton	FEMA FIS: Benton
27053CV001B 27053CV002B	Hennepin	FEMA FIS: Hennepin Vol. 1 FEMA FIS: Hennepin Vol. 2
27141CV000A	Sherburne	FEMA FIS: Sherburne
27171CV000A	Wright	FEMA FIS: Wright

* FIS Reports taken from FEMA Flood Map Service Center (https://msc.fema.gov/portal/home)

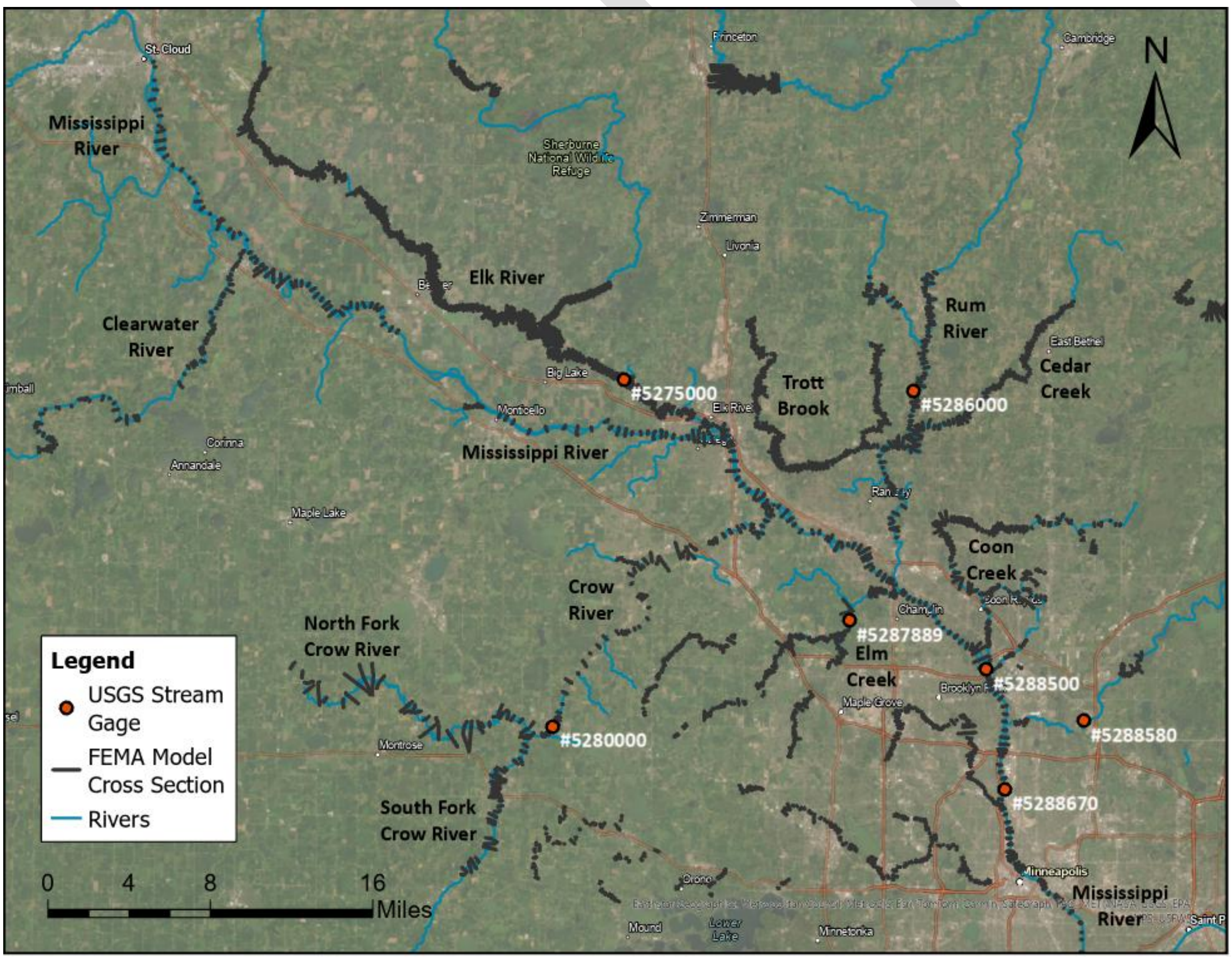


Figure 4. FEMA Effective 100-Year Floodplain Model Extents and USGS Stream Gauge Locations

In addition to using existing flood model and monitoring data, results were compared against Geospatial Information System (GIS) geoprocessing and analysis tools using ArcGIS Pro. The DNR developed a time of travel estimation tool that factors in watershed characteristics such as land-use, geology, channel shape, slope, surface roughness, and topography. The tool calculated an elapsed time for every cell upstream of a specified point, the Minneapolis Water Works intake, where the 8-hour boundaries could be defined (Figure 5). While rough, these results showed that the FIS model results were overly conservative and the ERA distance upstream was shortened, which was validated by past USGS studies (United State Geologic Survey, 2004).

The ERA boundaries were further refined using the cities of Brooklyn Center, Brooklyn Park, Champlin, Columbia Heights, Elk River, Fridley, Minneapolis, Mounds View, Anoka, and Otsego storm sewer data which included pipe network centerlines, culvert and best management practice (BMP) locations, and storm sewer outfalls into the Mississippi River, Coon Creek, Rum River, Crow River, and Elk River. These pipe network extents were incorporated into the ERA to account for direct stormwater flow collected from impervious urbanized areas.

The last step was to include manmade agricultural and major highway drainage channels that outfall directly into the rivers at increased rates. Some ditch networks adjacent to waterbodies collect overland and drain tile runoff from cropland, pasture, and roadways which flow directly into the previously delineated ERA. These channels were assessed and incorporated into the delineation when it was determined that they contribute significant flow within the 8-hour time of travel window.

Spill Management Area

The Spill Management Area (SMA) is designed to focus source water protection activities on potential contaminant sources within 500 feet of either 1) the centerline of a public stream, or 2) the shoreline of a lake contributing flow to a PWS's source waterbody within a 24-hour time of travel. Like the ERA, the SMA is designed to highlight point source contamination issues of immediate concern that could impact the water supply but at longer times of travel.

The methodology for determining the SMA was the same as that of the ERA. When available, the FEMA hydraulic floodplain model velocity outputs were used to determine the stream distance upstream (up to a 24-hour time of travel), picking up from the end of the 8-hour ERA delineation. Where FEMA model outputs were not available, data was supplemented by USGS stream gauge data and MPCA studies that included instantaneous flow measurements. There were little to no storm sewer influences on the SMA, but ditch networks that discharged directly into the stream and river reaches within the SMA were incorporated as necessary.

These results were also compared against the time of travel analysis completed in GIS, using the estimated 24-hour time of travel boundary output. This also showed that the FIS model results were overly conservative, and the distances upstream along the rivers were shortened. See Figure 5 below to see the estimated time of travel extents from the GIS analysis.

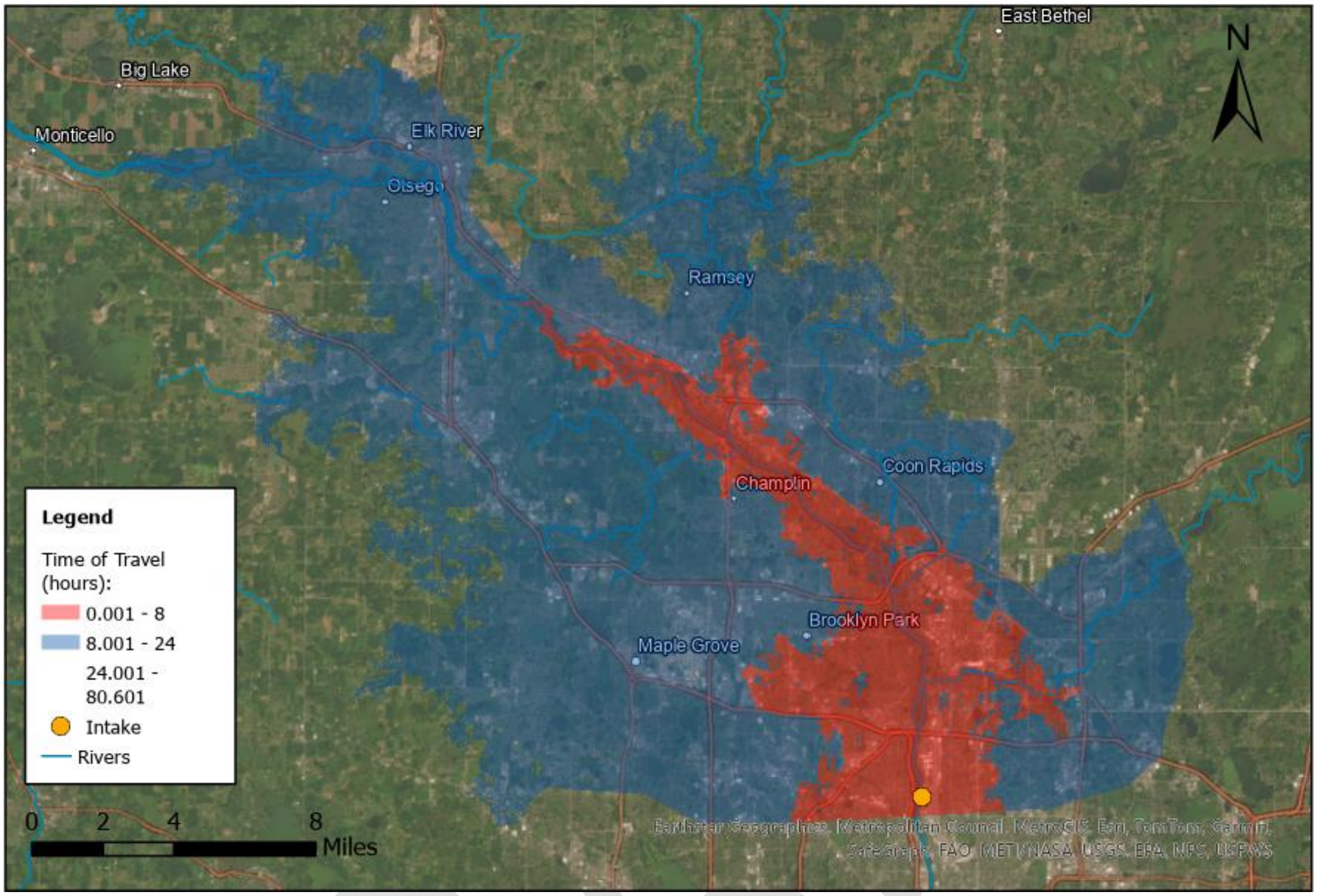


Figure 5. GIS Time of Travel Analysis Results (to Compare to Existing FIS Hydraulic Models)

Several lakes lie within the SMA along stream flow paths. These include (but are not limited to) Long Lake, Lake Sarah, Cook Lake, Pelican Lake, Hayden Lake, Mud Lake, and Locke Lake. Several of these lakes had water quality studies completed by the MPCA and various Lake Associations which estimated lake water retention times. Lake retention times were typically measured in years, so it was assumed most SMA delineated boundaries terminated at the lake waterbody and its immediate surrounding catchments. The immediate HUC12 adjacent lakeshed boundaries were included in the SMA terminus boundaries where applicable.

Drinking Water Supply Management Area – Surface Water

At a broader scale, the Drinking Water Supply Management Area – Surface Water (DWSMA-SW) is designed to protect water users from long-term health effects related to low levels of contamination that originate from diffuse, widespread sources (Figure 7). These contaminant sources, known as non-point contaminants, can pose a high-level threat when the combined concentration of the contaminant from across the watershed is substantially high. The DWSMA-SW also incorporates areas where future land use development may influence the source water quality. These future development issues are addressed below.

The DWSMA-SW includes the HUC12 watersheds that drain directly to the ERA and SMA and was delineated using data from the U.S. Natural Resources Conservation Service (NRCS) and the Minnesota

DNR. For Minneapolis, the DWSMA-SW encompasses 36 HUC12 watersheds upstream from or within the city. The resulting DWSMA-SW includes the watersheds listed below in Table 4, ranked in order of highest priority. Priority is based on percent overlap with the ERA and SMA, with the HUC12 watersheds closest to the intake and overlapping more of the ERA ranked highest. Historical aerial photos from the USGS and the MN Geospatial Information Office dating back several decades show that the current dataset of streams that are considered perennial is accurate.

Table 4. HUC12 Watersheds Included in the Minneapolis DWSMA-SW

	Watershed Name	HUC12 Code	Acres	% in ERA	% in SMA
1	Durnam Island - Mississippi River*	70102060702	32,110.94	42.6%	4.0%
2	Cloquet Island - Mississippi River	70102060701	11,112.99	23.5%	5.2%
3	Rum River	70102070707	18,028.42	18.5%	5.4%
4	Long Lake-Rice Creek	70102060306	16,940.01	8.7%	4.3%
5	Lower Coon Creek	70102060203	25,257.19	8.1%	12.1%
6	Diamond Creek - Elm Creek	70102060104	12,457.53	3.4%	7.3%
7	Shingle Creek	70102060402	18,765.00	1.0%	0.0%
8	Elk River	70102030507	13,812.29		17.1%
9	City of Becker - Mississippi River	70102030603	18,334.68		16.3%
10	Sand Creek	70102060202	10,017.87		14.3%
11	Crow River	70102040703	16,717.48		13.4%
12	City of Elk River - Mississippi River	70102030605	44,714.11		12.4%
13	City of Rockford - Crow River	70102040701	35,317.59		8.5%
14	City of Saint Francis - Rum River	70102070704	23,161.23		6.0%
15	City of Saint Cloud - Mississippi River	70102030103	22,627.48		5.5%
16	Fish Creek - Mississippi River	70102030601	26,848.49		5.4%
17	Lower Clearwater River	70102030205	10,428.81		5.1%
18	Otter Creek	70102030604	17,014.43		4.9%
19	South Fork Crow River	70102050705	14,503.16		4.7%
20	Pelican Lake	70102040702	31,594.36		2.4%
21	Ford Brook	70102070705	24,161.63		2.4%
22	Plum Creek	70102030102	18,997.37		2.4%
23	Trott Brook	70102070706	23,069.36		2.0%
24	Lower Cedar Creek	70102070603	14,093.07		2.0%
25	Silver Creek	70102030602	33,356.00		1.7%
26	Upper Coon Creek	70102060201	23,593.97		1.5%
27	Big Lake - Elk River	70102030505	19,843.52		1.4%

	Watershed Name	HUC12 Code	Acres	% in ERA	% in SMA
28	North Fork Crow River	70102040609	37,974.33		1.3%
29	Saint Francis River	70102030406	23,909.61		1.0%
30	Tibbets Brook	70102030506	24,205.09		0.4%
31	Seelye Brook	70102070703	25,927.44		0.3%
32	Turtle Lake - Rice Creek	70102060305	18,422.02		0.2%
33	Rush Creek	70102060102	18,105.14		
34	Fountain Lake	70102040608	11,253.54		
35	Snake River	70102030504	28,443.33		
36	Johnson Creek	70102030101	34,685.13		

* Not the full HUC12 watershed - truncated at DWSMA-SW boundary at intake.

Table 5 and Figure 6 below break down the land use classifications within each of the delineated protection areas. Land use acreage was taken from the 2024 NLCD dataset.

Table 5. Land Uses Within Minneapolis Delineated Protection Areas

Type of Area (unit size)	Emergency Response Area (acres)	Spill Management Area (acres)	Drinking Water Source Management Area – Surface Water[2] (acres)
Total Area	23,815	35,908	741,200
Lake area in acres (# of lakes/ponds)	168 (12 lakes)	870 (16 lakes)	52,351 (1,051 lakes)
Stream length in miles (# of stream segments[1])	46.9 (15 segments)	155.4 (61 segments)	346.8 (139 segments)
Development	18,849 (79.1%)	12,188 (33.9%)	214,213 (28.9%)
Wetlands	1,253 (5.3%)	6,522 (18.2%)	126,272 (17.0%)
Forest	1,137 (4.8%)	6,193 (17.2%)	98,150 (13.2%)
Open Water	1,925 (8.1%)	4,696 (13.1%)	26,077 (3.5%)
Hay/Pasture	374 (1.6%)	3,301 (9.2%)	105,609 (14.2%)
Cultivated Crops	265 (1.1%)	2,653 (7.4%)	165,412 (22.3%)
Grassland/Herbaceous	11 (<1%)	106 (<1%)	2,100 (<1%)
Barren Land	-	238 (<1%)	2,876 (<1%)
Shrub/Scrub	-	12 (<1%)	492 (<1%)

[1] Lakes and Streams are based on the DNR's Public Waters Inventory flowlines
[2] Area excludes acreage of the ERA and SMA

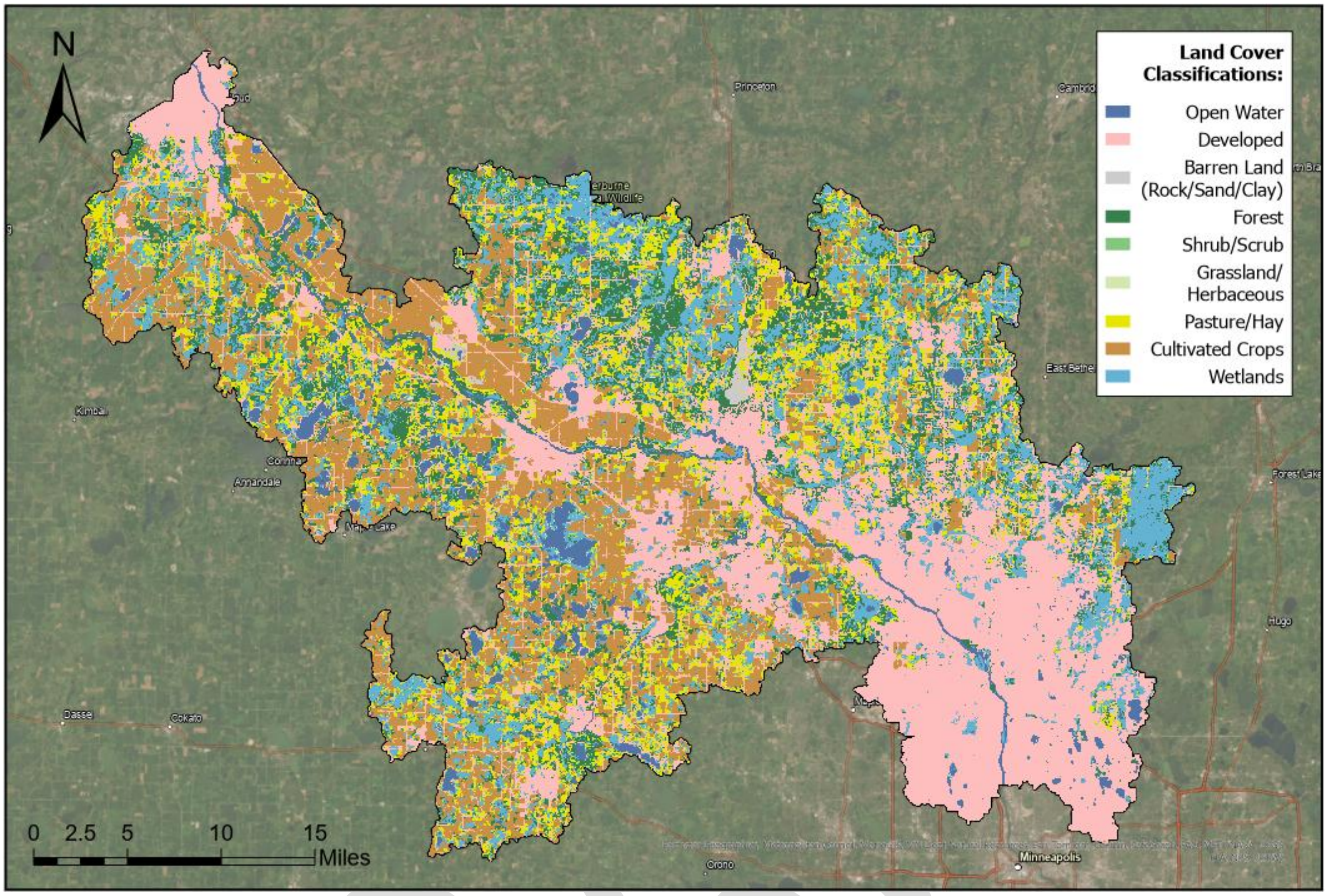


Figure 6. Land Cover Classifications Within Minneapolis DWSMA-SW (2024 NLCD)

In addition to DWSMA-SW areas, communities whose drinking water source is groundwater use groundwater modeling to define the area where water is likely to be pulled into the well within 10 years. These areas are also referred to as DWSMAs and detail the groundwater's vulnerability to surface activities. To see the location of existing groundwater DWSMAs overlaid Minneapolis' protection areas, refer to the figure in Appendix C or the [Source Water Protection Web Map Viewer](https://www.health.state.mn.us/communities/environment/water/swp/mapviewer.html) (https://www.health.state.mn.us/communities/environment/water/swp/mapviewer.html). For additional information and guidance regarding groundwater protection, reach out to MDH's Source Water Protection district hydrologist and planner (see *Contact Information*).

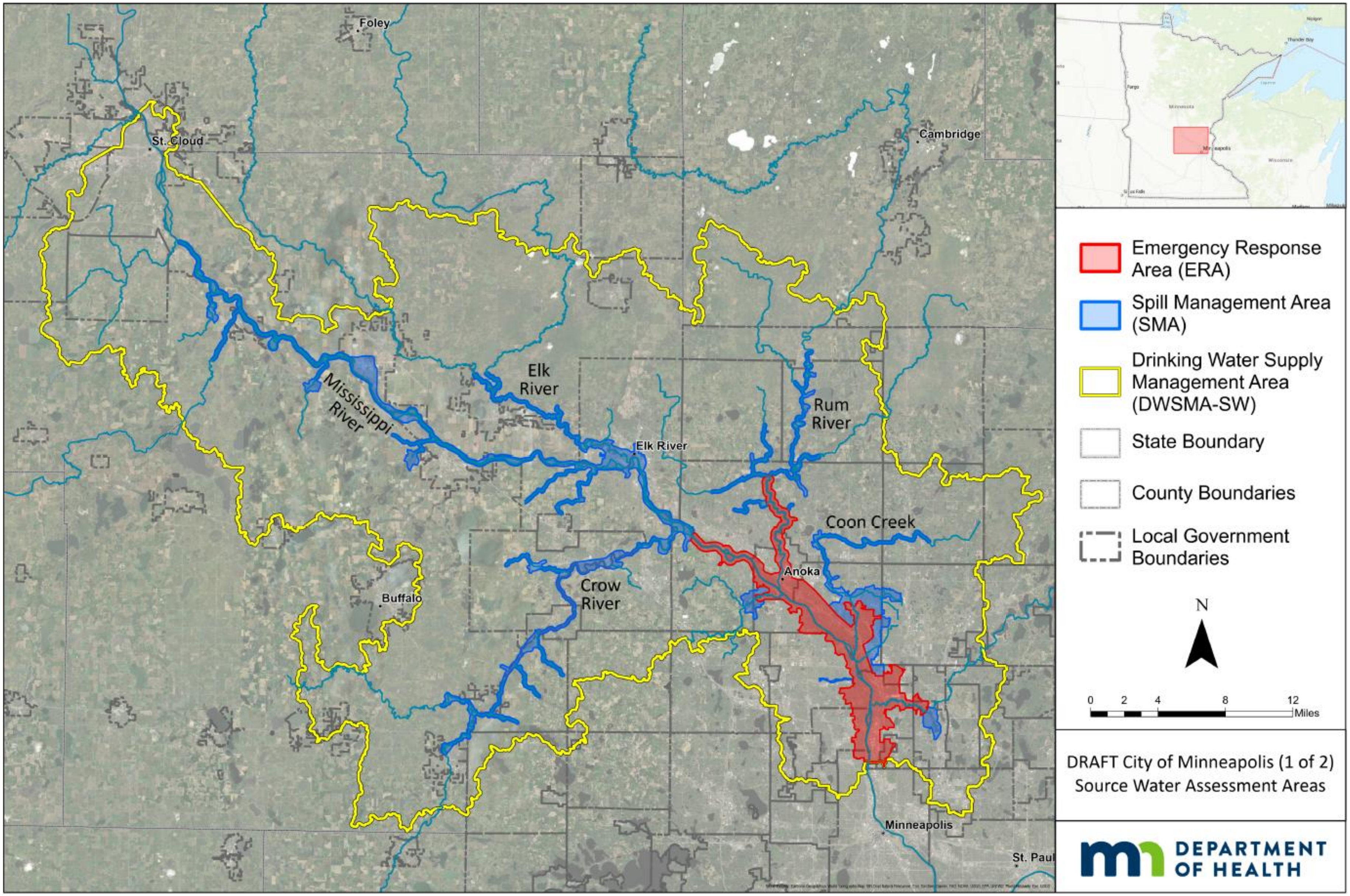


Figure 7. Minneapolis' Drinking Water Supply Management Area – Surface Water, Spill Management Area, and Emergency Response Area (1 of 2)

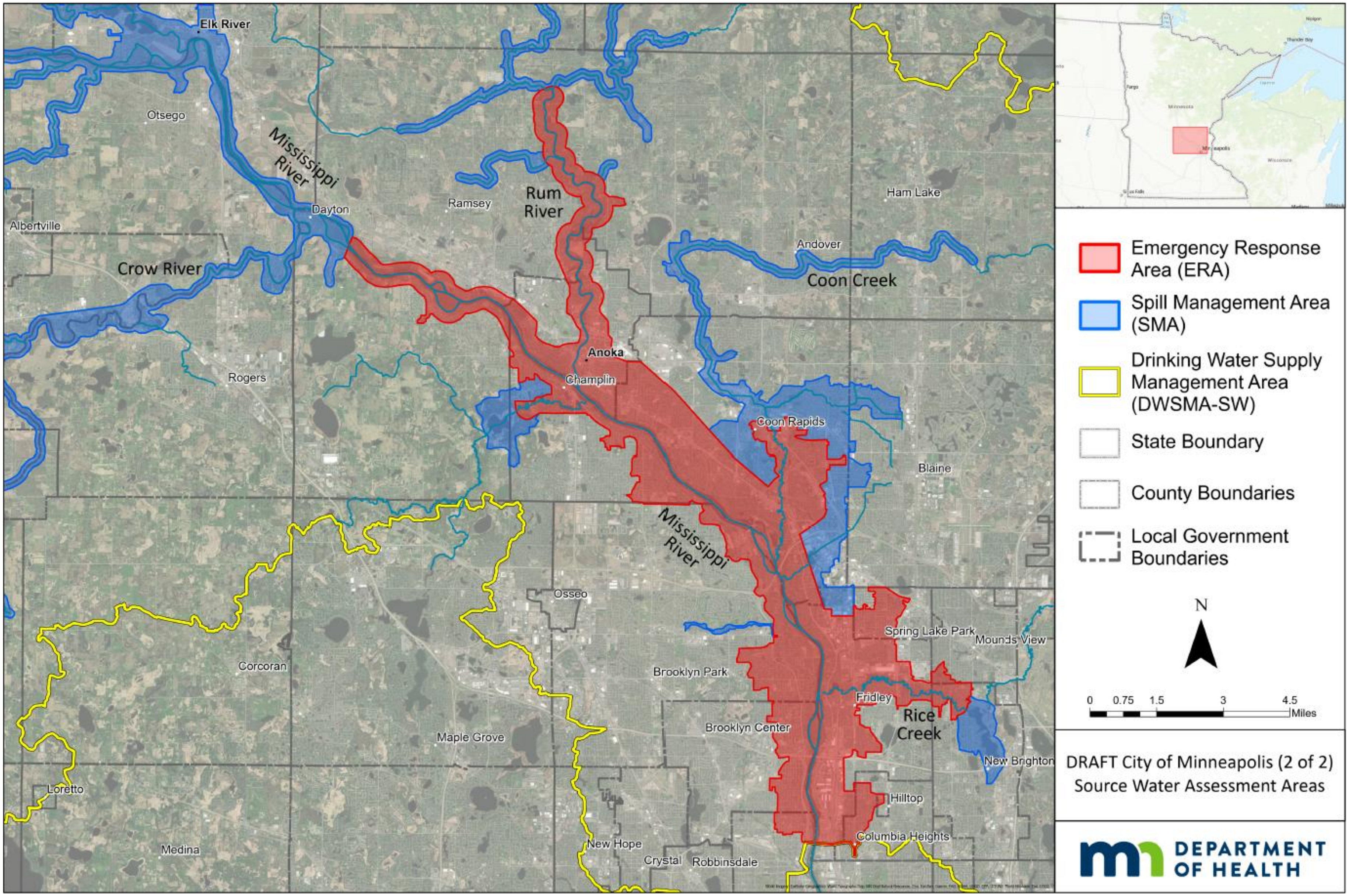


Figure 8. Minneapolis' Drinking Water Supply Management Area – Surface Water, Spill Management Area, and Emergency Response Area (2 of 2)

Source Water Assessment Area

The Source Water Assessment Area (SWAA) includes the entire watershed area upstream from a public water supply intake to the state border, if not terminated sooner. The purpose of the SWAA is to depict the contributing greater watershed upstream that can still have an impact on drinking water quality and allow for the city and local partners (such as Soil and Water Conservation Districts, SWCD) to provide input on future planning and implement protection initiatives. For Minneapolis, this is the upper portion of the Mississippi Headwater Watershed (HUC4 – 0701), which extends north and encompasses the Mississippi River headwaters at Lake Itasca. The SWAA encompasses 18,070 square miles upstream of the Minneapolis Water Works intake location and is shown below in Figure 9.

SWA Area Statistics for Minneapolis Water Works

Emergency Response Area: 23,815 acres

Spill Management Area: 35,908 acres (56 sq. miles)

Drinking Water Supply Management Area – Surface Water: 741,200 acres (1,158 sq. miles)

Source Water Assessment Area: 11,565,266 acres (18,070 sq. miles)

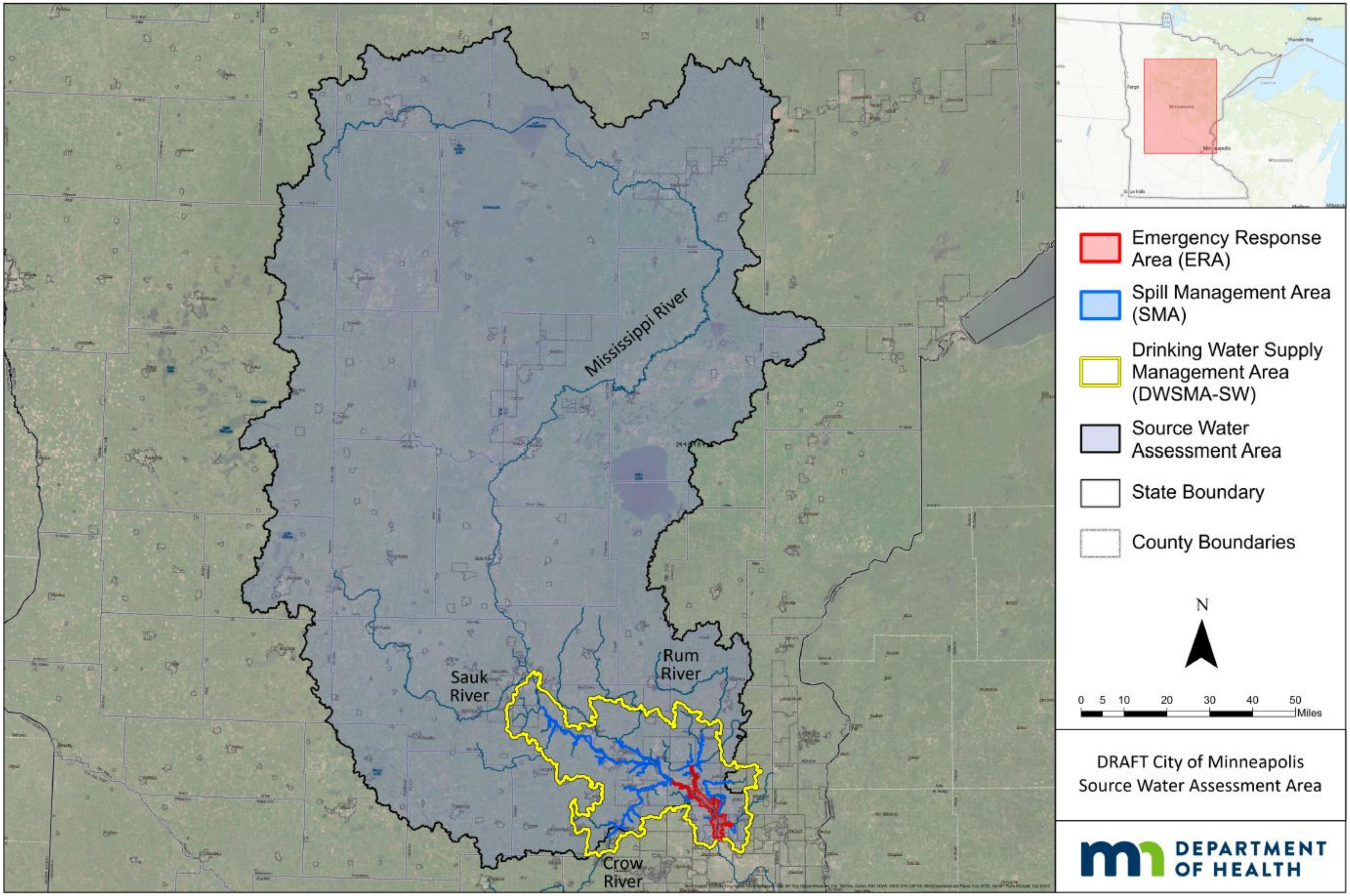


Figure 9. Minneapolis' Source Water Assessment Area

Contaminants of Concern

The federal Safe Drinking Water Act (SDWA) regulates primary contaminants, which are listed on the National Primary Drinking Water Regulations website (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations). They are divided into categories of microorganisms, organic chemicals, inorganic chemicals, radionuclides, disinfectants, and disinfection byproducts.

Water quality indicators are used to determine watershed health. Maintaining source water quality over time ensures that treatment processes remain effective and efficient for consumers. While there may not be drinking water standards or limits for some indicators like total organic carbon or total suspended solids, they can lead to creation of disinfection byproducts (DBPs) within drinking water treatment and distribution systems. DBPs are not usually found in source water and can be avoided by requiring PWSs that use conventional treatment to remove a significant percentage of total organic carbon prior to chlorination.

In addition to the contaminants regulated by the SDWA, some emerging contaminants are also of concern. Emerging contaminants are chemicals and toxins which we are gaining new understanding and awareness regarding their public health or environmental impacts. These emerging contaminants do not yet have SDWA regulated maximum contaminant levels (MCLs) but may have health-based guidance values (HBV) developed by the EPA or MDH.

Source Water Quality

Extensive past and continuous water quality monitoring efforts take place throughout the major watersheds upstream of Minneapolis' intake. These efforts are largely conducted through partnerships between MDH, MPCA, DNR, Soil and Water Conservation Districts (SWCD), watershed districts, cities, and counties. Studies are completed for numerous reasons, such as Total Maximum Daily Load (TMDL) projects on polluted waterbodies or as a part of monitoring and assessment reports in preparation for the MPCA Watershed Restoration and Protection Strategies (WRAPS) reports. The majority of water monitoring efforts are documented in various public online data portals and in published reports, which are referenced in the sections below.

The MPCA has established that several streams and lakes in the DWSMA-SW are impaired for aquatic recreation, consumption and life uses. Appendix B describes the reaches that are impaired and what those impairments are. There are 25 impaired waterbodies within Minneapolis' ERA and SMA, with mercury and *E. coli* being the most common impairments (Minnesota Pollution Control Agency, 2025). Many of the impairments have TMDL reports for those reaches. Aquatic recreation use, aquatic life use, and aquatic consumption use definitions can be found at the MPCA's 2024 Assessment Manual: Guidance for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report & 303(d) Impaired Waters List (https://www.pca.state.mn.us/sites/default/files/wq-iw1-04m.pdf). Water use classes are summarized on the MPCA's Water Quality Standards site (https://www.pca.state.mn.us/business-with-us/water-quality-standards).

While these impairments do not directly pertain to drinking water, they do further underscore the water quality issues observed in the watershed. It should be noted that while the city's drinking water treatment system protects against turbidity, fecal coliform, and *E. coli* bacteria, there are some contaminants that, while not a problem historically, may not be addressed by current treatment practices should they be found at levels of concern. These include substances such as nitrate and per- and polyfluoroalkyl substances (PFAS). These contaminants are particularly difficult to treat, so prevention is key. Preventing further impairments and mitigating existing impairments within the watershed is necessary for the long-term benefit of Minneapolis' drinking water.

As described above in the section *Source Water Characteristics*, the contributing watersheds to the Minneapolis drinking water intake are primarily dominated by altered land cover uses such as crop/range land and development (Appendix A). Therefore, water quality in the Mississippi River and its tributaries have been negatively impacted by human activities. Studies have shown that altered land cover can have a measurable impact on water treatment facilities and that planning for future land cover scenarios is necessary to continue meeting standards (Woznicki, Kraynick, Wickham, Nash, & Terry, 2023). The most notable observed impacts in the rivers and surrounding lakes that may or already have impacted drinking water quality include:

- Land use changes in vegetation, urban development, and agriculture have contributed to reduced water clarity, algal blooms, "flashy" storm runoffs, unsafe recreational conditions, and loss of sensitive aquatic species
- Erosion caused by streambank failure, cattle trampling, and upstream dam/culvert impoundments in the watershed, leading to high turbidity and sediment buildup
- Watercourse and floodplain alteration via manmade ditching, impoundments (i.e. dams, culverts, etc.), and channelization resulting in habitat degradation and lack of aquatic connectivity and diversity
- Low dissolved oxygen levels caused by natural wetland sources, low-gradient stream systems, and groundwater contributions
- Increased water temperature in streams due to surficial agricultural and stormwater runoff
- Increased nutrient loading, primarily phosphorus and nitrogen, from upstream fertilizer and pesticide applications to cropland and open green spaces
- Elevated chloride levels due to road salt applications, water softening, and agriculture runoff which result in degraded water quality

Additionally, Minneapolis Water Works has observed spikes in *E. coli* and total coliform detections around the month of November for the past several years. These observations are not linked to high or low flow volumes in the Mississippi River, so it is suspected that they are linked to manmade releases upstream, particularly around the Crow River. Minneapolis Water Works is interested in conducting qPCR testing to identify the source of these releases. Of lesser concern, Minneapolis has also observed elevated ammonia concentrations during the winter months. This is likely due to the river freezing over during extended cold periods which converts the flowing water underneath the ice to turn into a "groundwater source", being fed by shallow aquifers. These elevated ammonia concentrations are utilized in the treatment process and do not pose a risk to drinking water quality.

Drinking Water Ambient Monitoring Program

MDH has recently established a new Drinking Water Ambient Monitoring Program (DWAMP) that is intended to establish permanent ongoing capacity to address concerns about public health exposure to contaminants of emerging concern (CEC) and support advanced decision making to secure long term water resource management. As part of this work, they are conducting continuous bi-weekly monitoring of surface water sources, including the Mississippi River upstream of Minneapolis' intake.

Four types of cyanobacteria were tested from 2024 to 2026, with positive samples being returned in April through September. These toxins include Anatoxin-a, Microcystin, Cylindrospermopsin, and Saxitoxin. While positive detections were found in the raw water, these cyanotoxins are largely removed during treatment and almost no detections were found in the finished treated water. These results did not always correlate with a harmful algal bloom (HAB) event and warrant future frequent sampling to account for interannual variability.

Buffer Law Compliance

The Minnesota buffer law was established in November 2017 for all public waters and in November 2018 for public ditches. Compliance with the buffer law is beneficial for managing surface water runoff near waterbodies and with agricultural runoff located in the DWSMA-SW. The law provides flexibility to all landowners to comply with by using practices that are outlined in the NRCS Field Office Technical Guide. Sherburne, Wright, Isanti, Anoka, and Hennepin counties are within 99% compliance with this law. Buffered waterbodies that are in compliance are low priority for SWA and planning purposes.

Intake Water Quality

Table 6 and Table 7 summarize important water quality detection data for both the raw water taken from the Mississippi River and the treated water. These samples were taken by either the PWS or MDH and reported to MDH's Minnesota Drinking Water Information System (MNDWIS) data portal (Minnesota Department of Health, 2025). Identified pollution types including total organic carbon, nitrates, *E. coli*, metals, and many other organic and inorganic chemical constituents were noted in the watershed for the Mississippi River. Although the detections listed below are not associated with specific sources within the study area, common sources of water quality impacts include septic systems, biomass decay, cropland fertilizer and pesticide applications, erosion and sedimentation from construction and drainage ditches, petroleum and chemical contaminants from spills, winter road salt applications, watercraft use on waterbodies, and road/rail traffic near or crossing rivers and streams.

Table 6. Raw Water Quality Results for Minneapolis Water Works[1]

Water Quality Parameters	Date Range of Samples	Total Detections	Detection Range	MCL[2]	Other[3]
Total Organic Carbon	01/2000 - 07/2025	379	5.2 – 18.0 mg/L	N/A	N/A
Dissolved Organic Carbon	08/2016 – 09/2018	2	9.4 – 14.8 mg/L	N/A	N/A
MPN *E. coli* QT Colilert	01/2015 – 12/2016	48	1.0 – 1,986.3 MPN/100 mL	<5% positive samples	0 MPN/100mL
Total Alkalinity	01/2000 - 07/2025	376	37.0 to 240.0 mg/L	N/A	N/A
Arsenic	07/25/2013	1	1.4 µg/L	10 µg/L	0 µg/L
Sulfate	07/25/2013	1	10.0 mg/L	N/A	250 mg/L
Dissolved Oxygen	07/25/2013	1	7.7 mg/L	N/A	N/A
Iron	07/25/2013	1	0.57 mg/L	N/A	N/A
Calcium	07/25/2013	1	110 mg/L	N/A	N/A
Manganese	07/25/2013	1	130 µg/L	N/A	100 µg/L
Ammonia Nitrogen	07/25/2013	1	0.05 mg/L	N/A	N/A
Total Nitrate and Nitrite	08/06/2014	1	0.24 mg/L	10 mg/L	10 mg/L
Total Phosphate	07/25/2013	1	0.22 mg/L	N/A	N/A
Chloride	07/25/2013	1	16.7 mg/L	N/A	230 mg/L
Vinyl Chloride	11/1997 – 10/1999	11	0.2 – 0.5 µg/L	0.2 µg/L	0 µg/L
Giardia	03/2015 – 12/2016	43	0.1 – 1.1 cysts/L	N/A	99.9% removal
Cryptosporidium	01/2015 – 12/2016	48	0.09 – 0.3 oocysts/L	N/A	0 oocysts/L
Turbidity	01/2015 – 12/2016	48	1.3 – 25.0 NTU	N/A	N/A
Cyanobacteria[4]	11/2024 – 07/2025	14	0.01 – 1.0 mm^3/L	N/A	N/A
Cyanobacteria[4]	11/2024 – 07/2025	12	200 – 30,030 particles/L	N/A	N/A

- 1 Water quality samples taken at the Mississippi River intake
- 2 Maximum Contaminant Level (MCL) set by the US EPA
- 3 Includes Maximum Contaminant Level Goals (MCLG) set by the EPA or Health Risk Limits, Health-Based Values, or Risk Assessment Advice set by MDH
- 4 Cyanobacteria monitoring includes identified strains (e.g. anatoxin-a, microcystin, cylindrospermopsin, and saxitoxin) as part of MDH's new Drinking Water Ambient Monitoring Program (DWAMP)

The following monitoring results were issued as part of Minneapolis' Consumer Confidence Report for 2025, which is a year-end summary of the City's treated drinking water quality and lists federal standards violations, if any (City of Minneapolis, 2025). There have been no water quality violations for Minneapolis Water Works in the past nine years and results for the listed water quality parameters have been consistent year to year. Minneapolis has been leading an initiative to replace all lead service lines by 2033, which is in line with the state's goal.

Table 7. 2025 Treated Drinking Water Quality Results for Minneapolis Water Works

Water Quality Parameters	MCLG[1]	Violations	Highest Average	Range of Detected Results	Typical Sources
Lead	0 ppb	None	< 2 ppb[2]	< 1.0 – 4.0 ppb[2]	Corrosion of household plumbing
Copper	0 ppm	None	< 0.07 ppm[2]	< 0.02 – 0.12 ppm[2]	Corrosion of household plumbing
Nitrate	10 ppm	None	0.67 ppm	0.65 – 0.67 ppm	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Total Trihalomethanes, TTHM	80 ppb	None	36.8 ppb	8.5 - 66.1 ppb	By-product of drinking water disinfection
Total Haloacetic Acids, HAA	60 ppb	None	23.6 ppb	2.2 – 40.9 ppb	By-product of drinking water disinfection
Chloramine	4.0 ppm	None	3.27 ppm	2.70 - 3.50 ppm	Water additive used to control microbes
Turbidity	N/A	None	0.11 NTU	N/A	Soil runoff
Fluoride	4.0 ppm	None	0.67 ppm	0.65 - 0.69 ppm	Erosion of natural deposits; Water additive to promote strong teeth
Total Organic Carbon	N/A	None	55% removed	46-59% removed	N/A

- 1 Maximum Contaminant Level Goal (MCLG) set by the US EPA
- 2 One sample showed higher than average levels, but follow-up sampling indicated safe results

Potential Contaminant Source Inventory

MDH and the PWS developed a Potential Contaminant Source Inventory (PCSI) to evaluate the different types of contaminants found in the watershed that threaten the quality of the city's source water. These identified potential sources can have a direct or indirect threat to public health and the drinking water quality. The PCSI is organized by threats and potential risks closest to the intake (e.g. ERA), potential contaminants along contributing water bodies (e.g. SMA), and land use management within the DWSMA-SW. The data in the tables was collected from various federal, state, and local databases and discussed in detail with the city and other local partners.

A PCSI data package will be provided to the city. The data package will include a GIS shapefile of PCSI locations, a Keyhole Markup Language (KML) file of the PCSI locations, a large poster sized map including the ERA, SMA, and PCSI points, and a PCSI summary spreadsheet. MDH will archive all relevant information and can provide an archived map and its attributes for these locations to other partners upon request.

The following source summaries document the different types of contaminant sources within the ERA and SMA. Certain types of contaminants are indicated as being high priority due to the fact that they can have an immediate impact on surface water quality. In the event of a spill, each site must be evaluated on a case-by-case basis to determine the severity of risk. Each identified contaminant source went through a detailed analysis; MDH can provide the criteria for these analyses on request.

Point Source Contaminants in the ERA and SMA

The US EPA defines point source in section 502(14) of the Clean Water Act to mean any "discernible, confined, and discrete conveyance, including but not limited to tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or floating or other floating craft, from which pollutants are or may be discharged". The following table documents the point sources identified in the ERA and SMA:

Table 8. Point Sources in the ERA and SMA

Point Source Type	ERA	SMA	High Priority*
Aboveground Tanks	55	36	X
Underground Tanks	77	19	
Feedlots	1	2	X
Industrial Stormwater	2	-	X
MS4 Permit	1	-	
Municipal or Privately-Owned Stormwater Outlets	238	36	X
Wastewater, Municipal Collection System	5	1	X
Wastewater, Municipal NPDES/SDS Permit	-	6	

Point Source Type	ERA	SMA	High Priority*
Wastewater, Industrial NPDES/SDS Permit	7	2	
Construction Stormwater Permit	48	39	
Gravel Pit	-	1	
Underground Pipeline	6	22	
Petroleum Remediation, Leak Site	1	-	X
Superfund Site	1	-	X

* High priority meaning a potential spill or release at this site would have the quickest and largest impact on surface water quality at the intake.

Storage Tanks

Aboveground and underground storage tanks typically contain hazardous liquid materials and are susceptible to leaks/spills that can contaminate surface water and groundwater. Secondary containment measures such as a berm or double-walled system are required by the MPCA and are critical in capturing any leaks or spills and must be regularly inspected by the site owner.

The most common liquid materials held in tanks upstream of Minneapolis' intake are oil and fuel (gasoline, petroleum, and diesel), but other chemicals such as alcohol and antifreeze are also present.

Northtown railyard is one particular location that contains 18 above ground tanks that total over 2.3M gallons of fuel, chemicals, and oils. It is located just east of the Minneapolis Water Works building and is less than 0.35 miles from the Mississippi River. Northtown Yard has the most on-site aboveground tank storage in the ERA, with all the on-site substances being contained in large, bermed containment areas.

Feedlots

Feedlots are used for concentrated livestock farming and require permits from the MPCA to operate. They can be a large source of animal waste and composted organic material which result in excess nutrient runoff during large rainstorms and biannual maintenance cleanouts.

The Randy Dahlheimer Farm is the only feedlot in the ERA. It is near the Mississippi West Regional Park and contains 88 beef cattle. The grazing area for the cattle is 750 yards from the Mississippi River, but Dayton River Road/County Highway 12 does separate the property from the Mississippi River. Two other feedlots are located in the SMA: Lloyd & Leroy Gohman Farm near St. Augusta and Vernon Kolles & Sons near Elk River. Together they house 51 beef cattle.

A study was completed by the University of Minnesota in 2023 that studied N-nitrosodimethylamine (NDMA, a carcinogen) precursor concentrations along four major rivers upstream of Minneapolis, including the Crow River and Mississippi River. The study found that the presence of NDMA in the rivers was directly correlated with excessive feedlot and wastewater treatment plant releases upstream (Li, Arnold, & Hozalski, 2024). Currently, NDMA in drinking water is not regulated by any federal or state agencies in the United States.

Stormwater Outfalls

Stormwater outlets from upstream urban storm sewer networks can be a quick avenue for contaminants such as oils, leaf litter, and trash to be carried to a waterbody, especially if they do not pass through a BMP treatment train (a series of connected BMPs used to manage water quantity and quality). Some cities and private properties manage their own treatment trains to capture and treat stormwater before they outfall into a major waterbody, but many other stormwater outfalls are directly connected and offer little protection. It is important to keep track of any emergency spill events upstream of a directly connected storm sewer system, as this can quickly carry contaminants directly into a lake, river, or steam.

The BNSF Northtown Railyard located immediately adjacent to Minneapolis Water Works maintains a large storm sewer collection network that connects through a City of Fridley 96-inch storm interceptor and outfalls into the Mississippi River, located approximately 950 yards upstream of their drinking water intake. This network presents a large risk to Minneapolis as stormwater within the very active railyard has the potential to collect hazardous substances carried by the trains. While Northtown operates a series of private stormwater basins intended to filter out excess sediment and some contaminants, a large chemical spill could quickly make its way through the network and deposit into the river. Minneapolis Water Works would have a very short period of time to react to a spill incident located here, even if they are notified immediately. There is a documented history of past spill incidents originating from this outfall.

Wastewater

Wastewater from municipal and industrial sites are regulated by the MPCA and discharges are subject to pollutant limits. Many industrial manufacturing facilities maintain large quantities of chemicals and hazardous materials on site and must take care to control any substances on site and meet effluent limits set within their permit. This includes either capturing wastewater runoff and treating it in onsite BMPs or disposing of the hazardous material via incineration or non-exempt recycling/reuse.

There are many industrial manufacturing facilities located to the east side of the Mississippi River and its tributaries within the cities of Fridley, Coon Rapids, Brooklyn Park, and Anoka. The majority of the facilities store, maintain, and dispose of their hazardous materials and substances on site and do not discharge wastewater effluent to the nearby surface waters. The others that do, maintain their own BMPs and meet effluent limits set by their NPDES/SDS permits. While small quantity hazardous waste generators are not included in the PCSI, it is still important for these facilities to establish clear emergency response notification procedures with Minneapolis Water Works in the case of a significant emergency such as a fire.

Waste Management

Waste management facilities are at high risk of leaching contaminants and excess nutrients. Treating wastewater protects the environment and human health by removing pathogens and other contaminants before the water is discharged back into the environment. Permitting requirements and monitoring activities are in place for all permitted wastewater dischargers.

Construction Stormwater Permits

There are 87 construction stormwater permits upstream of Minneapolis' drinking water intake considered open and active at the time of publishing this assessment. The runoff from these sites can impact the city's source water if not handled appropriately. Several hundred other sites in both the ERA and SMA were flagged as it appears construction activity was completed but the permits were not closed out. They have not been included in this list for simplification purposes but should be followed up to determine if the construction activity is complete and the permits need to be closed. A simple on-site visit to these locations can determine if active construction areas are a potential contamination risk. Compliance with stormwater permit conditions for implementation and maintenance of BMPs prevent contamination of the river.

Pipelines

There are 28 underground pipeline crossings carrying hazardous materials underneath a stream or river within the ERA and SMA. These include the Magellan Pipeline Co. non-HVL petroleum line (highly volatile liquid), the Northern Natural Gas Co. natural gas lines, the NuStar Pipeline Operating Partnership non-HVL product lines, CenterPoint Energy Resources Corp. natural gas lines, and the Flint Hills Resources crude oil line. These pipes have the potential to leak or be damaged, resulting in chemical releases that can contaminate waterways and the groundwater system.

FMC Corp. Superfund Site

Upstream of the Fridley Water Treatment Plant sits a large US Environmental Protection Agency (EPA) Superfund site, which is a historically contaminated area identified by the EPA that can pose harmful risks to human health and the environment and in which formal cleanup is needed. The industrial site is located in the City of Fridley (Anoka County) and is approximately 1,000 feet east of the Mississippi River, upstream of Minneapolis' drinking water intake. This site is referenced under multiple names including BAE Systems Land and Armaments L.P., Burlington Northern Railroad – Northtown, and most commonly, the FMC Corp. (Fridley Plant) Site. Historical operations on site generated and disposed of solvents, paint sludge, plating wastes, and other harmful chemicals in several locations from the early 1940s to 1969 (Environmental Protection Agency, 2024). Waste disposal operations contaminated soil and groundwater in the nearby area. The site was placed on the National Priorities List in September 1983.

The MPCA is the lead agency for implementation of site remediation. The site's long-term remedy includes a groundwater pump-and-treat system using extraction wells and an on-site contaminant and treatment facility. Soils identified having high levels of volatile organic compounds (VOC) were also excavated and treated at the on-site facility. Cleanup work began in the 1980s and groundwater monitoring began in 1987.

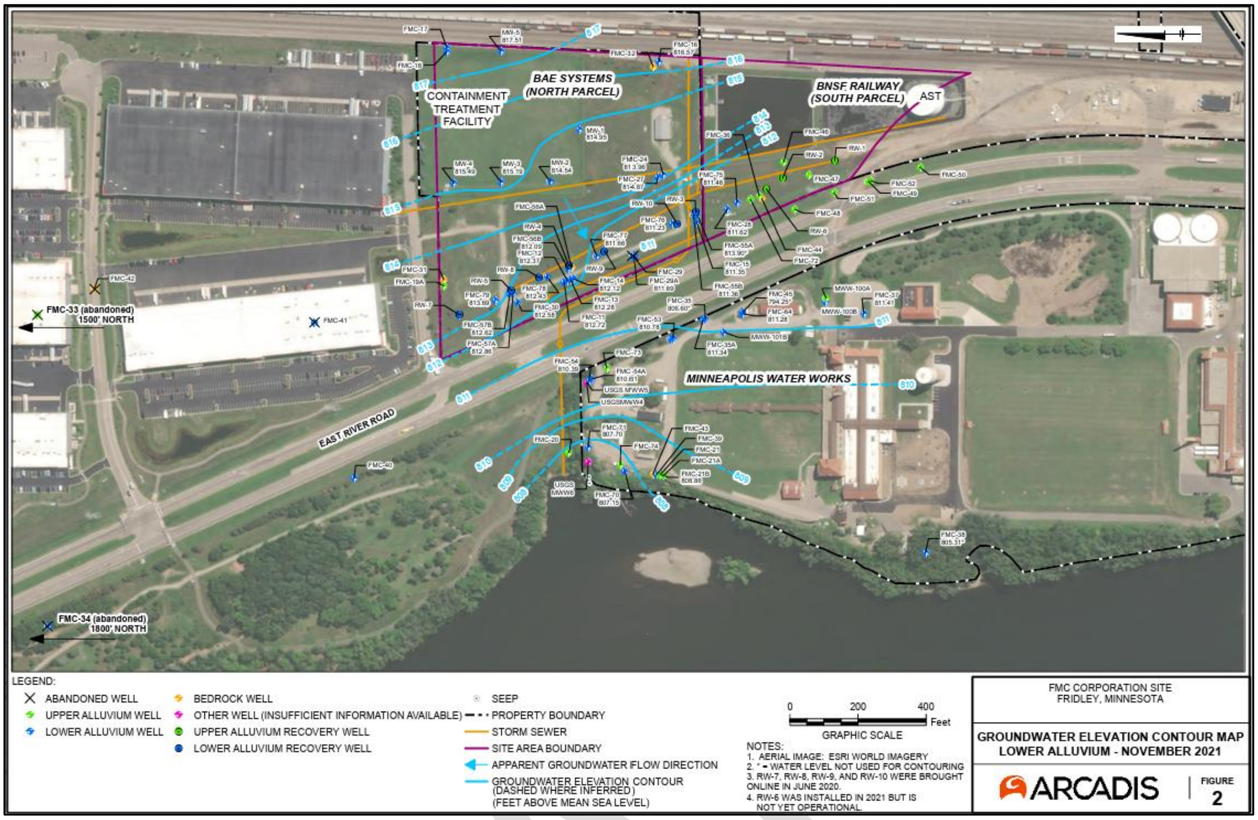


Figure 10. FMC Corp. Superfund Site Location and Groundwater Elevation Map

Operation and maintenance activities are currently ongoing, but the site still poses a risk to Minneapolis' drinking water as the groundwater contamination plume continues to migrate towards the Mississippi River through shallow glacial and alluvial deposits. Capture zone analysis from ongoing monitoring indicates the groundwater plume is not being adequately captured by current pumping, and it is recommended that the extraction well network be expanded to capture more contaminants. It is also recommended that future remedial operations include system enhancement and improved treatment technologies to address increased VOC levels. The groundwater contamination also negatively impacted Minneapolis ability to site groundwater wells near its existing treatment campuses as potential alternate supply source.

Monticello Nuclear Power Plant

The Monticello Nuclear Generating Facility operated by Xcel Energy sits on the south bank of the Mississippi River in Monticello, MN, approximately 45 miles upstream of the Minneapolis drinking water intake. The plant currently discharges reactor cooling water, radwaste treatment system effluent, and holdup pond effluent (consisting of heating system blowdown, softener waste, demineralizer regenerant, filter backwash, and deicing water) directly into the Mississippi. Both the facility and the MPCA conduct regular effluent monitoring to ensure the plant remains within their industrial permit requirements (Industrial NPDES/SDS Permit No. MN0000868).

In November 2022, the Monticello nuclear plant reported a radioactive tritium leak from a water pipe which made its way into the groundwater system migrating towards the Mississippi River. Xcel Energy and several state agencies responded to this incident and implemented increased groundwater pumping to recover the contaminated water, installed an underground barrier wall, and enhanced future monitoring efforts (Xcel Energy, 2025). It was determined that this leak posed no risk to public health and did not impact any drinking water sources. Tritium has a half-life of 12.3 years and tritiated water (tritium plus oxygen) moves through the environment like water. EPA has established an MCL of 4 millirems per year for beta emitters, and the average concentration of tritium that is assumed to yield 4 millirems per year is 20,000 picoCuries (pCi/L). The highest tritium measurement adjacent to the river as reported by Xcel after the November 2022 incident was 1,100 pCi/L, far below the 20,000 limit.

It is important that Xcel Energy, state agencies, and public water suppliers prepare and plan for well-coordinated emergency response to address the ever-present risk to Minneapolis and other drinking water supplies should another leak occur.

Non-Point Source Contaminants in the ERA and SMA

The US EPA describes non-point sources as generally resulting from “land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification” (United States Environmental Protection Agency, 2022). Non-point source pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and groundwater. Land use type greatly affects the types of contamination present in runoff. The following summary documents the non-point sources identified in the ERA and SMA:

Table 9. Non-point Sources in the ERA and SMA

Point Source Type	ERA	SMA	High Priority*
Railroad Crossings	6	10	X
Road Crossings	60	157	X
Dams	3	2	X
Chemigation Permit	1	4	
Open Green Spaces (Baseball fields, Golf courses, Parks, Cemeteries, etc.)	57	18	

* High priority meaning a potential spill or release at this site would have the quickest and largest impact on surface water quality at the intake.

Concerns about transportation corridors include the potential for spills and leaks from vehicles, locomotives, and transported containers. The are many types of chemicals transported daily which can potentially be released near the intake. Accidents, derailments, or ruptured tanks and hoses could cause spills and leaks, and there are many roads and railroads/railyards located near or crossing over the main stem of the Mississippi River upstream of the intake.

Another priority for Minneapolis Water Works is the proximity of the Coon Rapids dam and its potential for leaks of hydraulic fluids from its operations, which have caused concerns in the past. Partnerships between Minneapolis Water Works and the dam operators can alleviate risk factors and improve communication should a future leak occur.

Large green spaces can be a source of nutrient runoff and contamination during large storm events. Some properties have MDA permits to apply fertilizers, such as park fields and golf courses.

In 2014 Minnesota has established a Nutrient Reduction Strategy (NRS) to help reduce the phosphorus and nitrogen loads into the Mississippi River which are eventually carried down to the highly vulnerable Gulf of Mexico. The NRS was updated in 2025 and outlines voluntary and regulatory actions that can help reduce nutrient pollution. Wastewater effluent contributes a notable portion of Mississippi's total nutrient loading and is heavily referenced in the current and future editions of the NRS.

Drinking Water Supply Management Area – Surface Water

Point source contaminants are not considered for management within the DWSMA-SW except where those contaminant locations are also within the ERA and SMA. Non-point source management through analysis of land use, existence of drain tile, and nutrient and pesticide sourcing within the DWSMA-SW is addressed below in the section *Recommended Actions.*

Climate Change Impacts

Minnesota has become measurably warmer, particularly in the last few decades, and weather patterns have become more erratic, which has resulted in changes in air quality, precipitation rates, water quality, and ecosystems. As a result, these deviations can have measurable impacts on Minnesota's PWSs, particularly surface water systems, and they must take steps to build resiliency to these changes. Given the complexity of weather systems and variability in hydrologic systems around the state, the resiliency adaptations required will vary between cities.

The Minnesota DNR has a large database of climate data for every major watershed, including the Mississippi River – Twin Cities, Rum River, Mississippi River – St. Cloud, and North Fork Crow River watersheds. Climate data for these four watersheds is similar so for simplicity, only the data representing the Mississippi River – Twin Cities watershed will be shown in this assessment. They span from 1895 to the current year (Minnesota Department of Natural Resources, 2026). Figure 11 below provides precipitation data during this time. Over the past 12 decades, the average annual rainfall was approximately 29.6 inches, with an increasing trend over time. Since 1985, the watershed has gained 0.28 inches of rain per decade. The region has received higher than average annual precipitation for more than 70% of the past 20 years.

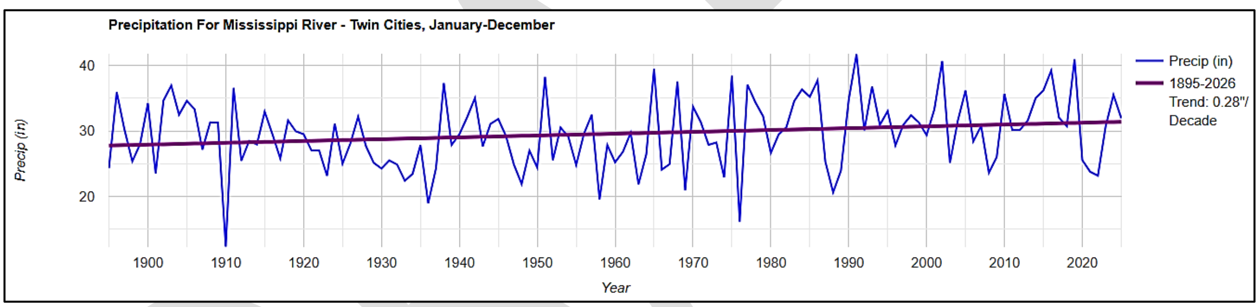


Figure 11. Observed Annual Precipitation Trend for the Mississippi River – Twin Cities Watershed

Figure 12 represents the Palmer Drought Severity Index (PDSI) between the years of 1895 to 2026. The PDSI uses readily available temperature and precipitation data to estimate relative dryness, and graph shows increased wetter conditions over time. There are only seven (7) years in the last 20 when the PDSI showed dryer conditions than the long-term average.

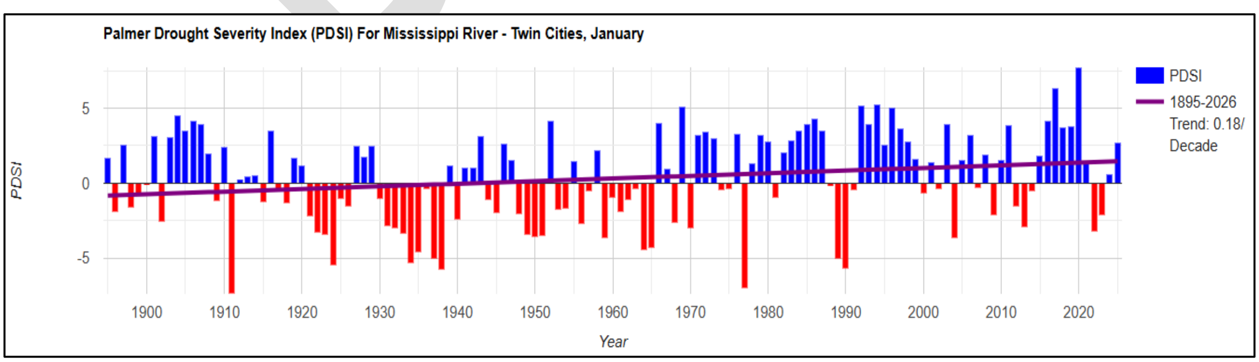


Figure 12. Observed Palmer Drought Severity Index (PDSI) Trend for Mississippi River – Twin Cities Watershed

Annual precipitation totals have increased over time and are expected to continue to increase as climate change progresses through the 21st century (Minnesota Department of Natural Resources, 2026). Figure 13 features data collected from the DNR's Minnesota Climate Explorer tool (https://climate-explorer.dnr.state.mn.us/main/historical), which shows the annual precipitation trend for the Mississippi River – Twin Cities watershed, and the annual mean climate projections of precipitation for the middle and late 21st century. The ranges shown below represent an average of the most commonly used climate model calculations, which in turn use the most plausible Intergovernmental Panel on Climate Change (IPCC) greenhouse gas emissions scenarios, including a mid-century reduction best case scenario in blue and a worst-case scenario in red. Representative Concentration Pathways (RCP) are climate change scenarios used to project future greenhouse gas concentrations:

- **Best-case scenario**: RCP 4.5, where greenhouse gas emissions begin to drop by 2040, and
- **Worst-case scenario**: RCP 8.5, where emissions continue to increase throughout the 21st century

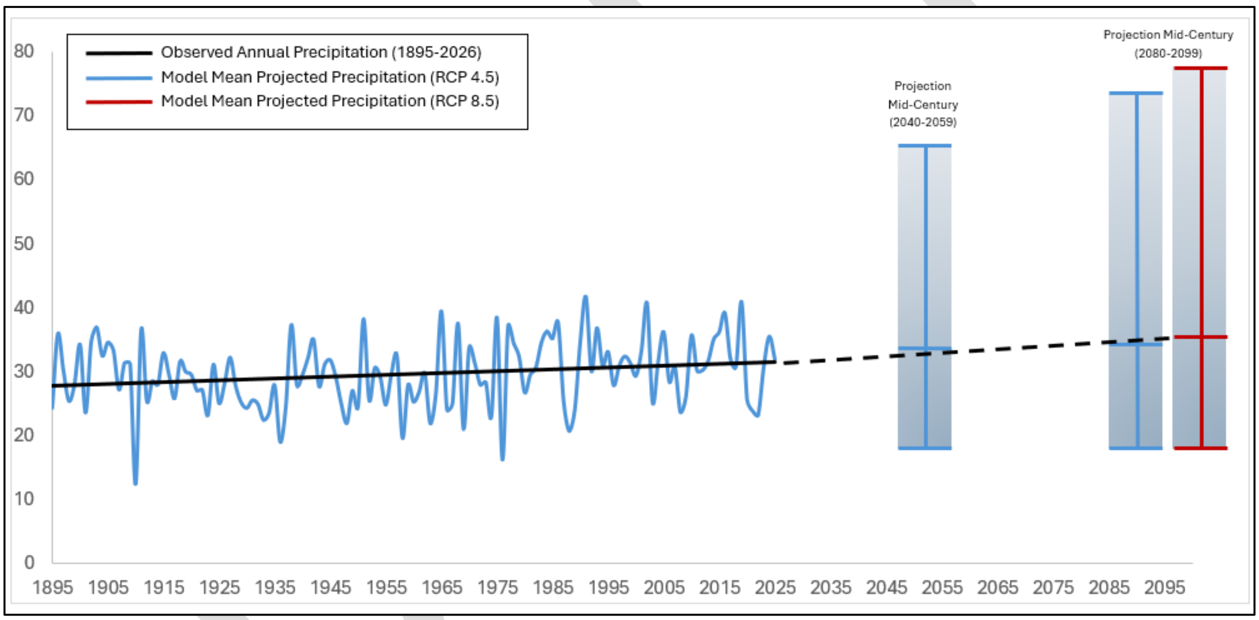


Figure 13. Recent and Future Projected Precipitation for the Mississippi River – Twin Cities Watershed

The projection's averages (means of all downscale model runs, represented by the longer line at the middle of the shaded ranges) of the two time points (mid- and late-century) highlight the range in uncertainty of all IPCC evaluated models. The projected precipitation ranges are large and illustrate what climate scientists have hypothesized about how climate change is expected to affect annual precipitation trends. Average annual precipitation is expected to increase by about 0.6 inches by mid-century. If CO^2 emissions continue at the current rates, average annual precipitation is expected to increase by an additional 1.2 to 3.8 inches by the year 2100 for RCP 4.5 and RCP 8.5, respectively. The plotted ranges shown indicate that annual precipitation amounts could be far greater or far less, as individual precipitation events are projected to become more extreme as well.

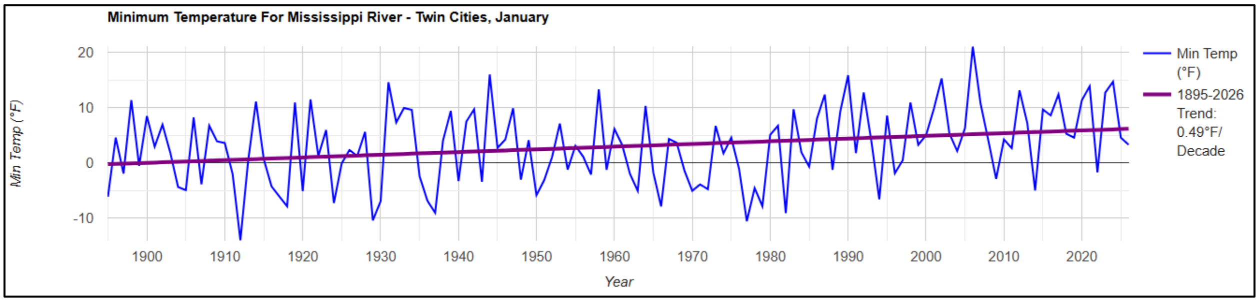


Figure 14. Observed Minimum Temperature Trend for Mississippi River – Twin Cities Watershed

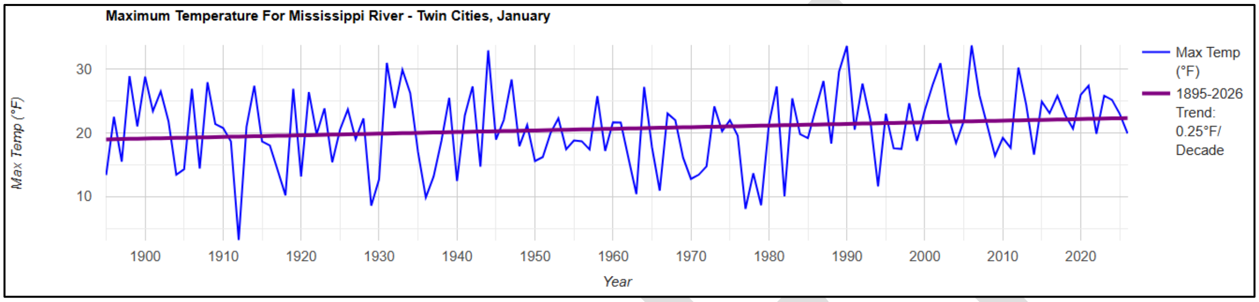


Figure 15. Observed Maximum Temperature Trend for Mississippi River – Twin Cities Watershed

Another factor in model trends is that increasing temperatures in the watershed could lead to the region experiencing more droughts, even with increased precipitation. Figure 14 shows annual low temperatures have increased 0.49°F per decade and Figure 15 show the annual high temperatures have increased 0.25°F per decade. Future model means for the two scenarios described above indicate average annual temperature increases of 6.0 to 9.8 degrees Fahrenheit for RCP 4.5 and RCP 8.5, respectively. These higher temperatures will drive increased evaporation rates and could lead to less flow available for supply. There will always be variability in weather, but over time the increases in precipitation, PDSI, and low and high temperatures will continue.

Summary of High-Priority Issues

Extensive watercourse alteration, agricultural land use, and large pockets of urbanization upstream of Minneapolis' drinking water intake has impacted water quality. This has led to numerous waterbodies within the surrounding watersheds to be placed on the MPCA's impaired waters list for water quality concerns such as excess sediment, nutrients, mercury, and increased presence of *E. coli* (Appendix B).

While future city population projections indicate minimal changes to water supply demand, future climate projections indicate increased average temperatures and precipitation with a higher likelihood of flood events, which can put additional stress on the PWS.

Emergency Response Area and Spill Management Area:

Land use runoff and wastewater outfalls upstream of the Mississippi River and its tributaries have contributed to excess contaminants present in the raw water intake. Some of these contaminants include *E. coli*, total coliforms, chloride, and ammonia. Minneapolis Water Works has observed increases in natural organic material that affects taste and odor, which may require additional treatment. Most of these contaminants are not influenced by seasonal variations, which suggest manmade influence.

There are several sites upstream of the water treatment facility that are of particular concern for Minneapolis Water Works: the FMC Corp. Superfund Site, BNSF Northtown Railyard, Coon Rapids dam, and the Monticello Nuclear Power Plant. The Superfund site sits adjacent to the treatment plant on the eastern upstream side and has an observed groundwater contaminant plume that is migrating towards the river. While remediation efforts are in place, Minneapolis Water Works is concerned that the risk is not being fully addressed by the current extraction wells in place.

In addition, the Northtown Railyard and industrial businesses whose storm sewer flows into the 96" outfall located close to Minneapolis' intake has the potential for transporting hazardous substances carried by the trains. Located just further upstream, the Coon Rapids dam has a history of leaking hydraulic fluids into the Mississippi River and improved communication with the dam operator and the MN Duty Officer is necessary for quick emergency response due to its close proximity to the river intake. The Monticello Nuclear Plant also poses a risk to Minneapolis Water Works should a spill release or other failure event to occur. A recent leak of radioactive material, while never posing a threat to the Minneapolis water supply, highlighted the need for an appropriate emergency response plan and improved communications between the city, Xcel Energy, MPCA, and MDH.

Ongoing land use changes upstream of Minneapolis also present future challenges to water quality. As the cities expand to accommodate growing population and commercial demands, more land use will be converted from forest and wetlands to industrial and impervious surfaces. There will also be greater stormwater management needs as land use changes, with the city highlighting concerns in increased stormwater runoff volumes and the introduction of excess sediments and nutrients from stormwater outfalls. In addition, more point sources may be added that can pose additional risk to water quality. It is important that the city be aware of these changes and keep track of any new point and non-point sources that are created within the ERA and SMA. It is also important for the city to keep tabs on the current identified point sources of highest concern such as the above and underground tanks, superfund sites, and wastewater outfall sites (both industrial and municipal).

Drinking Water Supply Management Area – Surface Water:

The DWSMA-SW is heavily dominated by agriculture. The long-term health of the watershed can be improved by focusing on best management practices for land use, fertilizer applications, and stormwater runoff, all of which can have negative impacts on water quality as noted above. Managing fertilizer, streambank erosion, and runoff issues can help mitigate harmful algal bloom risks in regional lakes as well.

Recommended Actions

The SWA is a tool for the PWS and local partners in deciding what source water protection actions would have the highest impact and provide the most multi-benefit uses. The PWS and local partners should consider implementing the activities below to protect the source water and its surrounding watershed. These activities will be included in Minneapolis' Surface Water Intake Protection Plan when it is developed.

It should be noted that the following recommendations are based on current data and resources that were made available at the time of this report. As these assessments are reviewed on a 10-year cycle, data gaps should be considered as future needs are addressed in subsequent source water assessments.

Monitoring Source Water

Continued monitoring of source water quality is needed to prioritize implementation actions to address the current and potentially worsening water quality in the contributing watershed. Targeted reaches within the ERA and SMA should be the main focus for implementation of measures that address point source contamination. As was mentioned in the *Contaminants of Concern* section, a number of reaches in the DWSMA-SW are impaired for aquatic recreation, aquatic life, and aquatic consumption uses. Continuous ongoing and seasonal water quality monitoring can be a useful tool in determining trends, and there are several agencies and watershed districts that have started this work. Minneapolis should consider partnering with these groups to better utilize these datasets.

Minneapolis Water Works has observed past spikes of *E. coli* and total coliforms during the autumn months, which are suspected to not be linked to seasonal flows or weather patterns. Future investigative monitoring and qPCR testing can help the city identify the source of these releases and inform potential upstream preventative actions.

Emergency Preparedness

Emergency spill prevention and response preparedness is a vital aspect of protecting the source water. The annual PWS emergency plan is necessary and should be updated to include the SWA delineations and coordination with the MN Duty Officer, MDH, MPCA Emergency Response unit, first responders, city planners, and local government staff. Existing coordination of emergency response with city, county, and state government partners should continue as well, particularly for cities located in the ERA. It is important to establish clear notification procedures with the above personnel so that the PWS is notified of any contamination event within the ERA and/or SMA so that they can respond appropriately in a timely manner.

Two sites upstream of Minneapolis Water Works have been identified as having a high potential for emergency releases: the Monticello Nuclear Power Plant and the Coon Rapids Dam. Both sites have had spills in the past which required emergency response and coordination with the site operators, MPCA, MDH, and local governments. Due to the fast moving-nature of the Mississippi River, the PWS often only has hours before they determine if they need to close their intake, so it is imperative that clear communication channels are activated the second the spill is discovered.

Preemptive meetings set up between Minneapolis Water Works and the above identified personnel can provide them with the opportunity to strengthen the existing Minneapolis Emergency Operations Plan to include spill event notification and response, or to create a separate emergency plan tailored to drinking water protection. Minneapolis Water Works could also collaborate with MDH to quickly collect water samples to identify the substance spilled ahead the routine MPCA sampling that occurs after the Duty Officer is notified. Depending on the location of the spill, a boat may be needed. This can help the PWS determine what emergency action they need to take in a timely manner.

Collaboration

The Twin Cities and surrounding regions operate numerous water management programs that range from local city implementation efforts to larger watershed-scale planning. Many of these upstream efforts can provide multiple benefits that include a drinking water protection component, so it would be beneficial for Minneapolis Water Works to be aware of all the programs currently being implemented and work together to prioritize action items that protect the Mississippi River. Identified stakeholder groups include but are not limited to upstream cities, watershed districts/organizations, SWCDs, the Metropolitan Council, state agencies, townships, tribal nations, environmental non-profits, and private property owners.

Ongoing watershed management implementation work as part of BWSR's One Watershed One Plan (1W1P) program and the MN Nutrient Reduction Strategy are helping to address point and nonpoint source risks. There is a potential for Minneapolis to collaborate on these existing efforts to provide multiple benefits. Detailed action items for each watershed with a completed 1W1P are identified in *Appendix A.* In addition, the Upper Mississippi River Source Water Protection Project (UMRSWPP, https://www.umrswpp.com) is currently restarting which will tie together source water protection efforts between the cities of St. Cloud, Minneapolis, and St. Paul. The goal of UMRSWPP is to promote and support communication and working relationships between the three utilities and local government units, PWSs, watershed districts, water management organizations, joint powers boards, and SWCDs in the source water protection area. This will be instrumental during the SWIPP implementation phase.

There are also many existing groundwater protection plans in place for regions that have a surface water contribution area and areas that are classified as highly vulnerable. While these implementation efforts focus on groundwater protection, many of the action items have multiple surface water protection benefits. The future SWIPP can tie into these efforts and utilize existing partnerships and resources with local city, county, and watershed governments.

On a smaller scale, many upstream watershed districts and SWCD's operate their own comprehensive management plans that identify many of the same water quality concerns that Minneapolis does. Partnerships with these key stakeholders will strengthen focus on source water protection efforts and unlock important communication channels, as these organizations have longstanding existing relationships with local landowners, agricultural producers, industries, and other businesses. Similar to the 1W1P program, these plans also identify many of the same implementation actions that can be taken to protect water and Minneapolis Water Works can avoid redundancy by partnering on these projects.

There are a handful of other factors to consider when deciding which projects to prioritize over others. Active TMDLs and impaired waterbodies can help Minneapolis target certain regions when deciding which projects to implement or partner with. Projects located in Environmental Justice(https://experience.arcgis.com/experience/bff19459422443d0816b632be0c25228/page/Page/?views=EJ-areas, EJ) regions can also be useful when considering implementation. Minneapolis' DWSMA-SW overlaps several EJ areas which may open additional funding opportunities. Several MN state agencies factor in EJ principals when considering grant awards. By identifying existing efforts and partnering together with local water and equity stakeholder groups, Minneapolis can leverage increased funding opportunities and avoid duplicating existing efforts. Better collaboration with outside water programs and state agencies can also improve emergency response preparedness and notification procedures in the event of a spill.

Potential Contaminant Source and Land Management

Point and non-point source contamination is a high priority for protecting source waters and public health. The point source locations of highest concern are listed in the *Potential Contaminant Source Inventory* section. For contaminants in Minnesota, each one of the PCSI points is associated with an agency (MPCA, MDA, etc.), local authority, or contaminant source owner. These entities should work together to set up an approach to mitigate the contaminant issue. Public education and engagement would improve the likelihood of long-term water system health. Of particular interest is growing sodium chloride (salt) levels in waterbodies, contaminant/hazardous material storage in the ERA, and nutrient applications to open green spaces that buffer surface waterbodies. Some strategies that will help reduce excess levels of contaminants include:

1. All salt storage should be maintained outside the ERA if possible, and the surrounding public works departments should adopt a "Low Salt No Salt" initiative or implement "Smart Salting" training to reduce sodium chloride applications to roadways, sidewalks, and parking lots in the winter.

2. All tanks located in the ERA should be secured and have secondary containment measures to mitigate any potential spills. The city should work with the MPCA to inspect these tanks regularly to note any signs of deterioration or mishandling.

3. Upstream cities and all residents should apply fertilizers to small-scale green spaces in accordance with the product manufacture directions to reduce any potential contamination from runoff into the streams and rivers. They should also follow the rules set forth by the Minnesota Department of Agriculture (MDA) in their Phosphorus Lawn Fertilizer Law or consider reducing or eliminating applications all together.

4. When possible, maintain existing forest canopy and wetlands during land development projects and consider planting native vegetation and buffer strips that limit the need for fertilizer and help prevent erosion from increased runoff flows.

Potential non-point issues such as sediment from farmland, open green spaces, improperly managed construction sites, forested lands, eroding streambanks, and residential areas can be addressed through cooperation with watershed authorities, local producers, foresters, agriculture, and agronomists. Non-point source pollution prevention should be focused within the DWSMA-SW but can be applied to any location that results in contaminated sheet flow runoff. Of greater concern for Minneapolis' water quality is sediment transport, which is the result of ditching and hydrologic alteration throughout the watershed. Streambank stabilization measures in areas of highly eroded soils, particularly along the Mississippi River, should also be considered when evaluating future implementation strategies.

Pesticides are of high concern due to their potentially harmful public health effects. Educating residents and farmers on manure management and pesticide occurrence should also be considered. There are numerous agricultural BMP strategies that can be employed by farmers to mitigate the release of excess sediments and nutrients such as planting off-season cover crops and installing vegetated buffer zones.

Public education is a powerful and cost-effective strategy that Minneapolis Water Works can take to notify nearby residents and farmers of their proximity to the Minneapolis DWSMA-SW and preventative actions and strategies they can employ to protect the source water. Mailers, signage on public lands adjacent to waterbodies, storm drain stenciling, community event presence, and webinars can all provide the public with knowledge of the risks associated with point and nonpoint sources and actions they can implement to protect their water. Outreach efforts should be tailored to their audiences (i.e. neighborhood associations, farmers, industrial manufacturers, environmental nonprofit organizations, etc.). Many of these efforts are already ongoing via watershed districts, SWCDs, and other agencies, this is another potential collaboration partnership Minneapolis can capitalize on.

Contaminant Conveyances and Potential Releases

Stormwater discharge in the ERA is a potential source of contamination resulting from periods of high runoff and storm events. Understanding the directional flow and contributing surfaces to the stormwater system is key to understanding how to mitigate any potential contamination. Additionally, investigation should be completed to determine if fueling stations near the ERA and SMA have stormwater conveyances that could rapidly move a large fuel spill to surface water bodies. This information should be added to emergency response plans so that first responders can block flow to these input points or capture materials at their source.

Contaminants conveyed by stormwater can also be mitigated by use of BMPs, which are structural/non-structural management devices to provide filtration or infiltration treatment to prevent pollution of waterways and aquifers. Example of BMPs are vegetated buffer strips along roadways, pretreatment bioretention basins prior to stormwater collection systems, and infiltration ponds at stormwater outfalls. Coordination and promotion of existing programs such as Adopt a Storm Drain (https://mn.adopt-a-drain.org/) also useful tools to reducing stormwater contamination.

Alternative Water Supply

Alternative and emergency water sources are an important factor in source water protection planning. Minneapolis does not have a backup water supply, so it may only rely on its current storage capabilities in the event of an emergency. A vulnerability assessment completed by the city in 2016 determined that additional wells on site would not be an effective solution to provide backup water supply.

Minneapolis should pursue additional feasibility studies to determine added intake, treatment, interconnect, and increased storage capabilities along with a cost benefit analysis to evaluate all other alternatives.

Source Water Protection Planning

MDH can assist Minneapolis Water Works and the city in developing a Surface Water Intake Protection Plan (SWIPP) that will lay out strategies for protecting and improving source water quality. Minneapolis Water Works can receive assistance from the MDH District Planner, Surface Water Planning Coordinator, and Surface Water Hydrologist to complete the planning document. Upon completion of the SWIPP, Minneapolis will be eligible for MDH plan implementation grants to fund documented plan activities. The SWIPP will also guide the PWS and local planning partners by documenting other potential complementary watershed-level activities to protect drinking water on a larger scale than can't be accomplished by Minneapolis alone.

This SWA is designed to provide guidance for planning purposes for the next 10 years. After the 10 years have elapsed MDH will reassess all aspects of the SWA. This updated SWA will then guide the amended SWIPP.

References

City of Minneapolis. (2025). *2025 Minneapolis Drinking Water Report.* Minneapolis: Minneapolis Water.

Environmental Protection Agency. (2024). *Seventh Five-Year Review Report for FMC Corp. (Fridley Plant) Superfund Site.* Chicago: EPA.

Federal Emergency Management Administration. (2025, August). *Floods & Maps*. Retrieved from FEMA Flood Map Service Center: https://msc.fema.gov/portal/home

Houston Engineering Inc., et. al. (2024). *South Fork Crow River Watershed Comprehensive Watershed Management Plan.*

ISG, et al. (2024). *Mississippi River St. Cloud Watershed - Comprehensive Watershed Management Plan.* BWSR.

Li, J., Arnold, W. A., & Hozalski, R. M. (2024, February 13). Animal Feedlots and Domestic Wastewater Discharges are Likely Sources of N-Nitrosodimethylamine (NDMA) Precursors in Midwestern Watersheds. *Environmental Science & Technology, 58*(6), 2973-2983.

Metropolitan Council. (2023). *The Regional Forecast: Population and employment in the Twin Cities region in 2050.* St. Paul: Metropolitan Council.

Mille Lacs Soil and Water Conservation District, et al. (2022). *Rum River Comprehensive Watershed Management Plan.* BWSR.

Minneapolis Department of Public Works. (2017). *Water Supply Plan.* Minneapolis: City of Minneapolis.

Minnesota Department of Health. (2023). *Source Water Assessment and Surface Water Intake Protection Plan Guidance.* St. Paul.

Minnesota Department of Health. (2025, July). Minnesota Drinking Water Information System. St. Paul, Minnesota.

Minnesota Department of Natural Resources. (2026). *Climate*. Retrieved from Drought in Minnesota: https://www.dnr.state.mn.us/climate/drought/index.html

Minnesota Department of Natural Resources. (2026). *Climate Trends*. Retrieved from Climate Change and Minnesota: https://arcgis.dnr.state.mn.us/ewr/climatetrends/

Minnesota Geological Survey. (2025, July). *County Geologic Atlas (CGA)*. Retrieved from Minnesota Geological Survey: https://cse.umn.edu/mgs/county-geologic-atlas

Minnesota Pollution Control Agency. (2013). *Mississippi River-Twin Cities Watershed Monitoring and Assessment Report.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2015). *Mississippi River – St. Cloud Watershed Restoration and Protection Strategy Report.* St. Cloud: MPCA.

Minnesota Pollution Control Agency. (2016). *Rum River Watershed Monitoring and Assessment Report.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2016). *Rum River Watershed Stressor Identification Report.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2017). *South Fork Crow River Watershed Stressor Identification Report.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2020). *North Fork Crow River Watershed Stressor Identification Report.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2022). *Mississippi River-St. Cloud Stressor Identification Update.* St. Paul: MPCA.

Minnesota Pollution Control Agency. (2025). *MPCA Impaired Waters Viewer*. Retrieved from Minnesota's impaired waters list: https://mpca.maps.arcgis.com/apps/webappviewer/index.html?id=fcfc5a12d2fd4b16bc95bb535d09ae82

St. Cloud State University. (2025, December). *Weather*. Retrieved from St. Cloud Climate Data: https://www.stcloudstate.edu/weather/climate/default.aspx

United State Geologic Survey. (2004). *Upper Mississippi River Source Water Protection Project Time of Travel Synopsis.* USGS.

United States Geological Survey. (2025, June 25). NLCD 2024 Land Cover. Minnesota.

United States Geological Survey. (2025). *USGS Water Data for the Nation*. Retrieved from USGS Current Water Data for Minnesota: https://waterdata.usgs.gov/mn/nwis/rt

Woznicki, S. A., Kraynick, G., Wickham, J., Nash, M., & Terry, S. (2023). Modeling future land cover and water quality change in Minneapolis, MN, USA to support drinking water source protection decisions. *JAWRA Journal of the American Water Resources Association, 59*(4), 726–742. Retrieved from https://doi.org/10.1111/1752-1688.13109

Xcel Energy. (2025, July). *Monticello Groundwater*. Retrieved from Xcel Energy: https://mn.my.xcelenergy.com/s/outage-safety/public-safety/monticello-groundwater

Appendix A

Appendix A - Watershed Characteristics

For clarity, each watershed is described separately below with a focus on the portions of the watershed the Minneapolis drainage area (or DWSMA-SW) encompasses:

Mississippi River – St. Cloud Watershed

The Mississippi River – St. Cloud Watershed is located within the Upper Mississippi River Basin and begins at the confluence of the Mississippi River and the Sauk River (Figure 1). The cities of St. Cloud and Sauk Rapids lie in the northernmost upstream point of the watershed. The approximately 50-mile Mississippi River segment within this watershed is designated as a “wild and scenic river” by the MN Department of Natural Resources (DNR) due to its abundance of wildlife habitat and recreational access (Minnesota Pollution Control Agency, 2015). The Minneapolis drainage area overlaps the greater part of this watershed and includes the entire Mississippi River reach from the city of St. Augusta in the northwest to the confluence with the North Fork Crow River in the southeast.

This watershed (and subsequent watersheds) is entirely contained within the North Central Hardwood Forests Ecoregion which outlines an area of similar land cover, land use, soil, topography, and types of vegetation. The surrounding land cover is characterized as being heavily agricultural (corn, soy, and forage row crop) with some rangeland, forest/shrub, and urbanization. Water quality is characterized as fair to poor in this watershed. The watercourses within the farms are heavily altered for irrigation and have been a primary stressor for water quality in this region.

Other stressors of note include increased nutrient runoff from farmland, low dissolved oxygen (DO), habitat loss from excessive bedded sediment, feedlots and developed land located in riparian corridors, elevated total suspended solids (TSS) concentrations, loss of biodiversity from aquatic invasive species (AIS) and climatic changes, loss of habitat connectivity due to manmade impoundments, and easily erodible soils (Minnesota Pollution Control Agency, 2022). Within the Minneapolis drainage area, the Mississippi River was delisted in 2004 from the Minnesota Pollution Control Agency’s (MPCA) impaired waters list for fecal coliform (Minnesota Pollution Control Agency, 2025). Several Total Maximum Daily Loads (TMDL) projects are in place for various rivers/streams, setting limits on total phosphorus (TP), DO, and turbidity loading.

A comprehensive watershed management plan has been developed for this watershed through the MN Board of Soil and Water Resources (BWSR)’s One Watershed, One Plan (1W1P) program (https://bwsr.state.mn.us/one-watershed-one-plan). The purpose of this program is to align local water planning efforts to create a systematic, watershed-wide, science-based approach to watershed management, which builds off existing local government and water plan services. The plan was completed in 2024 and is renewed on a ten-year cycle. This plan includes projects that target improved soil health, implementing agricultural best management practices (BMPs), providing more water storage via wetland restoration, lake management, and habitat restoration efforts (ISG, et al., 2024). A Groundwater Restoration and Protection Strategies (GRAPS) Report was also completed for this watershed in 2023, which outlines water quality risks and actions the watershed can take to protect their aquifers, The completed report, along with other GRAPS reports, can be found in MDH’s GRAPS Reports Tracker online (https://mdh.maps.arcgis.com/apps/dashboards/de90e06b161b476c9d2fed62114b1823).

Rum River Watershed

The Rum River Watershed lies within east-central Minnesota and stretches 145 miles southward from the Mille Lacs Lake outlet to its confluence with the Mississippi River in the city of Anoka. In addition to the many tributaries to the Rum River, this watershed also features over 200 lakes over 10 acres in size (the DNR lake threshold size) which are an important recreational resource.

While the majority of this watershed is characterized by hardwood forest/shrub, cropland, and rangeland, the Minneapolis drainage area only intersects the Rum River watershed in the lower third portion. This area transitions to more urbanized land cover, with the highest density of development occurring along the banks of lakes and rivers (Minnesota Pollution Control Agency, 2016). Wild rice is present within this watershed which typically indicates high water quality.

Water quality in the watershed is generally good, though it has exhibited some impairments to the river system and lakes due to extensive agricultural runoff and habitat alterations. Elevated nutrients such as phosphorus and nitrogen from excessive agricultural runoff, high turbidity, low DO, and connectivity issues are the most cited concerns in past assessments of the watershed's health (Minnesota Pollution Control Agency, 2016). Manmade barriers such as dams and culverts in the southern region have negatively impacted biological habitats and fish passage. Runoff from agricultural land to the north has also contributed to the elevated nutrient levels observed in the lower portion of the watershed.

A comprehensive watershed management plan has been developed for this watershed, completed in 2022 (Mille Lacs Soil and Water Conservation District, et al., 2022). This plan includes efforts to enhance education and outreach to the community, restore impaired surface waters and protect threatened waterbodies, prevent flooding, erosion, and water quality degradation, decrease the risk of groundwater contamination, increase habitat acreage and biological connectivity, restore critical shoreline areas, and reduce/mitigate the spread of AIS. A GRAPS Report was also completed for this watershed in 2020. The watershed includes significant natural features, including surface waters that depend on groundwater to sustain them, so if groundwater quantity or quality is degraded, these resources are at risk.

North Fork Crow River Watershed

The North Fork Crow River Watershed lies just to the south of the Mississippi River – St. Cloud and Sauk River Watersheds in south-central Minnesota. The primary waterbody flowing through this watershed is the North Fork of the Crow River, 150 miles from its headwaters to the west to its confluence with the South Fork of the Crow River in Rockford, MN in the northeast. Both forks join to form the Crow River which drains into the Mississippi River in Dayton, MN. There are many smaller tributaries to the Crow River as well as lake chain systems throughout. The Minneapolis drainage overlaps a small portion of the east end of this watershed.

The land cover within this watershed is predominantly agricultural (row crops and pasture), while the eastern half is metro-fringe development (residential and industrial). The Minneapolis source water area overlaps the eastern half of the watershed, where the cities of Rockford, St. Michael, and Rodgers lie. Due to extensive past timber removal, wetland draining, and stream channel modifications, lakes and streams in the North Fork Crow River watershed are showing signs of stress from pollution.

Water quality in this watershed is characterized as poor for aquatic life and recreation, citing agricultural practices as the main stressor. Excess nutrient runoff from applied fertilizers and pesticides, fluctuating oxygen levels in waterbodies (with low DO persisting), excessive streambank and cropland erosion resulting in high TSS, habitat loss due to channelization and impoundments, and failing or poorly maintained septic systems, feedlots, and urban stormwater systems have all contributed to the poor water quality (Minnesota Pollution Control Agency, 2020). Excessive feedlot runoff has contributed to increases in NDMA precursor concentrations, which has been studied by the University of Minnesota (Li, Arnold, & Hozalski, 2024).

Joint conservation efforts between the county Soil and Water Conservation Districts (SWCD), DNR, MPCA, BWSR, watershed districts, and the cities has resulted in a small measurable improvement to water quality parameters, but there are still many river and lake TMDLs in place that need to be addressed, primarily limits set on *E. coli*, chloride, TSS, TP, and total nitrogen (TN) loading. A comprehensive watershed management plan was created by a planning partnership in 2020 that highlighted drinking water (via groundwater), lakes, agricultural drainage systems, and surface runoff as their highest priorities. The plan also cites rivers, wetlands, rural development, shoreland/riparian corridors, public knowledge, urban stormwater, and terrestrial habitat as concerns of note. The measurable goals of the plan are to protect public health and a safe and secure food supply, retain water where it falls, restore public uses of lakes and streams, and ensure economic stability of the community. A GRAPS Report was also completed for this watershed in 2017.

South Fork Crow River Watershed

The South Fork Crow River Watershed lies below the North Fork Crow River Watershed in south-central Minnesota. Most of the watershed overlaps the Western Corn Belt Plains ecoregion, but the eastern third overlaps the North Central Hardwoods. The primary waterbody flowing through this watershed is the South Fork of the Crow River, from Little Kandiyohi Lake in the west to its confluence with the South Fork of the Crow River in Rockford, MN in the northeast. A major tributary to the South Fork Crow River is Buffalo Creek. This watershed is primarily agricultural, with most of the land dedicated to row crop farming and rangeland. The easternmost section of the watershed has some development with forest/shrub land cover, but minimally. The Minneapolis drainage area intersects a small insignificant portion at the northeast end, but it is still described below as the water quality contributions from the South Fork of the Crow River can have impacts on the city's water quality.

Water quality in this watershed is generally described as poor, with many stream impairments and TMDLs in place (Minnesota Pollution Control Agency, 2017). Groundwater in this region is also largely considered vulnerable. The primary stressors identified here are similar to the watersheds described above, citing agricultural practices, altered hydrology, excessive sedimentation, and low DO as the contributing factors for degraded aquatic life and habitat.

A comprehensive watershed management plan has been developed for this watershed, completed in 2024 by a planning committee comprised of counties, cities, SWCDs, and one watershed district (Houston Engineering Inc., et. al., 2024). This plan identifies five (5) priority issues: drainage water management, loss of water storage and altered hydrology, nutrient loading to surface waters, wind and water erosion, and soil health. The plan also highlights secondary issues such as bacteria loading and urban stormwater runoff. The goals of the plan are to foster improved community engagement and inter-agency collaboration, restore habitats, establish BMPs such as riparian buffers and wetland restoration, and increase water storage and permanent protected land easements.

Mississippi River – Twin Cities Watershed

The Mississippi River – Twin Cities Watershed is large and complex as it encompasses both the cities of Minneapolis and St. Paul, the two largest cities in Minnesota. The watershed is home to more than 1.9 million people across ninety-nine cities with over 250 lake basins greater than ten acres (Minnesota Pollution Control Agency, 2013). To simplify and to help provide more targeted protection strategies, this watershed is often broken down into its smaller HUC12 sub watersheds which are each managed by their own watershed district or joint powers watershed management organization. These subwatersheds exhibit similar water quality issues due to their proximity to the Twin Cities metro region and often work collaboratively to address these concerns. The Minneapolis drainage area intersects eight (8) of these subwatersheds: Upper Rum River, Lower Rum River, Coon Creek, Elm Creek, West Mississippi, Mississippi, Shingle Creek, and Rice Creek.

The land cover in this watershed is primarily urbanized with heavy commercial, residential, and industrial development. There is also forest, open water, and agriculture land use present throughout. Waterbodies and the surrounding parkland present in the Twin Cities are vital to recreation and provide natural habitat for birds, fish, and other wildlife. Land use in the watershed has changed drastically in recent years with the expansion of urbanized areas and increased impervious cover replacing farmland and previously forested regions.

These changes have resulted in declining water quality, with many waterbodies listed as impaired for aquatic recreation and life. Heavy stormwater runoff has resulted in increased nutrient, bacteria, and chloride runoff which in turn cause lake eutrophication and algal blooms. Large impervious surface percentages also contribute to large flashy stream flows and heavy rainfall runoff volumes during large storms, leading to localized flooding and water storage concerns. There is also surface water groundwater interaction which has affected surficial groundwater quality. The fringe of the Twin Cities also exhibits water quality impairments commonly associated with agricultural land use, which are detailed in the watershed summaries above.

Appendix B

Appendix B - Impaired Waters

Table 10. Waterbody Chemistry Impairments within Minneapolis' ERA and SMA

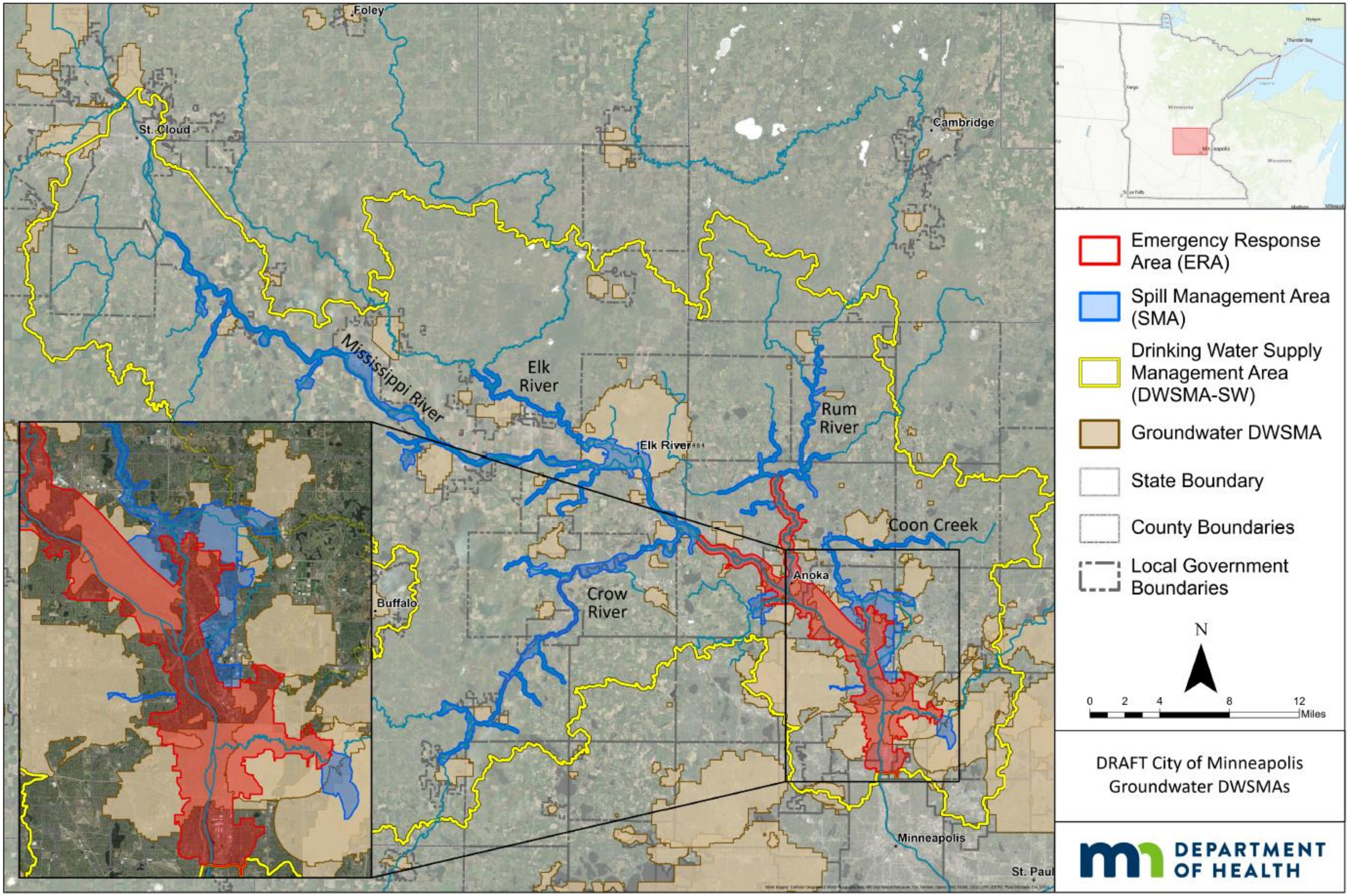
Lake or Stream Name	Reach Description	AUID	Use Classes[5]	Impaired Parameters	Parameters with TMDLs	In ERA or SMA
Mississippi River	Crow River to Upper St. Anthony Falls	07010206-805	1C, 2Bdg	Fecal Coliform[1], Mercury-Fish[2], Nutrients[1], PCB-Fish[3]	Mercury, Nutrients	ERA, SMA
Mississippi River	Clearwater River to Crow River	07010203-729	1C, 2Bdg	Fecal Coliform[1], Mercury-Fish[2], PCB-Fish[3]	Mercury	SMA
Unnamed Creek	Full length	07010206-824	2Bg	*E. coli*[1]	-	SMA
Rice Creek	Long Lake to Locke Lake	07010206-584	1C, 2Bdg	*E. coli*[1], Fish-Bio[3], Invertebrate-Bio[3]	*E. coli*	ERA
Long Lake	--	62-0067-01	2B	Mercury-Fish[2]	Mercury	SMA
Co. Ditch 17	Full length	07010206-557	2Bg	Chloride[1], *E. coli*[1], Invertebrate-Bio[3]	*E. coli*, Invert-Bio	ERA
Unnamed Creek	Full length	07010206-902	2Bg	*E. coli*[1]	-	SMA
Unnamed Ditch	Full length	07010206-594	2Bg	Chloride[1], *E. coli*[1], Invertebrate-Bio[3]	*E. coli*, Invert-Bio	ERA
Coon Creek	Full length	07010206-530	2Bg	*E. coli*[1], Fish-Bio[3], Invertebrate-Bio[3], TSS[1]	*E. coli*, FishesBio, Invert-Bio, TSS	ERA, SMA
Sand Creek	Unnamed Creek to Coon Creek	07010206-558	2Bg	*E. coli*[1], Fish-Bio[3], Invertebrate-Bio[3]	*E. coli*, Fish-Bio	SMA
Elm Creek	Full length	07010206-508	2Bg	Chloride[1], DO[3], *E. coli*[1], Fish-Bio[3], Invertebrate-Bio[3], TSS[1]	Cl, DO, *E. coli*, FishesBio, InvertBio, TSS	ERA
Rum River	Mississippi River to Trott Brook	07010207-556, 07010207-666	2Bg	Mercury-Fish[2]	Mercury	ERA
Rum River	Stanchfield Creek to Trott Brook	07010207-502, 07010207-503, 07010207-504	2Bg	Mercury-Fish[2]	Mercury	SMA
Trott Brook	Co. Ditch 51 to Rum River	07010207-680	2Bg	DO[3], Fish-Bio[3], Invertabrate-Bio[3], Sulfate[4]	DO	SMA
Cedar Creek	Full length	07010207-521	2Bg	*E. coli*[1]	*E. coli*	SMA
Seelye Brook	Full length	07010207-528	2Bg	*E. coli*[1]	*E. coli*	SMA
Crow River	South Fork Crow River to Mississippi River	07010204-502	2Bg	Fecal Coliform[1], Mercury-Fish[2], Fish-Bio[3], Invertabrate-Bio[3] Nutrients[1], Turbidity[3]	Fecal Coliform, Mercury, Nutrients, Turbidity	SMA
Unnamed Creek	Co. Ditch 21 to Crow River	07010204-542	2Bg	DO[3], *E. coli*[1], Fish-Bio[3], Invertabrate-Bio[3] Nutrients[3]	DO, *E. coli*, Nutrients	SMA
Sarah Creek	Full length	07010204-628	2Bg	*E. coli*[1]	*E. coli*	SMA

Lake or Stream Name	Reach Description	AUID	Use Classes[5]	Impaired Parameters	Parameters with TMDLs	In ERA or SMA
South Fork Crow River	Buffalo Creek to Crow River	07010205-508	2Bg	Fecal Coliform[1], Mercury-Fish[2], Fish-Bio[3], Invertabrate-Bio[3] Nutrients[1], Turbidity[3]	FishesBio, InvertBio, Nutrients	SMA
North Fork Crow River	Mill Creek to Crow River	07010204-503	2Bg	*E. coli*[1], Fish-Bio[3], Mercury-Fish[2], Invertabrate-Bio[3] Nutrients[3], Turbidity[3]	*E. coli*, Mercury, Nutrients, Turbidity	SMA
Elk River	Orono Lake to Mississippi River	07010203-525	2Bg	Mercury-Fish[2]	Mercury	SMA
Elk River	St. Francis River to Orono Lake	07010203-548	2Bg	*E. coli*[1], Mercury-Fish[2]	Mercury	SMA
Orono Lake	--	71-0013-01	2B	Mercury-Fish[2], Nutrients[3]	Mercury, Nutrients	SMA
Tibbits Brook	Unnamed ditch to Elk River	07010203-736	2Bg	*E. coli*[1]	--	SMA
Elk River	Elk Lake to St. Francis River	07010203-579	2Bg	Fecal Coliform[1], Mercury-Fish[2], Fish-Bio[3]	Fecal Coliform, Mercury	SMA
St. Francis River	Rice Lake to Elk River	07010203-702	2Bg	Fish-Bio[3]	--	SMA
Unnamed Creek	T121 R23W S19 to Mississippi River	07010203-528	2Bg	*E. coli*[1], Fish-Bio[3], Invertabrate-Bio[3]	*E. coli*	SMA
Silver Creek	Locke Lake to Mississippi River	07010203-557	2Bg	*E. coli*[1], Fish-Bio[3], Invertabrate-Bio[3]	*E. coli*	SMA
Locke Lake	--	86-0168-00	2B	Fish-Bio[3], Nutrients[3]	Nutrients	SMA
Clearwater River	Full length	07010203-511	2Bg	DO[3], Fish-Bio[3]	DO	SMA
Mississippi River	Sauk River to Clearwater River	07010203-728	1C, 2Bdg	Mercury-Fish[2]	Mercury	SMA

- 1 Aquatic Recreation Use
- 2 Aquatic Consumption Use
- 3 Aquatic Life Use
- 4 Wild Rice Production
- 5 Refers to the MPCAs beneficial use classes: Class 1 being domestic consumption (drinking water) and Class 2 being aquatic life and recreation (warm and cold water habitats)

Appendix C

Appendix C - Groundwater DWSMAs


Foley
St. Cloud
Cambridge
Mississippi River
Elk River
Rum River
Elk River
Coon Creek
Anoka
Buffalo
Crow River
Minneapolis
St. Paul
Emergency Response Area (ERA)
Spill Management Area (SMA)
Drinking Water Supply Management Area (DWSMA-SW)
Groundwater DWSMA
State Boundary
County Boundaries
Local Government Boundaries
N
0 2 4 8 12 Miles
DRAFT City of Minneapolis Groundwater DWSMAs
DEPARTMENT OF HEALTH