

Protecting Vulnerable Drinking Water Sources

SOURCE WATER PROTECTION

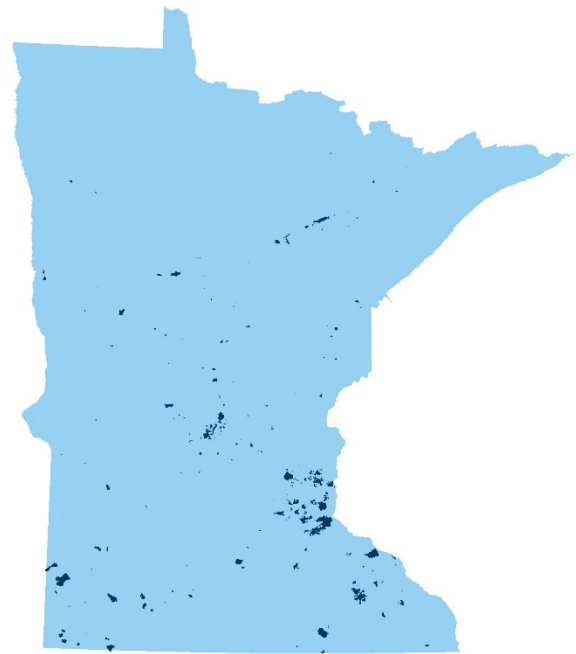
Background

Of the approximately 50 million acres in Minnesota, 1.2 million acres are located in Drinking Water Supply Management Areas (DWSMAs). DWSMAs are the areas surrounding public water supply wells that contribute water to the well or surface water intake.

Land within DWSMAs can be highly vulnerable to contamination from the land surface because of their geologic conditions. Currently, there are approximately 400,000 acres in vulnerable groundwater DWSMAs, although this may change over time as DWSMA delineations are updated. Vulnerable groundwater DWSMAs represent less than 1 percent of the overall land area of the state (see right). These vulnerable areas cover a wide range of land uses, ranging from urban to agricultural to forested areas.

Surface water DWSMAs can also be vulnerable to contaminants in runoff from the land surface. MDH is working towards delineating DWSMAs for all systems using surface water, but there are over 7 million acres in Source Water Assessment areas for these systems.

In vulnerable DWSMAs, land use is an important factor that can influence water quality. Certain land uses are more protective of water quality than others, such as forested land, wetlands, perennial cover, prairies, or public parks. There are increasing efforts to target vulnerable areas in DWSMAs and protect them with conservation practices, easements, zoning overlays or other measures.



Map of DWSMAs in Minnesota with high and very high vulnerability

Goal and objectives

The Source Water Protection Program at Minnesota Department of Health (MDH) has a goal to protect vulnerable land in DWSMAs statewide by 2034. MDH plans to achieve this goal by working with state and local partners to protect vulnerable areas with land uses and activities that benefit water quality. State partners can help manage point sources of contamination, such as tanks and landfills, and local partners can assist with management of nonpoint sources of contamination, such as fertilizer or pesticide application. In doing so, state and local partners can assure continued safety of drinking water sources.

In cases where threats extend beyond the scope and jurisdiction of local partners, this initiative will also inform priorities for state planning through comprehensive watershed framework.

What it means to protect vulnerable sources

MDH aims to secure long-term sustainability of source water quality and quantity for all Minnesotans. While “protection” sounds like a simple concept, in practice, it can be difficult and complex to achieve because settings and threats vary considerably across Minnesota.

Given the diversity in settings and threats, activities to achieve protection need to vary as well. In some places, protection may involve land use controls, conservation measures, or easements, while in others, protection may be achieved by managing potential sources of contamination. MDH is developing a conceptual framework and resources to characterize DWSMAs’ physical settings, assess risks to the source, and address risks in a systematic fashion.

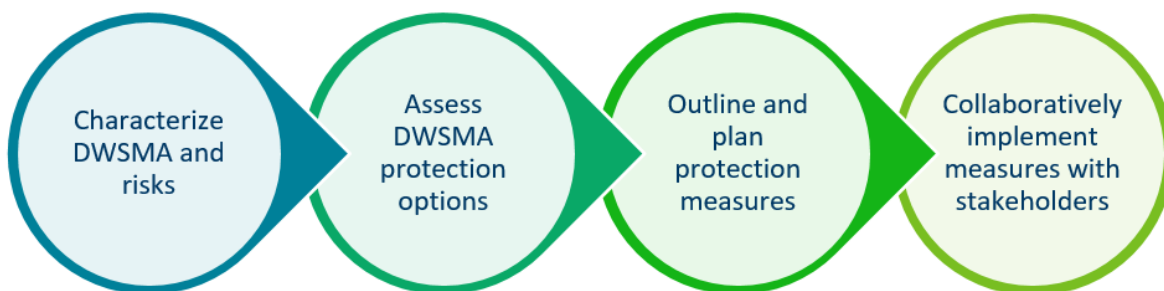
Our approach

MDH is planning activities to measure and evaluate protection of the vulnerable areas within DWSMAs. MDH will also work with state and local partners to create the tools and plan needed to advance this initiative. These resources will allow MDH, public water systems, and other stakeholders to identify appropriate protection measures for the diverse DWSMAs in the state, and measure progress accordingly.

Our approach includes the following steps:

- **Characterizing DWSMAs** – MDH will assess and categorize vulnerable DWSMAs based on their characteristics, such as physical setting, land use, and risks to drinking water.
- **Comparative risk assessment** – MDH will compare, evaluate, and rank potential contaminant sources in vulnerable DWSMAs by their public health risk.
- **Creating a framework** – MDH will develop a conceptual framework that outlines appropriate protection measures based on DWSMA characteristics and potential contaminant sources.
- **Developing a measurement and evaluation plan** – MDH will develop indicators, tools, and benchmarks to measure and evaluate progress towards the goal.

After developing the framework and associated resources, MDH, public water systems, and partners will work together to identify, implement, and evaluate protection measures in DWSMAs.



Considerations for planning and implementation

1. DWSMAs have diverse characteristics

Across Minnesota, landscapes can look dramatically different. Below the land surface, the geology of Minnesota is also varied. DWSMAs across the state can have diverse characteristics that affect the types of contaminant threats they face, their vulnerability to contamination, and the feasibility of protection.

Factors that can affect contaminant risks within a DWSMA include:

- **Land use** - Activities or features on the land can affect the quality of drinking water sources. Land use varies across urban, rural, and suburban settings. Examples of different land uses include row crop agriculture, forested land, and sewered subdivisions.
- **Potential contaminant sources** - Certain activities and features in the DWSMA can introduce contamination to the drinking water source. These can include abandoned wells, septic systems, feedlots, or aging wastewater or stormwater infrastructure. Practices on the land surface can also introduce contamination into source waters, such as fertilizer and pesticide application.

Factors that can affect the vulnerability of the DWSMA include:

- **Hydrogeology** - The geology in the DWSMA affects how easily and quickly contaminants can move through soils and subsoils into the aquifers that supply drinking water. The hydrogeology across the state is diverse and there are several unique regions, such as the karst region in southeastern Minnesota and the Central Sands region.

- **Water use** – The type and amount of water use can affect the vulnerability of drinking water sources. High pumping at wells can influence vulnerability by creating flow conditions that draw water from shallow, vulnerable environments into deeper settings.
- **Groundwater-surface water interactions** – In many settings across Minnesota, water is exchanged between surface water bodies and groundwater aquifers. This can be a concern where vulnerable surface water recharges or infiltrates into groundwater near public water system wells. These conditions can create pathways for contaminants in surface water to enter groundwater.

Factors that can affect the feasibility of protecting land in the DWSMA include:

- **Ownership** – Land within a DWSMA may be publicly owned, privately owned, or a combination of both. Privately owned land may also be rented, and the owner may not reside in the area.
- **Jurisdictional area of the public water system** - MDH and public water systems have limited ability to influence land use in DWSMAs, since much of the land is privately owned and outside of municipal jurisdiction.
- **Type of contaminant source** - Addressing nonpoint source contamination on a regional scale is a major challenge. Activities to address regional nonpoint source contamination can also be affected by changes to programs such as Clean Water Fund programs, Clean Water Act programs, or the Farm Bill.
- **Groundwater or surface water source** - In Minnesota, most community public water systems use groundwater for their source of drinking water, but 23 systems use surface water. Source water protection is required for systems using groundwater, but voluntary for systems that use surface water.
- **Geographic DWSMA characteristics** – The geographic characteristics of a DWSMA can also affect the feasibility of protection, such as DWSMA size. Surface water DWSMAs often receive water from large watersheds.
- **Area** - DWSMAs in urban, suburban, and rural areas may face different regional water-related issues and pressures based on their characteristics, such as land use, potential for urbanization, and industries. Additionally, the types of appropriate implementation activities and tools can vary across urban, suburban, and rural settings.
- **Updated DWSMA delineation from amendment process** – The boundaries of some communities' DWSMAs may change over time as they update and amend their Source Water Protection Plans. Changing boundaries may affect the size of the DWSMA and properties within it.

2. There is no one-size-fits-all approach to protection

Since DWSMAs have diverse characteristics and potential contaminants, there are many ways to protect them from contamination. This means there is no one-size-fits-all approach to protecting our drinking water sources.

For example, conservation easements on former agricultural lands place significant land use restrictions on enrolled lands for long periods of time. In urban areas, “protected” lands may feature BMPs that reduce contamination from stormwater, underground storage tanks, turf management practices, or aging wastewater infrastructure. An array of protection measures is needed to address different potential sources of contamination, land uses, and settings.

Protection measures will also need to be tailored for individual DWSMAs based on what is economically, socially, or politically feasible for the community. Indicators to track and measure progress will need to be flexible to the situation within each DWSMA. Certain protection measures will be more beneficial than others based on their:

- **Duration** - For example, one-year easement contracts do not provide the same benefits to water quality as permanent easements.
- **Renewal** - For example, annual payments for cover crop adoption do not guarantee that cover crops will be planted the following year.
- **Impact** - Managing a potential source of contamination does not provide the same protection as eliminating or removing it.
- **Location and coverage** - Protection measures are generally more impactful if they cover a larger area and are closer to the intake or well.
- **Multiple benefits** - Some protection measures may provide benefits to the community or ecosystem in addition to drinking water protection.
- **Local support and feasibility** - Certain measures will be more successful in areas where there is existing technical expertise, support, and capacity at the local level.

3. There are practical barriers to land use changes

Achieving the highest level of protection may require substantial land use changes, which has several practical barriers. Most lands within DWSMAs are outside the jurisdictional boundaries of public water systems, and systems have limited influence on how those lands are used. Agricultural land uses and practices are driven by complex existing agricultural and economic systems, which are difficult to change. Lastly, where land use changes are recommended for protection, implementation of Source Water Protection Plans is largely voluntary.

However, truly sustainable protection for the most vulnerable drinking water sources may require transformational change, and that is the ultimate goal for vulnerable DWSMAs.

4. Land use data is limited, and multiple data sources will be needed

There are several data challenges to tracking and evaluating progress towards this goal. One challenge in tracking changes in land use over time is the availability of data. While some lands within DWSMAs are permanently protected through easements or conservation, this data is not currently available. Having publicly available data on land in conservation would provide a more accurate representation of long-term protection of drinking water sources. Making these data available would help local implementers plan activities to protect Minnesota drinking water now and in the future. However, some of this data is protected by statute or rule and will not be readily available for this initiative.

Statewide data on land use is available through the National Land Cover Database (NLCD). These data show land uses such as forestry, wetlands, agriculture, and development. However, these land use categories are an insufficient indicator for drinking water protection. Land use categories do not account for BMPs that protect water quality. For example, conservation practices can mitigate contamination in agricultural areas, and stormwater BMPs can reduce contamination from runoff in urban areas. Additionally, updated NLCD data is only released every five years.

We also lack predictive tools to predict and evaluate the impacts of protection measures on water quality. Without these tools, it is difficult to assess the number of acres and practices needed to maintain or reduce contaminant levels.

Multiple data sources will be needed to track the various protection measures used in DWSMAs. A number of indicators will be needed to reflect protection activities and BMPs that are appropriate across various settings. Some of these activities and BMPs may be tracked by other state agencies or partners, although data may be reported at the county, watershed, or state scale, requiring MDH to estimate or request data at the DWSMA scale.

In summary, this initiative will require multiple sources and types of data, and additional challenges remain for data availability and obtaining DWSMA-scale data. MDH will need to work with its state and local partners to identify and modify existing tools and create new tools to collect data needed for this initiative.

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