PROTECTING SOURCE WATER AREAS

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Draft Research Paper - January 17, 2023

Table of contents

Table of figures

Table of tables

Acronyms and abbreviations

- BWSR – Minnesota Board of Water and Soil Resources
- CAP – Metropolitan Council's Climate Action Plan
- DNR – Minnesota Department of Natural Resources
- DWSMA – Drinking Water Supply Management Area
- EI – Environmental Initiative
- EPA – Environmental Protection Agency
- LWSP – Local Water Supply Plan
- MDA – Minnesota Department of Agriculture
- MDH – Minnesota Department of Health
- MGD – Million Gallons per Day
- MPCA – Minnesota Pollution Control Agency
- MWSP – Metropolitan Council's Master Water Supply Plan
- NDMA – N-nitroso-dimethylamine
- NPR – National Public Radio
- RDG – Metropolitan Council's Regional Development Guide
- SSTS - Subsurface Sewage Treatment Systems
- SWPA – Source Water Protection Area
- TCMA – Twin Cities Metropolitan Area
- UMN – University of Minnesota
- UMRSWPP – Upper Mississippi River Source Water Protection Project
- WHO – World Health Organization
- WHPA – Wellhead Protection Area
- WHPP – Wellhead Protection Plan
- WRPP – Metropolitan Council's Water Resources Policy Plan

Policy research approach

The Metropolitan Council (Met Council) is charged by state statute to develop plans for the growth and economic development of the seven-county Twin Cities metropolitan region (metro region). Publications like the metropolitan development guide (***Thrive MSP 2040***) and associated system plans, including the ***Water Resources Policy Plan***, are the primary vehicle for us to share our vision and goals for the region. They are updated every ten years but have a twenty five-year planning horizon to allow for long-term development of the region. Each iteration of regional planning builds upon the previous effort, while adjusting our actions, policies, and vision to address current issues, mitigate future risks, and optimize regional opportunities.

The 2050 Water Resources Policy Plan, like the 2040 plan before it, will be an integrated plan that supports our core mission to operate and manage the regional wastewater system, provide water supply planning, and provide surface water planning and management throughout the region. It will serve as our guide to address issues affecting our waters, and to protect these resources for future generations.

This research paper is part of a series investigating current and future water concerns for the metro region. Together, these papers will inform our 2050 Water Resources Policy Plan. The paper topics are:

- Protecting source water areas
- Rural water concerns
- Water and climate
- Water availability, access, and use
- Water reuse
- Water quality
- Wastewater concerns

The project intent is to share our current understanding of issues, identify current policy connections or gaps, and to propose future policies and strategies to ensure sustainable water resources. Not all the recommendations included in the papers will move forward for inclusion into the Water Resources Policy Plan, and conversely, the Water Resources Policy Plan may include policies not discussed in these papers. The intent is to begin to develop a shared understanding and conversation about topics that are connected to all aspects of our core services.

Research paper topics were investigated using three core principles:

1. **One Water, integrated water management:** The metro region is water-rich, and that water holds immense value. Integrated water management, also known as "One Water", addresses water as it moves from water supply, through wastewater systems and into surface waters. The ultimate goal of integrated water management is sustainable, high-quality water in the region.
2. **Utilize existing systems:** The metro region has a robust water planning and wastewater operations system with many actors – community water and wastewater utilities, watershed management organizations, and regional, county, state, and federal agencies. Coordination and collaboration between these groups is necessary to protect our water for future generations.
3. **Metric-based policies:** It is hard to quantify policy success without accountability. We will provide policy options with associated metrics and measurable outcomes where possible, to demonstrate the effectiveness of our water policies and actions.

Introduction

This research paper informs readers about the benefits and complex challenges of protecting the areas that are important sources of water supply across the region. While the paper focuses on our perspective in Environmental Services (with input from partners), it also includes information about other facets of the Met Council's work. It is meant to help readers understand the issue and the range of possible approaches to address it. With this information, policymakers and planners can make more informed decisions.

'Source water' refers to the origin (or source) of water from streams, rivers, lakes, or underground aquifers that provides drinking water to public water supplies and private wells. **Figure 1** and **Figure 2** illustrate these sources of drinking water for the various communities in the metro.

Over half of Minnesota's population lives in the metro region. A safe supply of water is critical to meeting the needs of the region and protecting public health and the environment.

Source water protection is a community effort to prevent water pollution before it can reach our drinking water and become a public health and economic problem.

Considering source water protection in its full context, **Figure 3**, highlights how source water protection may be impacted by climate change and how land use planning and best practices that protect water quality can have downstream benefits for wastewater treatment and other water users.

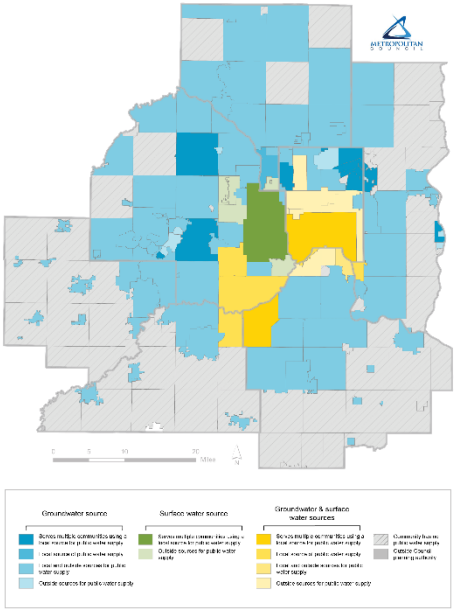


Figure 1: Sources of water for communities in the metro region
For larger image, see Appendix A.

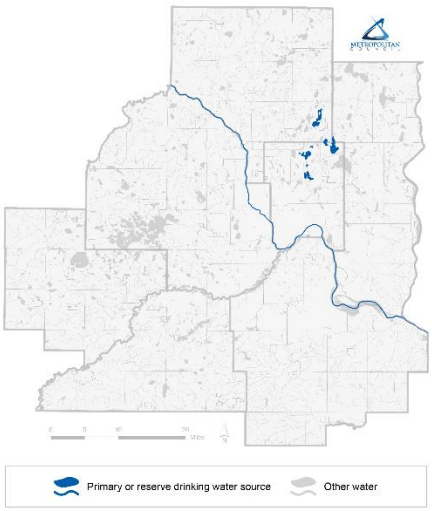


Figure 2: Surface waters that are primary sources for drinking water in the metro region.
For larger image, see Appendix A.

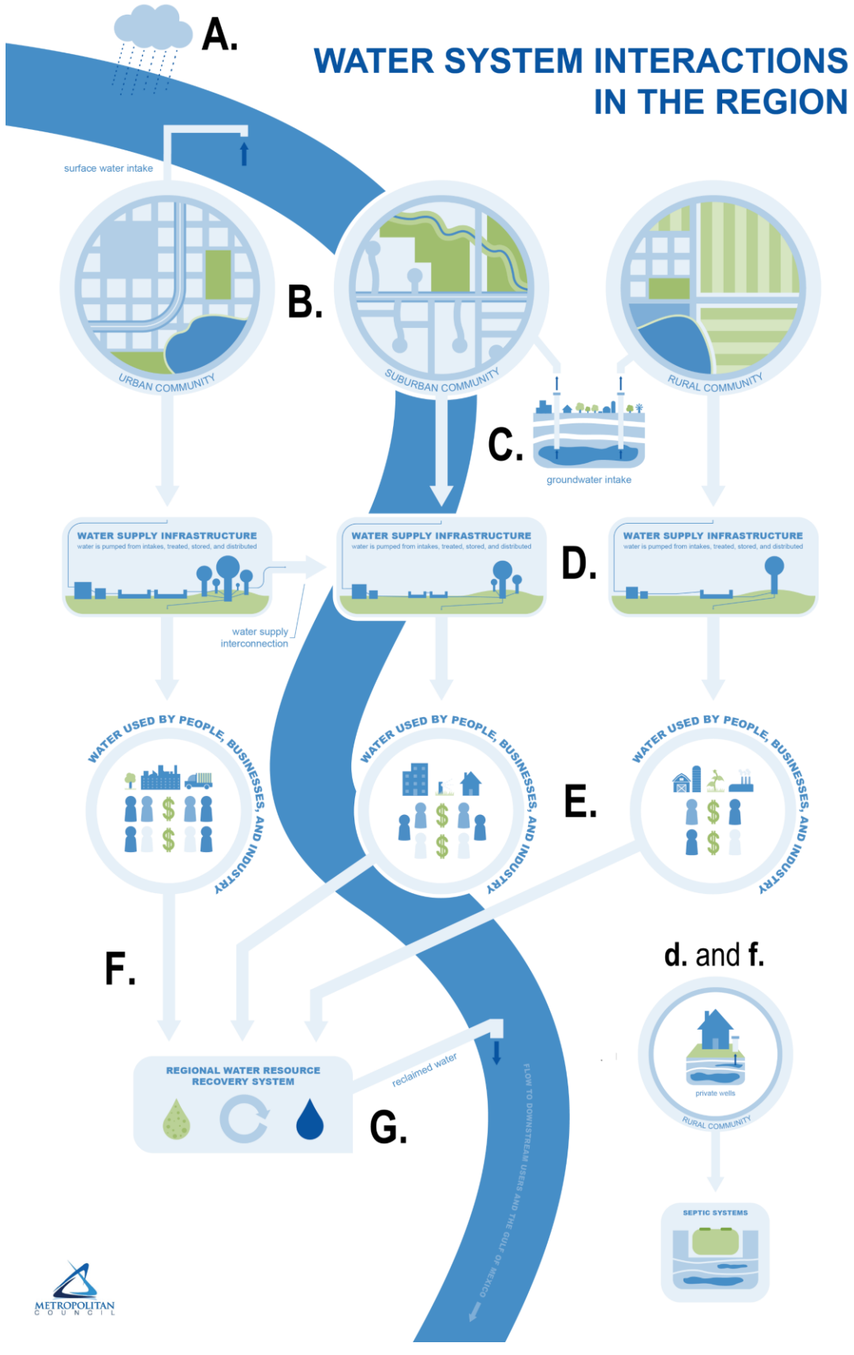


Figure 3. Key components and connections in the region's water supply network

The impact of source water protection is best understood in the context of the broader water supply context. This infographic illustrates key components of the region's complete water supply network. Its purpose is to set the stage for conversations about water supply policy and planning so that the Met Council and our partners keep in mind our region's broader water system interactions whenever we focus on just part of the network.

A. The ultimate source of water for the region is precipitation – rain and snow, which varies from season to season and year to year.

B. To reach our surface water intakes and wells, rain and snowmelt move across the natural and manmade landscape to surface waters or infiltrate down below plants' roots through the soils and rock units below.

C. The environment and landscape in the places we pump water from (surface waters and aquifers) affect the amount and quality of those water supply sources. In our region, we have a range of urban, suburban, and rural communities – all with different surface water resources, soils, and land use patterns.

D. Private wells serve parts of many communities, but local water supply infrastructure serves the bulk of the region and includes surface water intakes, wells, and any interconnections with neighbors; treatment; storage; and distribution pipes that provide safe water. Private homes and businesses may use private wells or connect to a community water supply system. Private well and septic system infrastructure processes are designed to meet well code and local ordinances.

E. It is the people and businesses in our communities who pay to use the water supply infrastructure, with help as needed by state and federal funding through programs like the Minnesota Drinking Water and Clean Water Revolving Funds. People and businesses use water for a wide range of purposes; lean water is critical for everyone to function. The same people and businesses also pay to dispose of the water once it has been used. If improvements are needed – to increase water treatment, for example – they also bear this cost.

F. Local wastewater infrastructure collects used water and conveys it to a regional system. Private homes and businesses may use private septic or connect to a community wastewater system. Private well and septic system infrastructure processes are designed to meet well code and local ordinances.

G. At regional treatment plants, water is treated to meet state and federal water quality standards. The treated effluent is discharged back into the environment, sometimes cleaner than the water it is being put back into. From there, water generally flows downstream to other users and eventually to the Gulf of Mexico.

Source water protection work focuses primarily on the landscape that water moves across and the places we pump water from (B and C). It is impacted by the climate and the actions of landowners and property managers. The effectiveness of source water protection work has downstream implications for public water supply systems and rate payers, private well owners, and wastewater treatment.

Source water protection areas for public water supplies

Water supply planners and public water suppliers focus activities in areas most important to drinking water sources: Drinking Water Supply Management Areas (DWSMAs).

Over 100 metro communities, working with the Minnesota Department of Health (MDH), have defined DWSMAs to help protect their water supplies. Together, these areas cover about a third of the metro region. Local implementation plans to protect these areas have been adopted. Information can be found on a specific community's plan in the Minnesota Department of Health's online database (MDH, 2022a).

The four largest DWSMAs for groundwater in the state are located in the metro region in Hastings, Saint Paul, Bloomington and Eden Prairie (MDH, 2019).

Priorities for source water protection implementation are strongly informed by how vulnerable the DWSMAs is determined to be, as illustrated in **Figure 4**.

In areas that supply water to multiple communities, such as the southern part of Hennepin County and northern Ramsey County, it is important to have a shared understanding about DWSMA vulnerability. These areas may also benefit from resources for multi-community source water planning and implementation.

The Met Council has two opportunities to protect our region's water source water. First, we can directly act to protect sources of water where we own and manage land. For example, **Figure 5** and **Figure 6** illustrate Met Council owned properties and regional parks in relation to designated source water protection areas. Met Council can also work to protect source water on a larger scale through our planning and policy work.

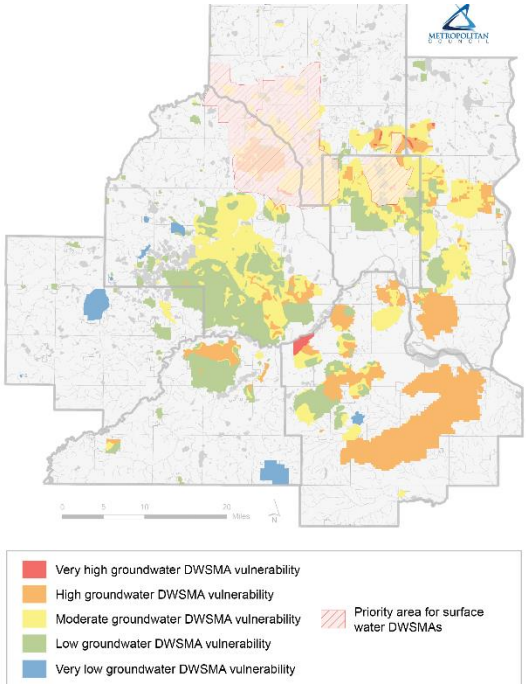


Figure 4: Metro region DWSMAs and their vulnerability
(MDH, 2019), *For larger image, see Appendix A.*

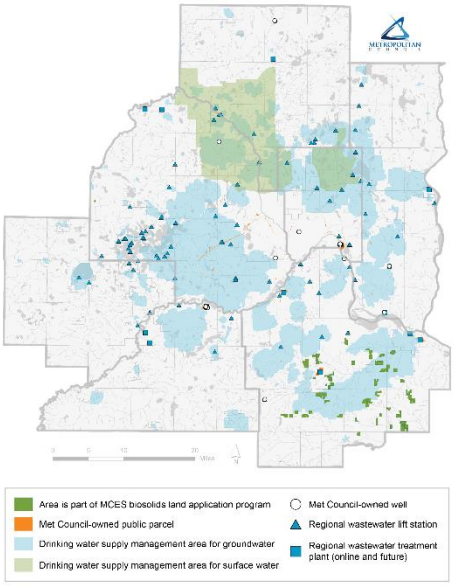


Figure 5: Met Council properties in relation to DWSMAs
(MDH, 2019), *For larger image, see Appendix A.*

Planning efforts that support the protection and assessment of source water areas

Local comprehensive plans

Local comprehensive plans identify long-range (25-30 year) planned land use, growth forecasts, and related infrastructure plans. These factors all contribute to challenges and opportunities to protect source water areas. The 30-year planning horizon and content in local comprehensive plans have the potential to strongly influence source water protection planning.

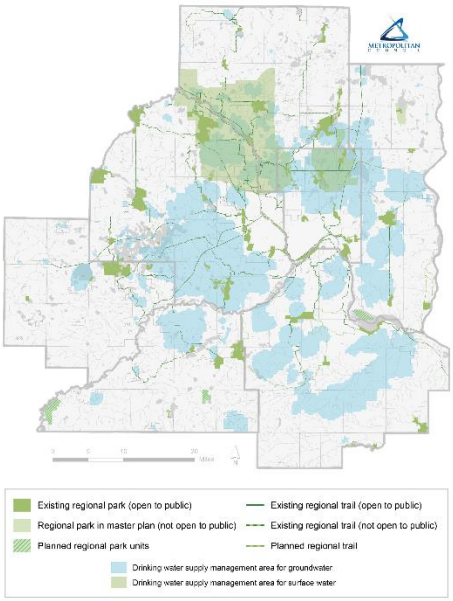


Figure 6: Met Council regional parks in relation to DWSMAs
(MDH, 2019), *For larger image, see Appendix A*

Local source water protection (wellhead) plans

Source water protection and wellhead protection plans cover a shorter planning period compared to the local comprehensive plans – only 10 years versus 30 years. Some of the information they are required to include, like land use, may be redundant with the local comprehensive plan. Possible redundancies include:

- Data elements and assessment of their implications for the use of well(s), delineation criteria, the quality and quantity of water supplying the well(s), and the land and groundwater uses in the drinking water supply management area.
- Delineation of the Wellhead Protection and Drinking Water Supply Management Areas
- Vulnerability assessment
- Impact of changes on public water supply well(s) during the next 10 years resulting from change in the physical environment, land use, surface water and groundwater
- Issues, problems, and opportunities related to water use and land use
- Wellhead protection goals for present and future water use and land use
- Objectives and a plan of action, including actions that require the cooperation of a local unit of government or state and federal agency beyond the public water supplier alone
- Evaluation program
- Alternate water supply or contingency strategy

The schedule to create and update source water protection plans is not consistent with the local comprehensive plan update schedule – source water protection plan updates are staggered and heavily influenced by the installation of new wells or intakes. The schedule to update source water protection plans are also not consistent with neighbors. For example, plan updates are not required when a neighboring plan with an overlapping Drinking Water Supply Area is

updated. The schedule to update each community's source water protection plan is on the ***MDH Source Water Assessments*** website (MDH, 2022a).

Wellhead protection plans are required for public water suppliers using groundwater sources. Protection plans for surface water supplies are recommended but not required. Minneapolis and St. Paul have partnered with St. Cloud to develop a shared protection plan for intakes on the Mississippi River. These plans identify vulnerable drinking water supply management areas, potential contaminant sources in those areas, and an implementation plan and budget.

Until 2007, wellhead protection plans were required to be included in, and consistent with, metro region communities' local comprehensive plans (***Minnesota Statutes § 473.859, Subd. 3 (4) (vii) (2006)***). Today, these wellhead protection plans are no longer required to be connected to local comprehensive plans, weakening the link between local land use decisions and water supply protection.

Local water supply plans

Local water supply plans, required and approved by the Minnesota Department of Natural Resources (DNR), also have the potential to be closely linked to source water protection planning. Like source water (wellhead) protection plans, local water supply plans cover a 10-year planning horizon. While the schedules to update these plans are not currently aligned, there is notable overlap in the required content of both local comprehensive plans and source water protection plans. Local water supply plans must include content as described in Minnesota Statutes § 103G.291, subdivision 3, including:

- Projected water demand
- Adequacy of the water supply system and planned improvements
- Existing and future water sources
- Natural resource impacts or limitations
- Emergency preparedness
- Water conservation/supply and demand reduction measures
- Allocation priorities

The scope of this challenge is big

A third of the metro region has been designated as a priority for source water management by over 100 metro region communities, with guidance and approval from the Minnesota Department of Health. This includes Priority A Area DWSMAs for surface water sources (where contaminants could present an immediate health concerns) and DWSMAs for groundwater sources. Several of these areas overlap one another -as illustrated in **Figure 7** (MDH, 2019).

Around three million people, over half of Minnesota's population, are supplied by water flowing through these areas. In addition, roughly 200,000 people source their water from private wells in areas that have not been designated for protection.

The metro region residents get their drinking water from a mix of extensive, complex underground aquifers and surface waters whose sources often lay in their community or at the region's borders.

The array of risks facing drinking water sources means many players can contribute to a problem and solutions must involve multiple stakeholders. Problems affecting drinking water sources can take communities many years to fix.

Protecting our source waters depends on:

- Environmental conditions like climate, ecology, and geology
- Community support for effective management decisions, policies, and actions, such as development practices, land use policy, and surface water protection
- Collaboration across overlapping Drinking Water Supply Management Areas

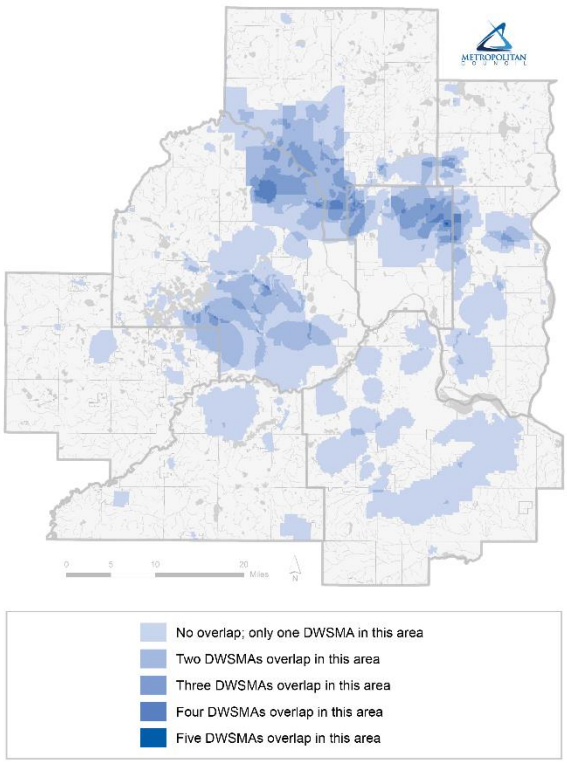


Figure 7: Source water protection areas in the metro region, highlighting overlaps (MDH, 2019), *For larger image, see Appendix A*

Environmental conditions determine the vulnerability of source water areas by affecting where and how quickly contaminants flow. The environment (like geologic formations) can also be a source of naturally occurring radium, arsenic, manganese and other potential contaminants which pose risks to water supplies.

Community development decisions around land use changes, commercial and industrial practices, water use in our homes and businesses, and turf and landscape management can also pose potential threats. Actions that generate chemical threats and pathogens are of particular concern. Where aquifers, lakes, and rivers are polluted, water resources become limited in their safe use, requiring extra expense to access, treat, and manage so that the water can be safely used or consumed.

Water utilities documented their common source water protection challenges in a recent American Water Works publication (American Water Works Association, 2018). Common challenges include:

- Resource limitations
- Making a compelling case
- Lack of jurisdiction
- Inability to reach common agreement
- Lack of knowledge

- Competing and complex economic, environmental and community priorities
- Limited cross-sector engagement
- Lack of willing leaders and champions

Collaboration across borders is important since source water areas extend beyond, or overlap, residential boundaries. Current source water protection efforts are mostly done independently by each community and can be inconsistent, sometime redundant, and not as effective as they should be.

Issue statement

We work to ensure safe, sustainable, and sufficient drinking water for the region by partnering with public water suppliers, land use planners and developers, watershed management organizations, business owners/managers, residents, and others. The goal is to improve understanding and collaboration in order to protect the land areas that serve as the sources for our region's water supply. This work is particularly important where source water protection areas extend beyond any one jurisdiction's boundaries. Adequate and proactive protection will prevent threats to water supplies from becoming a public health problem.

Our role

The Met Council was created in 1967 as "a regional solution for regional problems."

Our role related to source water protection is shaped by our role as the regional policymaking body, planning agency, and provider of essential services in the seven-county Twin Cities metro region, as well as by federal and state source water protection requirements led primarily by the Minnesota Department of Health.

As the regional wastewater system operator and wastewater, surface water, and water supply planning agency, we strive to ensure sustainable water resources through intentional planning and operations. Our wastewater treatment plants consistently meet National Pollutant Discharge Elimination System (NPDES) permit requirements. Our wastewater, surface water and water supply planning functions work to promote sustainable water resources while addressing pollution and other factors that impact those resources. Clean water for drinking, recreating, and treated by our wastewater treatment plants are all important parts of the region's livability and prosperity. We work with our partners, our regional influence, and perform our statutory responsibilities to protect and preserve our water.

While we are responsible for essential regional services such as regional water supply planning and wastewater treatment, local governments focus on planning for their communities, including source water protection planning. Together, we work as a team to ensure clean water for future generations.

This paper recognizes that we as the Met Council play several distinct roles that relate to source water protection:

- We partner,
- We plan for the long-term and set a regional vision,
- We provide regional investments and system operation, including facilities management,

- We provide technical assistance through convening, training, guidance, regulations and incentives, and
- We provide research and assessment.

The Met Council has multiple divisions, and while this paper's main focus is the work and scope of the Environmental Services division, there are other statutory responsibilities of the organization that relate to source water protection.

Water planning

We have three primary water planning focuses supported by state and federal statutes.

- **Wastewater:** We prepare a comprehensive development guide consisting of policy statements, goals, standards, programs, and maps prescribing guides for the orderly and economical development of the region. The regional wastewater collection and treatment system one of the four regional systems included in this effort (see Minn. Stat. § 473.145).
- **Water Resources Management:** State and federal law requires us to adopt a water resources plan and federal requirements for a regional management plan to address pollution from point sources, such as treatment plant discharges, and nonpoint sources, such as stormwater runoff (Minn. Stat. § 473.157; 33 U.S.C. §1288).
- **Water Supply Planning:** We are required to create plans to address regional water supply needs, including the regional Master Water Supply Plan, developing and maintaining technical information related to water supply issues and concerns, providing assistance to communities in the development of their local water supply plans, and identifying approaches for emerging water supply issues (Minn. Stat. § 473.1565).

As a part of our statutory authority, we are required to review and comment on Local Comprehensive Sewer, Local Surface Water Management, and Local Water Supply Plans (as described in Minn. Stat. § 103G.291, subd. 3) to ensure that they are in conformance and compliance with the regional plans.

The following additional statutory authority related to water is also highlighted as it pertains to the topic of source water protection:

- **Total watershed management:** The Total Watershed Management statute (Minn. Stat. § 473.505) allows the Met Council to enter into agreements with other governmental bodies and agencies to identify and quantify at a watershed level means to achieve the best water quality at the lowest total costs for the region. Applied to source water protection, this statute gives the Met Council authority to determine the most cost-effective methods to address drinking water pollutants generated by its regional system operations and work with others in the region to address source water protection. This could include identifying and quantifying enhanced watershed management approaches to protect some of the region's primary water supply source areas.
- **Sewage sludge disposal:** The Sewage Sludge Disposal statute (Minn. Stat. § 473.516, subd. 4) directs the Met Council when practical to minimize elements that are not essential for plant growth when sludge is disposed of on private property as a soil conditioner or amendment. This may be particularly relevant and important in designated source water protection areas.

- **Urban research:** The Urban Research statute allows the Met Council to complete feasibility studies or demonstration projects related to water supply, surface water drainage, and other subjects of concern to the peoples of the metropolitan area (Minn. Stat. § 473.242).

Framework for comprehensive regional planning

We also have a range of comprehensive planning responsibilities designated by state and federal statute.

- **Long-range comprehensive development guide policy plans:** The statutory requirement to create long-range plans (Minn. Stat. § 473.145) allows us to address source water protection as it relates to both the physical (public health) and the economic (water treatment and pollution mitigation) needs of the metro region and thus presents a statutory driver for Met Council involvement. Further, addressing source water protection has the potential to impact design and operation of wastewater services and water utilities in the region, which are needed to support planned growth and development. Understanding and incorporating source water protection considerations is critical to guiding and planning for growth and development in the region with our local government partners.
- **Land use planning:** Multiple sections of Minnesota statutes (Minn. Stat. § 462.355, Minn. Stat. § 473.175, and Minn. Stat. § 473.851 to 473.871) grant the Met Council power to work with local governmental units to ensure land uses protect the health, safety, and welfare of residents and to ensure coordinately, orderly, and economic development. This planning includes water resource and water supply elements.[1]
- **Local planning assistance:** Regarding water resources specifically, "The Metropolitan Council may provide technical assistance to cities, counties, and towns to expedite adoption and enforcement of local ordinances under sections 103F.121, 103F.201 to 103F.221, and 473.206 to 473.208" (Minn. Stat. § 473.191, Subd. 2). This authority may be particularly relevant to assist in the creation of local controls (ordinances, codes, and other regulations) that protect surface water supply sources or surface waters connected to underlying groundwater supplies.

The metro region has several levels of water governance with municipal, county, watershed, regional, state, and federal agencies all having a role. Cross-agency coordination and partnerships are key to successfully managing the region's waters which do not always align with jurisdictional boundaries (**Figure 8**).

These partnerships broaden our ability to achieve regional water goals. For example, we support collaborative water supply planning and implementation in partnership with researchers and communities by:

- Monitoring regional river, lake, and stream water quality.
- Assessing surface water and groundwater conditions using data collected.

[1] Note: Until 2007, Minn. Stat. § 473.859, which defines the required content of local comprehensive plans, required the inclusion of both the local water supply plan *and* the wellhead protection plan as part of the public facilities plan (Subd. 3). A wellhead protection plan is no longer required to be included in the comprehensive plan.

- Providing technical guidance on surface water management and drinking water protection through research, advisory committees, plan reviews, and other activities to cities, townships, counties and watershed organizations.
- Assisting communities through grants to implement water efficiency, stormwater, and inflow and infiltration (I/I) programs.

Every day, we work with our partners to make planning and system operation decisions that affect the region's future drinking water supply.

We as an organization can better integrate source water protection actions into our regular duties, from visioning, to planning, to funding, in order to provide sustainable sources of drinking water for the region.

The current update of regional policies, plans, and related implementation programs is a critical opportunity for improvement. New resources exist to help us better integrate source water protecting into regional policy and planning. For example, the *Source Water Collaborative Guide for Land Use Planning* provides options for the Met Council to consider including in updated policies and plans (Sourcewater Collaborative, 2017).

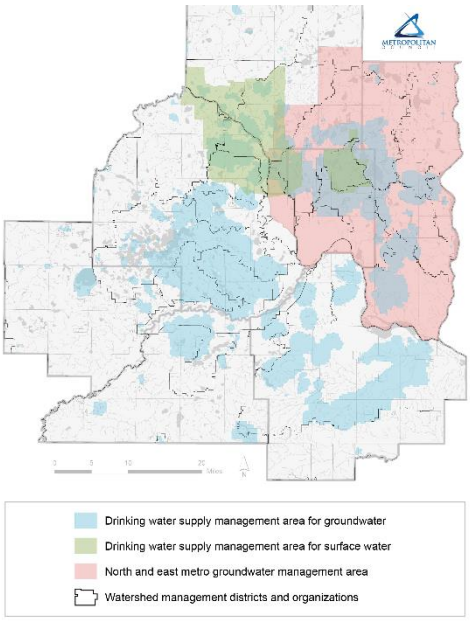


Figure 8: Overlapping management jurisdictions versus source water protection areas (MDH, 2019; DNR, 2017), *For larger image, see Appendix A.*

Integrated water planning recommendations

Establish a clear policy for long-range integrated water planning to better address the root causes of events that threaten water supply sources. This should incorporate the watershed approach and connect it to water management throughout all our water planning efforts (groundwater, surface water, wastewater). It should include support for long-term source water management.

Proposed supporting actions to protect source water areas include:

- The Metropolitan Council will promote integration across watershed, water supply, and wastewater planning.

- The Metropolitan Council will support local planning efforts to increase source water protection activities.

Crucial concerns

To improve our regional source water protection, we need to highlight the challenges we face in the process. In this section, we explore the primary drivers that influence source water related hazards and risks.

With those drivers in mind, along with the need to protect the land areas that are the sources for region's water supply, we need to highlight areas to focus policy and planning work (our crucial concerns). These form the basis of our policy recommendations.

Primary drivers

To better understand source water related hazards and the risks they pose, it is important to consider the key components of the region's complete water supply network (**Figure 3**). The Minnesota Department of Health also offers guidance (MDH, 2021a).

With that framework and guidance in mind, along with the Council's role, primary drivers to consider include for regional policy development include climate (current and future), hydrogeologic sensitivity to pollution, land use (current and future), and federal and state programs.

Current and future climate

The ultimate source of water for the region is precipitation, which varies from season to season and year to year. Minnesota is known for its extreme seasonal differences, and climate change may cause the amount of precipitation (both rain and snow) to change and seasonal patterns to shift even more.

Climate change impacts include acute and chronic changes to weather events and patterns, which create water challenges that impact the resources we rely on for drinking, economic productivity, and recreation. These impacts influence the length of the growing season, which can impact the amount of water that infiltrates below the root zone to recharge aquifers below. **Figure 9** illustrates model-predicted changes in infiltration due to potential changes in precipitation and growing season length.

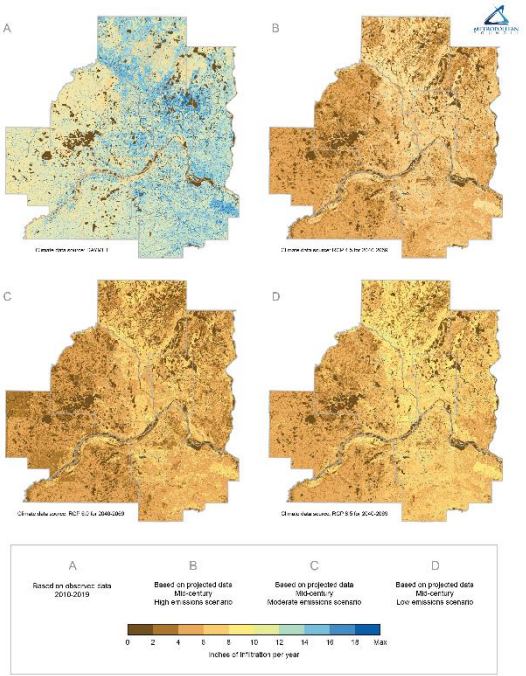


Figure 9: Model prediction of reduced infiltration due to climate change
For larger image, see Appendix A.

In addition to affecting runoff and recharge, changing precipitation can also affect the types of contaminants that are mobilized. For example, floods may increase sediment and nitrate loads or sewage overflows (MDH, 2022a).

These changes also impact our wastewater and local water supply utilities that provide essential public health services to the region. Climate change poses a threat to infrastructure, service delivery, and the regulatory environment; increasing costs for service providers and those that they serve.

Examples of planning efforts that may incorporate climate change impacts on protecting source water areas:

- The Met Council recently adopted a Climate Action Work Plan (Metropolitan Council Meeting, December 14, 2022). The work plan describes the Met Council's role in addressing climate change and meeting the goals of the governor's Minnesota Climate Action Framework.
- A pilot program started by the Minnesota Environmental Quality Board (EQB) in 2022 will evaluate the inclusion of climate change information in environmental review throughout Minnesota. To do this, EQB facilitated the development of a draft revised environmental assessment worksheet (EAW) form that includes climate information along with the existing content like source water and groundwater protection.

For a more in-depth exploration of climate change, see the Environmental Services' research paper 'Water and Climate Change: Impacts on Water and Water Utilities in the Twin Cities Metropolitan Area'. The paper details the effects of climate change on our region.

Sensitivity of near-surface sediments and bedrock to potential contamination

To reach our surface water intakes and wells, rain and snowmelt move across the landscape to surface waters or infiltrate down below plant roots through the soils and rock below.

In some parts of the region, stormwater runoff may flow into and recharge groundwater more easily than other parts depending on the texture of near-surface sediments like sand, silt, or clay (DNR, 2018). This is illustrated by **Figure 10.** When this water picks up contaminants, pollutants are carried along into those water sources.

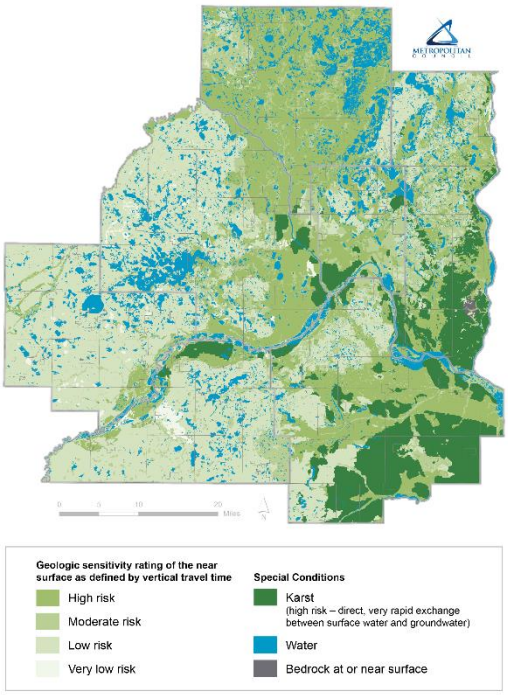


Figure 10: Pollution sensitivity of near-surface materials in the metro region (DNR 2018), *For larger image, see Appendix A.*

The pollution sensitivity of near-surface materials is one factor that the MDH uses to determine the vulnerability of drinking water supply management areas. Well construction, maintenance, and use; and groundwater chemistry and isotopic composition also provide important information about how vulnerable deeper groundwater sources are to contamination (MDH, 2021b).

Relatively high sensitivity does not mean that water quality has been or will be degraded. If there are no contaminant sources, pollution will not occur. Low sensitivity does not guarantee protection. For example, leakage from an unsealed well may allow the contaminant to bypass the natural protection and degrade the groundwater.

To protect source waters, land use decisions (including best management practices to mitigate risks) should be shaped by considerations such as the sensitivity of surficial sediment to potential contamination.

Land cover and land use

The environment and landscape near surface waters and aquifers affect the amount and quality of our water supply sources.

In our region, we have a range of urban, suburban, and rural communities – all with different surface water resources, soils, and land use patterns.

Current (2020) land use varies across the 550,000 acres that have been designated as groundwater DWSMAs and/or Priority 'A' Areas of surface water DWSMAs. The top five largest land uses in metro DWSMAs are single family detached (33%); agricultural (15%); undeveloped (12%); parks, recreational, or preserve (12%); and open water (7%) (**Figure 11**).

Land use affects the types and number of potential contaminants, and land use change creates opportunities to increase or decrease potential contaminant sources. This is particularly important in known vulnerable Drinking Water Supply Management Areas and areas that are sensitive to potential contamination.

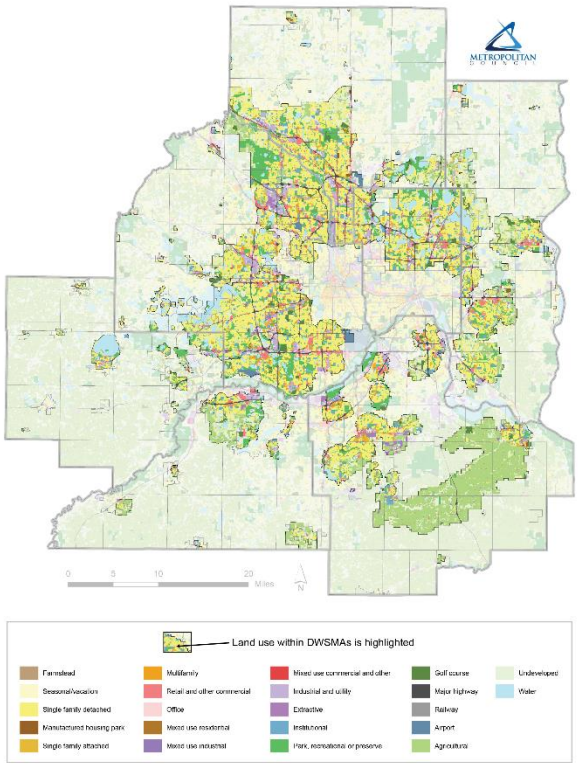


Figure 11: Generalized 2020 land use in the metro region drinking water supply management areas.
For larger image, see Appendix A.

Many of the potential contaminants associated with land use are documented in the Minnesota Pollution Control Agency's What's in My Neighborhood tool (MPCA, 2022a). MPCA also documents known contamination plumes in the Minnesota Groundwater Contamination Atlas (MPCA, 2022b).

Areas where groundwater contamination has, or may, result in risks to the public health, a Special Well and Boring Construction Area may be designated by the Minnesota Department of Health (MDH, 2021b).

The purpose of documenting potential and existing contaminants and defining management areas is to inform the public of potential health risks in areas of groundwater contamination, provide for the construction of safe water supplies, and prevent the spread of contamination due to the improper drilling of wells or borings.

Potential contaminants associated with the most common land use in metro DWSMAS are summarized in **Table 1**. **Figures 12a-h** illustrate a more detailed comparison of information from MPCA's What's in My Neighborhood database versus the Met Council's 2020 generalized land use information.

Much of the land within drinking water supply management areas is owned privately.

While public water suppliers and the Minnesota Department of Health are responsible for providing safe drinking water, they do not have the authority or capacity to protect drinking water sources on their own. They work with local decision-makers, other state agencies, and partner organizations like the Met Council to plan and implement activities that protect drinking water sources.

Assessing regional water resources policy recommendations

Consider establishing a more focused and integrated policy to shape our work to assess regional water resources (groundwater, surface water and wastewater). This should include source water areas. The region has additional assessment needs that are discussed in other research papers.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will support research and partnerships when assessing regional water resources, including assessment of source water areas.
- The Metropolitan Council will support efforts that investigate water supply approaches to increase water conservation, enhance groundwater recharge, and most effectively use all our water resources.
- The Metropolitan Council will analyze the impact of land practices on water quality and the vulnerability of source water areas and water supplies.

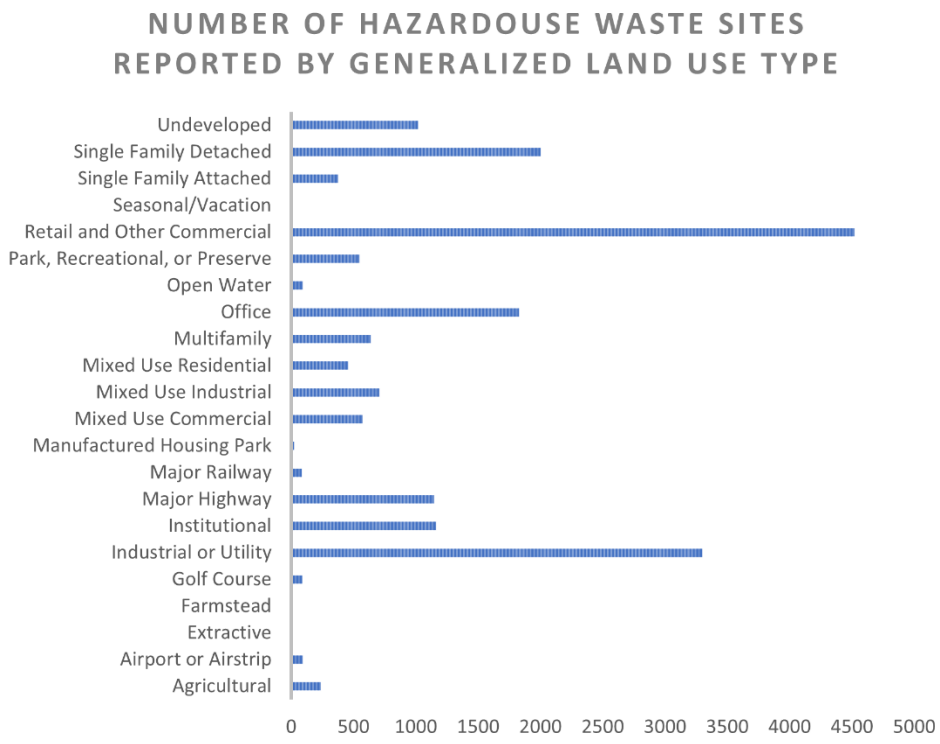


Figure 12a: Number of potential contaminant records by land use type in the metro region (MPCA, 2022a). *For graphs 12b-h, see Appendix A.*

Table 1: Potential contaminants associated with different land use types
Includes the number of records in the 'What's in my Neighborhood' application and the acres of each land use type within DWSMAs in the seven-county Twin Cities metro region (MDH, 2018a; MPCA, 2019).

Land use type	Associated potential contaminants	Metro-wide # of selected 'What's in My Neighborhood' sites	Acres in DWSMAs
Single family detached – Includes areas with a mixture of constructed materials and vegetation. These areas most commonly include single-family housing units.	Wells; Septic systems; Turf management; Chemical application and storage; Storm water basins, drains, and infiltration practices; Storm water runoff; Above ground storage tanks (AST); Class V wells; Transportation corridor	2,002 hazardous waste-related records 202 AST and underground storage tanks (UST) records 92 Feedlot records	180,782 (33% of DWSMAs)
Agricultural – Areas used for the production of annual crops such as corn, soybeans, and perennial woody crops such as orchards and vineyards. This class also includes all actively tilled land.	Land application (bio solids, septage, pesticides); Nutrient application and management (commercial fertilizer, animal waste); Feedlots; Storage and preparation area (tanks, ag chemicals, petroleum products)	237 hazardous waste-related records 92 AST and UST records 643 Feedlot records	75,513 (14% of DWSMAs)
Undeveloped – Includes barren land or unprotected wetlands	Wells; storm water runoff; Road or rail crossing over water;	1,018 hazardous waste-related records 208 AST and UST records 132 Feedlot records	67,153 (12% of DWSMAs)
Park, recreational, or preserve - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. These areas most commonly include large-lot housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	Wells; Septic systems; Turf Management; Chemical application and storage	549 hazardous waste-related records 192 AST and UST records 31 Feedlot records	64,245 (12% of DWSMAs)

Open water - All areas of open water, generally with less than 25% cover of vegetation or soil.	Storm water runoff; Road or rail crossing over water	93 hazardous waste-related records 50 AST and UST records 7 Feedlot records	38,833 (7% of DWSMAs)
Institutional - Includes areas with a mixture of constructed materials and vegetation.	Wells; Septic systems; Turf management; Chemical application and storage; Storm water basins, drains, and infiltration practices; Storm water runoff; Above ground storage tanks; Class V wells; Transportation Corridor	1,162 hazardous waste-related records 522 AST and UST records 7 Feedlot records	19,853 (4% of DWSMAs)
Industrial or utility - Includes highly developed areas used for commercial/industrial purposes. In some areas, may include some limited residential use. Examples: manufacturing, warehouses, construction companies, transportation, and landfills.	Wells; Septic systems; Turf management; Chemical application and storage; Storm water basins, drains, outlets, and infiltration practices; Storm water runoff; Above ground storage tanks; Underground storage tanks; Leaking underground storage tanks; Class V wells; Transportation corridor; Road and rail crossings (spills over water); Solid waste management site; Pipeline; Gravel pit; Suspected contaminant of concern; Hazardous waste handler and/or generator	3,300 hazardous waste-related records 391 AST and UST records 6 Feedlot records	18,511 (3% of DWSMAs)
Single family attached – Includes areas with a mixture of constructed materials and vegetation. These areas most commonly include housing like townhouses	Wells; Septic systems; Turf management; Chemical application and storage; Storm water basins, drains, and infiltration practices; Storm water runoff; Above ground storage tanks; Class V wells; Transportation Corridor	337 hazardous waste-related records 117 AST and UST records 2 feedlot records	17,662 (3% of DWSMAs)
Retail and other commercial - Includes highly developed areas where people reside or work in high numbers. Examples include stores, restaurants, hotels, and stadiums.	Wells; Septic systems; Turf management; Chemical application and storage; Storm water basins, drains, outlets, and infiltration practices; Storm water runoff; Above ground storage tanks; Underground storage tanks; Leaking underground storage tanks	4,521 hazardous waste-related records 574 AST and UST records 10 Feedlot records	16,938 (3% of DWSMAs)
All other land uses	Mix	-	(9% of DWSMAs)

Some landscape features, while not contaminants themselves, may create pathways for contaminants to enter water supply sources more quickly (**Figure 13**). These features include:

- Wells
- Aggregate and other mining
- Stormwater basins, drains and infiltration practices
- Transportation corridors, including road and rail crossings over water

As the region grows, land use is expected to change. This will result in corresponding changes to potential contaminants. Our future may unfold in a variety of ways we can not necessarily predict.[2] We cannot predict how exactly growth will play out, but we can prepare for different growth scenarios and consider robust policies that will be effective for the most scenarios.

We can prepare to protect source waters for a range of possible futures by taking time now to consider the potential land use changes and what they might mean for source water protection areas. Another action we can take to prepare is to test current and proposed policies and strategies applicable under that range of conditions.

Land use planning is logically tied to protecting source water areas. Resources like the ***Source Water Collaborative's Guide for Land Use Planning*** summarize options that regional and local entities can use to protect drinking water through their land use authority (Sourcewater Collaborative, 2017). Examples of local, regional, and statewide planning efforts that could be leveraged to better protect source water through land use include:

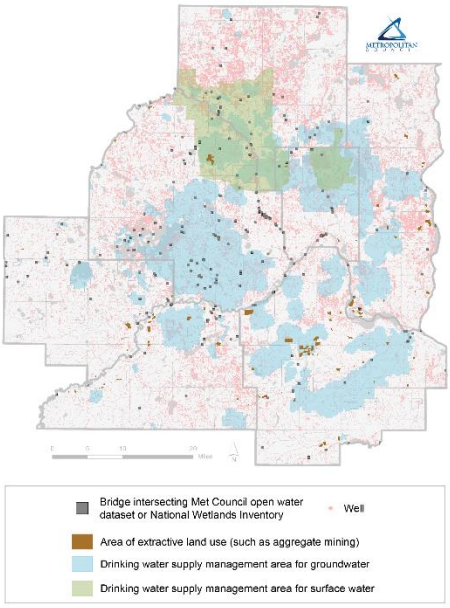


Figure 13: Wells, bridges, and aggregate mining in the metro region (MDH, 2019a; MDH 2022b; MPCA, 2019), *For larger image, see Appendix A.*

- Regional land use policies and local comprehensive plans. These plans relay information about how land cover and land use can be guided to protect drinking water supply source areas. These plans identify long-range (25-30 year) conditions.

- Minnesota's Groundwater Protection Rule, though specific to agricultural land management plans, has the intent to minimize potential nitrogen fertilizer sources of nitrate pollution to groundwater and protect drinking water (MN Rule 1573).

[2] Scenario analysis can help identify critical source water issues that emerge under alternative futures. These issues, which are likely to be different in each scenario, require flexible policy responses. The Met Council will be incorporating this analysis for the first time as a part of the 2050 planning process.

Wastewater sustainability policy recommendations

Enhance the implementation strategies under the policy on sustainable wastewater to support source water protection activities at wastewater facilities and project sites to reduce risk (public health, regulatory).

Proposed supporting actions to protect source water areas:

- The Metropolitan Council Environmental Services will identify opportunities to protect source water on Met Council owned property and project/program sites (Appendix B offers guidance to consider).
- The Metropolitan Council Environmental Services will identify opportunities to manage assets in ways that protect source waters.

Federal and state programs

A long history of water contamination and related damages led to federal and state source water protection programs that drive much of our work today.

Measurable action to protect America's waters began in the 1960's and 1970's after increasing public concern about environmental issues, like the Cuyahoga River catching fire in 1969. This and other events led to legislation protecting public health and the environment.

Passage of the Safe Drinking Water Act (SDWA) in 1974 and the Clean Water Act (CWA) in 1977, plus subsequent amendments to these laws and other environmental laws, have since improved America's waters. These laws were implemented not only to protect human, animal, and aquatic health, but also restore and maintain the chemical, physical and biological integrity of the nation's water. The CWA aims to prevent, reduce, and eliminate pollution in the nation's waters through regulating pollutant discharge into US waterways and controlling the introduction of pollutants through water and wastewater standards.

In Minnesota, the Department of Health is responsible for enforcing the federal SDWA, including administering the state's program for source water protection through Minnesota's Wellhead Protection Program (Minn. Stat. Ch. 103I; Minn. R. Ch. 4720).

In 1990, Congress passed the Pollution Prevention Act (P2 Act). This act recognizes the value of preventing or reducing pollution at the source, wherever feasible. Its passage focused industry, government, and public attention on reducing the amount of pollution through cost-effective changes in production, operation, and raw materials use. This is important because source reduction is fundamentally different and more desirable than waste management and pollution control.

While federal and state programs are in place, implementation remains a challenge. Determining who should initiate and coordinate activities and who should pay for source water protection is not simple. Additionally, water sources for drinking water utilities often extend over multiple communities, and the utilities usually have little or no ability to legally control activities in

those areas to protect the source water. Another issue is that as new products and chemicals are developed and produced, society often doesn't understand the risks they present until years, or even decades, after they have been used and disposed.

Key concerns

Given the primary drivers influencing source water related hazards and risks, and our role as a regional planning organization, our key concerns for improving both understanding and collaboration to protect source water areas focus on:

- Land management and source water protection implementation
- Costs and benefits of source water protection
- Source water contamination

These three crucial concerns form the basis of our policy recommendations.

Land management and source water protection implementation

Approximately 75% of the metro region gets its drinking water from groundwater, either from a public/municipal well or a private well. The surface area contributing to a public or private well varies, depending on surrounding geology, well depth, and pumping rate (MDH, 2018b). This often means the surface area of land that can impact a public or private well source may extend outside the municipal or legal boundaries of that well owner, water user, or water utility organization.

Municipal source water protection areas provide water to approximately 90% of the region's residents. Some provide water to larger populations than others, such as the watershed above the Minneapolis and Saint Paul intakes on the Mississippi River and parts of western Hennepin and northern Ramsey counties (**Figure 14**).

In addition to municipal water supply source water protection areas, *non-municipal* public suppliers are also responsible for protecting source waters. Examples of non-municipal water suppliers include correctional facilities, schools, and manufactured home parks. These entities are responsible for providing safe water, but have few resources and jurisdictional authority on land beyond their boundaries. Over 3,000 acres in the metro region have been designated as source water protection areas for these non-municipal systems.

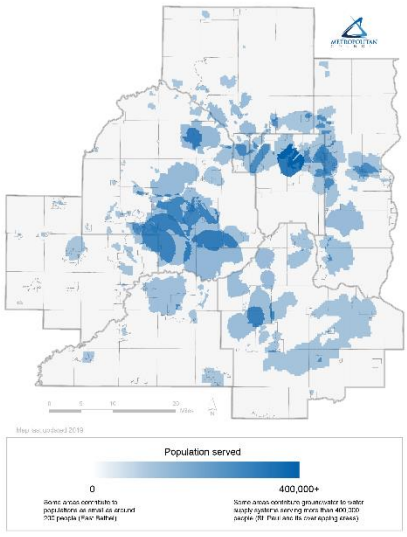


Figure 14: Populations served by different municipal source water protection areas (MDH, 2019), *For larger image, see Appendix A.*

Source water protection is complicated ever further by the different overlapping management jurisdictions. Some examples include community boundaries, watershed organizations, Minnesota Department of Health and community-designated drinking water supply management areas, groundwater management and special well and boring constuction areas, and more informal water supply subregions. Although it benefits the region to have many organizations and groups working to protect water resources, the overlapping boundaires, different priorities, and scope of impact can make it challenging to efficently protect our water supply sources.

Because so much of source water protection depends on land use, utilities, communities, industries, and residents need to work together to protect the shared resource. Planning and partnerships are proven ways for these groups to join and have a bigger impact on resource protection.

Frameworks for joint efforts

Multiple concepts for joint ownership and management are used throughout the metro. There is no one right way for joint management, the system depends on the scenario. Three agreement methods are commonly used. They are:

- Joint powers agreements (JPA). This type of agreement provides authority to the participating governmental units to jointly or cooperatively exercise any power similar or common to the governments to accomplish something larger than any one entity could do (Minn. Stat. § 471.59). Often these agreements are used to provide a service to a group that extends beyond a single jurisdiction.
- A memorandum of understanding (MOU). An MOU is a non-legally binding document describing shared work and common goals. It is not a contract.
- A Contract. A contract is a binding legally that can be used to hold the entities responsible for participation or commitment towards a shared project or objective.

Other metro region groups and agences are also working to protect our water supply. It is our responsibility at the Met Council to stay aware of the efforts of these other groups and support where possible through convening, participation, and financial support, as appropriate.

Watershed Districts

Watershed districts also play an active role in source water protection. Their boundaries span all levels of vulnerable drinking water supply management areas, as shown in **Figure 15**.

Roles of watershed districts include stormwater management, land use and water interaction, and other land management activities. Their impact spans from residents to businesses within their watershed boundares. These organizations are an effective partner in the goal of source water protection. It is recommended to continue conversations with these districts and to support their efforts of local water supply protection.

Minnesota Department of Health

The Minnesota Department of Health (MDH) is very active in metro region source water protection. This protection extends to both areas that contribute to groundwater and surface water supplies. They provide resources for public water suppliers, communities, and residents to protect source water and manage their wells (MDH, 2022b).

MDH, with funding from the Clean Water Land and Legacy Amendment, has supported grants to PWS to fund work to protect drinking water supplies. Activities that may be supported by these grants include well sealing, well construction, installation of monitoring wells, well inspection, educations, and more.

Public water suppliers also work with residents who are using a private well for their drinking water or have an old well on their property. They work to ensure that a functioning well is maintained, and any unused wells are sealed properly. Unsealed wells can contaminate the aquifer, adding to the challenge of source water protection. Unsealed wells can be difficult to find and seal, potentially allowing contaminants to move down into aquifers and negatively impacting the region.

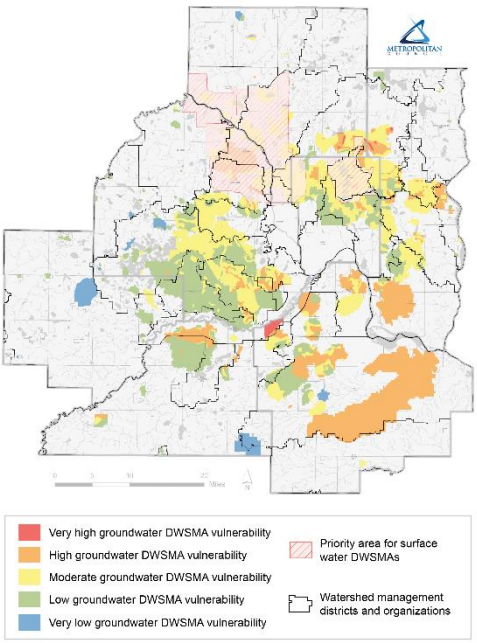


Figure 15: Watershed Districts and DWSMA vulnerabilities
(MDH, 2019), *For larger image, see Appendix A.*

Minnesota Source Water Protection Collaborative

The Minnesota Source Water Protection Collaborative convenes local experts in the source water field. They provide space and resources for outreach and education (EI, 2022). The group is focused on building relationships and includes groups that have been traditionally marginalized from government decision making, including farmers, rural residents, immigrant and Black, Indigenous, and people of color (BIPOC) communities, and small business owners.

We were part of the steering committee to establish the Collaborative in 2019 and has been involved as a member ever since. In addition to the relationship building benefit of the Collaborative, the Met Council has been able to add a different perspective to the conversation that promotes our expertise and values around community engagement and equity.

Upper Mississippi River Source Water Protection Project (UMRSWPP)

The UMRSWPP is a joint powers agreement between St. Cloud, Minneapolis, St. Paul, and other local government entities created to protect the source water of the Mississippi River. These municipalities rely on the Mississippi River for all or most of their drinking water supply.

The Mississippi River source water-watershed for these communities is approximately 7,700 square miles and is impacted by both point and non-point source pollution from both urban and rural environments. A challenge for this group is that the contribution area for their source water is very large, and mostly outside the boundaries of these cities.

The agreement provides a space for the cities to create a source water protection plan and schedule implementation activities together. They work together to identify and minimize pollution and contamination to their Drinking Water Supply Area. For example, the cities applied

for grant funding from the State of Minnesota and pooled their awarded funds to develop an interactive mapping tool to aid in the prioritization of source water protection projects. The UMRSWPP illustrates what can be accomplished when many organizations commit to partnering on work; larger projects with higher impact are achieved.

We at the Met Council are committed to supporting efforts like this to help with work like watershed restoration and protection planning and implementation in the North and South Fork Crow River watershed. Our strength is to convene, bring diverse perspectives together, and to support existing groups that further the mission of the region.

Met Council Subregional Water Supply Work Groups

A less formal collaborative effort undertaken by the Met Council is the subregional water supply work groups. **Figure 16** graphically shows these groups.

They provide space for public water suppliers and others in the water supply community to meet with colleagues in their area to network and discusses shared experiences. The past focus of these groups has been on the water supply utility, but focus could be expanded to include watershed districts, and support water quality of source water supplies with water quantity.

The Met Council should continue supporting these groups and providing convening space and leadership to promote cross-community collaboration.

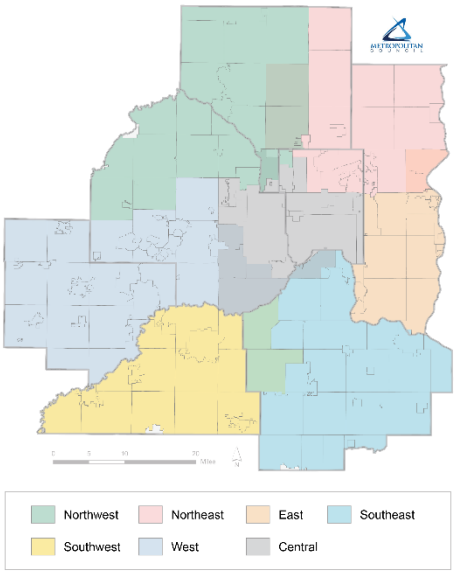


Figure 16: Subregional water supply work groups. *For larger image, see the Appendix.*

Metropolitan Area Water Supply Advisory Committee

The Metropolitan Area Water Supply Advisory Committee (MAWSAC) is a formal committee established by Minnesota Statutes (473.1565) to advise the Met Council on its water supply planning activities.

Members include the Minnesota Departments of Agriculture, Health, and Natural Resources and the Pollution Control Agency, Minneapolis Water Works and St. Paul Regional Water Services, and governor-appointed representatives from municipalities in all eleven counties in the metro region. MAWSAC is supported by a technical advisory committee (TAC).

The committees have repeatedly highlighted the importance of source water protection (Metropolitan Area Water Supply Advisory Committee, 2022). Concerns raised include:

- How long-term integrated water management is needed to protect source waters and vulnerable areas. This includes creating a better understanding of groundwater and surface water interactions.
- Guidance and tools to support development that protects quantity and quality of source waters, while balancing local economic needs/goals. It is important to highlight that each community has goals and caring for another's DWSMA could impact those goals.
- Support for collaborative management strategies, research, and monitoring. This supports better understanding of groundwater and surface water interactions and more effective implementation to reduce impacts.

Each joint endeavor may be best served by any of the above agreements. Even with options and examples, it shows that joint work is challenging. In its convening and technical assistance roles, the Met Council may be able to help.

Collaboration and partnership recommendations

Establish a clear policy for collaboration and partnerships to advance equity along with other water goals, clarifying what Environmental Services will do with whom to achieve the goals of the 2050 Regional Development Guide and Water Resources Policy Plan.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will support cross-community collaboration among public water suppliers and their communities.
- The Metropolitan Council will support and participate with partners on outreach and engagement.
- The Metropolitan Council will engage with residents and businesses to understand water values.
- The Metropolitan Council will prioritize inter-agency collaboration.

Source water contamination

Our metro region gets its water supply from both surface water and groundwater, each of which presents challenges in mitigating and protecting against contamination that are both unique and similar. Preventing contamination and pollution at the source can be difficult, especially when the avenues for entry into a source water can vary greatly. The watershed upstream of the Minneapolis and Saint Paul intakes covers over 20% of the State of Minnesota, and the many conditions impacting the quality of runoff in this watershed can affect downstream water supply quality. Contamination can also result when the water recharging groundwater carries land-applied contaminants along with it toward wells.

When considering water supply contamination, drinking water quality is a top priority. Good quality water is also important for ecosystem health and industrial processing, which are also important uses of the region's water supply.

The list of drinking water contaminants, guidance levels, and federal standards is quite extensive. The MDH provides a detailed comparison of state water guidance and federal drinking water standards on their website (MDH, 2022c). **Table 2** identifies high priority, local contaminant concerns developed by UMRSWPP and MDH.

Table 2: High priority surface and groundwater contaminant concerns

Surface water contaminant concerns [a]	Groundwater contaminant concerns [b]
• Improper manure management • Known stormwater discharge sites • Cropland sediment runoff • Streambank erosion • Transportation corridors • Hazardous waste cleanup sites • Leaking underground storage tanks	• Fertilizer, pesticide, and animal manure application • Abandoned wells • Industrial pollution • Feedlots • Aging and failing stormwater and wastewater infrastructure (including septic systems)

[a] UMRSWPP presentation (2022), [b] MDH, 2021b

Existing contamination areas have been identified and mapped in **Figure 17**. This map highlights the groundwater contamination plumes in the East Metro and higher urban core density of brownfield sites. Agricultural practices in rural areas are also a potential source of contamination, particularly given that 50% of the metro region is agricultural and undeveloped land. **Figure 18** illustrates nitrate risk to the water table.

One of the key planning-related differences between surface water and groundwater sources are the communities that rely on those sources and the different challenges and opportunities they have. **Figure 19** compares communities' sources of water to areas of concentrated affluence and poverty.

Specific concerns about sources of water and our region's water supply are listed below.

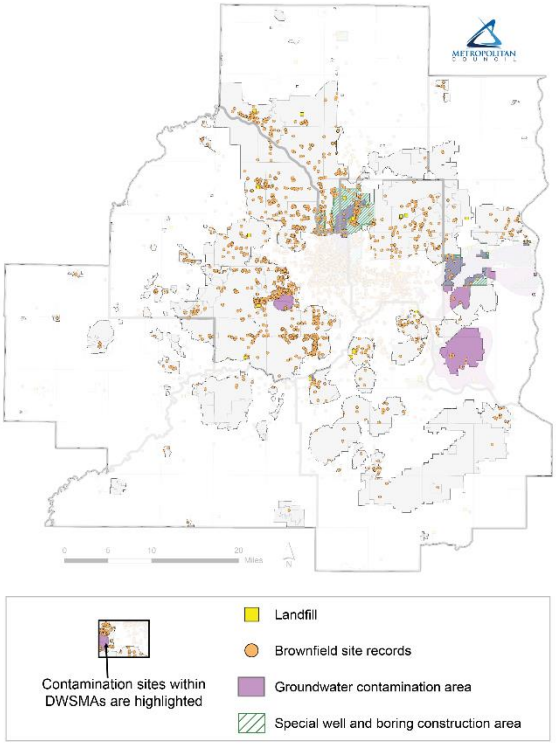


Figure 17: Examples of known contamination sites in metro region DWSMAs (MPCA, 2022b; MN Geospatial Commons, 2022). *For larger image, see the Appendix.*

Surface water

- Proximity of Met Council's wastewater treatment plants and nearby drinking water intakes
- Emerging concerns like N-Nitroso-dimethylamine (NDMA) precursors and watershed management strategies.
- Collaborative watershed management amongst upstream communities, local partners, and impacted downstream communities - including stormwater and agricultural best practices, education and outreach, land use and water planning, and shared resources.

Groundwater

- Leaching of disposed of contaminants (i.e., landfills, septic systems) into groundwater aquifers is a high concern for our region. A regional proactive approach to reduce these potential sources of contamination is needed for source water protection.
- In more rural areas, nitrate intrusion remains a concern as it can infiltrate and move deeper between aquifers, impacting drinking water sources.
- Naturally occurring elements in rocks and soil that can increase the risk of serious health effects when found in drinking water (e.g., arsenic, manganese, radium).

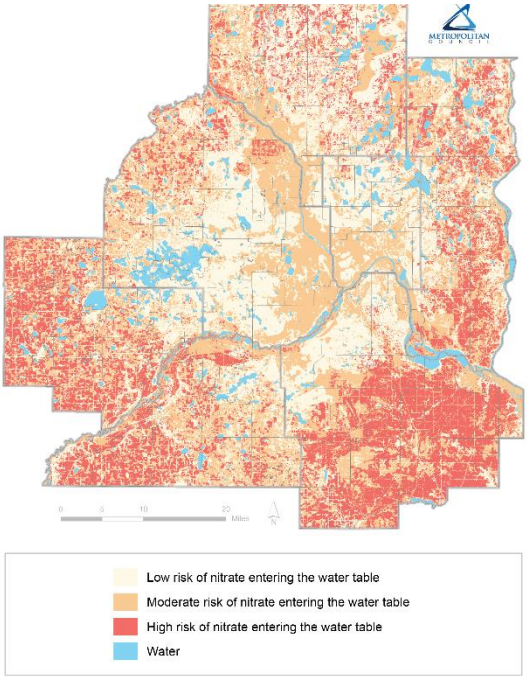


Figure 18: Nitrate risk to the water table in the metro region (MDH, 2016), *For larger image, see Appendix A.*

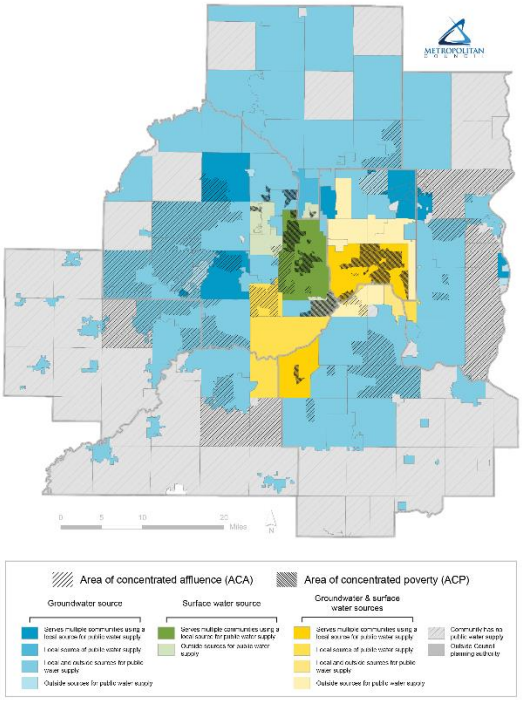


Figure 19: Areas of concentrated affluence and poverty versus community water sources. *For larger image, see Appendix A.*

Protecting regional water resources policy recommendations

Establish a more focused and integrated policy and supporting actions to shape ES's work to protect water resources (groundwater, surface water and wastewater), including source water areas.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will identify areas where local integration is required to protect source waters including a process for equitable stakeholder input and results.
- The Metropolitan Council will support implementation related collaboration to protect regional water resources.
- The Metropolitan Council will provide data, information, and planning tools to assist local governments in resilient water resources and infrastructure planning and decision-making.

Case study: Considering nitrate-nitrogen from agricultural practices

The state's Nutrient Reduction Strategy has concluded that "nitrate in groundwater used as drinking water source is a concern in several areas in Minnesota that are susceptible to contamination" (MPCA, 2014).

Through the Minnesota Department of Agriculture (MDA) Groundwater Protection Rule Mitigation Level Determination process, MDA determines the mitigation levels for community water supply wells and their DWSMAs that have elevated levels of nitrate-nitrogen, based on monitoring data (MDA, 2022a). Generally, these determinations are updated annually.

In the metro region, four public water suppliers currently have nitrate-nitrogen levels high enough to trigger attention and mitigation work by MDA.

- Hastings (nitrate level of 8 mg/L or greater; or are projected to exceed 10 mg/L in the next ten years)
- Oak Grove Mobile Home Park (nitrate level of 8 mg/L or greater; or are projected to exceed 10 mg/L in the next ten years)
- Shakopee (nitrate level of 8 mg/L or greater; or are projected to exceed 10 mg/L in the next ten years
- Rosemount (nitrate level of 5 mg/L or greater)

One of them, Hastings, is the largest Drinking Water Supply Management Area (DWSMA) in the state and is primarily agricultural land:

The MDA is committed to work with local farmers in the Hastings, Oak Grove Mobile Home Park, and Shakopee DWSMAs to adopt practices that can reduce nitrate levels in groundwater. Depending on the size of the DWSMA, an advisory team will be formed to include local farmers, agronomists, local government staff, public water suppliers and other key stakeholders to help

recommend best management practices and alternative management tools (MDA, 2022b). In addition, a local groundwater monitoring well network may be developed. The MDA will promote the implementation of appropriate nitrogen fertilizer best practices and alternative management tools. To help facilitate tool implementation, the MDA has worked with other agencies to make DWSMAs with elevated nitrate among the highest priority areas for state and federal funding.

The MDA will conduct surveys to assess the adoption rates of best management practices and use computer modeling to estimate the change in nitrate losses over a DWSMA (MDA, 2022c). The modeling will consider the soils, crops, agricultural practices and precipitation in the DWSMA and help local farmers estimate whether changes in practices will improve water quality.

Costs and benefits of source water protection

The Twin Cities metro region has many areas with contaminated groundwater. Communities where contaminated groundwater has impacted drinking water supplies are included in **Table 3** below. The table only includes water sources that have or will incur substantial costs for additional water treatment processes that would not be needed if the contamination were not present. Several cities in the table below have also had to abandon well use due to contamination, as additional treatment was not cost-effective for those areas.

Regionwide commitment to investing in source water protection supports the economical development of the metropolitan area. As history has demonstrated, once a source water is contaminated, the costs to clean up the contamination and repair damages are almost always larger than preventative costs. The availability of state and federal funds greatly offset the costs to local water suppliers and provides the benefit of protected water sources.

Table 3: Contamination locations impacting drinking water sources in the metro region. (Premier Water Technologies, 2018)

Contamination location	Main type(s) of contamination	Impacted water utilities	Additional water treatment needed due to contamination	Year treatment added
Twin City Army Ammunition Plant (TCAAP)	1,4-dioxane	Cities of New Brighton, Fridley, TCAAP water supply	UV/AO	2017
Twin City Army Ammunition Plant (TCAAP)	Trichloroethylene (TCE), VOCs	Cities of New Brighton, Fridley, TCAAP water supply	TCAAP Groundwater Recovery System and air stripping	1987
Blaine Plume	1,2-Dichloroethane (1,2-DCA)	City of Blaine	Water Treatment Plant #1, air stripping	2006
Baytown Township Plume	Trichloroethylene (TCE)	City of Bayport, Bayport Township and West Lakeland (private wells)	Air stripping	2007

Reilly Tar & Chemical Plume	Polycyclic aromatic hydrocarbons (PAH)	Cities of St Louis Park and Hopkins	Granular activated carbon filtration, and constant well pumping to manage plume	1985
3M PFAS contamination	PFAS	City of Oakdale	Granular activated carbon	2006
3M PFAS contamination	PFAS	City of Cottage Grove	Granular activated carbon	2017
3M PFAS contamination	PFAS	City of Woodbury	Granular activated carbon	2020

Several regional and local planning efforts inform cost and benefit evaluations of protecting source water areas. Examples include:

- Local capital improvement plans, water supply plans, and water supply-related reporting to the state provide information about current water supply infrastructure and planned investments. These plans generally cover 5–10-year planning horizon.
- Local source water protection plans identify vulnerable drinking water supply management areas, potential contaminant sources in those areas, and an implementation plan and budget. These plans generally cover 5–10-year planning horizon.
- Local comprehensive plans identify long-range (25-30 year) planned land use, growth forecasts, and related infrastructure plans. These factors all contribute to cost estimates and provide opportunities to protect source water areas into the future.
- Regional wastewater system plans (25-30 year) provide information about service availability and treatment and can support cost estimates to extend service and/or upgrade treatment.

Case study: Costs of industrial contamination in the eastern Twin Cities metro region

A current and well-known example of the costs to repair damages and clean up contamination in source water areas is the east metro region. 174,000 people spanning multiple communities live and work in this area and have been impacted by per- and polyfluoroalkyl substances (PFAS) contamination.

As part of a $850 million Natural Resource Damage lawsuit Agreement and Order (Settlement) in 2018 between the State of Minnesota and the 3M Company, a conceptual drinking water supply plan was developed (State of MN v. 3M Company, 2018; State of MN, 2021). The plan evaluates and recommends a set of projects that provide safe, sustainable drinking water to the 14 communities currently known to be affected by PFAS contamination now and into the future. The plan directs investment of $700 million in east metro community water supply projects to address the contaminated source waters.

The plan stresses the goal of a long-term solution based on these key components:

- Recognizing that our understanding of PFAS and the ability to detect it is continually evolving. The plan provides treatment for wells at or above half of the current Health Limit.

- The plan sets aside contingency funds for unexpected needs.
- The plan uses 2040 water demand estimates to ensure that infrastructure built today will serve the east metro region in the future.
- The plan includes using granulated activated carbon treatment.
- In some areas, the plan calls for connecting homes to municipal systems to reduce future risk of contamination.
- The plan includes money for drinking water protection projects to reduce PFAS in groundwater and help reduce future treatment needs and costs, and to improve overall water quality.

Access to the full conceptual drinking water supply plan is on the MPCA website (MPCA, ndc).

Investment policy recommendations

Improve the clarity and focus of the current investment policy to better establish roles for Environmental Services and other parts of the Met Council.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will describe the process to determine regional benefits (particularly important for source water protection investments).
- The Metropolitan Council will recognize and leverage different funding sources.

Reuse policy recommendations

Improve the clarity and focus of the current reuse policy, including recommended approaches to protect source water quality and reduce risk.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will plan for long-range regional investments that protect source water quality and quantity.
- The Metropolitan Council will identify and evaluate the economic and technical feasibility of best practices to enhance groundwater recharge.

Equity considerations

All people should have access to clean, safe, affordable water and wastewater services. All water and wastewater systems should have sufficient funding to provide affordable services. All communities should share in the economic, social, and environmental benefits of investment in water systems.

It is the people and businesses in our communities who pay to use water supply infrastructure for a wide range of purposes. It is critical to their life and environment. These same people and

businesses also pay to dispose of the water once is has been used. If improvements are needed – to increase water treatment, for example – they also bear this cost.

Recent events have elevated the national awareness of equity in water supply. Whether it was through failed treatment, causing corrosion in lead pipes in Flint, Michigan (NRDC, 2018), or underinvestment in treatment facilities in Jackson, Mississippi (NPR, 2022), our country's black and brown communities have been disproportionately impacted and have carried the elevated burden of advocating for themselves in order to obtain clean, safe water.

Within the metro region, we have our own unique challenges with our water supply and the infrastructure to deliver it. Protecting the source water area for the Mississippi River intakes is very different from protecting the source water areas supplying roughly 800 municipal wells across the region. About seventy-five percent of metro region residents, primarily in the suburban and rural parts of the metro, get their drinking water from groundwater sources, while the remaining 25%, in urban and inner-ring suburban cities, get their water from surface water supplies.

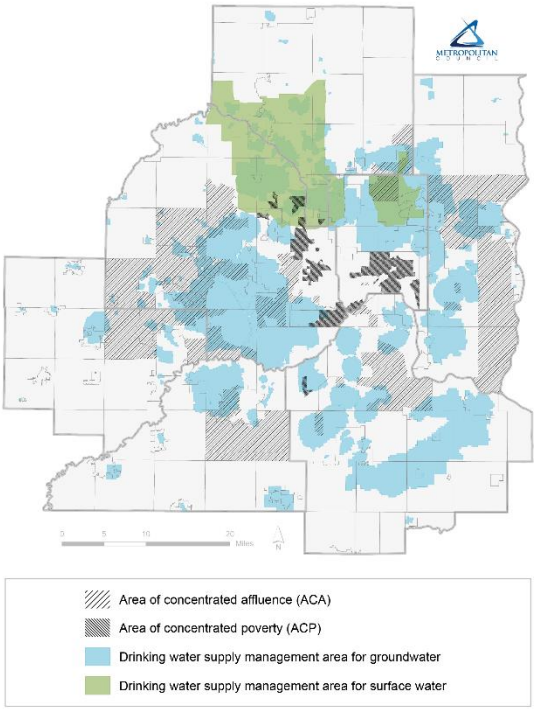


Figure 20: Areas of concentrated affluence and poverty versus DWSMAs (MDH, 2019), *For larger image, see Appendix A.*

Shared source waters and long flow paths connect us as a region. Activities in one area of the metro can affect the water quality for residents in another. It is important to understand your impact as an individual, and that different groups of people use and face threats to different sources of water.

However, different groups of people use different sources of water, and they face different threats and have different opportunities to protect water sources.

Consider communities' access to resources to protect source water and to mitigate for contamination.

Larger, more urban and suburban communities might have a larger tax base, more staff, or a wealthier population to financially support source water protection. Those communities might also be able to be more selective about what types of businesses/industries can develop on vulnerable land. Suburbs and more rural communities may have more green space and related opportunities to help filter storm water for infiltration.

The cities of Minneapolis and Saint Paul, along with the communities to whom they supply water, rely almost entirely on the Mississippi River. In comparison, suburban and rural communities rely heavily on groundwater.

Based on community population data reported on the Met Council's Community Profile website, roughly 50% of Black, Indigenous, and people of color (BIPOC) residents live in communities supplied by the Mississippi River while 50% live in communities supplied by groundwater. Approximately 30% of white residents live in communities supplied by the Mississippi River versus 70% living in areas supplied by groundwater.

Both the responsibility for source water protection and the ability to act vary by water supplier type:

- Municipal water suppliers – both surface water suppliers and groundwater suppliers - draw water from the largest source areas with the most potential contaminant sources, but they often have more resources (money, staff time, and influence) to direct toward source water protection.

- Non-municipal public water suppliers – like manufactured home parks, schools, or correctional facilities – are also responsible for preventing contamination of their wells with little authority beyond their property boundaries. Their resources for source water protection vary, though are generally less than those available to municipal suppliers.

- Private well owners are responsible for preventing contamination of their private wells, but their ability to act is limited to their own properties and ability to influence neighbors. Private well owners are often in rural areas, where they are more likely to have agricultural pollution in their water supply. They are also less likely to have information on potential contamination and less likely to have access to testing and treatment options in comparison to municipal water suppliers.

Another facet of how community resources vary across the region is illustrated by comparing areas of concentrated poverty and areas of concentrated affluence versus the sources of water used by communities and to the locations of DWSMAs (**Figure 19** and **Figure 20**).

In the fall of 2022, we created an equity task force to support the update of the regional development guide and related policies and system plans. The group will propose and define a framework and expectations for the Met Council as we work integrate equity into our policies in order to create a more equitable region.

The Met Council has also developed a dataset and user guide to support ***Equity Considerations for Place-Based Decisions and Advocacy***. This information may be used in a wide range of ways. For this paper, staff used this dataset to explore who may be most impacted by place-based decisions. This information is also available to policymakers and planners in order to target investments and tailor engagement efforts accordingly.

Connections to current water policy

Across the Met Council's regional policy plans, there are several current policies which state our intent and approach to protecting recharge and source water.

The 2040 Water Resources Policy Plan is the most direct tie to the topic and includes five policies with supporting actions that relate to the protection of source water and vulnerable areas.

2040 Water Resources Policy Plan water sustainability goal:

To protect, conserve and utilize the region's groundwater and surface water in ways that protect public health, support economical growth and development, maintain habitat and ecosystem health, and provide for recreation.

2040 Water Resources Policy Plan policy on watershed approach:

We will work with our partners to develop and implement a regional watershed-based approach that addresses both watershed restoration (improving impaired waters) and protection (maintaining water quality in unimpaired waters)

Supporting actions related to protecting source waters:

- Work with the watershed management structure in the metro region on issues that transcend watershed organization boundaries. This supports the preparation of water management plans and promotes the protection and restoration of local and regional water resources (lakes, rivers, streams, wetlands and groundwater).
- Provide technical information to watershed organizations that can improve water quality at supply sources. This information includes best practices for water management and planning use.

2040 Water Resources Policy Plan policy on sustainable water supplies:

While recognizing local control and responsibility for owning, operating, and maintaining water supply systems, we will work with our partners to develop plans that meet regional needs for a reliable water supply that protects public health, critical habitat and water resources over the long term.

Supporting action related to protecting source waters:

- The Metropolitan Council will, as required by Minnesota Statutes, review and comment on wellhead protection and county groundwater plans.

2040 Water Resources Policy Plan policy on assessing and protecting regional water resources

The policy and actions on assessing and protecting regional water resources may also be generally related to source water protection, though it is not explicitly discussed. The Council will continue to assess the condition of the region's lakes, rivers, streams, and aquifers to evaluate impacts on regional water resources and measure success in achieving regional water goals.

2040 Water Resources Policy Plan policy on water conservation and reuse:

We will work with our partners to identify emerging issues and challenges for the region and on solutions that include the use of water conservation, wastewater and stormwater reuse, and low-impact development practices to promote a more sustainable region.

Supporting actions related to protecting source waters:

- While not explicitly linked to source water and vulnerable area protection, actions related to low-impact development and groundwater recharge could support protection of water supply sources as part of broader water resource and water demand management.

2040 Water Resources Policy Plan policy on serving the rural areas:

The Metropolitan Council will acquire wastewater treatment plants owned by Rural Centers, based upon their request through the comprehensive plan and comprehensive sewer plan processes, and based upon criteria that ensure direct identifiable regional benefits, after soliciting customer input and conducting a public hearing on the request.

Supporting action related to protecting source waters:

- Preserve areas outside the Long-Term Wastewater Service Area for agricultural and rural uses, while protecting significant natural resources, supporting groundwater recharge, protecting source water quality, and allowing limited unsewered development.

Draft new and revised policy and implementation strategies/actions

This section proposes some revisions to the existing policies and supporting actions summarized in the section above, 'Connections to Current Policy'. It also proposes some new policies and supporting actions. Not all the recommendations included in this paper will move forward for inclusion into the Water Resources Policy Plan, and conversely, the Water Resources Policy Plan may include policies not discussed in this research paper.

Each recommendation starts with a general description of the proposed policy, followed by *draft* proposed policy and strategy (specific actions) language.

These recommendations are intended to spark discussion about policy direction for the 2050 Water Resources Policy Plan. They are not to be considered final recommendations.

As staff developed the following language, they considered:

- The full range of Met Council functions and how they relate to vulnerable areas and impact source water protection
- How the Met Council can enhance and leverage partners' programs
- How proposed policies and related actions represent an integrated water and/or watershed approach
- How resilient the proposed policy and related actions might be under different scenarios of future growth and climate
- The equity impacts of proposed policies and related actions
- Feedback from Metro Area Water Supply Advisory Committee, Water Resources Policy Plan Advisory Group, and Met Council staff during an internal workshop on the topic of public health.

New policy on collaboration and partnerships:

Regional policymakers should consider establishing a clear policy for collaboration and partnerships to advance equity and other water goals, clarifying what Environmental Services will do with whom to achieve the goals of the 2050 Regional Development Guide and Water Resources Policy Plan.

This may connect with the proposed policy on environmental justice and water equity in the water quality paper.

Proposed policy language: The Metropolitan Council and Environmental Services will engage constructively across the boundaries of public agencies, levels of government, private and civic spheres, in order to carry out integrated water resource management activities that could not otherwise be accomplished.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will support cross-community collaboration among public water suppliers and their communities. Desired result: reduced barriers and increased local implementation for source water protection, particularly in areas that are water supply sources for multiple communities. Example activity:
    - Facilitate subregional water supply work groups.
    - Communicate and coordinate with and between local communities and state agencies to stay on top of emerging contaminants (like PFAS).
- The Metropolitan Council will support and participate with partners on outreach and engagement. Desired result: increased landowner practices to protect source waters. Example activities:
    - Support groups such as the Upper Mississippi River Source Water Protection Project, MN Source Water Collaborative and other. Provide support for convening and advocacy, and maintain the Met Council's advisory role. This supports local control while growing collaboration for better source water management.
    - Identify and recommend opportunities to increase funding and outreach for partners for agricultural practices to protect source water (Examples: MN Department of Agriculture, U of M Extension).
    - Coordinate with growing state funding programs for source water protection (such as BWSR and MDA).
- The Metropolitan Council will engage with residents and businesses to understand water values. Desired results: better understanding of how our region's citizens view their water and more targeted and effective outreach for source water protection.
- The Metropolitan Council will prioritize inter-agency collaboration. Desired result: stronger understanding of the effectiveness of best management practices including impacts on source water area risk levels. Example activity:

- With MPCA and others, evaluate infiltration as a stormwater management practice, particularly under a range of potential climate futures, and collaboratively update stormwater infiltration requirements and recommendations in the MN Stormwater Manual and other tools as appropriate.

- Partner with MDH to develop and support multi-community wellhead protection efforts, including potential rule revisions to streamline efforts.

New policy on integrated water planning

Regional policymakers should consider establishing a clear policy for long-range integrated water planning to better address the root causes of events that threaten water supply sources. This should incorporate the watershed approach and connect it to water management throughout all our water planning efforts (groundwater, surface water, wastewater). It should include support for long-term source water management and the creation of collaborations and partnerships, where appropriate.

Proposed policy language: The Metropolitan Council will work with our partners to develop and support long-range integrated water resource planning that addresses the region's watershed, water supply, and wastewater needs.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will promote integration across watershed, water supply, and wastewater planning. Desired results: local and regional plans for water management will direct resources to better achieve multiple water benefits and reduce contradictory actions and investments. Example activities:

    - The Metropolitan Council will update regional water policies, the wastewater system plan, and the metro region water supply plan using a long-term, integrated water management approach.

    - Environmental Services will work with Community Development's Local Planning Assistance team to update plan review guidance and processes. This will ensure that local comprehensive plans acknowledge source water protection areas and existing and planned source water hazards. It also supports local commitments to relevant and effective actions to protect vulnerable source water areas.

    - Environmental Services technical review staff will ensure that local comprehensive plans, local water plans, local water supply plans, wellhead protection plans, and watershed management plans consistently acknowledge and commit to relevant and effective actions to protect vulnerable source water areas.

- The Metropolitan Council will support local planning efforts to increase source water protection activities. Examples:

    - Environmental Services will work with Local Planning Assistance to provide technical assistance.

- Environmental Services will support the implementation of local best management practices for stormwater management that keep pollutants out of drinking water sources.

Water reuse policy:

Regional policymakers should consider improving the clarity and focus of the current reuse policy, including recommended approaches to protect source water quality and reduce risk.

This paper supports the policy recommendations and implementation activities related to wastewater reuse proposed in the Water Reuse research paper. In addition, we offer the actions below that support the protection of source water areas.

Proposed supporting action to protect source water areas:

- The Metropolitan Council will plan for long-range regional investments in wastewater and stormwater reuse that protect source water quality and quantity. Example activity:
  - Support cost-effective investments in property management in areas designated as source water protection areas, focusing on risk management for potential contaminants.
- The Metropolitan Council will identify and evaluate the economic and technical feasibility of best practices that enhance groundwater recharge and make the best use of reclaimed wastewater and stormwater while protecting source water quality.

Enhanced policy on wastewater sustainability:

Across its multiple divisions, the Met Council is responsible for significant facilities and land holdings across the region. Figure 5 illustrates several different facilities and properties that the Met Council is responsible for. These assets should be managed in ways that protect source waters.

Regional policymakers should consider enhancing the implementation strategies under the policy on sustainable wastewater. Revising these strategies could better support source water protection activities at wastewater facilities and project sites to reduce risk.

Proposed policy language: The Metropolitan Council will provide efficient, high-quality, and environmentally sustainable regional wastewater infrastructure and services.

Proposed supporting actions to protect source water areas:

- Environmental Services will identify opportunities to protect source water on Metropolitan Council owned property and project/program sites. Example activity:
  - Recognizing designated source water protection areas and partner with landowners and agencies such as Minnesota Department of Agriculture as part of Environmental Services biosolids land application program.
- Environmental Services will identify opportunities and manage assets in ways that protect source waters by reducing the number of potential contaminants on Met Council

properties and project sites and/or the creation of up-to-date mitigation plans. Example activities:

- Incorporating Minnesota Department of Health source water protection ***guidance for managing specific potential contaminant sources*** into Met Council property/asset management plans.
- Creating or updating documentation of all wells on Met Council-owned properties along with maps of all wells with setback areas delineated to assist with siting of chemical storage areas, infrastructure, etc.
- Highlighting additional benefits for source water protection when conducting existing condition assessments of Met Council-owned properties to identify priority locations for protection, enhancement, and restoration of climate-resilient landscapes.
- Educating Met Council staff responsible for managing chemical storage, drilling and sealing wells, and emergency response planning with source water protection-related content.
- Including source water protection elements in emergency preparedness and response plans – particularly focusing on potential contaminants generated by wastewater and transportation assets located in areas designated as source water protection areas.

Revised policy on investment:

Regional policymakers should consider improving the clarity and focus of the current investment policy to better establish roles for Environmental Services and other parts of the Met Council. This is particularly relevant for leveraging resources to protect source water areas.

Proposed policy language: The Metropolitan Council will strive to maximize regional water resource benefits from regional investments, through coordination among its divisions and across the integrated water cycle.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will describe the process to determine regional benefits (particularly important for source water protection investments), with the desired result of transparent and credible decision-making process for Met Council Environmental Services investments.
- The Metropolitan Council will recognize and leverage different funding sources to increase the impact of Council Environmental Services investments. Example funding possibilities:
  - Partner matches in implementation grant programs (ex: water efficiency grant program).

- Clean Water Land and Legacy funds for short-term work that supplements Environmental Services' basic functions and advances both regional and state goals.

- Collaborative partnerships with research institutions to enhance assessment of the region's water resources and the impact of best practices.

- Evaluation of possible funding sources to establish and/or maintain a reliable and readily accessible state-wide or regional emergency fund to address new and emerging water supply contaminants.

New policy on protecting regional water resources:

Regional policymakers should consider establishing a more focused and integrated policy and supporting actions to shape Environmental Services' work to protect regional water resources (groundwater, surface water and wastewater), including source water areas.

This might include redefining the current policy on assessing and protecting regional water resources as two separate policies: protection and assessment.

Proposed policy language: The Metropolitan Council will support programs to enhance planning and implementation activities that prevent and reduce contamination sources and water pollution, including potential contaminant sources and pathways in water supply source water areas. This will protect public health, critical habitat and water resources over the long-term.

Proposed supporting actions to protect source water areas:

- The Metropolitan Council will identify areas where local integration is required to protect source waters and a process for equitable stakeholder input and results.

- The Metropolitan Council will support implementation-related collaboration to protect regional water resources. Examples:

    - Recognize and work to address legacy contaminants that continue through the system due to past practices likes pesticide use, spill events, or contaminant dumping.

    - Establish and promote local grant programs to seal wells, prioritizing areas that provide water to multiple communities.

    - Partner with Minnesota Technical Assistance Program for projects intended to manage and reduce potential contaminants in businesses located in areas that provide source water to multiple communities.

    - Sponsor regular multi-community emergency response planning and training, such as table-top exercises.

    - Promote access and use of state-developed information about contaminants in metro region drinking water supplies and local best practices to mitigate risks.

- Enhance Metropolitan Council Plant resources for community planners and public water suppliers to protect source water areas.

- The Metropolitan Council will provide data, information, and planning tools to assist local governments with planning resilient water resources and infrastructure planning, given changing climate and land use conditions. Example activities:

    - Document, maintain, and promote a list of state agency-documented potential contaminants and contamination areas in the metro region for community planners, environmental document writers, and technical reviewers to influence planned landscape practices (American Water Works, 2018).

    - Others, as identified in the water quality research paper.

New policy on assessing regional water resources:

Regional policymakers should consider establishing a more focused and integrated policy to shape our work to assess regional water resources (groundwater, surface water and wastewater). This should include source water areas. The region has additional assessment needs that are discussed in other research papers.

This might include redefining the current policy on assessing and protecting regional water resources as two separate policies (protection and assessment).

Proposed policy language: The Metropolitan Council will collaboratively assess the condition of the region's lakes, rivers, streams, and aquifers – and how water and contamination move between them – to evaluate impacts on regional water resources and measure success in achieving regional water goals.

Proposed supporting actions to assess source water areas:

- The Metropolitan Council will support research and partnerships when assessing regional water resources, including assessment of source water areas. Example activities:

    - Enhance existing monitoring and/or join existing programs to monitor and assess specific contaminants that threaten source water (PFAS, nitrate, N-Nitrosodimethylamine (NDMA)precursors, etc.). This could include funding, letters of support, or convening to bring stakeholders together. Refer to ***Priority Waters List*** to identify and prioritize surface waters related to drinking water sources.

    - Support efforts like those in the Crow River watershed

    - Partnering with the University of Minnesota to identify potential drinking water contamination sources and reduce runoff in high-risk areas.

    - Analysis of properties likely to have unused wells, to target well sealing programs in areas that supply water to multiple communities.

- The Metropolitan Council will support efforts that investigate water supply approaches to increase water conservation, enhance groundwater recharge, and most effectively use our water resources. Example activities:
    - Support community efforts to identify and evaluate the economic and technical feasibility of water supply approaches and best practices that increase water conservation, enhance groundwater recharge, and make the best use of groundwater, surface water, reclaimed wastewater, and stormwater.
    - With partners such as MPCA, establish research stations to study the quality and quantity impacts of infrastructure such as large-scale infiltration projects or pumping centers near sensitive groundwater-supported surface waters.
- The Metropolitan Council will analyze the impact of land practices on water quality and the vulnerability of source water areas and water supplies. Example activities:
    - Explore a range of long-term (30-50 years or more) planning scenarios, beyond the typical 10-year time frame of local source water protection plans.
    - Consider climate change scenarios as part of this effort.
    - In partnership with others, research low-impact development, land use practices, agricultural best practices, and cooperative water use practices that minimize negative water quality impacts on aquifers and maximize groundwater recharge, where practical (revision of 2040 WRPP strategy supporting the policy on water conservation and reuse).

Next steps

This topical research paper is the first step in the process of creating regional water policies to safeguard our waters and to protect the livability and prosperity of the region (**Figure 21**). The ideas in this paper are intended to spark discussion and generate additional water-focused policy recommendations to provide the foundation of the 2050 Water Resources Policy Plan. This paper was created and reviewed by Met Council staff. Our planned next step is to gather and include vital perspectives from our partners on needed policy recommendations.

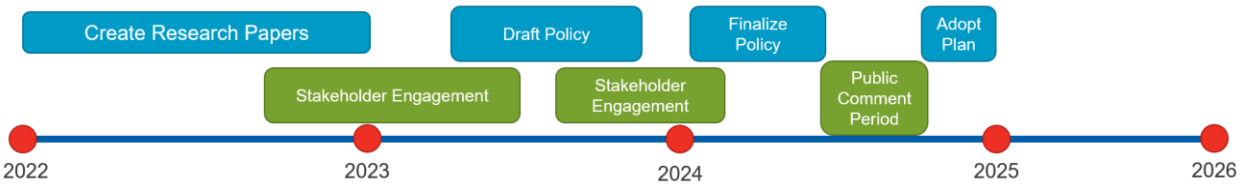


Figure 21: Water Resources Policy Plan timeline

After this additional information is gathered, Met Council staff will update the draft policy recommendations through an iterative process of drafting policies, listening to stakeholder feedback, and integrating the information collected to assist the Met Council members to develop, evaluate, refine, and adopt policies. Alternating between engagement and policy creation will allow stakeholders to participate and shape plan content from the very beginnings of policy research and development through the public comment period prior to the adoption of

the plan. This proposed process is an intentional attempt to bring in more voices and perspectives to help the Council produce polices and implementation strategies that are reflective of the region's water priorities.

If you have any questions or feedback about the content of this paper, please contact **Lanya Ross** at ***Lanya.Ross@metc.state.mn.us***.

References

American Water Works Association. (2018). *Source water protection justification toolkit.* American Water Works Association. Retrieved 12/16/2022, from https://www.awwa.org/Portals/0/AWWA/ETS/Research/Final_Source%20Water%20Protection%20Toolkit.pdf

Breslow, J. (2022, August 31). The water crisis in Jackson follows years of failure to fix an aging system. *National Public Radio.* https://www.npr.org/2022/08/31/1120166328/jackson-mississippi-water-crisis

Denchak, M. (2018, November 8). Flint water crisis: Everything you need to know. *Natural Resources Defense Council, Inc. https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know*

Environmental Initiative. (2022). *Our work: source water protection collaborative*. https://environmental-initiative.org/our-work/source-water-protection-collaborative/

Groundwater Protection. Minnesota Administrative Rules, Chapter. 1573.0010-0090 (2022). https://www.revisor.mn.gov/rules/1573/

Metropolitan Area Water Supply Advisory Committee. (2022, February). *Recommendations for water supply planning in the metro area.* Metropolitan Council. https://metrocouncil.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/REPORTS-TO-THE-LEGISLATURE/2022-MAWSAC-Recommendations-for-Water-Supply-Plann.aspx

Metropolitan Council Meeting. (2022, December). *Adopt Climate Action Work Plan.* Metropolitan Council. https://metrocouncil.org/getdoc/643c2db3-176c-4b1f-8324-a8ca44d9c4d8/Agenda.aspx

Minnesota Department of Agriculture. (2022a). *Mitigation level determination*. https://www.mda.state.mn.us/mitigation-level-determination

Minnesota Department of Agriculture. (2022b). *Local advisory teams*. https://www.mda.state.mn.us/local-advisory-teams

Minnesota Department of Agriculture. (2022c). *Computer modeling.* https://www.mda.state.mn.us/computer-modeling

Minnesota Department of Health (2016). *Nitrate risk to the water table aquifer (geospatial data).* Retrieved on September 27, 2022 from https://gisdata.mn.gov/dataset/health-nitrate-risk

Minnesota Department of Health. (2018a). *Land cover and associated potential contaminant sources.* Retrieved December 16, 2022, from https://www.health.state.mn.us/communities/environment/water/docs/swp/nlcclassiftn.pdf

Minnesota Department of Health. (2018b). *Wellhead protection area delineation fact sheet.* Retrieved January 12, 2023, from https://www.health.state.mn.us/communities/environment/water/docs/swp/delineation.pdf ***https://www.health.state.mn.us/communities/environment/water/docs/swp/nlcclassiftn.pdf***

Minnesota Department of Health. (2019a). *Drinking water supply management areas* [Data set]. https://gisdata.mn.gov/dataset/water-drinking-water-supply

Minnesota Department of Health. (2021a). *Special well and boring construction areas* [Data set]. https://gisdata.mn.gov/dataset/geos-special-well-const-areas

Minnesota Department of Health. (2021b). *Protecting vulnerable drinking water sources.* https://www.health.state.mn.us/communities/environment/water/docs/cwf/vulnacres.pdf

Minnesota Department of Health. (2022a). *Source water assessments*. Retrieved September 13, 2022, from https://www.health.state.mn.us/communities/environment/water/swp/swa.html

Minnesota Department of Health. (2022b). *Minnesota well index*. [Data set] https://gisdata.mn.gov/dataset/health-mn-well-index

Minnesota Department of Health. (2022c). *Isolation distances from a water-supply well.* Retrieved September 18, 2022, from https://www.health.state.mn.us/communities/environment/water/wells/construction/isolate.html

Minnesota Department of Health. (2022a). *Water changes*. https://www.health.state.mn.us/communities/environment/climate/water.html#:~:text=Climate%20change%20may%20impact%20Minnesota's,temperatures%20of%20lakes%20and%20streams.

Minnesota Department of Health. (2022b). *Resources for source water protection implementation.* Retrieved December 9, 2022, from https://www.health.state.mn.us/communities/environment/water/swp/resources.html

Minnesota Department of Health. (2022c, June). *Comparison of state water guidance and federal drinking water standards.* https://www.health.state.mn.us/communities/environment/risk/guidance/waterguidance.html

Minnesota Department of Natural Resources. (2017, April 1). Groundwater management areas, Minnesota [Data set]. https://gisdata.mn.gov/dataset/bdry-groundwater-mgmt-areas

Minnesota Department of Natural Resources. (2018, October 31). Pollution sensitivity of near-surface materials [Data set]. https://gisdata.mn.gov/dataset/geos-hydrogeology-atlas-hg02

Minnesota Geospatial Commons. (2022). *Minnesota groundwater contamination atlas.* [Data set] https://gisdata.mn.gov/dataset/env-mn-gw-contamination-atlas

Minnesota Pollution Control Agency. (2014, September). *The Minnesota nutrient reduction strategy.* https://www.pca.state.mn.us/sites/default/files/wq-s1-80.pdf

Minnesota Pollution Control Agency. (2022a). *What's in my neighborhood*. Retrieved September 18, 2022, from https://webapp.pca.state.mn.us/wimn/search

Minnesota Pollution Control Agency. (2022b). *Minnesota groundwater contamination atlas* [Data set]. 27https://www.pca.state.mn.us/about-mpca/minnesota-groundwater-contamination-atlas

Minnesota Pollution Control Agency. (2022a). Minnesota 3M PFAS settlement Retrieved September 18, 2022, from https://3msettlement.state.mn.us/full-plan-documents-conceptual-drinking-water-supply-plan

Premier Water Technologies. (2018, August 14). *A History of Twin Cities Drinking Water Contamination.* https://www.premierwatermn.com/a-history-of-twin-cities-drinking-water-contamination/

Public Water Supplies. Minn R. 4720.0010-9080 (2022). https://www.revisor.mn.gov/rules/4720/

Sourcewater Collaborative. (2017, May). *Advice worth drinking: Your water. Your decision: How today's land-use decisions can protect tomorrow's water supply. A planner's guide*. Retrieved from https://www.sourcewatercollaborative.org/guide-for-land-use-planners/

State of Minnesota v. 3M Company. Agreement and Order 27-CV-10-28862 (Fourth Judicial District Court, Hennepin County, MN 2018). Retrieved from https://3msettlement.state.mn.us/sites/default/files/State%20of%20MN%20v.%203M%20Company%20Agreement%20and%20Order.pdf

Kaufenberg, L., Dahlmeier, A., Mabry, M., Abt Associates, Wood Environment & Infrastructures Solutions. (2021, August). *Conceptual drinking water supply plan: Long-term options for the east metropolitan area.* Minnesota Pollution Control Agency and Minnesota Department of Natural Resources.https://3msettlement.state.mn.us/full-plan-documents-conceptual-drinking-water-supply-plan

Wells, Borings, and Underground Uses. Minn. Stat. Ch. 103I (2022). https://www.revisor.mn.gov/statutes/cite/103I

Appendix A: Enlarged Figures

Figure 1. Sources of water for communities in the metro region

Over 100 different public water utilities and 60,000 private wells use groundwater, surface water, or a combination of both. Everyone should be aware of this information and keep it in mind when making decisions that could impact the drinking water supplies for over half of the people in Minnesota. Effective source water protection planning and implementation recognizes that communities face very different opportunities, challenges, and limitations.

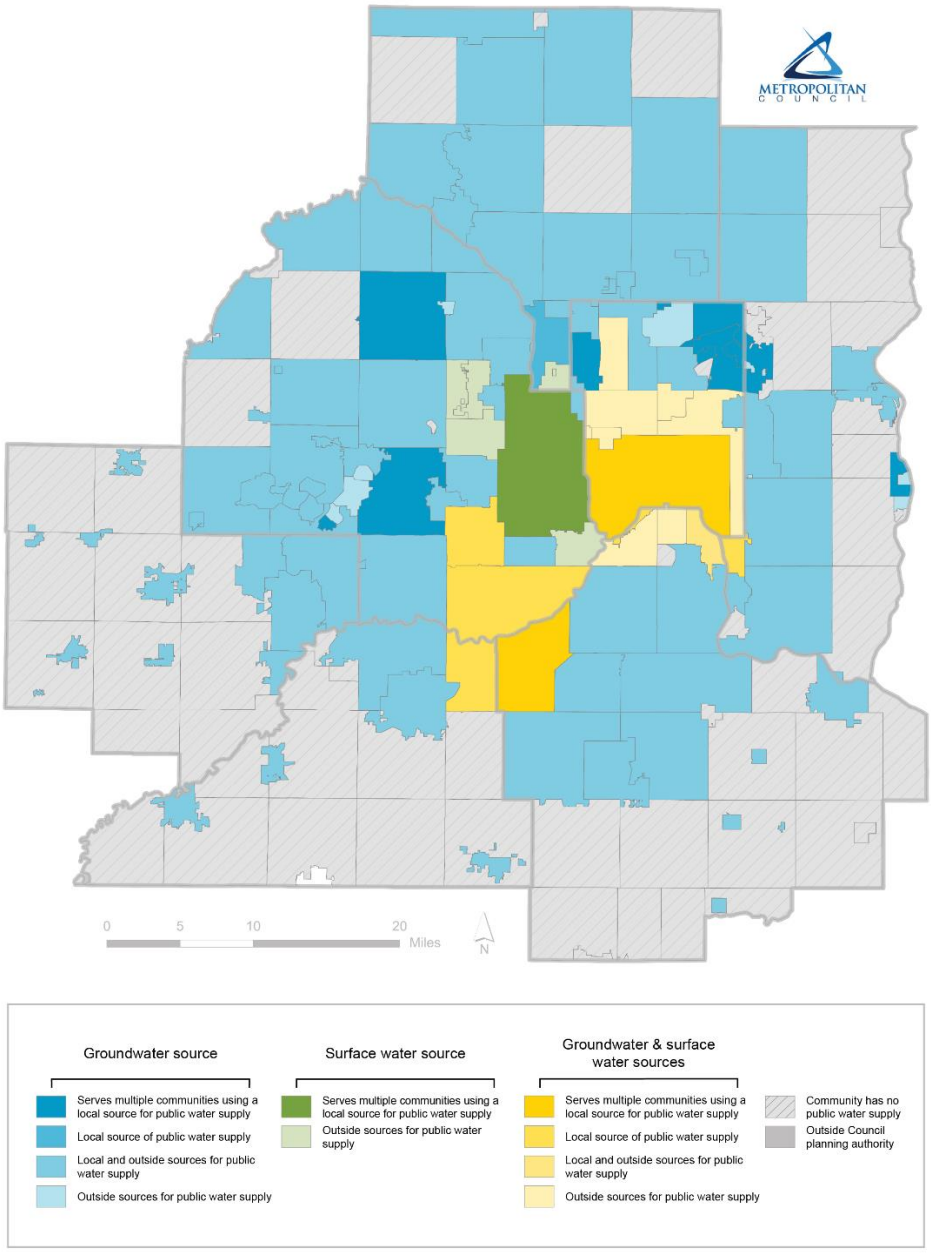


Figure 2. Surface waters that are primary sources for drinking water in the metro region

The Priority Waters List identifies surface waters that are a direct source of drinking water for Minneapolis and Saint Paul and the communities that they provide water to. This and other information included in the Priority Waters list can guide resources to monitor, assess, plan for, and improve the region's water bodies to benefit drinking water supplies.

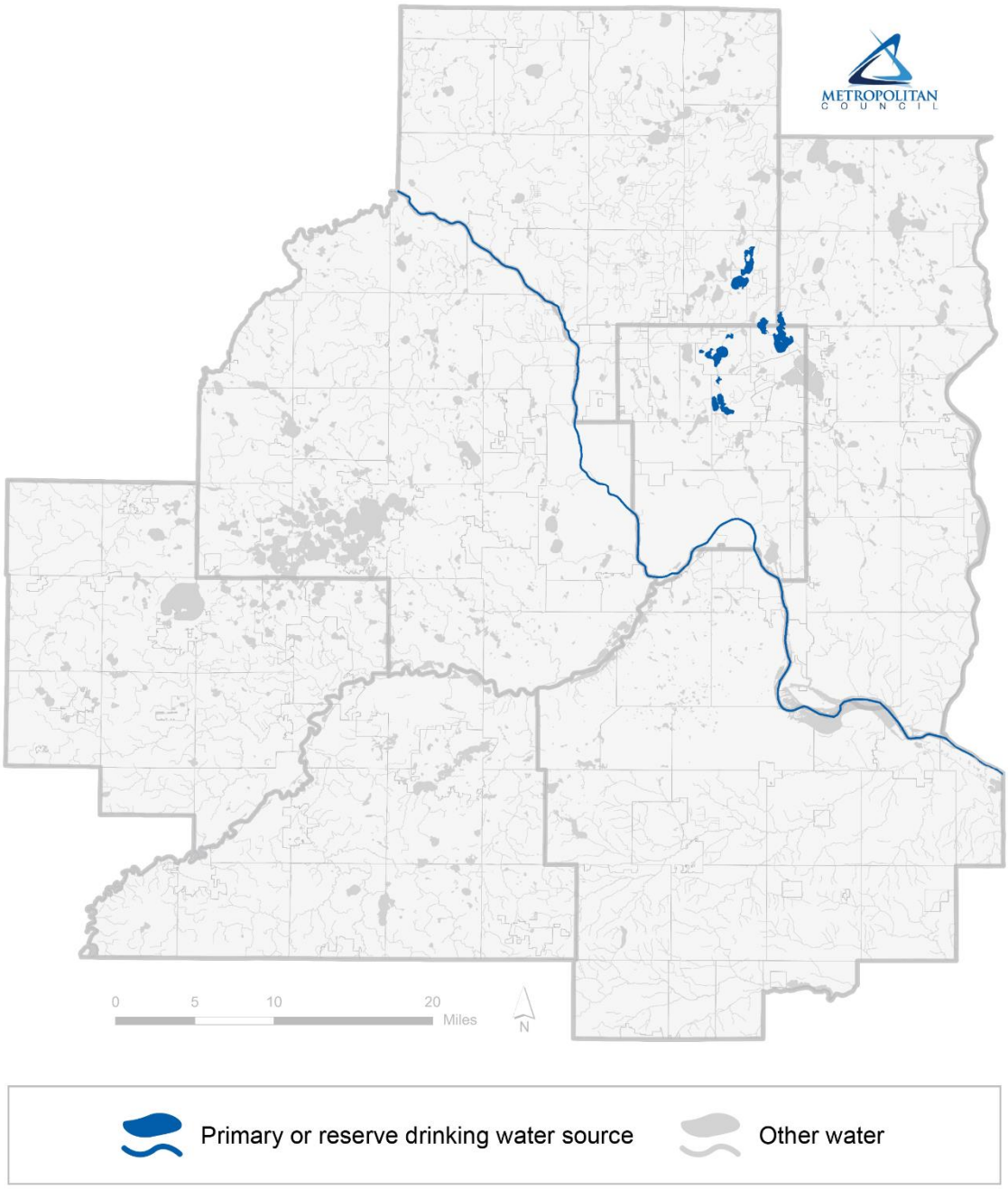


Figure 3. Key components and connections in the region’s water supply network

See page 3 of the research paper.

Figure 4. Metro region drinking water supply management areas and their vulnerability (MDH, 2019)

Water supply planners and public water suppliers focus activities in areas most important to drinking water sources. These drinking water supply management areas (DWSMAs) are defined by public water systems (PWSs) working with the Minnesota Department of Health (MDH). Over 600 separate drinking water supply management areas have been defined by over 100 PWSs, covering approximately 30% of the metro region. Within these areas – particularly where they are most vulnerable - contamination on the land surface or in water can affect drinking water supplies. While MDH and PWSs are responsible for providing safe drinking water, they do not have authority or capacity to protect drinking water sources on their own. Much of the area surrounding drinking water wells and intakes is privately owned and outside of municipal jurisdiction.

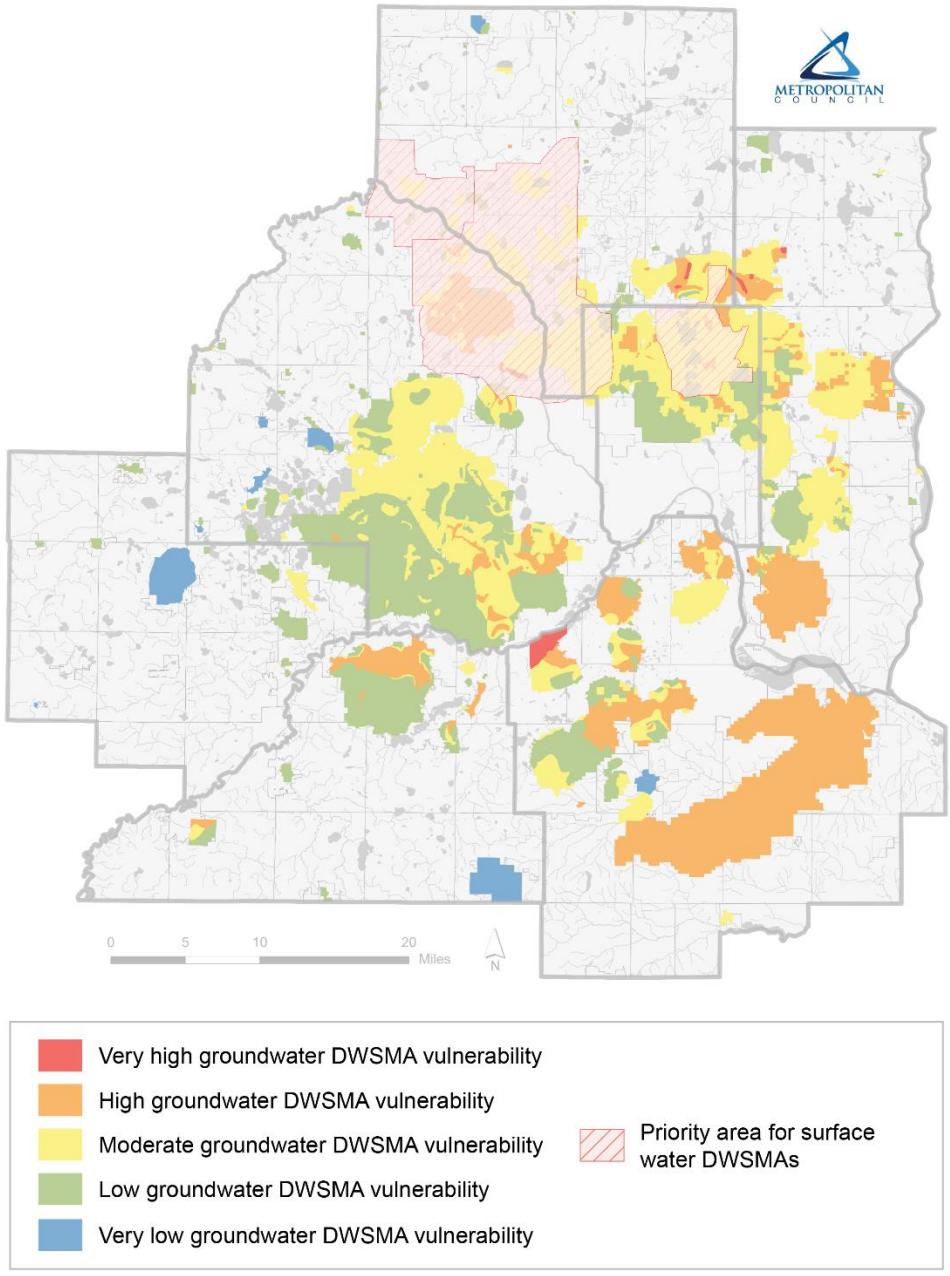


Figure 5. Examples of Met Council properties versus DWSMAs (MDH, 2019)

Several Met Council properties and facilities are in or near source water protection areas. Of the approximately 550 public parcels owned by the Met Council, about 80 are associated specifically with Environmental Services and around 20 are associated with Metro Transit. Met Council takes steps to ensure these assets are managed in ways that protect source waters. Information about source water protection areas and vulnerability should continue to be considered and prioritized as property and facility plan implementation is evaluated and as plans are updates.

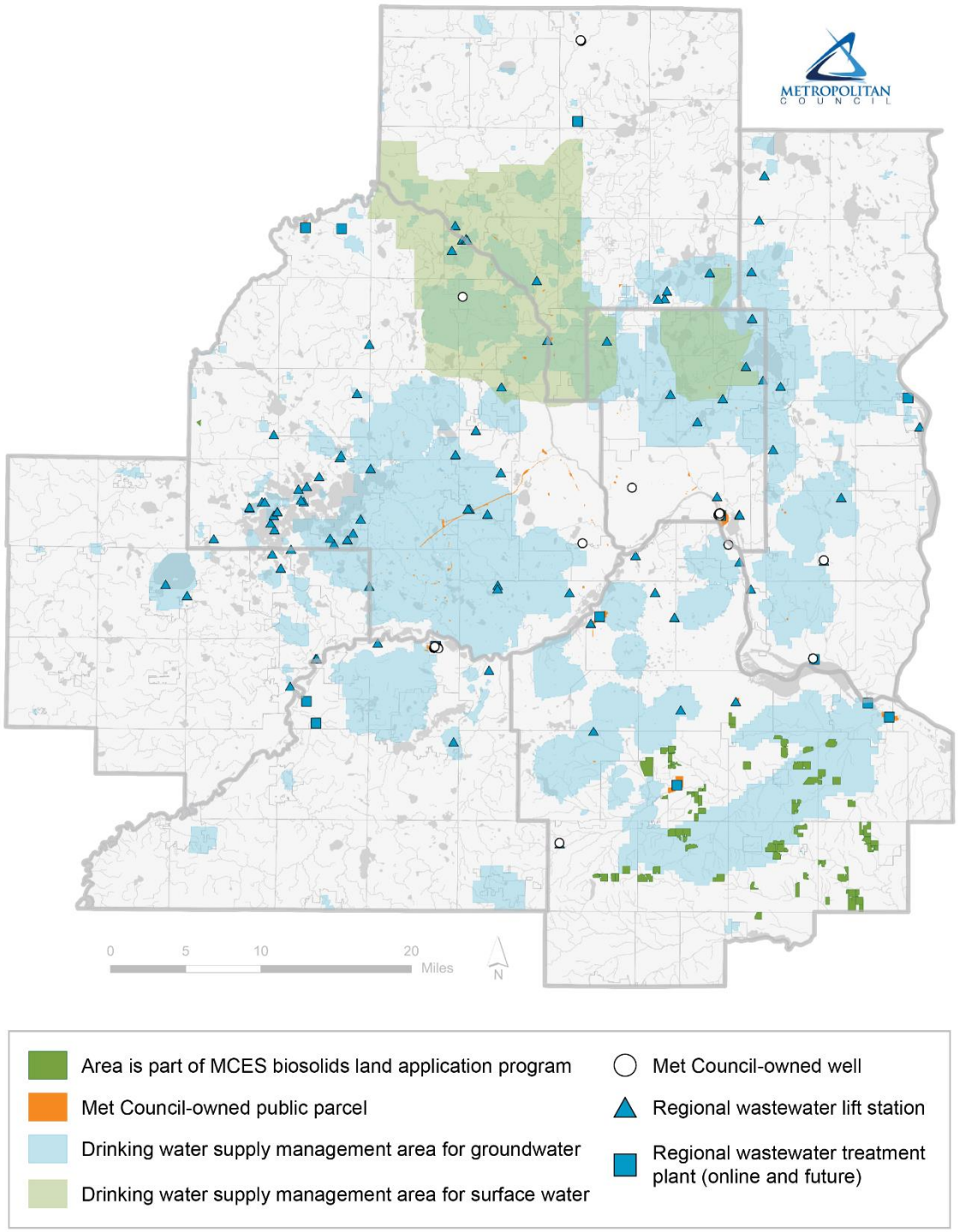


Figure 6. Regional park elements in relation to DWSMAs (MDH, 2019)

The great majority of regional parks; state parks, trails, scientific and natural areas, and wildlife management areas; and national parks and federal wildlife refuges are adjacent to water. Regional trails also often follow rivers, streams, and creeks. There are opportunities for water quality protection through land management and outreach and engagement.

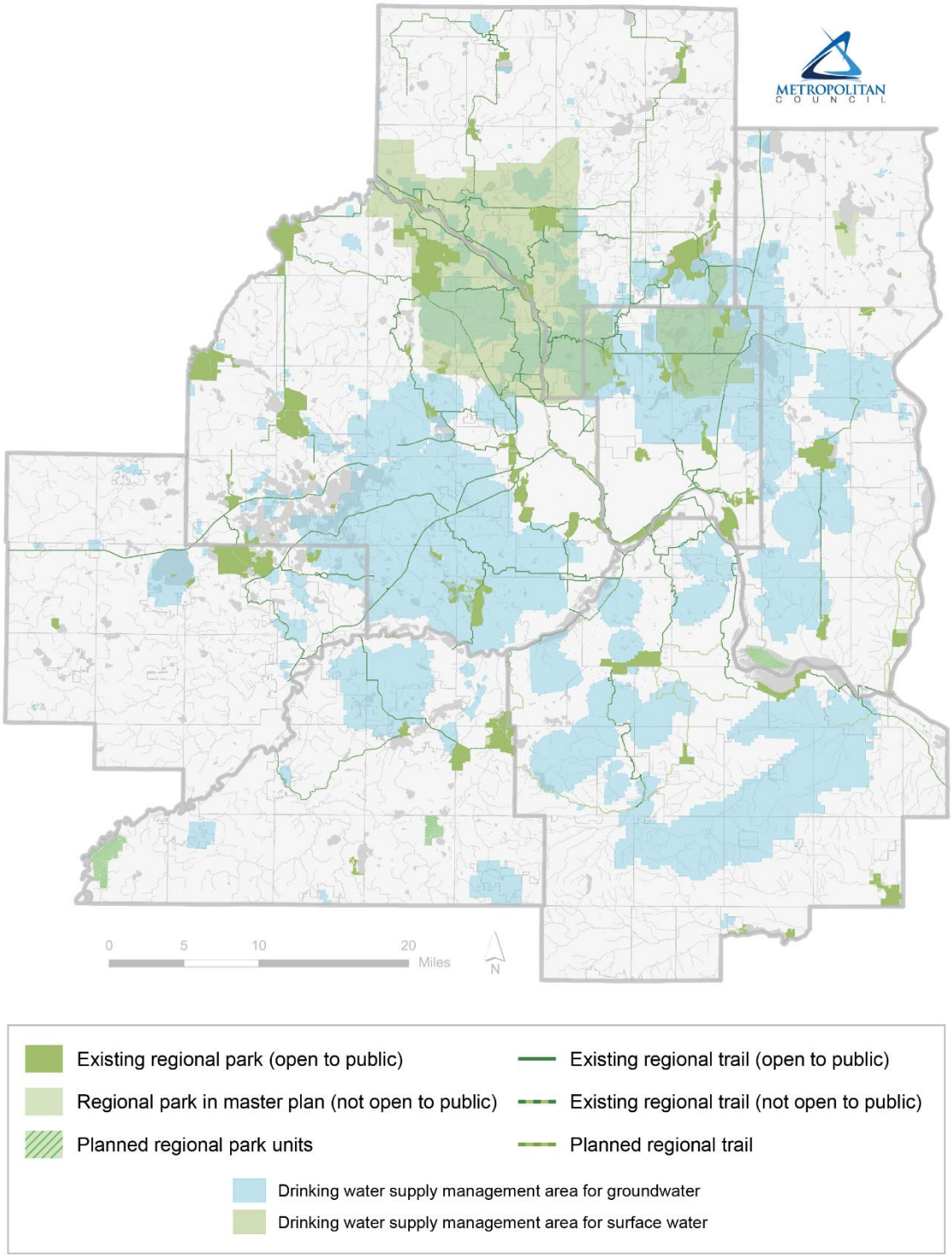


Figure 7. Source water protection areas in the metro region, highlighting overlaps (MDH, 2019).

Individual water supply planners and public water suppliers focus activities in DWSMAs the define with the MDH. However, several of the over 170 separate drinking water supply management areas in the metro region overlap one another. This condition highlights the importance of developing consistent and targeted outreach to properties that impact multiple public water supply systems. For example, areas in the southern part of Anoka County, eastern Hennepin County and northern Ramsey County supply water to multiple communities and could benefit from resources for multi-community source water planning and implementation.

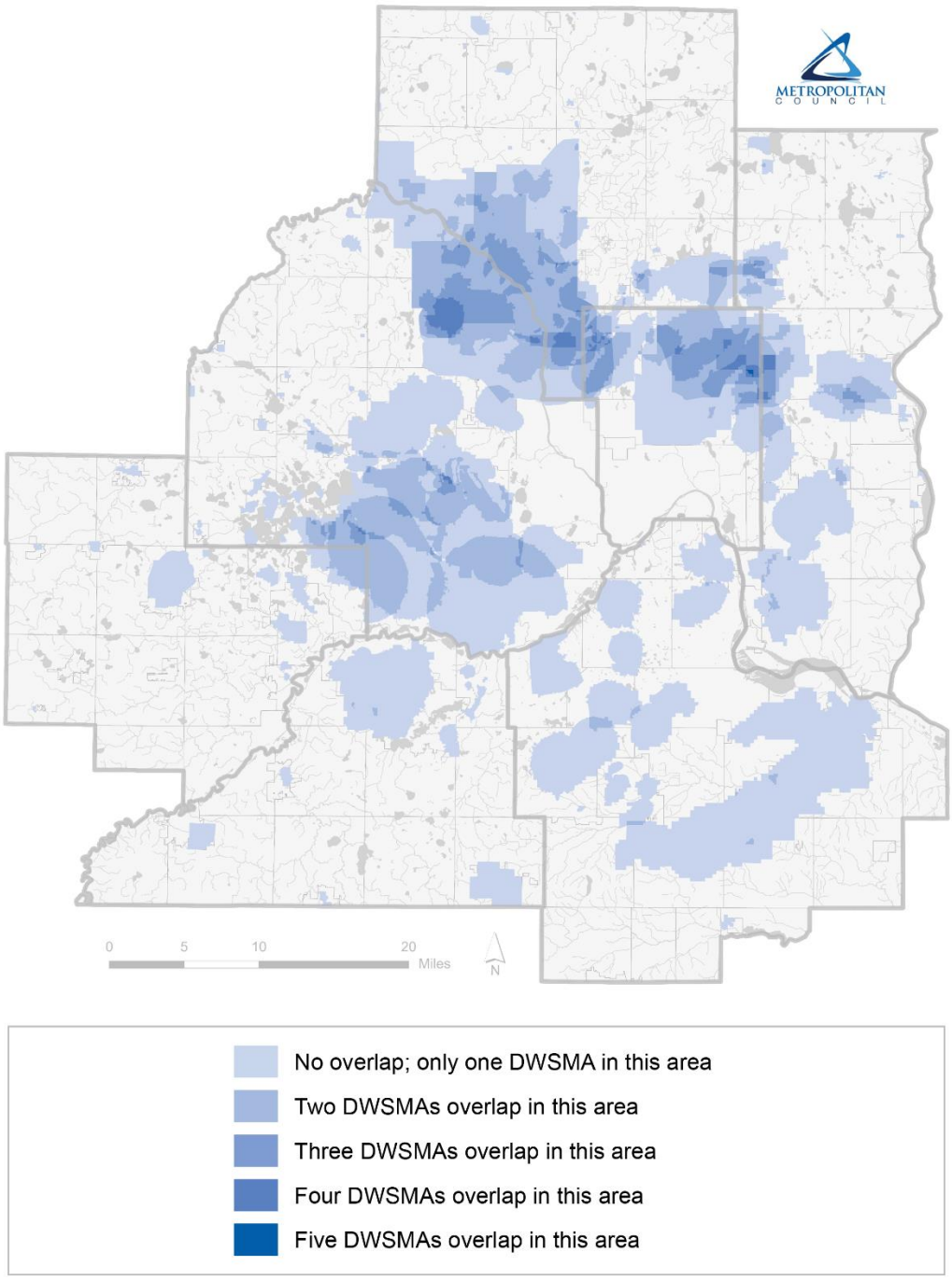


Figure 8. Overlapping management jurisdictions compared to source water protection areas

There are wide variety of entities with intersecting roles that impact source water protection such as county and community boundaries, MDH and community-managed community-designated drinking water supply management areas, DNR-led groundwater management area, and watershed organizations.

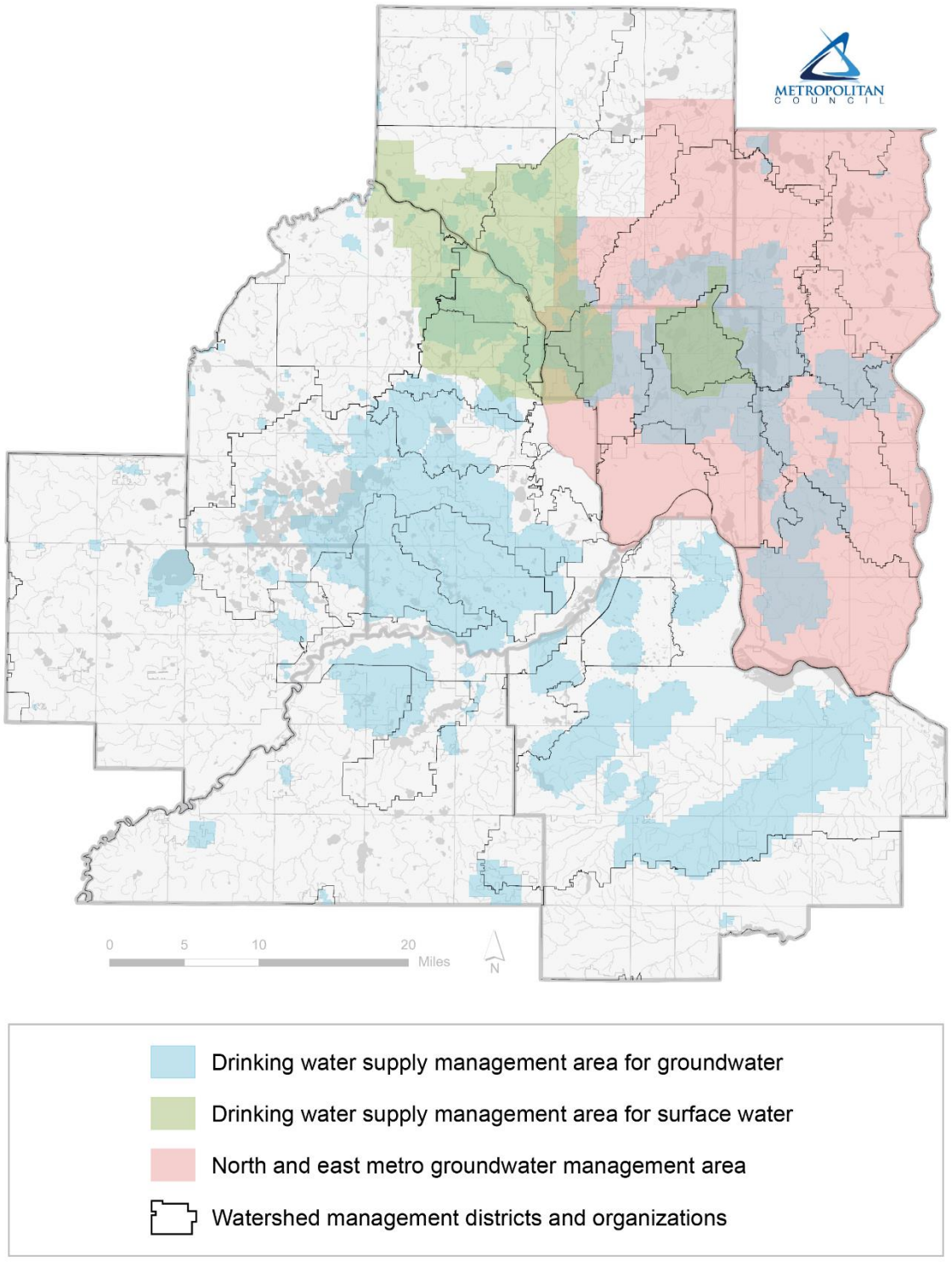


Figure 9. Model prediction of reduced infiltration due to climate change

Model prediction of reduced infiltration due to climate change. Although the region just experienced a historically wet decade from 2010-2019, a suite of global climate model projections still suggest that infiltration may go down, limiting the amount of water available to recharge drinking water aquifers. Policy makers and planners should consider a range of strategies that prepare for both wet and dry conditions. As more refined climate projection data is developed for Minnesota and the region, this analysis should be updated.

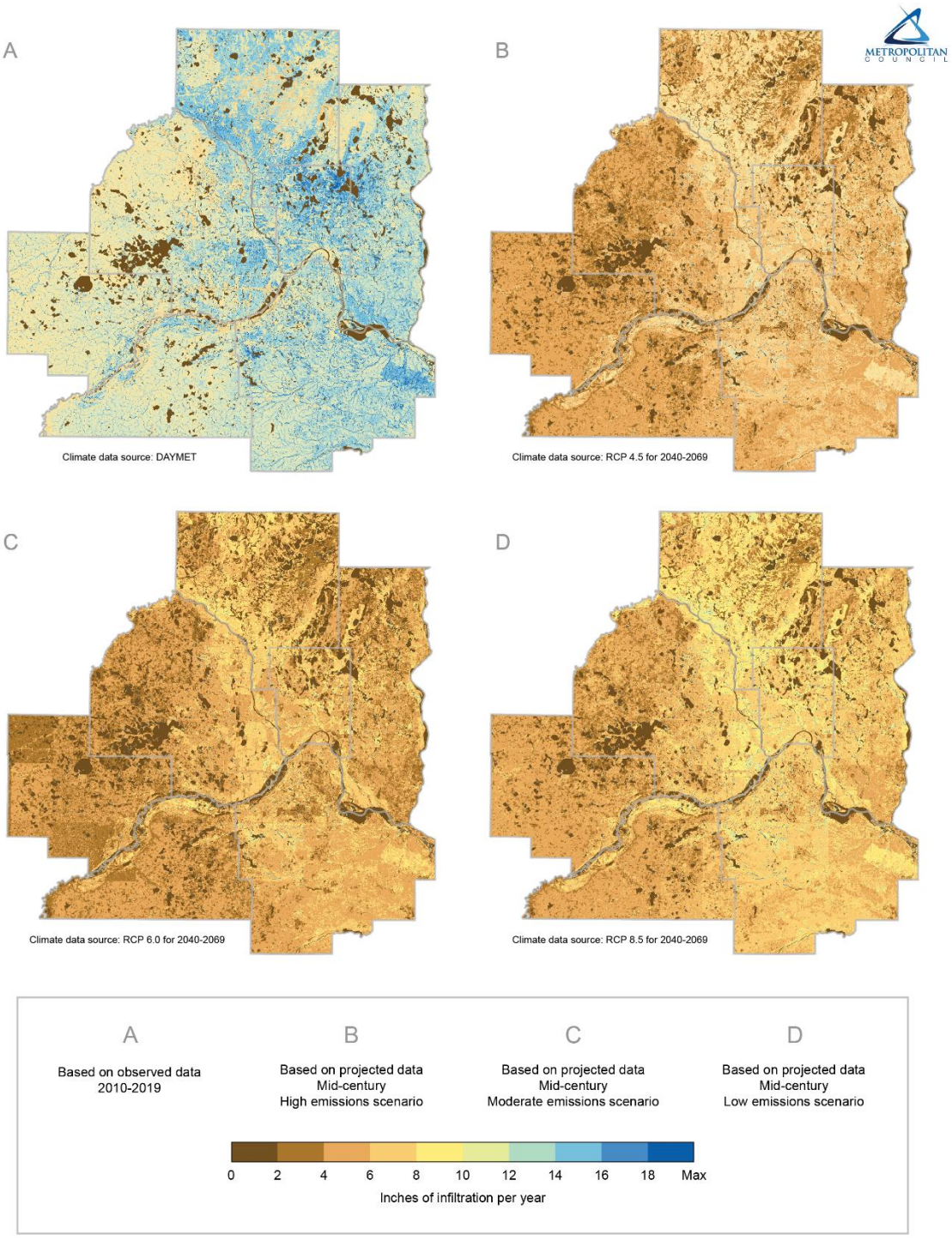


Figure 10. Pollution sensitivity of near surface materials in the metro region (DNR, 2018)

Soil type, depth to water, and deeper bedrock conditions vary across the region, making some areas more sensitive to pollution. Land use planners and best management practice guidance should share this information with developers or other project teams to mitigate source water risks. This information is also useful for prioritizing pollution prevention or remediation programs.

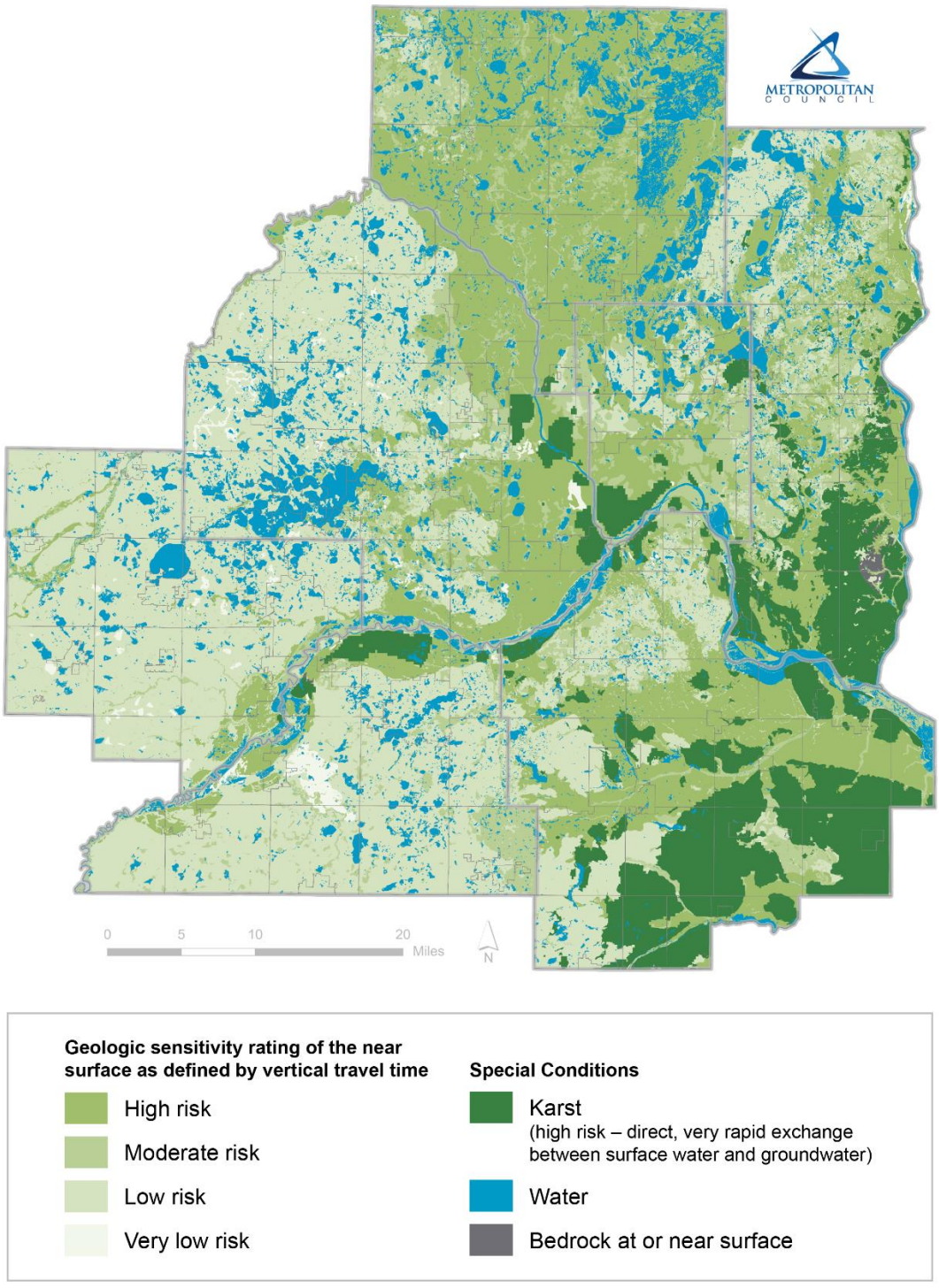
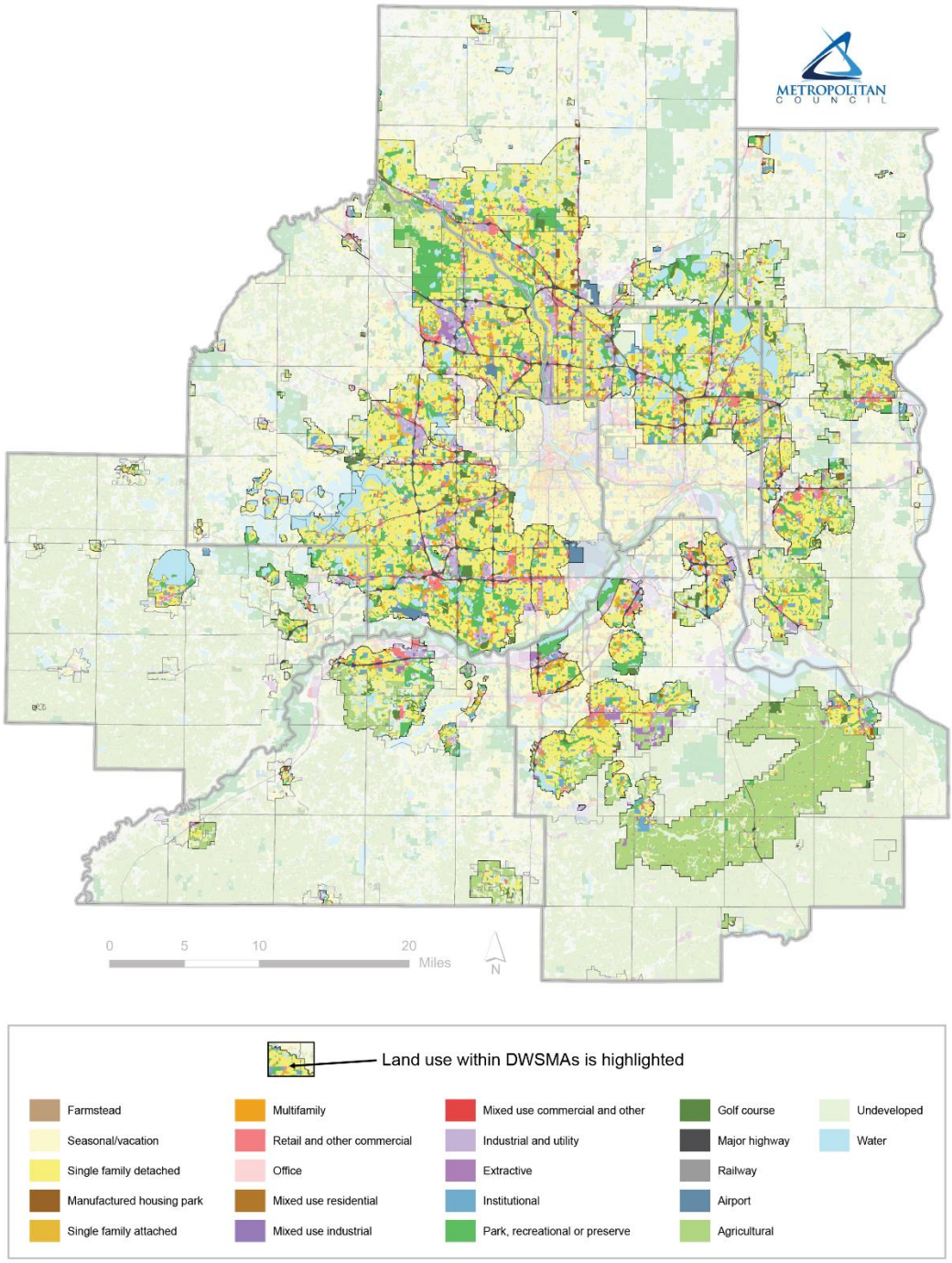


Figure 11. Generalized 2020 land use in the metro region, highlighting DWSMAs

While MN Department of Health and public water systems are responsible for providing safe drinking water, they do not have authority or capacity to protect drinking water sources on their own. Much of the area surrounding drinking water wells and intakes is privately owned and outside of municipal jurisdiction. Current (2020) land use varies across the 550,000 acres that have been designated as groundwater DWSMAs and/or Priority 'A' Areas of surface water DWSMAs. The top five largest land uses in metro DWSMAs are single family detached (33%); agricultural (15%); undeveloped (12%); parks, recreational, or preserve (12%); and open water (7%). This information should be considered as part of regional policy development and technical assistance programming.

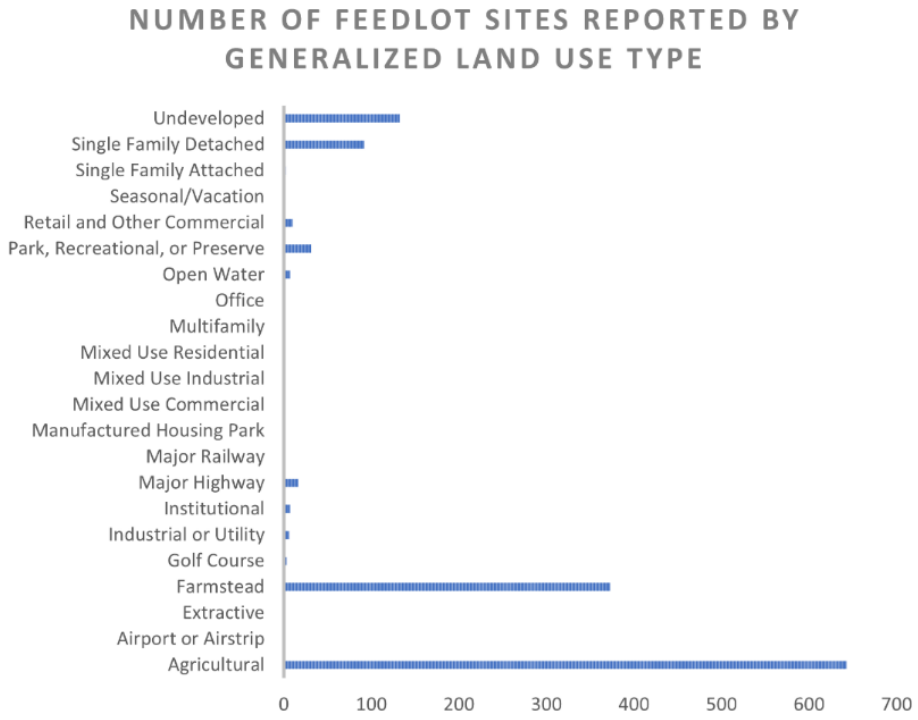


Figures 12a-h. Number of potential contaminant records by land use type in the metro region (MPCA, 2022a)

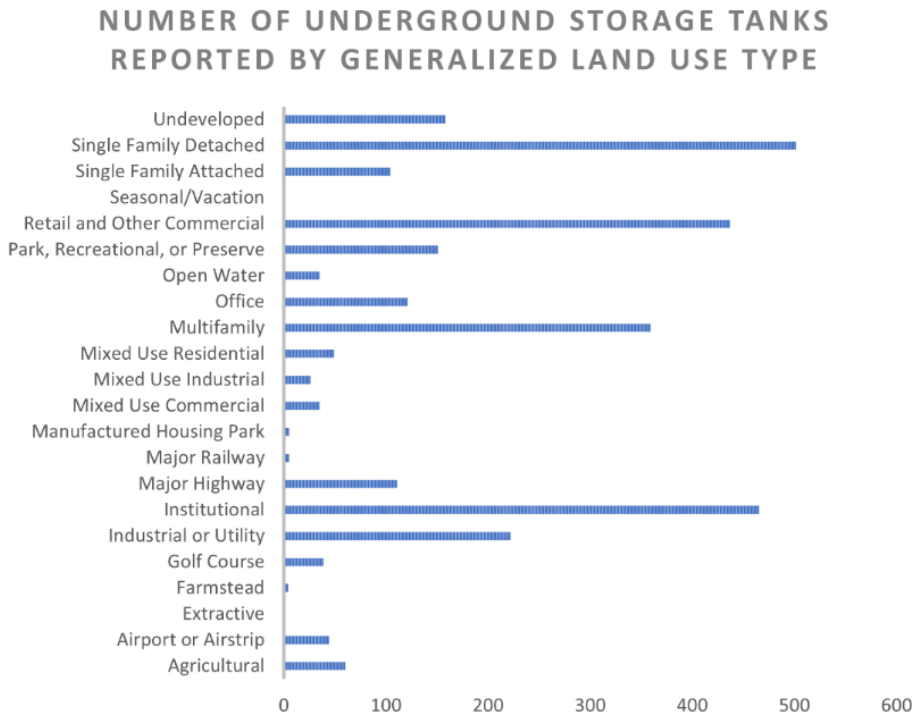
Graphs 12a-12h below summarize how the records in MPCA's What's in My Neighborhood database compare to the Met Council's 2020 generalized land use information. This information may help policymakers and land use planners better understand potential drinking water risks of certain land use types. Thinking comprehensively about land use, potential associated contaminants, and the location and vulnerability of DWSMAs may improve source water protection into the future.

a) Most hazardous waste site records are currently in areas designated as retail and other commercial, followed by industrial or utility.

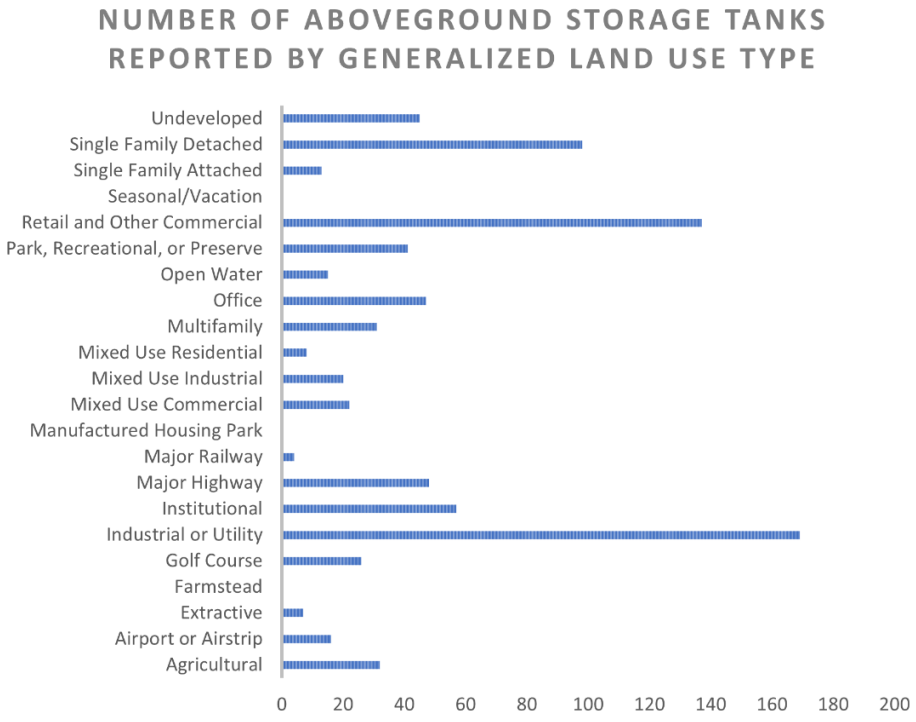
b) Most feedlot site records are currently in areas designated as agricultural, followed by farmstead.



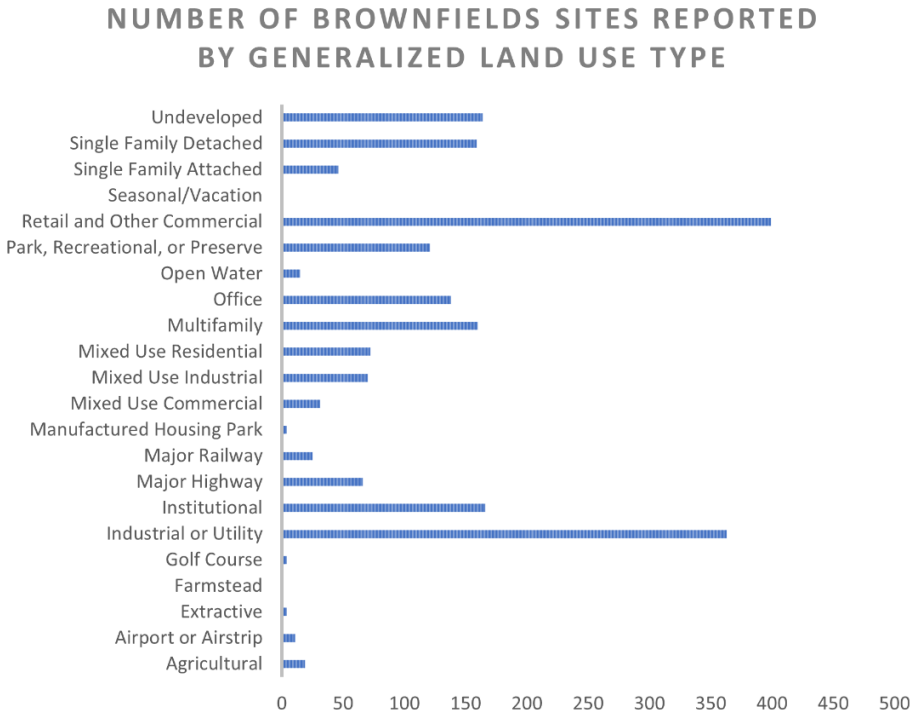
c) Most underground storage tank site records are currently in areas designated as single family detached, followed by institutional, and retail and other commercial.



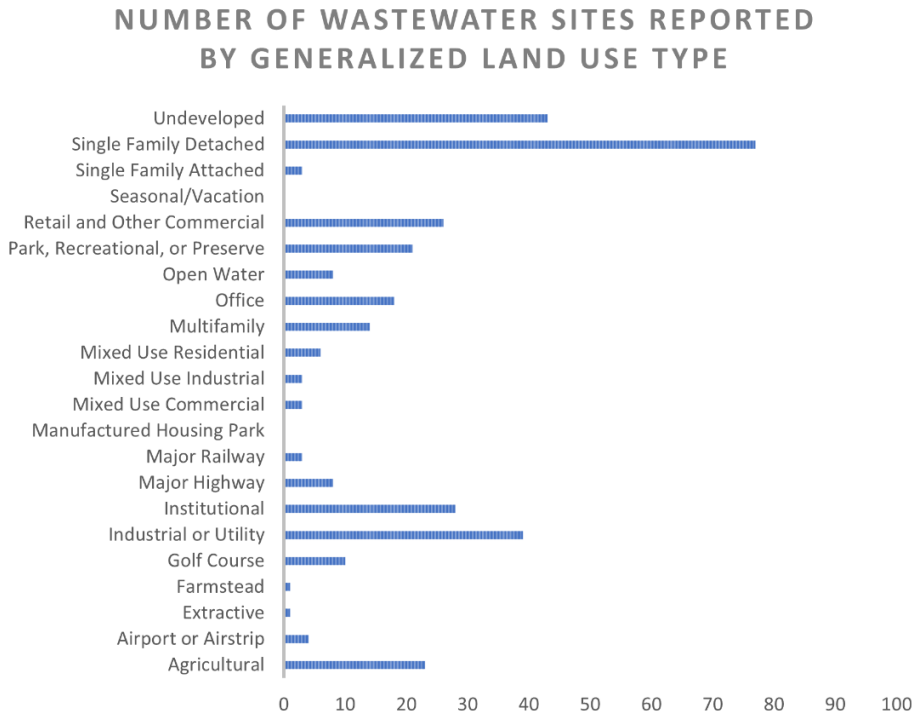
d) Most aboveground storage tank site records are currently in areas designated as industrial or utility, followed by retail and other commercial, then single family detached.



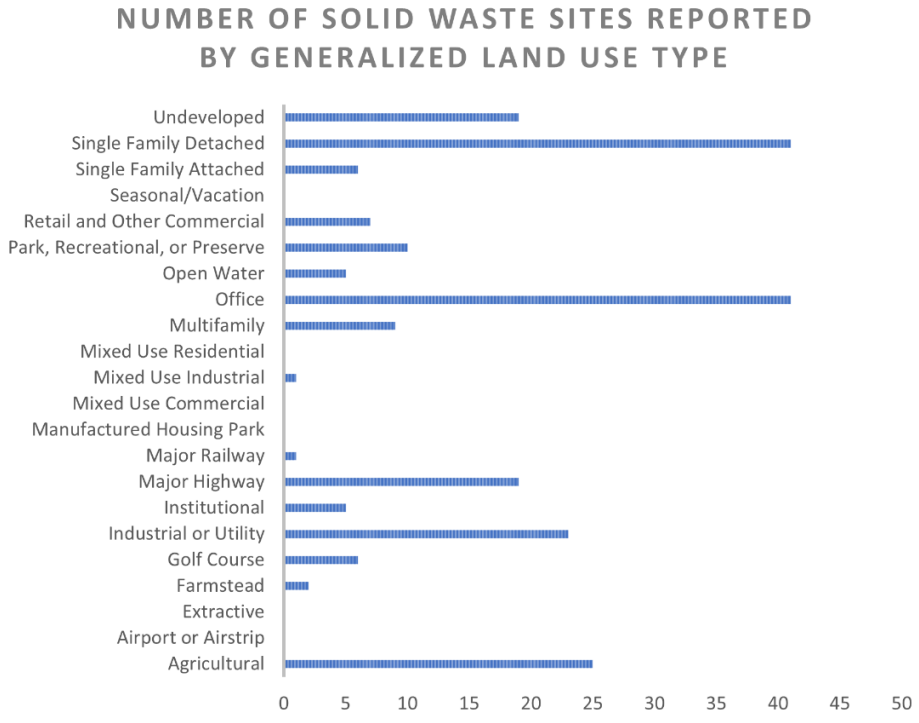
e) Most aboveground storage tank site records are currently in areas designated as industrial or utility, followed by retail and other commercial, then single family detached.



f) Most wastewater site records are currently in areas designated as single family detached, followed by undeveloped.



g) Most solid waste site records are currently in areas designated as single family detached, followed by office, then agricultural.



h) Most Superfund site records are currently in areas designated as industrial or utility, followed by park, recreational or preserve.

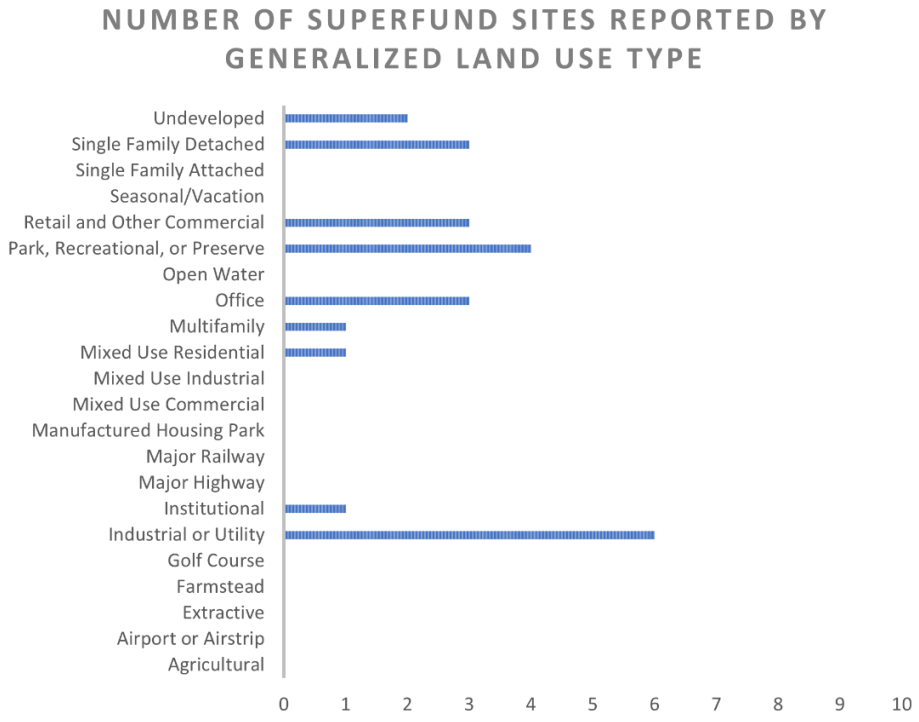


Figure 13. Wells, bridges, and aggregate mining in the metro region (MDH 2019, MDH, 2022b, MPCA, 2019)

Some landscape features, while not contaminants themselves, may create pathways for contaminants to more quickly enter water supply sources. Examples include wells; aggregate and other mining; stormwater basins, drains and infiltration practices; and transportation corridors including road and rail crossings over water. Watershed managers, emergency response planners and other should consider information like this alongside information about source water protection areas and vulnerability.

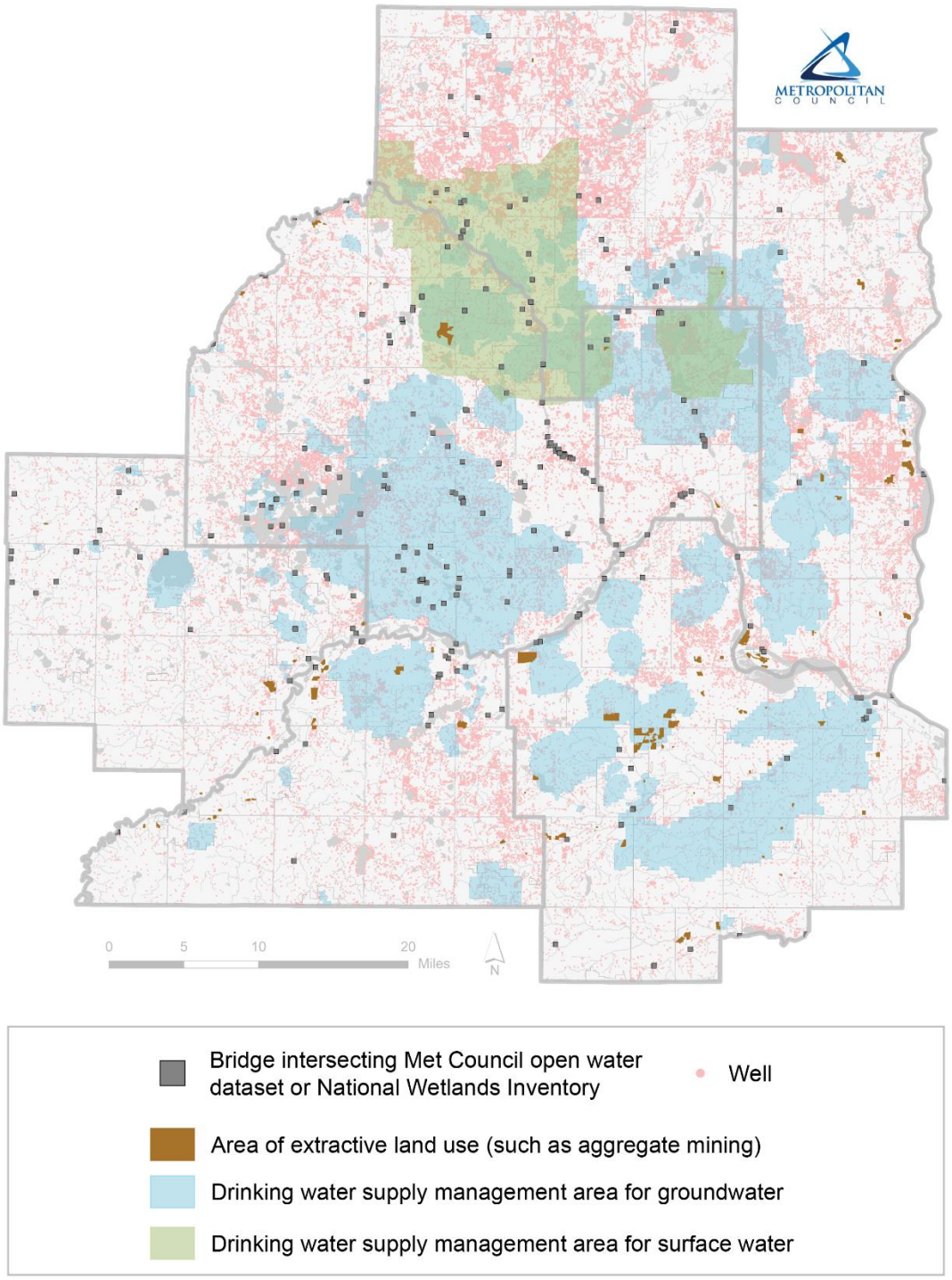


Figure 14. Populations served by different municipal source water protection areas (MDH, 2019)

Water for over 90% of the people living in the metro region flows through areas defined as DWSMAS. However, some areas supply many more people than others. The watershed above the Minneapolis and Saint Paul intakes on the Mississippi River supplies the largest population, but areas in western Hennepin and northern Ramsey counties also supply very large populations. They might be prioritized for regional investment in outreach/engagement and incentives to reduce potential contaminant sources.

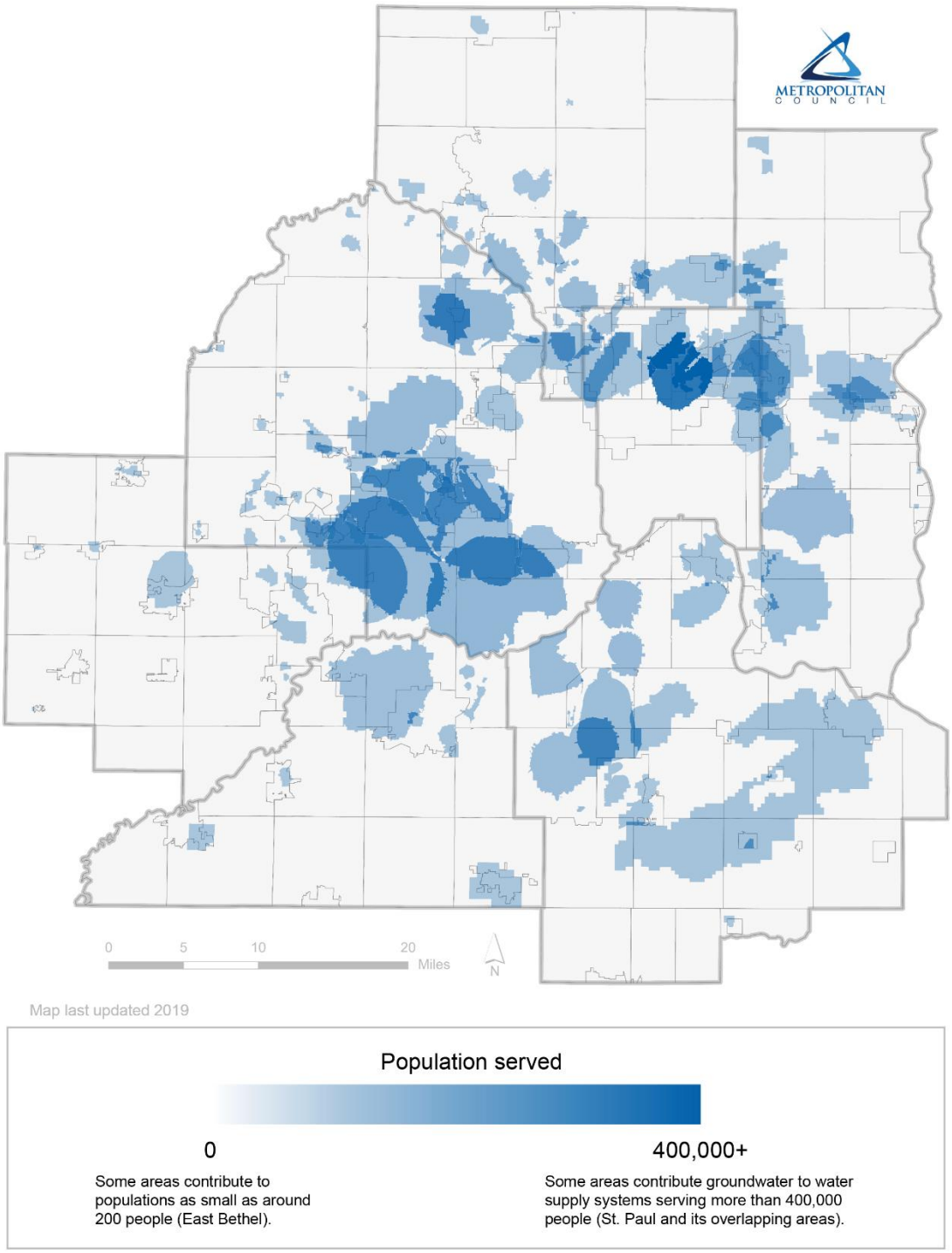


Figure 15. Watershed districts versus drinking water supply management area vulnerability (MDH, 2019)

Watershed districts should and do play an active role in source water protection including stormwater management; land use and water interaction and other land management activities; and their relationships with residents and businesses. Their boundaries span all levels of vulnerable drinking water supply management areas.

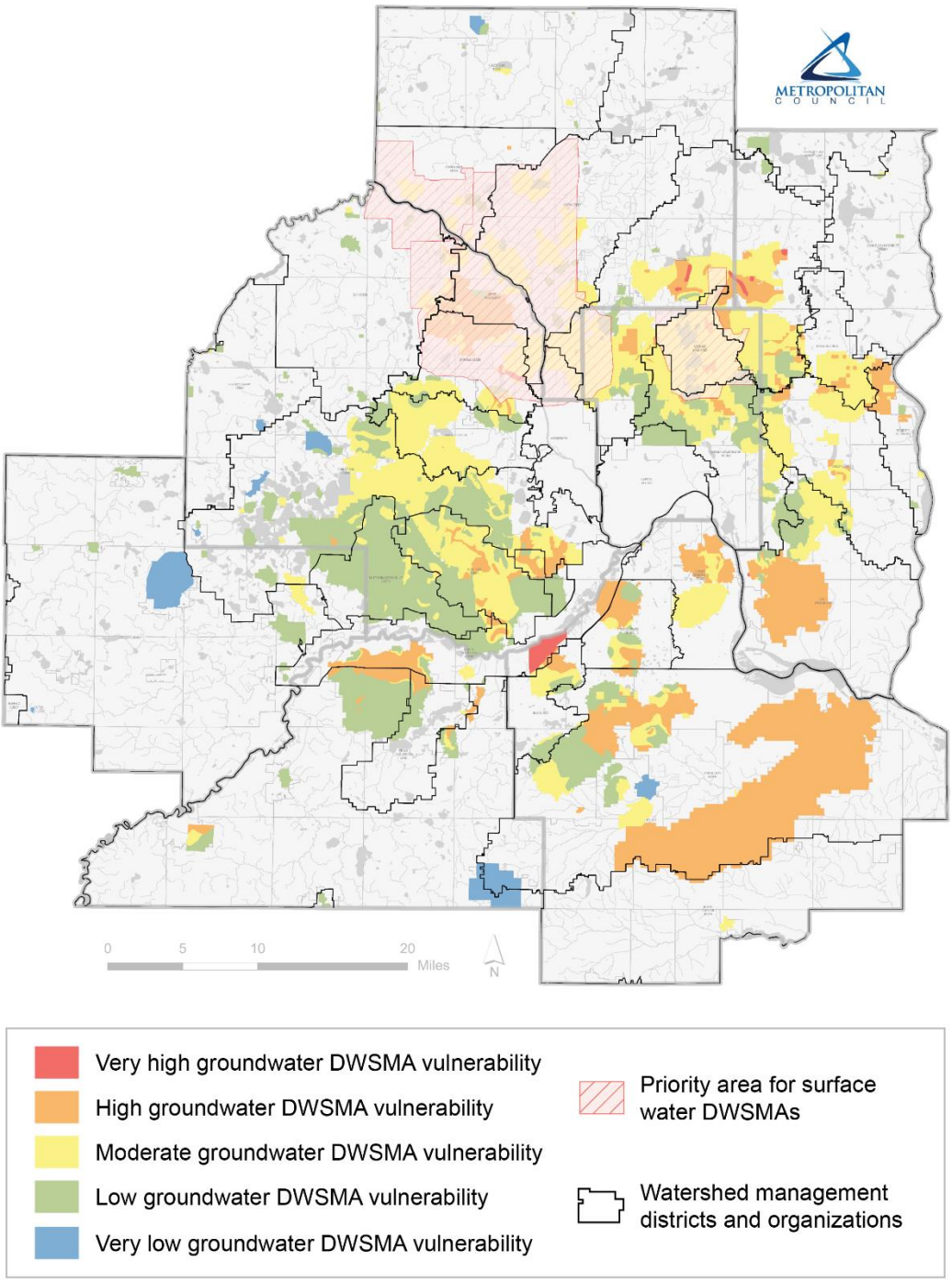


Figure 16. Subregional water supply work groups

These informal work groups provide a venue for neighboring communities and water utilities to exchange information about water supply-related projects and to collaborate on efforts too big for any one community to tackle alone. Going forward, subregional water supply work groups can provide guidance and shared recommendations to regional and local policymakers and planners. The Met Council should continue supporting these groups and providing convening space and leadership to promote cross-community collaboration.

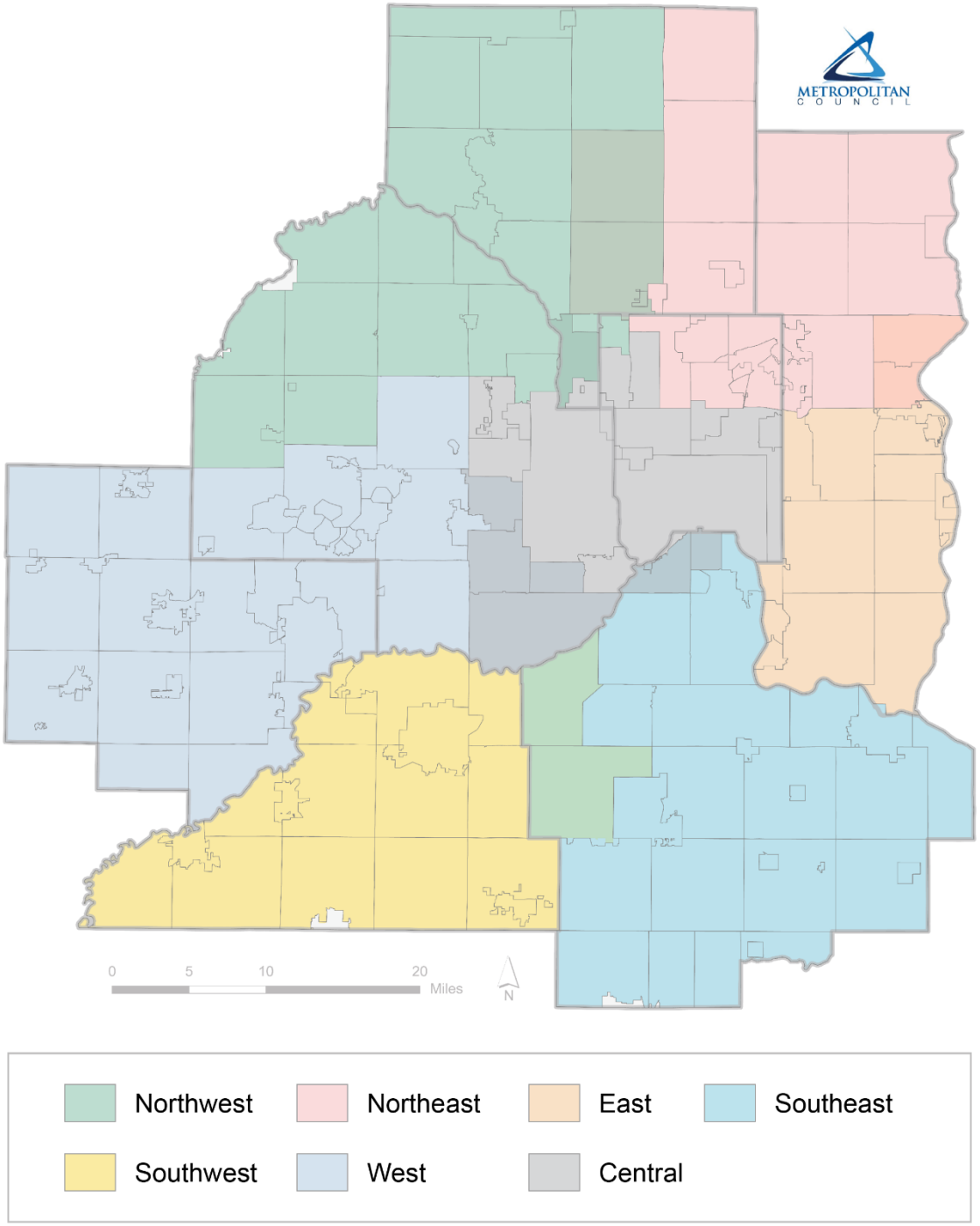


Figure 17. Examples of known contamination site in the metro region, highlighting DWSMAs (MPCA, 2022b, MN Geospatial Commons, 2022)

Existing contamination areas have been identified and mapped across the metro region. The groundwater contamination plumes in the East Metro and higher urban core density of brownfield sites are just two examples of contamination that the region currently faces. In defined DWSMAs, contamination remediation programs provide local benefits along with long-term benefits to the people who get their water from those areas.

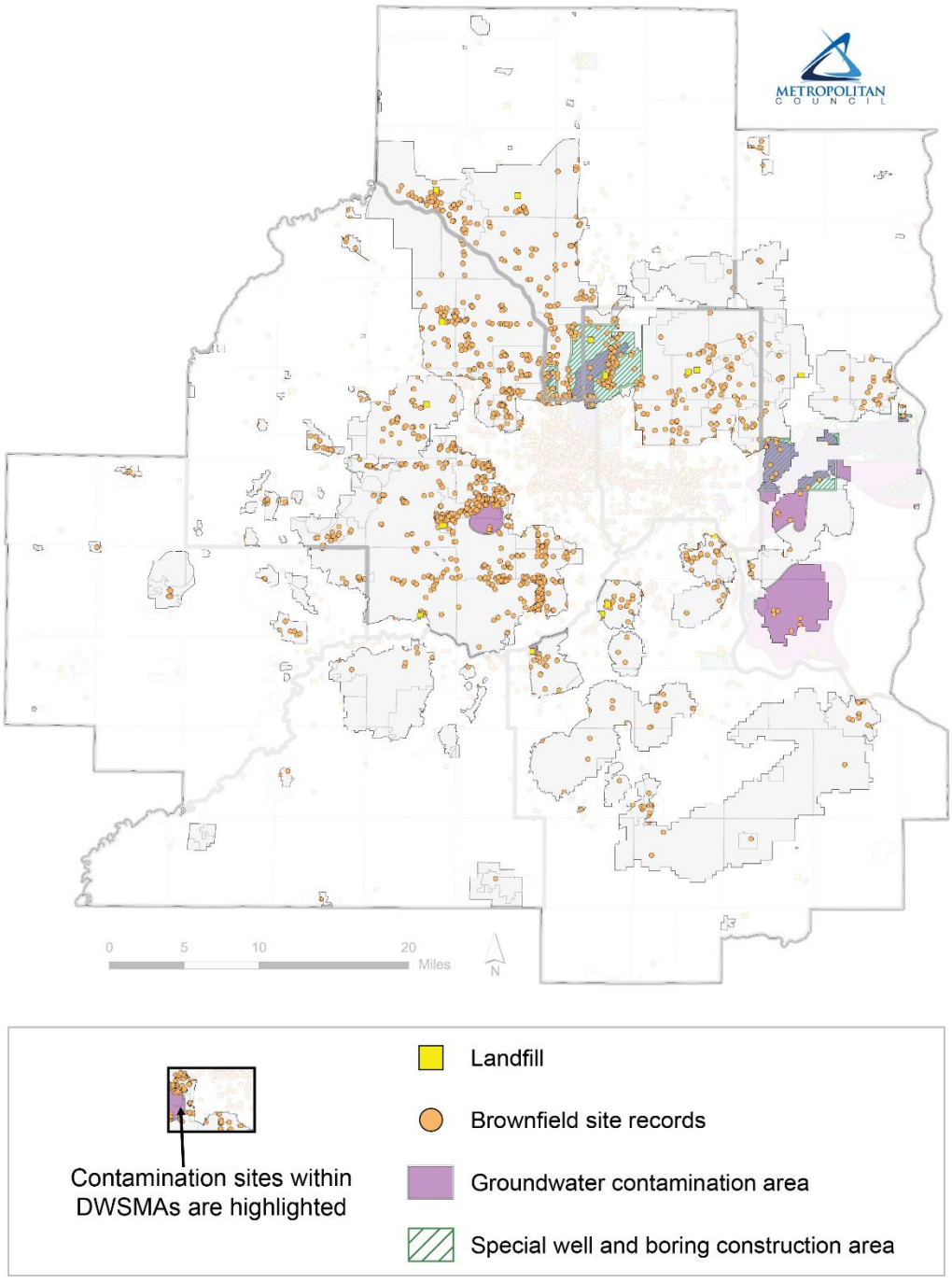


Figure 18. Nitrate risk to the water table in the metro region (MDH, 2016)

Agricultural practices in rural areas are a potential source of contamination, particularly given that 50% of the metro region is agricultural and undeveloped land, The nitrate risk to the water-table vary across the region. Programs to support nitrate reduction – particularly in southern Dakota County and western Scott and Carver counties - have long-term benefits for the region's water supplies.

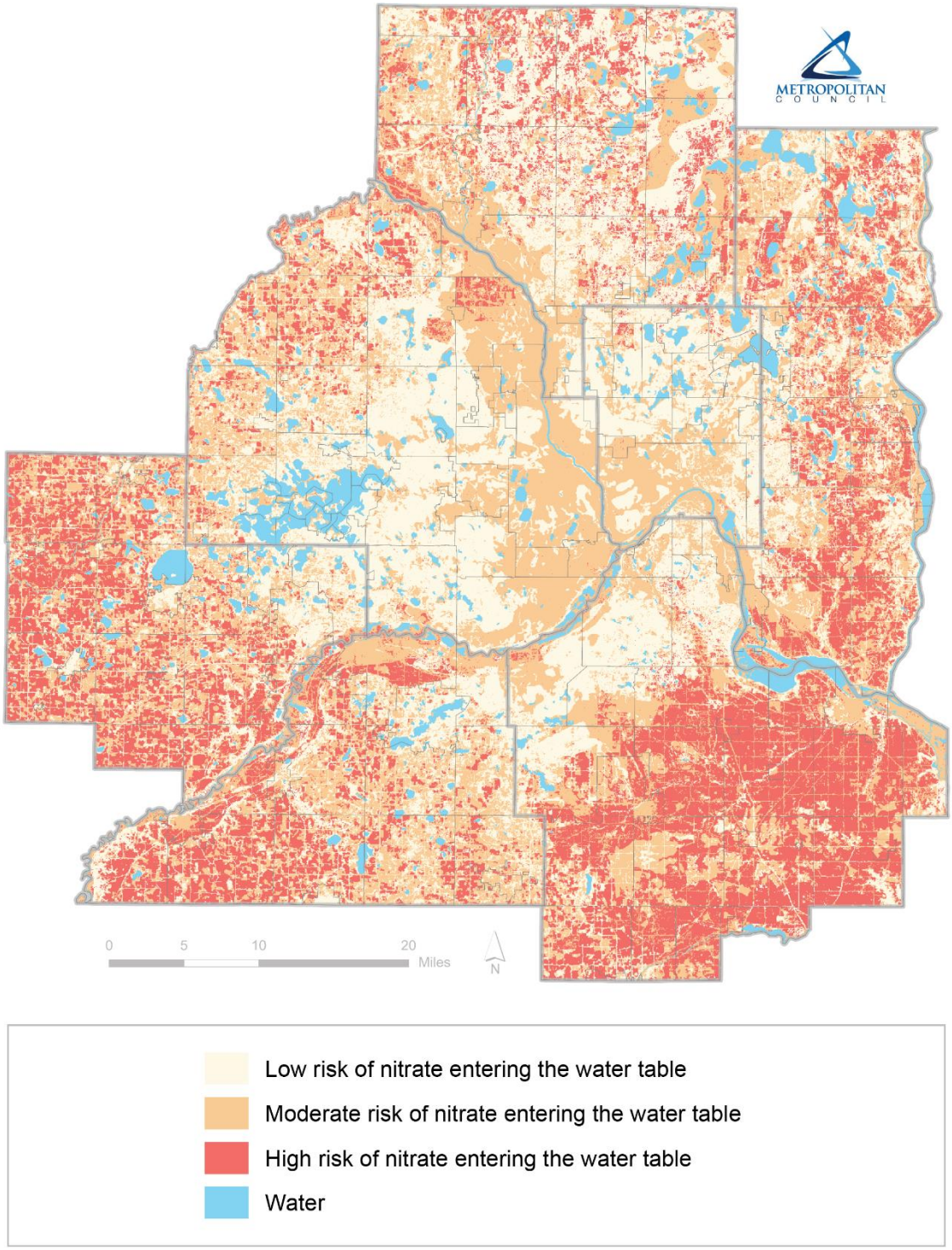


Figure 19. Areas of concentrated affluence and poverty versus community water supply sources

Effective source water protection planning and implementation recognizes that communities face very different opportunities, challenges, and limitations. For example: communities relying on private wells in eastern Washington County, and groundwater-supplied communities in the western metro are more likely to be in or near areas of concentrated affluence, highlighting opportunities to implement source water protection are relatively strong in these areas.

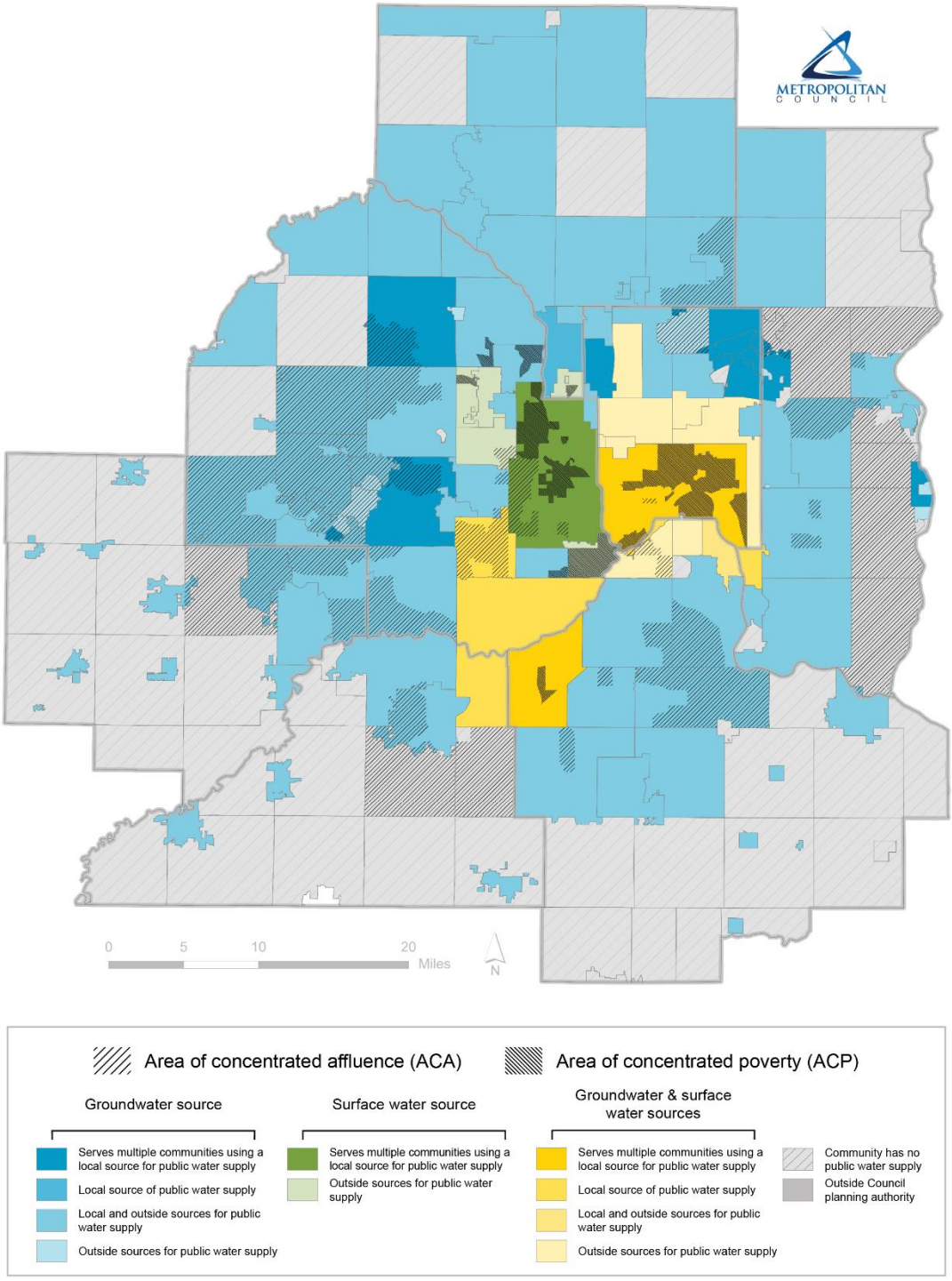
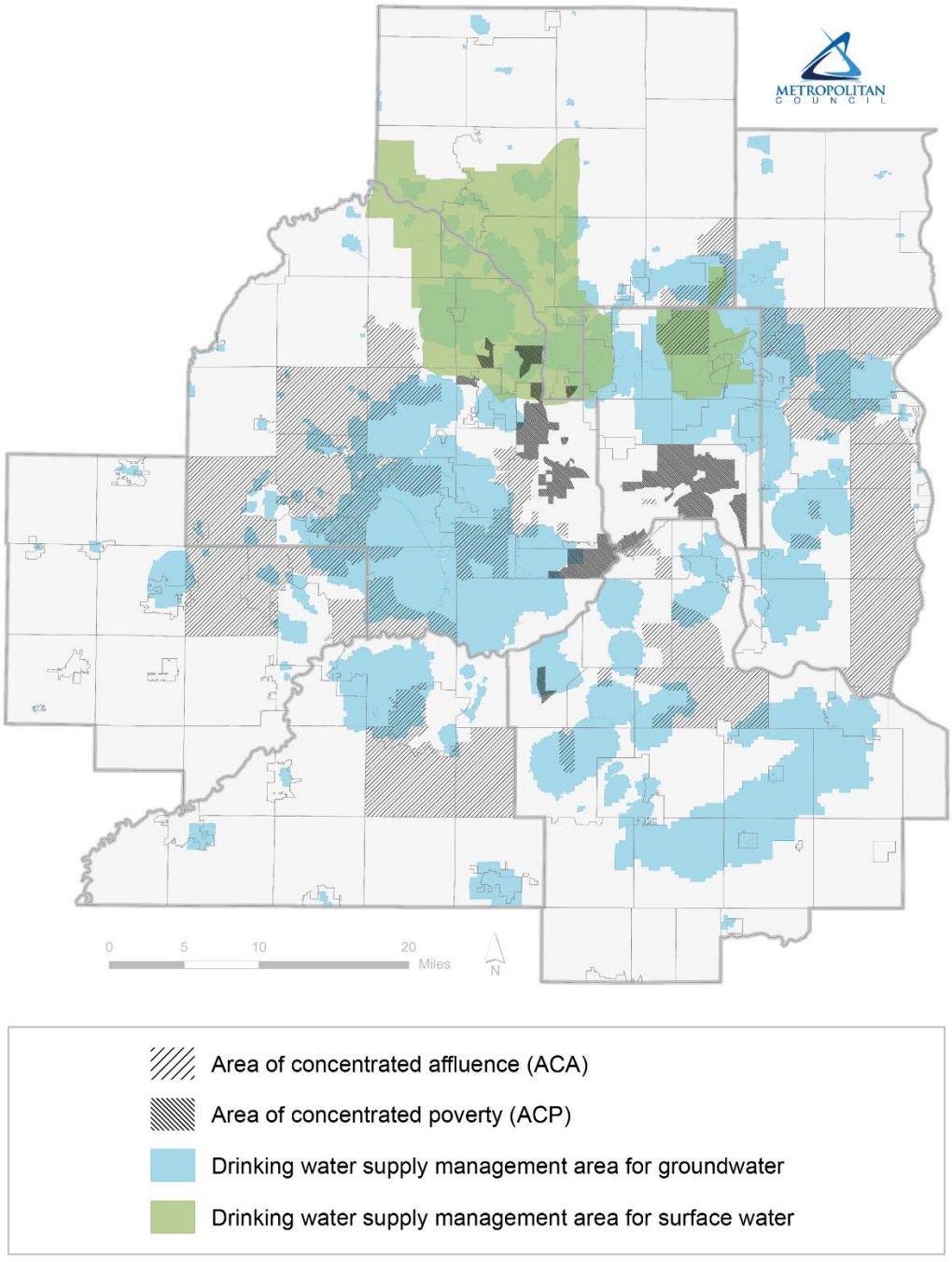


Figure 20. Areas of concentrated affluence and poverty versus drinking water supply management area (MDH, 2019).

Effective source water protection planning and implementation recognizes that communities face very different opportunities, challenges, and limitations. For example: the source water areas for municipal water supply systems using groundwater and for part of the St. Paul Regional Water Services surface water source area are more likely to be located near or in areas of concentrated affluence, highlighting opportunities to implement source water protection are relatively strong in these areas. Conversely, source water areas supplying most of the region's surface water – the water supply for people living in the region's areas of concentrated poverty – are located in relatively moderate-income areas and may benefits from increased engagement and incentives.



Appendix B: Guidance for property owners

Source water protection guidance for industrial, commercial and institutional property owners

The following guidance is offered, based on resources developed by Wellington Source Water Protection: ***http://www.wellingtonwater.ca/en/how-does-this-affect-me/industrial-commercial-institutional-properties.aspx***

MDH has identified actions that every Minnesotan can take or encourage others to take: ***Actions To Protect Drinking Water - EH: Minnesota Department of Health (state.mn.us)***.

The information below highlights the role that industrial, commercial, and institutional property owners can take to protect sources water. This information is included here because it relates to Metropolitan Council's role - and Environmental Services' role in particular – as a major property owner and manager in the region. Committing to protecting source water on our properties joins us with other leaders in this important challenge.

Potential hazards

There are several pathways that contamination from commercial/industrial activities can occur.

Examples of possible contamination are:

- Storage of fuel at locations such as bulk plants or gas stations that may lead to leaks or spills
- Handling and storage of Dense Non-Aqueous Phase Liquids DNAPLs
- Handling and storage of organic solvents
- Discharge of industrial effluent
- Improper handling and storage of commercial fertilizer
- Improper handling and storage of pesticides
- Application of road salt
- Storage of snow (chloride, sodium, and petroleum hydrocarbons)

Contamination can move to drinking water sources along with stormwater or by infiltrating into groundwater.

Examples of possible flow paths are:

- Stormwater infrastructure
- Wells (particularly if damaged or abandoned)

Mitigation to manage property risk

Properties with ***wells***, near municipal wells, or within ***vulnerable areas*** need to take extra care to protect drinking water sources.

Consider the following:

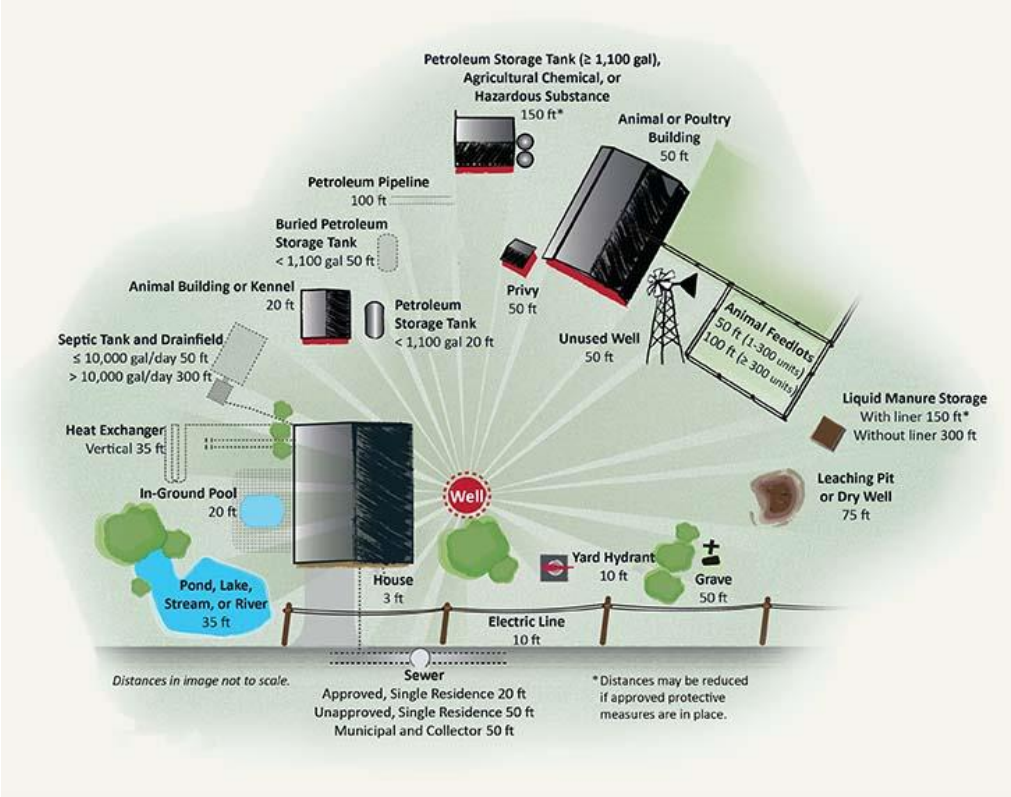
a) Periodically compare well records for the property against the ***Minnesota Well Index***, to verify that historic and new well records have been submitted along with the current status of the well (in use, sealed, abandoned).

b) Wells that are no longer in use should be ***sealed*** and a well sealing record submitted to the Minnesota Well Index.

c) Be aware of the Minnesota Department of Health's '***Owners Guide to Wells***'

d) Site visits to properties with wells and in drinking water supply management areas will illuminate the level of risk and opportunities to reduce risk as needed. This information should be included in relevant risk management plans.

e) For sites with wells, it is useful to consider the ***isolation distances from water supply wells*** set by Minnesota Rules.



Partial list of minimum isolation distances for wells (MDH, 2022c).

Isolation distances keep pollutants away from a well to protect water. Some sensitive wells will require greater isolation distances. For a complete list of isolation distances, see *Isolation Distances from a Water-Supply Well* **(from Minnesota Department of Health).**

Industrial, commercial and institutional properties located in ***vulnerable drinking water supply management areas (DWSMAs)*** areas should be using Low Impact Development (LID) best management practices to reduce potential contaminant sources, reduce water consumption, and manage recharge on their properties. MPCA provides more information about ***Low Impact Development*** (LID) in the Minnesota Stormwater Manual (note that the content is currently undergoing revisions).

Reference Materials

Minnesota Department of Health

- Owner's Guide to Wells – ***https://www.health.state.mn.us/communities/environment/water/wells/waterquality/test.html***
- Protecting your Well – ***https://www.health.state.mn.us/communities/environment/water/wells/construction/protect.html***
- Minnesota homeowners guide to sealing unused wells - ***https://www.web.health.state.mn.us/communities/environment/water/wells/sealing/abandwel.html***
- Sealing of wells and borings - ***https://www.health.state.mn.us/communities/environment/water/wells/sealing/index.html***
- 2009 guidance in revising local government land use comprehensive plans, rules, or regulations regarding aggregate mining in a Drinking Water Supply Management Area (DWSMA) - ***https://www.health.state.mn.us/communities/environment/water/docs/swp/mining.pdf***
- 2012 issue paper about potential impacts to drinking water from feedlots - ***https://www.health.state.mn.us/communities/environment/water/docs/swp/feedlot.pdf***
- 2012 issue paper about potential impacts to drinking water from Subsurface Wastewater Treatment and Disposal Systems (SSTS or Septic Systems) - ***https://www.health.state.mn.us/communities/environment/water/docs/swp/subsurface.pdf***
- 2012 issue paper about potential impacts to drinking water from Industrial and Commercial Liquid Chemical and Fuel Storage Tanks - ***https://www.health.state.mn.us/communities/environment/water/docs/swp/tanks.pdf***
- 2019 Isolation distances from a water supply well - ***https://www.health.state.mn.us/communities/environment/water/docs/wells/construction/isolate.pdf***

Minnesota Pollution Control Agency MN Stormwater Manual

- MPCA guidance and recommendations for determining the appropriateness of infiltrating stormwater in a Drinking Water Supply Management Area (DWSMAs) – ***https://stormwater.pca.state.mn.us/index.php?title=Stormwater_and_wellhead_protection***

Wellington Source Water Protection

- Example of a site survey form - ***http://www.wellingtonwater.ca/en/wswp-resources/resources/WSWP-All-Threat-Activity-Verification-Survey--V-2.3-May-2017.pdf***