CARVER COUNTY GROUNDWATER PLAN [2016 – 2025]

Photo: A nested well located in Seminary Fen used to monitor this groundwater dependent natural resource. This well is operated through a partnership between Carver County, the DNR, and the Lower Minnesota River Watershed District.

Carver County Public Services Division

Supporting implementation of both the Carver County 2030 Comprehensive Plan and the Carver County Watershed Management Organization (CCWMO) 2010-2020 Comprehensive Water Resources Management Plan (Water Plan) by defining Carver County's role in groundwater resource management for the next ten years

February 2, 2016

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Introduction & Scope

Groundwater serves a number of critical functions in Carver County. Perhaps most importantly, all drinking water in Carver County comes from groundwater sources. With a population forecasted to grow from about 97,000 in 2014 to over 161,000 by 2040, adequate groundwater supplies will become increasingly important to support population and economic needs.[1]

No less important than providing drinking water is the role groundwater plays in supporting critical natural resources at the surface. In Carver County, Seminary Fen is one example of a delicate and rare resource dependent on groundwater that provides natural habitat and incalculable water management benefits for our community. Natural resources like the Seminary Fen need to be protected for their critical links to the greater ecosystem, recreational opportunities, and contributions to Carver County's unique natural amenities.

The Carver County Groundwater Plan supports implementation of both the Carver County 2030 Comprehensive Plan and the Carver County Watershed Management Organization (CCWMO) 2010-2020 Comprehensive Water Resources Management Plan (Water Plan). This Groundwater Plan defines Carver County's role in groundwater resource management for the next ten years by identifying goals and actions the County will take over the life of this plan.

The three overarching goals in this plan seek to protect groundwater quality, groundwater supply, and groundwater dependent natural resources in order to meet today's needs without compromising availability of this critical resource for future generations. Carver County intends for its role toward meeting these goals to complement the many existing stakeholders operating at the state, regional, local, and private levels. Accordingly, the County has focused its implementation strategies around four key roles: planning, education, cost share, and research and monitoring.

Minnesota State Statute 103B.255 assigns responsibility to Counties for writing, coordinating, and administering groundwater plans. However, no single entity acting alone can accomplish the goals of this Plan. Accordingly, Carver County seeks partnership and collaboration with all stakeholders in order to advance the goals of this Plan.

[1] Metropolitan Council. (April 9, 2015). Draft Local Forecasts.
Population forecasts are likely to be updated after this plan is adopted, and may slightly change the 2040 population number.

Existing environment & expected changes

Carver County is located in the southwest corner of the Twin Cities Metropolitan Region, and is poised for the fastest rate of population growth in the Metro through 2040. Township land use and zoning policies established in the 1960's will continue to guide growth to Cities and preserve the rural nature and agricultural economy Carver County is known for. Growth in the County's Cities will increase demand on municipal wells that draw water from aquifers deep below the surface. At the same time, rural residents will continue to draw water from private groundwater wells located closer to the surface.

Carver County's Comprehensive Plan and Water Resources Management Plan guide management of public physical infrastructure and natural resources to meet the demands of population growth. This section draws from these two guiding documents to provide an overview of the County's physical environment, existing land use, and future development. Successful groundwater management must fit within the context of the existing environment and account for expected changes in order to meet the needs of the existing population without compromising natural resources that depend on groundwater like the Seminary Fen, or the ability of this critical resource to meet future demands.

Physical environment

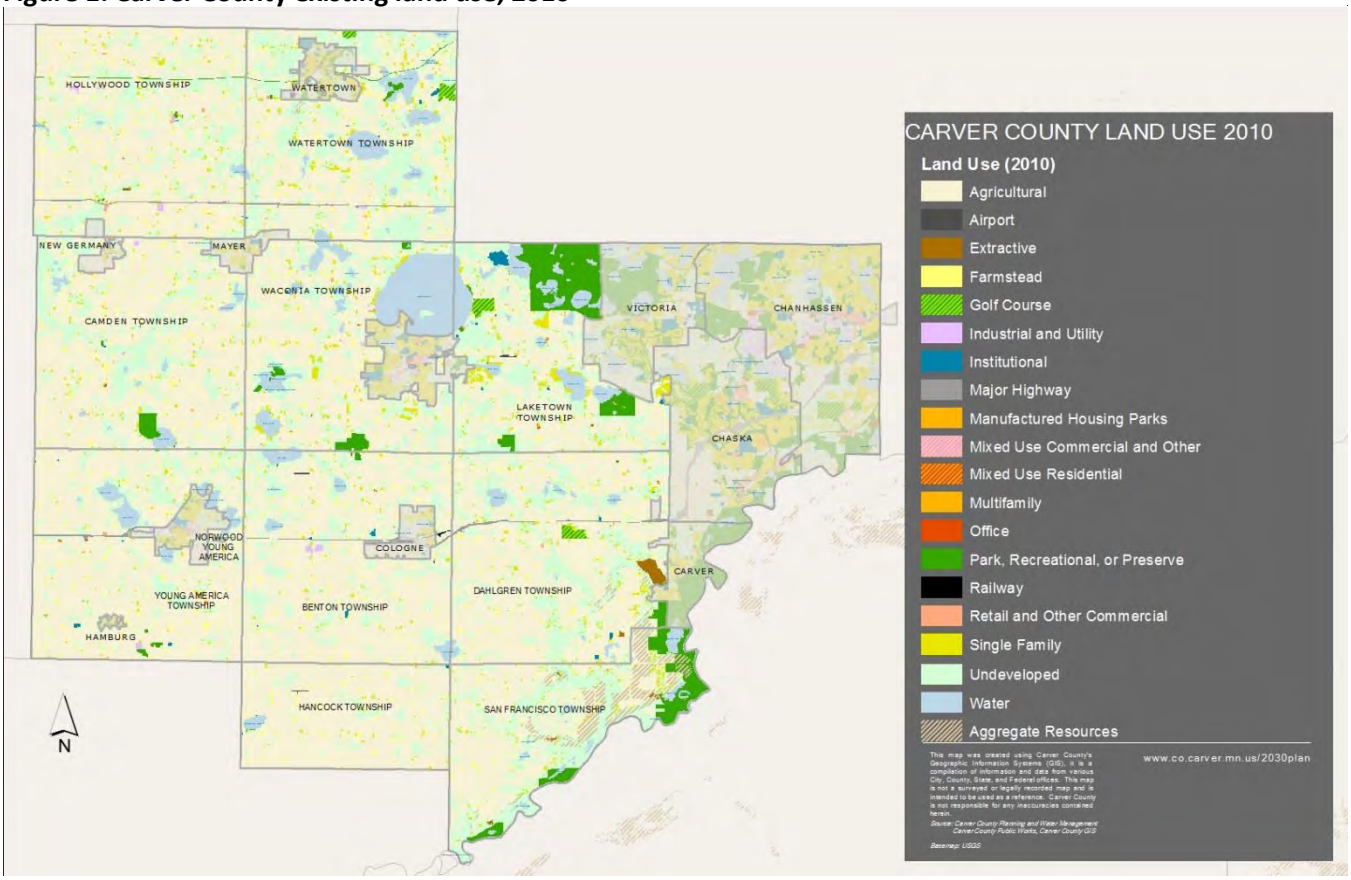
Detailed information about Carver County's groundwater resources are provided later in this document. Some key characteristics of Carver County's broader physical environment directly influence the County's groundwater resources, and inform the direction of this groundwater plan. These key characteristics, detailed in the Carver County Watershed Management Organization (CCWMO) 2010-2020 Comprehensive Water Resources Management Plan (Water Plan), include:

- Carver County receives an annual average of 31.85 inches of precipitation. A portion of the precipitation comes in the form of snow with 43 inches being the average annual snow total. Precipitation impacts surface aquifer levels that serve many small private wells.
- The County's bedrock geology includes a number of alternating aquifer layers that provide water resources and confining layers that protect aquifer layers from surface contamination, but also prevent recharge.
- Much of Carver County's soils have clayey textures that have high runoff potential when thoroughly wet. This decreases opportunities for infiltration and groundwater recharge.
- Feedlots, because of their high density of animals and the corresponding lack of vegetation, are likely to produce runoff contaminated with animal waste, sediment, and other pollutants that can potentially harm surface and ground waters.
- Wells can act as a conduit for surficial and subsurface contaminants to enter the groundwater. Properly sealing abandoned wells is necessary to prevent contamination.
- Carver County consists of several hydrogeological layers, most of which are, or could be utilized for domestic water supply purposes. Aquifers in the County include the glacial drift, the Prairie du Chien-Jordan, and the Tunnel City-Wonewoc, and the Mt. Simon. No layer acts as a true aquiclude, or impervious layer that stops vertical water movement.

View the CCWMO 2010-2020 Water Management Plan Land and Water Resource Inventory Chapter for more details: http://www.co.carver.mn.us/home/showdocument?id=624

Land use

Figure 1: Carver County existing land use, 2010



Source: Carver County

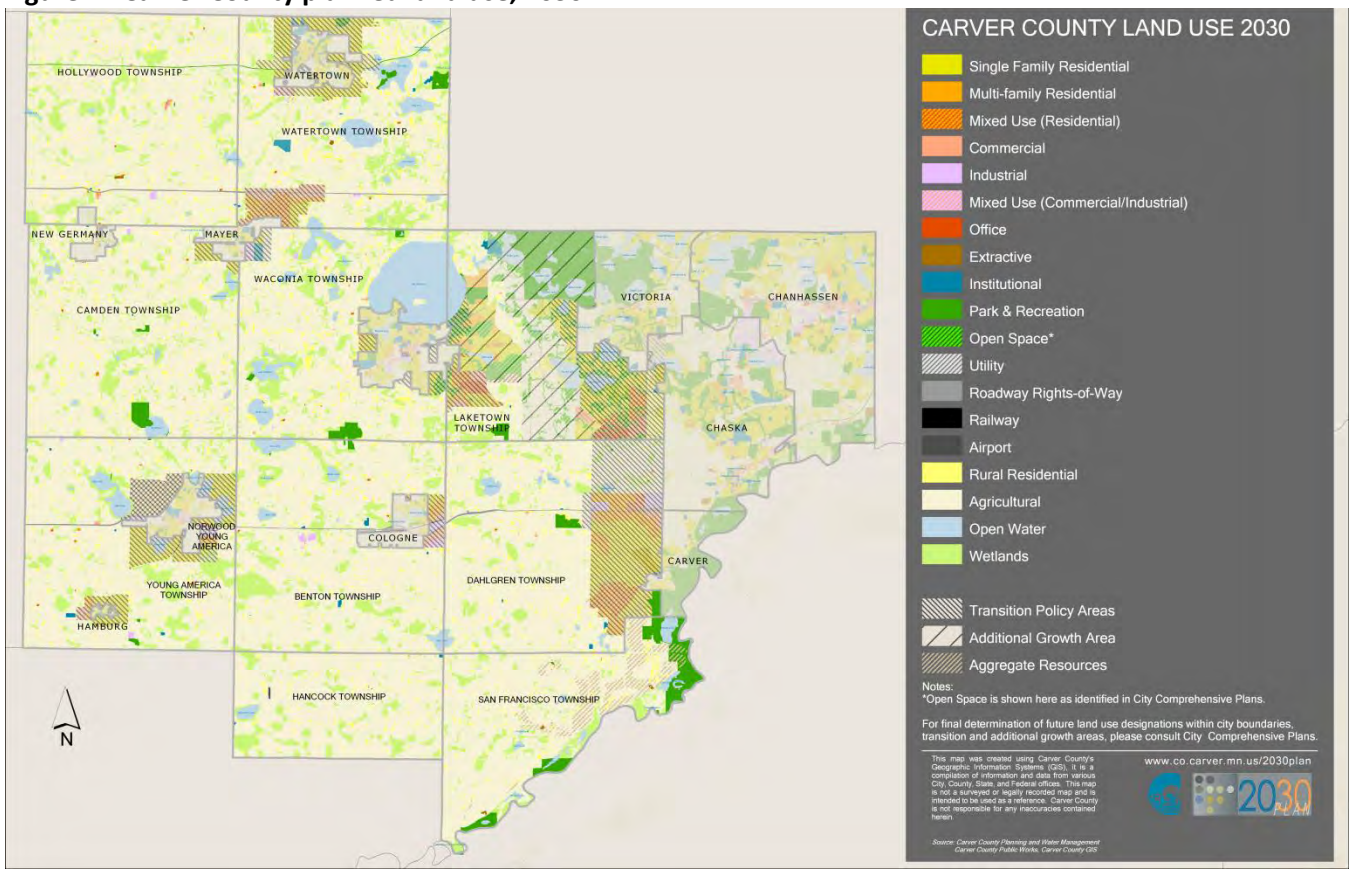
As the Carver County 2030 Comprehensive Plan explains, the current land use pattern of Carver County is a reflection of the historic land use policy of directing commercial and residential land uses to the cities of Carver County, and limiting non-agricultural land uses in rural areas. This supports a vision for the County that was established in the 1960's for healthy, stable or growing urban communities and a rural area where agriculture is the principal land use. Today, the majority of land in the rural areas of the county are currently used for agricultural production, mainly corn and soy beans. Within the cities of Carver County, the majority of land is used for commercial or residential activity, or public green space. Figure 1 is an existing land use map of Carver County as of 2010, the most recent data available. The light yellow color that dominates the townships indicated the importance of agriculture in the County's rural areas.

View the Carver County 2030 Comprehensive Plan Land Use Chapter for more details: http://www.co.carver.mn.us/home/showdocument?id=592

Future development

The Carver County 2030 Comprehensive Plan notes Cities and Townships of Carver County are planning for tremendous growth. Although the Great Recession slowed the pace of growth following adoption of the Comprehensive Plan in 2010, population forecasts adopted by the Metropolitan Council in May, 2014, still support substantial growth in the County through 2040. As displayed in Figure 3, according to Metropolitan Council population forecasts, Carver County will grow from its 2014 population of about 97,000 to a population of 161,000 by 2040.[2] Cities are planning for this growth by developing land use plans and collaborating with townships on developing annexation agreements. The land use strategy explained in the preceding section, and displayed in Figure 2, will continue to concentrate growth within the Cities and preserve rural areas for primarily agricultural uses.

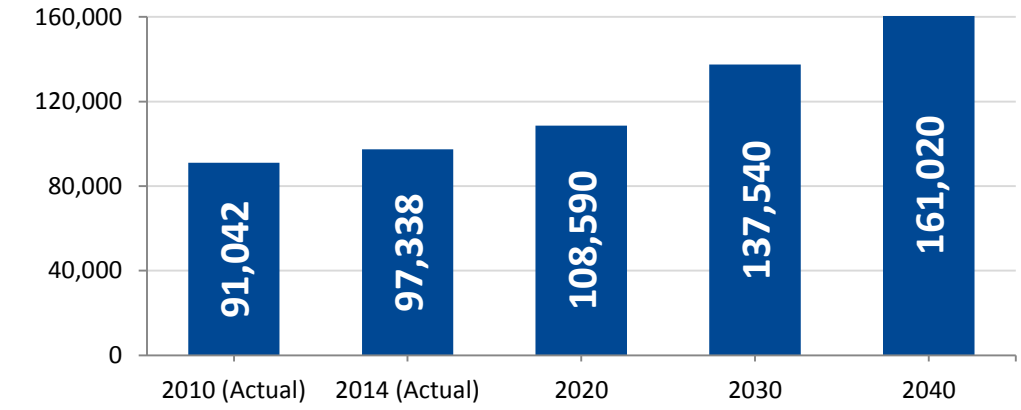
Figure 2: Carver County planned land use, 2030



Source: Carver County 2030 Comprehensive Plan, Land Use Chapter: http://www.co.carver.mn.us/home/showdocument?id=592

[2] Metropolitan Council. (April 9, 2015). Draft Local Forecasts.
Population forecasts are likely to be updated after this plan is adopted, and may slightly change the 2040 population number.

Figure 3: Carver County Population Forecast



Source: Metropolitan Council (April 9, 2015); U.S. Census Bureau

View the Carver County 2030 Comprehensive Plan Land Use Chapter for more details: http://www.co.carver.mn.us/home/showdocument?id=592

Planning Process

The Carver County Groundwater Plan has been developed according to the guidance provided in Minnesota Statute 103B.255.

The process for developing this Plan began in spring, 2014 by holding initial meetings with state agency representatives and City staff respectively. These meetings laid the groundwork for this Plan by identifying key issues based on state, regional, and local perspectives. The spring, 2014 meetings were critical to formulating the appropriate role for Carver County in groundwater management by identifying work currently conducted by the many groundwater stakeholders and understanding the roles held by meeting participants.

Advisory Committee

Following the spring, 2014 meetings Carver County assembled a stakeholder advisory committee which met three times over the span of January through April, 2015. The stakeholder advisory committee included representatives of municipal water suppliers, watershed districts, the Carver County WMO, a well driller, and engineering consultants. The stakeholder advisory committee provided input about unmet groundwater management needs and roles in Carver County. The advisory committee also provided direct input into the goals, objectives, and strategies identified by this plan and assisted with reviewing and commenting on drafts in order to prepare the final draft plan for broader review by the public and elected officials. Appendix B lists the advisory committee members.

Public Review & County Board Adoption

Following the groundwater plan stakeholder advisory committee's involvement, the plan was reviewed by the Carver County Water Management Organization Advisory Committee (CCWMOAC) and recommended to the Carver County Board. Based on the CCWMOAC's recommendation, the Carver County Board held a sixty day public comment period prior to approving the plan's submission to the Metropolitan Council and Board of Water and Soil Resources (BWSR) for review. Upon completing Metropolitan Council and BWSR's review, the Carver County Board adopted this plan on February 2, 2016. Appendix B lists members of CCWMOAC and the Carver County Board. Appendix D summarizes comments received through the sixty day public comment period.

Relationship to Other Plans and Potential Conflicts

This groundwater plan has been developed to support goals of the Carver County 2030 Comprehensive Plan and the CCWMO 2010-2020 Water Management Plan. This plan also recognizes the many organizations and agencies that are involved in groundwater management in Carver County, the Twin Cities Metro region, and the State of Minnesota. This section summarizes the County's understanding of the roles key agencies have in managing groundwater resources. Carver County seeks to address gaps and tailor its role by building upon existing efforts and avoiding duplication.

To identify potential conflicts with other existing plans Carver County has reviewed plan documents of State, regional, and local agencies summarized in the following text, has involved representatives of these agencies in the planning process, and has held a sixty-day public comment period. As the Planning Process section of this plan states, initial meetings with state agency representatives and City staff were critical to formulating the appropriate role for Carver County in groundwater management. Additionally, the stakeholder advisory committee (members listed in Appendix B) provided input to inform the County's roles in implementing the goals, objectives, and strategies identified by this plan and assisted with reviewing and commenting on drafts. Appendix D summarizes comments received through the sixty day public comment period, and the County's response to the comments.

The plan review, stakeholder involvement, and public comment period all serve to minimize conflicts with other plans. At this time, as evidenced by the comments received in the sixty-day public comment period, no known conflicts with other plans exist. Going forward, the County will work with other jurisdictions and agencies to review new plans for consistency with this Groundwater Plan in order to avoid conflicts in the future. Should a conflict arise, the County will work with the appropriate jurisdictions and agencies to resolve the matter to the extent possible.

Carver County 2030 Comprehensive Plan

The Carver County 2030 Comprehensive Plan, adopted in 2010, is a statement of the vision and goals of Carver County. The document reflects community values, ideas, and perspectives to set a framework that guides County planning for future growth and development through 2030. The Water Resources Chapter of the Comprehensive Plan meets regional guidelines in order to protect the County's ground and surface water resources so that the growing population of the County and region will continue to have a safe and adequate water supply. Goals, policies, and strategies are identified related to subsurface sewage treatment systems (SSTS), and impaired waters and total maximum daily load (TMDL). The Comprehensive Plan notes that policies protecting groundwater are referenced in the local water management plan and the adopted Carver County Water Management Organization (CCWMO) water management plan.

> View the Water Resources Chapter:
> www.co.carver.mn.us/departments/LWS/docs/05_Water_Resources_100427.pdf.

CCWMO 2010 - 2020 Water Resources Management Plan

The CCWMO is made up of six major subwatersheds and covers approximately 320 square miles of Carver County's 376 total square miles. The organization administers all water management

responsibilities within its jurisdiction. Because the CCWMO covers much of Carver County, it plays a large role in setting the tone for water management practices and policy throughout the entire County. One result is the alignment of County and WMO planning efforts to the extent possible.

The 2010 – 2020 Water Resources Management Plan guides CCWMO activities. The plan sets goals, policies, and implementation strategies for the areas of surface water management, impaired waters and TMDL approach, urban stormwater management, wetland management, agricultural practices, sanitary sewer discharge, upland natural resource management, groundwater management, solid and hazardous waste, education, and monitoring and assessment. A section of the plan summarizes groundwater resources within the CCWMO to support related goals, policies, and strategies.

The plan sets three overarching goals related to groundwater:

- Protect groundwater quality and groundwater supplies.
- Establish more uniform local policies and official controls for surface and groundwater management.
- Promote groundwater recharge.

The Water Resources Management Plan states the Groundwater Chapter should be updated upon completion of the Carver County Geologic Atlas. This Carver County Groundwater Plan fulfills that strategy. Accordingly, the Carver County Groundwater Plan and the CCWMO Water Resources Management Plan complement and support each other.

> View the 2010-2020 Water Management Plan:
> www.co.carver.mn.us/departments/LWS/2010_water_management_plan_update.asp

Carver County Role

Carver County currently manages a number of programs that play a role in protecting groundwater resources. Many of these programs provide other environmental benefits outside the scope of this Plan in addition to groundwater protection. The County intends to continue implementation of these important programs moving forward. The following summarizes Carver County's current role in groundwater management.

- ***Education:*** Carver County Planning and Water Management administers a well-developed water education program that targets students, community leaders and officials, private land owners, and other stakeholders. The education program includes a strong emphasis on water conservation, addresses wellhead protection, and provides information on other pertinent topics of interest to the community.
- ***Technical Assistance:*** Carver County staff is available to assist public supply well operators with obtaining and interpreting data. The County's role in development and interpretation of the Geologic Atlas is an example of technical assistance that has been provided in the past.
- ***Cost Share:*** Carver County manages a cost share program to assist property owners with sealing abandoned wells. Abandoned wells provide a direct conduit from the surface to the

groundwater supply. Sealing abandoned wells is important to protect subsurface aquifers from contamination.

- ***Monitoring:*** Carver County actively monitors multiple nested wells located in the Seminary Fen. Seminary Fen, a calcareous fen, is an important and rare groundwater dependent natural resource. Through a partnership with the DNR, and the Lower Minnesota River Watershed District, Carver County monitors groundwater levels in the fen to gain a better understand of how the fen contributes to Carver County's ecosystem and is affected by changes in groundwater levels.
- ***Solid & Hazardous Waste:*** Properly managing solid and hazardous wastes is important to ensure these wastes do not become a threat to the groundwater. Carver County Environmental Services regulates hazardous waste generators according to state mandate. In addition, Environmental Services administers a number of programs to reduce and manage solid waste materials by encouraging recycling, operating drop-off sites and service centers for household waste, and increasing options for organic waste management. Presently no landfills or transfer stations are located in Carver County.
- ***Septic Inspections:*** Carver County Environmental Services permits and inspects subsurface sewage treatment systems (SSTS) in the County to protect public health and safety, groundwater quality, and prevent or eliminate the development of public nuisances. Environmental services seek to ensure proper construction, placement, and maintenance of SSTS by property owners.
- ***Manure Management:*** Carver County Environmental Services and the Carver County Soil and Water Conservation District work to assist feedlot operators to apply manure best management practices and regulate operation by issuing feedlot permits. Among other purposes, proper manure management is important to prevent contaminants from entering subsurface aquifers and potentially impacting drinking water sources.

State & Regional Agencies

Minnesota uses a decentralized approach to water management. As the following will describe, a combination of state and regional agencies, local government units and Counties, and Water Management Organizations and Watershed Districts all have a stake in managing water resources. Many of these organizations are involved in planning. All of these organizations are involved in some combination of monitoring, data development and interpretation, permitting, regulation and rule making, education, conservation and other activities to protect and maintain water resources for public use. Table 1 summarizes the roles of organizations that are involved in groundwater management.

Carver County's plan compliments existing efforts by focusing on addressing gaps, and building connections between stakeholders to contribute to effective management practices. In many cases, Carver County does not have decision making authority for groundwater management. However, the County is in a position to develop and promote partnerships that advance strategies when groundwater issues transcend local boundaries of LGUs and Water Management Organizations or Watershed Districts.

Table 1: Roles of organizations involved in groundwater management

Organization	Planning	Regulation	Water Supplier	Education	Cost Share	Research/ Monitoring
MDH	✓	✓		✓		
BWSR	✓				✓	
Met Council	✓			✓		✓
MGS						✓
MDA	✓	✓		✓		✓
MPCA		✓				✓
DNR	✓	✓		✓		✓
WDs/WMOs	✓	✓		✓		
LGUs	✓	✓	✓	✓		
Carver County	✓			✓	✓	✓

Minnesota Department of Health (MDH)

Roles: Regulation, Education

MDH works to protect drinking water resources for public health purposes. The Department administers a number of programs to ensure safe drinking water supplies. The following summarizes MDH's primary water related programs:

- Wellhead Protection protects public water supply wells as required by provisions of the 1986 amendments to the federal Safe Drinking Water Act. MDH assists public water suppliers with preparing and implementing wellhead protection plans.
- Source Water Assessments are prepared in accordance to provisions of the 1996 amendments to the federal Safe Drinking Water Act. Assessments are completed for all public water systems to make results publically available.
- Protection of Surface Water Intakes, although not required, is being coordinated by MDH based on expressed interest from suppliers drawing from surface water sources.
- The Well Management Program coordinates rules, standards, and educational materials to assure proper construction of new wells and borings, and the proper sealing of unused wells and borings. This program also maintains the County Well Index in coordination with the Minnesota Geological Survey to provide standardized well location data.

See Minnesota Department of Health Drinking Water Protection for more details: www.health.state.mn.us/divs/eh/water/index.html.

Board of Water & Soil Resources (BWSR)

Roles: Planning, Cost Share

BWSR's mission is to, "Improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners." Accordingly, BWSR provides guidance and resources to support County comprehensive local water management, metro watershed management, watershed districts and water management organizations, soil and water conservation district plans,

and metro County groundwater management plans. To support plan implementation BWSR administers a number of grant programs. BWSR's primary role in groundwater management and planning is to review and approve metro County groundwater management plans for compliance with Minn. Stat. 103B.255.

See the BWSR website for more details: www.bwsr.state.mn.us/index.html.

Metropolitan Council

Roles: Planning, Education, Research/Monitoring

Thrive 2040, the Twin Cities Metropolitan Region's plan adopted May 28, 2014, states the Metropolitan Council was created by the Minnesota Legislature in 1967, "with the responsibilities for planning and coordinating the region's growth and setting policies to deal with regional issues." Under this authority, Thrive 2040 sets regional policies and goals for systems including transportation, water resources, and regional parks. Regional outcomes identified in Thrive 2040 include stewardship, prosperity, equity, livability, and sustainability. System plans provide further details about how future development can advance the five Thrive 2040 goals.

The Metropolitan Council's 2040 Water Resources Policy Plan, one of the agency's legislatively mandated system plans, states the agency's, "roles and responsibilities… provide a unique regional perspective for planning and management, all aimed at protecting our region's valuable water resources." The plan also states, "The Council provides wastewater services to municipal and industrial customers…, [and] promotes sustainable water resources through its planning and technical assistance for surface water and water supply."

According to the Metropolitan Council's website, the Master Water Supply Plan, adopted in September, 2015, is an extension of the Water Resources Policy Plan that, "provides a framework for sustainable long-term water supply planning at the local and regional level." Through the Metro Water Model, the plan identifies that Twin Cities Metro Region groundwater resources are limited, and sets goals to manage this resource to ensure reliable and secure water supplies. Importantly, the plan recognizes local control and responsibility for owning, maintaining, and operating water systems.

The following summarizes the Metropolitan Council's key functions related to water systems:

- The Council owns and operates the wastewater treatment system for the Metropolitan Urban Service Area (MUSA) which contains over 90 percent of the region's population. In Carver County, the Cities of Carver, Chaska, Chanhassen, Victoria, and Waconia are currently served by the MUSA.
- Section 208 of the Clean Water Act designates the Council as the regional water quality planning agency. This gives the Council authority to ensure implementation of water quality management policies and programs related to point- and nonpoint-source pollution. This includes monitoring and assessment of surface water body conditions, provision of technical assistance, and review of local water management plans, watershed plans, and local sewer plans.

- Minn. Stat. 473.1565 authorizes the Council to develop a regional Master Water Supply Plan to establish a framework for achieving sustainable water supply that meets the needs of current and future generations.
- Minn. Stat. 103B.255 authorizes the Metropolitan Council to conduct a 60-day review of Metro County groundwater plans.

See Metropolitan Council Environmental Services for more details: http://www.metrocouncil.org/Wastewater-Water/Planning.aspx

Minnesota Geological Survey (MGS)

Roles: Research/Monitoring

MGS is a part of the University of Minnesota, and provides geoscience data to support stewardship of water, land, and mineral resources. Data resources and technical assistance developed by MGS are to support water resource planning, land management and mineral exploration policy, energy system development, and other planning and resource management activities. MGS's County Geologic Atlas and County Well Index are critical datasets that support this groundwater management plan.

See the MGS website for more details: www.mngs.umn.edu/index.html.

Access the County Well Index (www.mngs.umn.edu/cwi.html) and the County Geologic Atlas (www.mngs.umn.edu/county_atlas/countyatlas.htm).

Minnesota Department of Agriculture (MDA)

Roles: Planning, Regulation, Education, Research/Monitoring

The MDA lists the following examples of its involvement in water quality programs and initiatives on its website:

- Agricultural Best Management Practices Loan Program to help finance water quality practices with low interest loans.
- Minnesota Clean Water Legacy Act supported research and other projects to improve effectiveness of cleanup efforts.
- The lead agency for all aspects of pesticide and fertilizer environmental and regulatory functions as directed in the Groundwater Protection Act (Minnesota Statute 103H). These include but are not limited to the following:
    - Serve as lead agency for groundwater contamination from pesticide and fertilizer nonpoint source pollution (http://www.mda.state.mn.us/grants/loans/agbmploan.aspx).
    - Conduct monitoring and assessment of agricultural chemicals (pesticides and nitrates) in ground and surface waters (http://www.mda.state.mn.us/protecting/cleanwaterfund/research.aspx and http://www.mda.state.mn.us/protecting/cleanwaterfund/gwdwprotection.aspx).
    - Oversee agricultural chemical remediation sites and incident response
    - Regulate use, storage, handling and disposal of pesticides and fertilizer

See the MDA Water Protection webpage for more details:
www.mda.state.mn.us/protecting/waterprotection.aspx .

Minnesota Pollution Control Agency (MPCA)

Roles: Regulation, Research/Monitoring

The MPCA works to protect the State of Minnesota's waters by monitoring quality, setting standards, and controlling contamination. MPCA manages a number of programs related to groundwater including monitoring and assessment, feedlot permitting, sewage treatment system permits and standards, National Pollutant Discharge Elimination System Permitting (NPDES), Metropolitan Area Groundwater Model, Petroleum Remediation Program, Resource Conservation and Recovery Act (RCRA) Corrective Action, Superfund Program, Voluntary Investigation and Cleanup (VIC) Program, and the Wellhead Protection Program.

See the MPCA Groundwater in Minnesota webpage for more details:
www.pca.state.mn.us/index.php/water/water-types-and-programs/groundwater/index.html .

Minnesota Department of Natural Resources (DNR)

Roles: Planning, Regulation, Education, Research/Monitoring

The DNR's 2013 Draft Strategic Plan for the Groundwater Management Program states the DNR's role in groundwater use is, "through its permit programs, information collection and analysis activities, law enforcement responsibilities, education, and technical assistance opportunities." Goals, objectives, and strategies of the plan focus on effective management and enforcement of groundwater appropriations permitting, encouragement of conservation practices for permitted users and the general public, developing and improving groundwater data resources like the Geologic Atlas and monitoring networks, and addressing groundwater management in areas of high use and/or limited supply.

See the DNR Groundwater Section webpage for more details:
www.dnr.state.mn.us/waters/groundwater_section/index.html.

Neighboring Watershed Districts and Watershed Management Organizations

Roles: Planning, Regulation, Education

Carver County contains, or shares a border with, Water Management Organizations and Watershed Districts. These include Carver County WMO, Buffalo Creek Watershed District, Lower Minnesota River Watershed District, Riley Purgatory Bluff Creek Watershed District, and Minnehaha Creek Watershed District. WMOs and Watershed Districts are responsible for watershed plans, resource inventories, and rules and permitting to protect water resources.

Neighboring Counties and Local Government Units (LGUs)

Roles: Planning, Regulation, Water Supplier, Education

LGU's are responsible for developing comprehensive plans and managing zoning codes, which are broad documents that impact water issues among many other topics. More directly, LGUs must develop local

water plans, wellhead protection plans, and water supply management plans. Carver County is responsible for reviewing LGU planning documents as they are developed and amended. Reviews promote local coordination for water management efforts.

Minn. Stat. 103B.255 authorizes Metro Counties to develop groundwater plans and provides guidance for plan processes and contents. Carver County shares borders with two other Metro Counties; Hennepin County and Scott County. According to BWSR, Hennepin County's groundwater plan was drafted, but never approved or implemented. BWSR's website indicates Scott County's groundwater plan was approved in 1999, and identifies the following issues, "controlling feedlot runoff and getting enforcement to the county level, prevention of contamination by underground storage tanks, enforce current Subsurface Sewage Treatment Systems state rules and the county maintenance program, hazardous waste facility siting in the county, stormwater pond siting utilizing the sensitivity map, replacement wetlands and siting, protecting the county's water supply, proper sealing and capping of abandoned and unused wells, and underground injection of liquid waste other than domestic sewage."

BWSR's website does not indicate groundwater plans for Wright, Sibley or McLeod Counties. All three Counties were invited to comment during the sixty-day public comment period, however no comments were submitted.

Groundwater Resource Overview

The Groundwater Resource Overview provides technical information necessary for understanding and addressing groundwater issues in the county. Topics discussed include:

- Geology
- Groundwater Hydrology
- Groundwater Supply
- Groundwater Quality and Sensitivity to Pollution
- Groundwater Dependent Natural Resources

Geology

Groundwater moves through several geologic formations in the County. Advancing and retreating marine seas left behind a sequence of limestone, sandstone, and shale bedrock layers dating back to the Paleozoic Era (504 to 458 million years ago). Following the final retreat of marine seas, the bedrock was subject to a long period of erosion. Beginning about 1.5 million years ago, a sequence of glaciers advanced and retreated across the county shaping the land and leaving formations of clay, silt, sand, and gravel on top of the bedrock formations. Understanding the materials that comprise the bedrock and surficial geologic layers and the relationship between the layers is important to understanding how groundwater flows in the county.

Bedrock Formations.

In Carver County, the bedrock formations closest to the surface were deposited as sediment in shallow seas that covered the region during the Paleozoic era, about 504 to 458 million years ago, and again during the Cretaceous Period 95 million years ago. The shallow seas covered a large portion of central North America from central Iowa, into southeastern and south-central Minnesota during the early and middle parts of the Paleozoic era. As older layers of sediment were buried by succeeding layers, they gradually consolidated and lithified into rock: limestone, dolostone, siltstone, shale, and sandstone. These layers are divided into groups of formations based on age or type of rock. Figures 4 and 5 show the bedrock geology of the county. Table 2 includes a description of bedrock formations, including information on the type of material and location of the formations in the County.

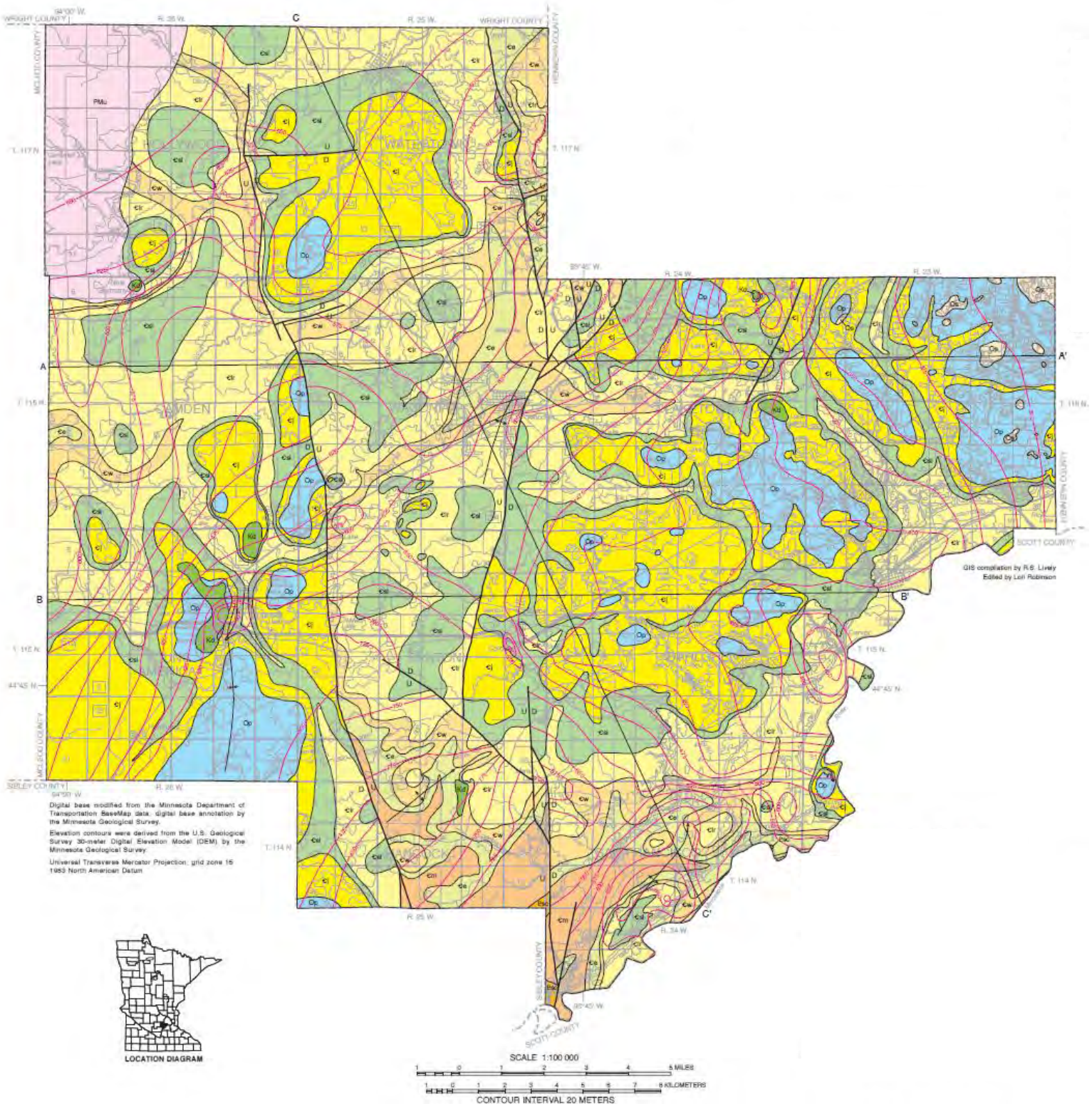
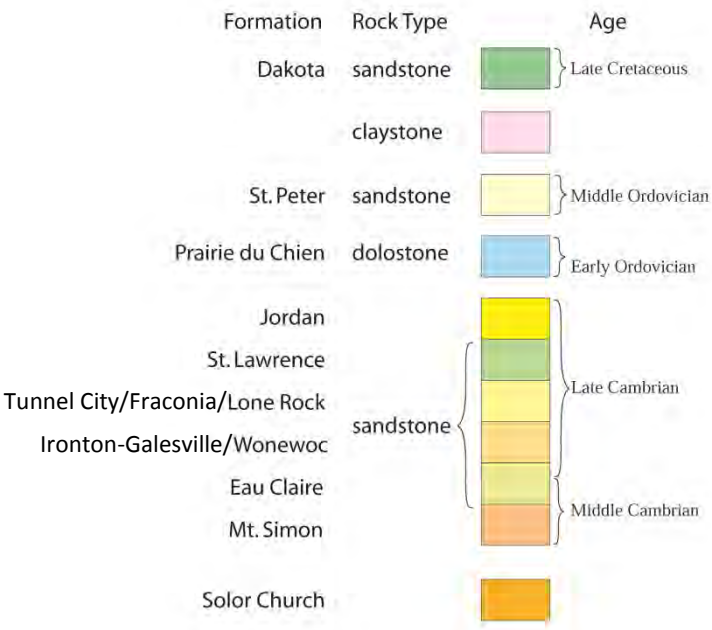
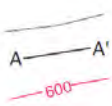


Figure 4. Carver County Bedrock Geology

Source: Carver County Geologic Atlas, Part A, Plate 2: Bedrock Geology: conservancy.umn.edu/bitstream/handle/11299/59648/pl2_bg%5b1%5d.pdf?sequence=6&isAllowed=y





Geologic contact—Approximately located.

Location of geologic cross section.

Line of equal elevation of the top of the Wonewoc Sandstone—Contour interval is 25 feet (8 meters). The contours show the manner in which bedrock layers are tilted and faulted in Carver County.

Fault—Faults in Paleozoic rocks are interpreted to be dip-slip. Letters indicate relative vertical displacement: U, up; D, down. The faults are concealed by Quaternary sediments and recent alluvium and are inferred from subsurface geologic data supplemented by aeromagnetic and gravity data (Chandler, 2009). Contrasts in magnetic intensity on the aeromagnetic map are inferred to be largely the expression of faults in the underlying Mesoproterozoic volcanic and sedimentary rocks. Offsets of Paleozoic strata indicate that some of these faults were rejuvenated during post-Mesoproterozoic time.

Fold—Axial trace of syncline, anticline. All folds have shallowly dipping limbs, arrows indicate the direction of plunge. No arrow implies that plunge direction is uncertain.

Figure 5. Map Explanation for Figure 4. Bedrock Geology
Source: Carver County Geologic Atlas, Part A, Plate 2: Bedrock Geology: conservancy.umn.edu/bitstream/handle/11299/59648/pl2_bg%5b1%5d.pdf?sequence=6&isAllowed=y

Table 2 Carver County Bedrock Geology

Age	Bedrock Formation or Group	Description	Thickness (feet)
Cretaceous (95 million years ago)	Dakota Formation	Uppermost bedrock layer comprised of fine to coarse grained sandstone. Present only in a few locations in the county.	15-80
Mesozoic or Paleozoic (age unknown)	Unnamed	An interbedded claystone, siltstone, and sandstone layer found in northwestern Carver County.	150-200
Ordovician (488 -458 million years ago)	St Peter Sandstone	A fine to coarse grained sandstone; it has a patchy distribution in the eastern part of Carver County.	35
	Prairie du Chien Group	A layer of finely crystalline dolostone and fine to medium grained sandstone. Mostly eroded in Carver County, it appears on plateaus between buried bedrock valleys and is thickest in Chanhassen.	130-160
Upper Cambrian (501 – 488 million years ago)	Jordan Sandstone	A medium to coarse grained sandstone.	80-100
	St Lawrence Formation	A fine grained sandstone and siltstone. Widely distributed throughout the county.	40-50
	Tunnel City Group (also called the Lone Rock formation and formerly called the Fraconia Formation)	Fine grained, silty, feldspathic, and glauconitic sandstone with poor to moderate cementation. It appears within and adjacent to the buried bedrock valleys in the county.	120-140
	Wonewoc Sandstone (Formerly: Ironton-Galesville)	A layer of fine to coarse grained sandstone. It appears within deeper buried valleys in Carver County.	45-70
Middle Cambrian (504 – 501 million years ago	Eau Claire Formation	A very fine grained, feldspathic sandstone and siltstone. It subcrops in the deeper parts of buried bedrock valleys.	65-75
	Mt Simon Sandstone	A thick layer of friable and poorly cemented sandstone.	160-210

Bedrock Structure

Bedrock structure refers to the angle of bedrock layers, faults, fractures, and erosional features and can play a large role in how groundwater moves through bedrock layers. In Carver County, faulting and broad folding has locally disrupted the layers of sedimentary Paleozoic rocks. A large horst (a large, uplifted crustal block that is bounded by faults along its long sides) crosses through the center of the county. East of the horst structure, the Paleozoic formations dip gently to the east. West of the horst, the layers dip gently toward the southeast.

The distribution of Paleozoic formations is also affected by deep, buried valleys eroded into older formations. Prior to glaciation, river and stream systems cut deep valleys into the bedrock formations. When glaciation occurred, the valleys were filled in with various types of glacial material. As the glaciers melted, new river valleys followed the approximate course of some of the pre-glacial river valleys. The Minnesota River Valley in Carver County, for example, follows the approximate course of a large pre-glacial valley. The bedrock valleys, however, can provide an opportunity for potential intermixing of water from all of aquifers through which the valley cuts.

Paleozoic formations in Carver County are also affected by faults, especially by those that bound the horst in the central part of the county. These faults have displacements that range from a few tens of feet to over 300 feet, sufficient to juxtapose two different bedrock formations at the fault contacts. Similar to the bedrock valleys, the faults can allow intermixing of groundwater where two different aquifers come into contact.

> See the Carver County Geologic Atlas, Part A, Plate 2: Bedrock Geology for more detailed information on bedrock geology: conservancy.umn.edu/bitstream/handle/11299/59648/pl2_bg%5b1%5d.pdf?sequence=6&isAllowed=y

Surface Geology

Most of the surficial sediment in the county is glacial in origin and was deposited by Des Moines lobe ice from the northwest. The Des Moines lobe carried sediment from southwestern Manitoba and from North Dakota. These glacial deposits include varying amounts of distinctive, gray, siliceous shale fragments.

As meltwater flowed from these glaciers, they deposited sand and gravel beds that serve as shallow aquifers today. The repeated advance and retreat of glacial ice and meltwater not only deposited sediments, but also eroded older, underlying sediments, creating a very patchy distribution of sand and gravel material. The net effect of this depositional and erosional activity is that sand and gravel bodies that provide water to wells in Carver County tend to be discontinuous. See Figures 6 and 7 for the surface geology of Carver County.

> See the Carver County Geologic Atlas, Part A, Plate 3: Surficial Geology for more detailed information on surficial geology: conservancy.umn.edu/bitstream/handle/11299/59648/pl3_sg%5b1%5d.pdf?sequence=5&isAllowed=y

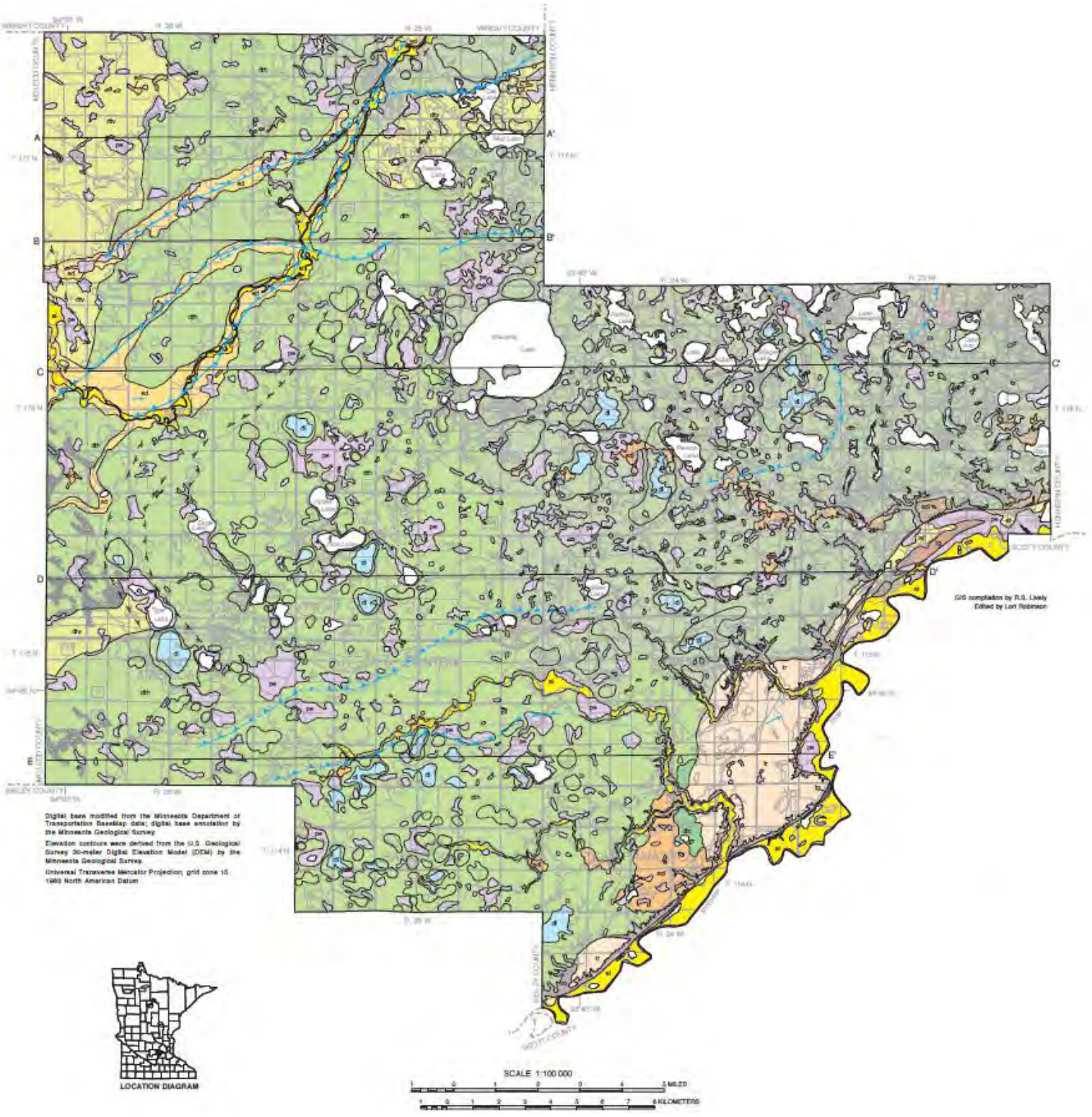
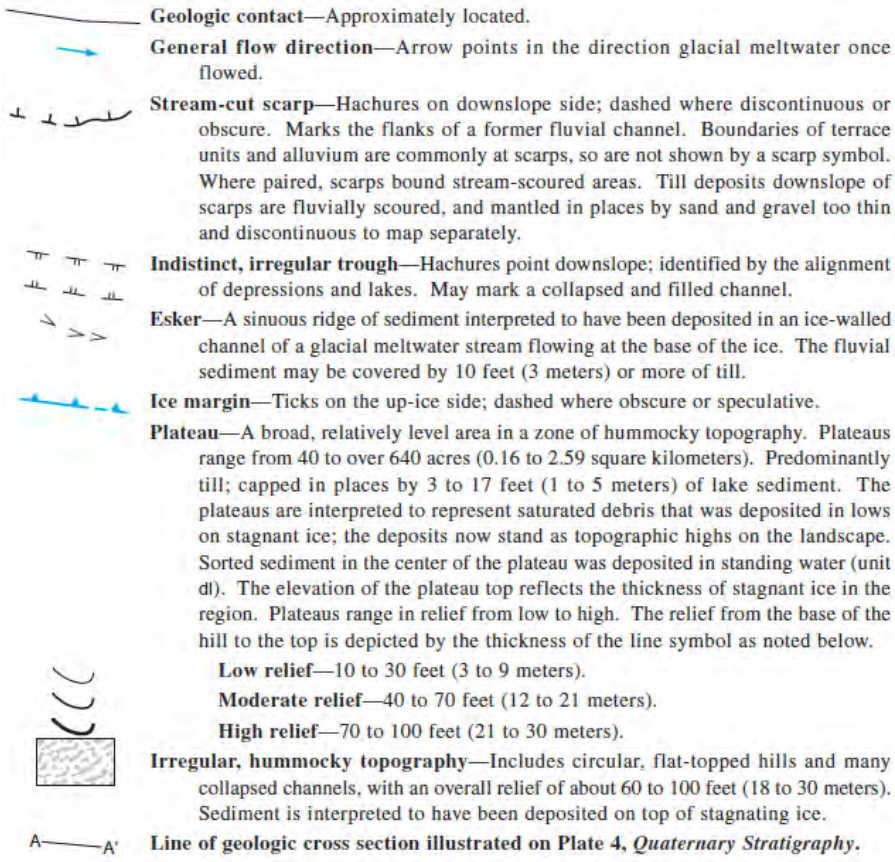


Figure 6. Carver County Surficial Geology

Source: Carver County Geologic Atlas, Part A, Plate 3: Surficial Geology: http://conservancy.umn.edu/bitstream/handle/11299/59648/pl3_sg%5b1%5d.pdf?sequence=5&isAllowed=y



HOLOCENE DEPOSITS

lb — Sand, loamy sand, loam (lacustrine beach deposits)

pe — Organic debris, clay, and silt (wetland sediment)

al — Silty clay loam to sandy loam (floodplain alluvium)

af — Loam to loamy fine-grained sand (alluvial fan sediment)

co — Clay to boulders (colluvium)

PLEISTOCENE DEPOSITS

Alluvial Terrace Deposits

tg — Grey Cloud Terrace – sand to gravelly sand

tl — Langdon Terrace – sand to gravelly sand

tr — Richfield Terrace – sand to gravelly sand

PLEISTOCENE DEPOSITS (cont.)

Des Moines Lobe Sediments

dz — Silt loam to silty clay

sd — Sand, gravelly sand, and cobbly gravel (outwash)

sdi — Sand, gravelly sand, and cobbly gravel (ice contact deposits)

dl — Clay and silt (lake sediment)

dtc — Clay to silt loam (glacial till)

dth — Loam to clay loam (glacial till)

dtv — Clay loam to sandy loam (glacial till)

Figure 7. Map Explanation for Figure 6. Carver County Surficial Geology

Source: Carver County Geologic Atlas, Part A, Plate 3: Surficial Geology: conservancy.umn.edu/bitstream/handle/11299/59648A/pl3_sg%5b1%5d.pdf?sequence=5&isAllowed=y

Groundwater Hydrology

Sand and Gravel Aquifers

A surficial sand aquifer and six Quaternary buried sand and gravel aquifers are mapped in Carver County. The extent, depth, and thickness of these aquifers vary considerably across the county. Some areas of Carver County are underlain by multiple buried sand and gravel aquifers; other areas are underlain by only one or two. This variation in mapped aquifer distribution is partly due to irregular deposition of sediment, but is also a reflection of the limited well data available.

Bedrock Aquifers

Several bedrock aquifer units are found beneath the county. The units vary in thickness, porosity, permeability, and water quality. The principal bedrock groundwater sources used by county communities, well owners, and industry are the Prairie du Chien and Jordan aquifers. Other bedrock aquifers include the St. Peter Sandstone, the Tunnel City or Lone Rock Group (formerly named the Franconia formation, hereafter referred to as the Tunnel City Group) the Wonewoc Sandstone (formerly named the Ironton-Galesville Sandstone, hereafter referred to as the Wonewoc), and the Mt. Simon Hinckley Sandstone formations. Three bedrock hydrostratigraphic units function as major confining layers. . Table 3 provides a description of the bedrock hydrostratigraphy of the county.

Aquifer Recharge and Discharge Conditions

Recharge and discharge are terms for describing groundwater flow and the interaction of groundwater and surface water. Recharge is the inflow of water to the groundwater system, while discharge is the outflow from the system. Identifying areas of recharge and discharge can help locations for aquifer recharge and locations where contaminants can enter the system.

Recharge to the groundwater system occurs mainly as infiltration of precipitation and percolation through unsaturated soils to the water table and, eventually, groundwater aquifers. In Carver County, relatively low permeability clay-loam and loam glacial sediment at the land surface limits downward percolation of surface water to deeper aquifers. Tritium-age testing of well water shows that most areas of Carver County have very limited local recharge. Recent tritium-age water (since 1950) is only found to a depth of 100 feet in most of the county. Groundwater in deeper bedrock aquifers is typically 2,000 to 20,000 years old. Pumping may be withdrawing water from these aquifers faster than they are being recharged to the northwest of Carver County.

Bedrock faults, which often act as conduits for groundwater recharge, do not act as groundwater recharge zones in Carver County. Bedrock aquifers are buried under a thick sequence of fine-grained, low permeability glacial sediment that prevents recent groundwater from entering most bedrock aquifers.

There are areas of local recharge of the sand and gravel aquifers near Watertown, Lake Zumbra, Lake Minnetonka, and the Minnesota River. In these areas recent tritium-age water has penetrated to about 150 feet. The major discharge zone for bedrock aquifers in Carver County is in the Minnesota River valley.

Importantly, most recharge of the bedrock aquifers in Carver County occurs outside the county and at a very slow rate.

Table 3.Carver County Bedrock Hydrostratigraphy

Formation	Function	Description	Thickness (feet)
St. Peter Sandstone	Minor Aquifer	This aquifer is a minor source of water in Carver County.	35
Prairie du Chien-Jordan	Major Aquifer	This aquifer is a major source of water in Carver County. The formation consists of several types of rock in the Prairie du Chien group and Jordan sandstone. It is confined by the St. Peter sandstone formation in northern Chanhassen, and by drift elsewhere in the county.	130-160 80-100
St Lawrence Formation	Confining Layer	This unit acts as a confining layer due to its silty and shaley composition. The formation is present throughout the county and is missing only in areas where erosion has created bedrock valleys. While it does perform a confining function, it does not completely stop the movement of water. The rate of flow through this formation is slower than through the formations typically considered aquifers. Thirty-two percent of the bedrock wells interpreted by the MGS are finished in this formation and most are used for domestic water supply in Carver County.	40-50
Tunnel City Group (also called the Lone Rock formation and formerly called the: Fraconia Formation)	Aquifer (upper) Confining Layer (lower)	These formations function as a multiple aquifer with the lower Tunnel City Formation acting as a confining unit separating the upper Tunnel City Formation from the Wonewoc sandstone. The aquifer is present throughout the county and is absent only where dissected by bedrock valleys	120-140
Wonewoc Sandstone (Formerly: Ironton-Galesville Formation)	Aquifer		45-70
Eau Claire Formation	Confining Layer	This formation acts as a confining bed for the Mt. Simon aquifer. As with the St. Lawrence/Franconia formation, the Eau Claire formation does not totally stop vertical transmission of water, but rather transmits the water at much slower rate. In some areas, wells may be finished in this formation, but it does not appear to be a significant source of water in Carver County	65-75
Mt Simon Formation	Major Aquifer	This formation is a major aquifer. The aquifer underlies the entire county and is confined by the Eau Claire sandstone. The Mt. Simon aquifer is exposed in the major valley and fault areas in San Francisco and Hancock Townships. Statute limits the use of this aquifer to potable water and only when there are no other feasible or practical alternatives.	160-210

See Carver County Geologic Atlas, Part B, Plate 7: Hydrogeologic Cross Sections for additional information on Aquifer Recharge and Discharge Conditions: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate07.pdf

Groundwater Supply

Current Groundwater Use

The Minnesota Permitting and Reporting System (MPARS) is maintained by the Minnesota Department of Natural Resources (DNR) and is used to regulate and better understand water-use patterns across the State of Minnesota. All water users that withdraw more than 10,000 gallons per day or 1 million gallons per year must have a valid DNR permit and report their water use.

Table 4 summarizes average Carver County groundwater use by category for 2010-2014. The largest use of was for municipal water supply, which accounted for an average of 88.75 percent of groundwater use groundwater between 2010 and 2014. Agricultural processing and noncrop irrigation together accounted for an average of 10.52 percent of the groundwater used between 2010 and 2014. Use of groundwater for major crop irrigation is low as most of the county has loam and clay loam soils which do not require irrigation.

Table 4. Groundwater Use by Use Category (2010-2014)

Use Category	2010	2011	2012	2013	2014	Average Water Use 2010-2014 (MGY[1])	Percent of Use 2010-2014
Municipal waterworks	3,088.1	3,237.6	3,605.7	3,286.0	3,090.2	**3,261.5**	**88.75**
Agricultural processing	196.5	266.7	278.4	299.1	307.5	**269.7**	**7.34**
Noncrop irrigation	113.2	158.5	161.7	87.9	64.4	**117.1**	**3.19**
Water Level Maintenance	61.1	0.0	24.5	11.9	0.1	**24.4**	**0.66**
Special Categories[2]	16.3	10.4	0.0	0.0	0.0	**5.3**	**0.14**
Major crop irrigation	1.0	0.9	2.6	1.6	1.4	**1.5**	**0.04**
Once-through heating or A/C	1.2	0.7	0.2	0.0	0.0	**0.4**	**0.01**
Total	**3,477.4**	**3,674.7**	**4,073.3**	**3,686.4**	**3,463.6**	**3,675.1**	**100.0**

Source: Minnesota Department of Natural Resources, Minnesota Permitting and Reporting System

1. MGY = million gallons per year
2. "Special Categories" includes livestock watering, pipeline and tank testing, pollution containment, and other misc. uses.

NOTE: Groundwater usage from small, residential wells that do not require DNR appropriation permits is not included.

Table 5 summarizes Carver County groundwater use by aquifer for the calendar year 2010. Seventy-eight percent of water use was from bedrock aquifers. Pumping from sand and gravel aquifers accounted for only 17.5 percent. The Prairie du Chien and Jordan are the most-used aquifers; a total of 31.1 percent was withdrawn from these two aquifers. The Prairie du Chien and Jordan are separate aquifers, but most of the water is pumped from nine wells owned by the City of Chanhassen that are constructed across both aquifers. The Upper Tunnel City and Wonewoc aquifers are the second-most used. Wells constructed across these two adjacent aquifers account for 17.5 percent. The Mt. Simon and Fond du Lac aquifers are the third-most used, collectively accounting for 14.1 percent. Two wells constructed over the entire Wonewoc to Mt. Simon interval account for 9.3 percent.

Table 5. Groundwater Use by Aquifer (2010-2014)

Aquifer	2010 Water Use (MGY[1])	2011 Water Use (MGY[1])	2012 Water Use (MGY[1])	2013 Water Use (MGY[1])	2014 Water Use (MGY[1])	Average Water Use 2010-2014 (MGY[1])	Average Percent of Use 2010-2014
Surficial Sand	80.5	69.5	45.2	45.0	38.4	**55.7**	**1.5**
Buried Sand and Gravel	528	579.1	658.9	518.5	517.2	**560.3**	**15.2**
Bedrock Aquifers							
Prairie du Chien-Jordan[2]	862.2	1,034.4	1,189.6	1,049.8	964.5	**1020.1**	**27.8**
Jordan	220.6	244.7	244.0	244.9	228.1	**236.5**	**6.4**
St Lawrence-Upper Tunnel City[2]	1.6	0.0	0.0	0.0	0.0	**0.3**	**0.0**
Upper Tunnel City	12.3	4.5	4.8	0.4	0.4	**4.5**	**0.1**
Upper Tunnel City-Wonewoc[2]	546.2	528.2	598.0	580.9	535.6	**557.8**	**15.2**
Upper Tunnel City-Wonewoc-Eau Claire[2]	40.4	24.2	36.1	20.3	10.5	**26.3**	**0.7**
Upper Tunnel City-Mt Simon[2]	209.9	237.7	337.9	223.2	251.0	**251.9**	**6.9**
Wonewoc	6.8	141.6	126.6	148.7	163.1	**117.4**	**3.2**
Wonewoc-Mt Simon[2]	322.6	313.9	319.7	309.6	311.5	**315.5**	**8.6**
Mt Simon	449.9	494.3	485.0	530.4	437.3	**479.4**	**13.0**
Mt Simon-Fond du Lac[2]	41.2	--	--	--	--	**8.2**	**0.2**
Undefined	155.2	2.6	27.5	14.6	6.1	**41.2**	**1.1**
Total	**3,477.4**	**3,674.7**	**4,073.3**	**3,686.4**	**3,463.6**	**3,675.1**	**100.0**

Source: Minnesota Department of Natural Resources, State Water Use Data System.

1. MGY = million gallons per year
2. Well constructed across more than one aquifer
3. Dashes (--) = no data available

NOTE: Groundwater usage from small, residential wells that do not require DNR appropriation permits is not included.

See Carver County Geologic Atlas, Part B, Plate 6: Hydrogeology of the Surficial Aquifer and the Buried Sand and Gravel Aquifers for additional information on current groundwater use in Carver County: files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate06.pdf .

Groundwater Availability

Locations of aquifers available in Carver County are shown in the following figures:

Figure 8	Potentiometric surface elevation of the buried sand and gravel aquifers
Figure 9	Map Explanation for Figure 8
Figure 10	Potentiometric surface elevation contours of the Prairie du Chien and Jordan Aquifers
Figure 11	Potentiometric surface elevation contours of the Upper Tunnel City and Wonewoc Aquifers
Figure 12	Potentiometric surface elevation contours of the Mt. Simon Aquifer
Figure 13	Map Explanation for Figures 10-12

Table 6 summarizes the extent, maximum and minimum elevation, discharge location, direction of water flow, and specific capacity of aquifers in Carver County.

Table 6. Availability and Other Characteristics of Aquifers in Carver County

Aquifer Name	Percent of County Coverage	Highest Elevation	Lowest Elevation	Discharge Location	Direction of Water Flow	Specific Capacity
Buried Sand and Gravel Aquifers[1]						
sr	Limited	950 ft.	800 ft.	-	NW to SE	-
sg	Limited	1,000 ft.	700 ft.	-	NW to SE	-
sx	Limited	1,000 ft.	700 ft.	-	NW to SE	74 gpm/ft. (avg)
su	Limited	1,000 ft.	<700 ft.	-	NW to SE	69 gpm/ft. (avg)
Bedrock Aquifers						
Prairie du Chien-Jordan	41	925 ft.	750 ft.	Minnesota River	NW to SE	50 gpm/ft. (avg)
Upper Tunnel City-Wonewoc	82	925 ft.	725 ft.	Minnesota River	NW to SE	6 gpm/ft. (avg)
Mt. Simon	approx. 100	900 ft.	700 ft.	Minnesota River	NW to SE	16 gpm/ft. (avg)

1. The sdv and sb buried sand and gravel aquifers are not included due to their limited extent.

See the Carver County Geologic Atlas, Part B, Plate 6: Hydrogeology of the Surficial Aquifer and the Buried Sand and Gravel Aquifers (http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate06.pdf) and Carver County Geologic Atlas, Part B, Plate 8: Bedrock Hydrogeology (http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate08.pdf) for additional information on the extent and availability of aquifers in Carver County.

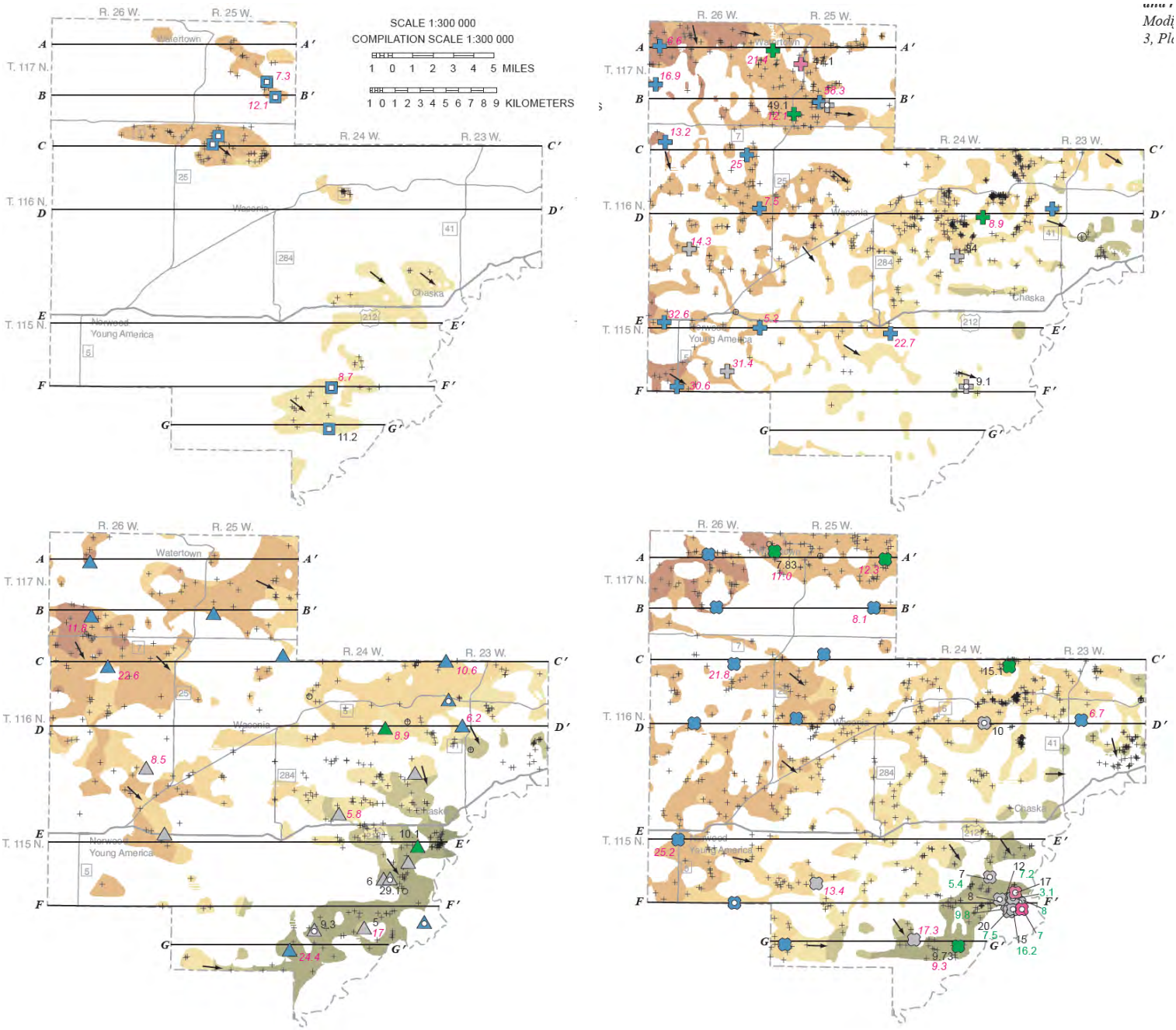


Figure 8. Potentiometric surface elevation contours of the buried sand and gravel aquifers (clockwise from top left: sr, sg, sx, and su)

Source: Carver County Geologic Atlas, Part B, Plate 6: Hydrogeology of the Surficial Aquifer and the Buried Sand and Gravel Aquifers:
files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate06.pdf

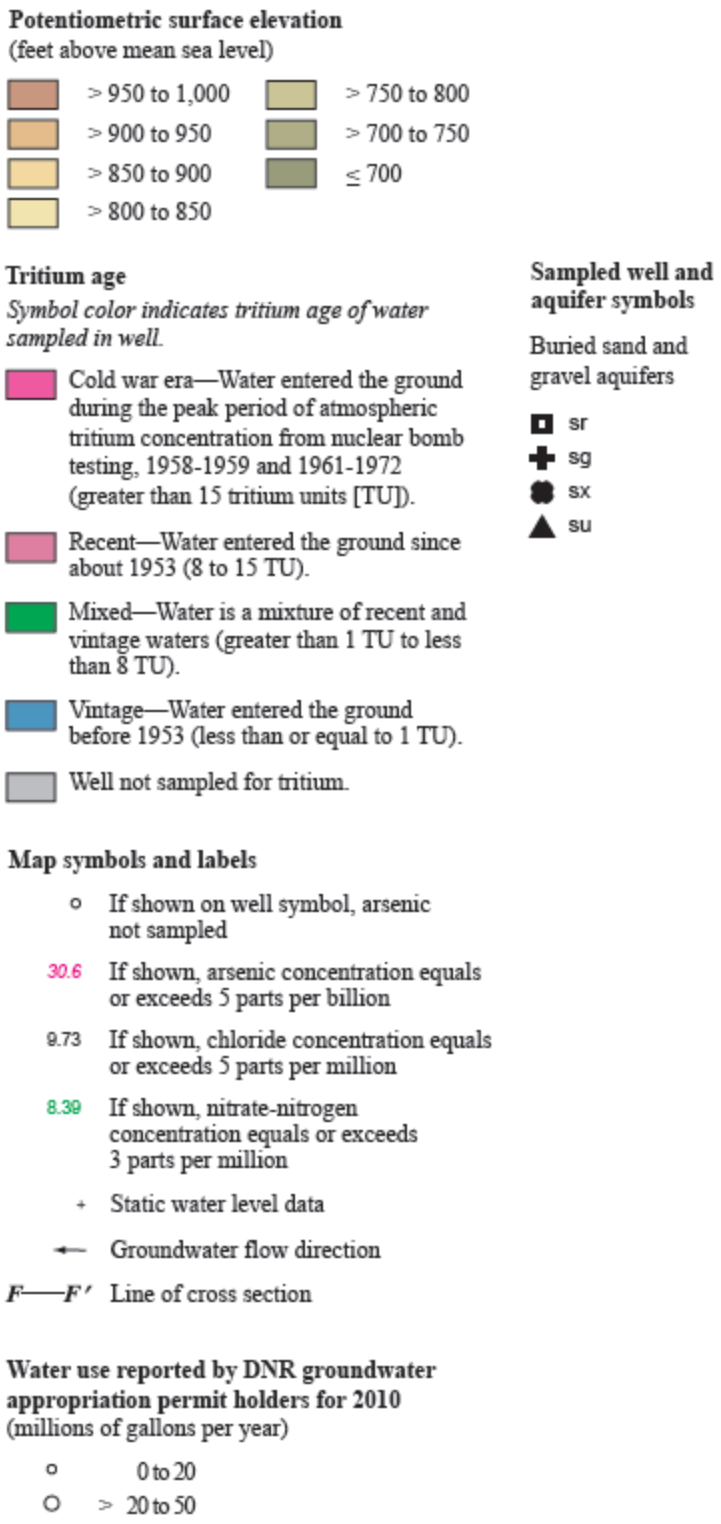


Figure 9. Map Explanation for Figure 8

Source: Carver County Geologic Atlas, Part B, Plate 6: Hydrogeology of the Surficial Aquifer and the Buried Sand and Gravel Aquifers:
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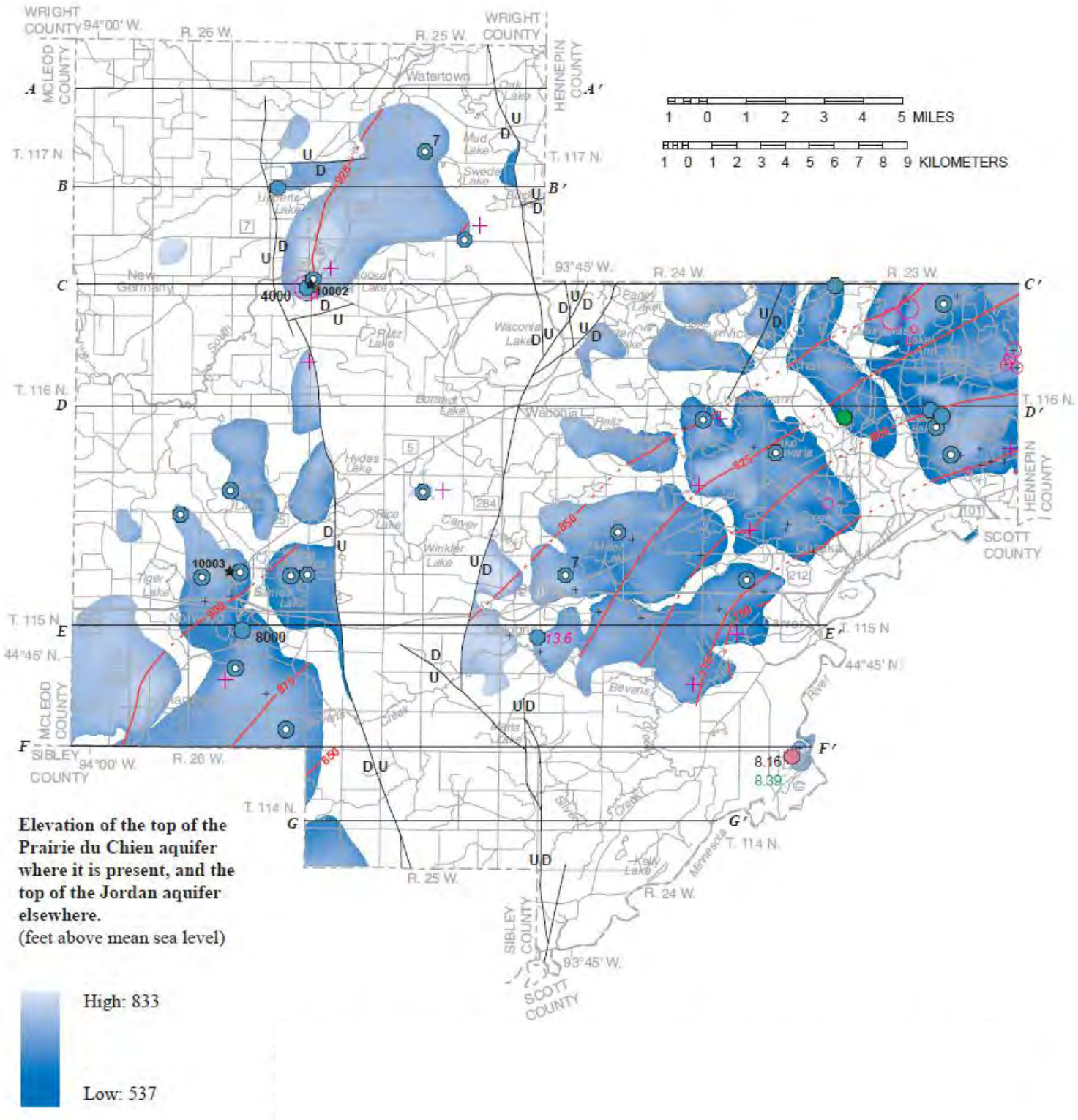


Figure 10. Potentiometric surface elevation contours of the Prairie du Chien and Jordan Aquifers
Source: Carver County Geologic Atlas, Part B, Plate 8: Bedrock Hydrogeology: files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate08.pdf

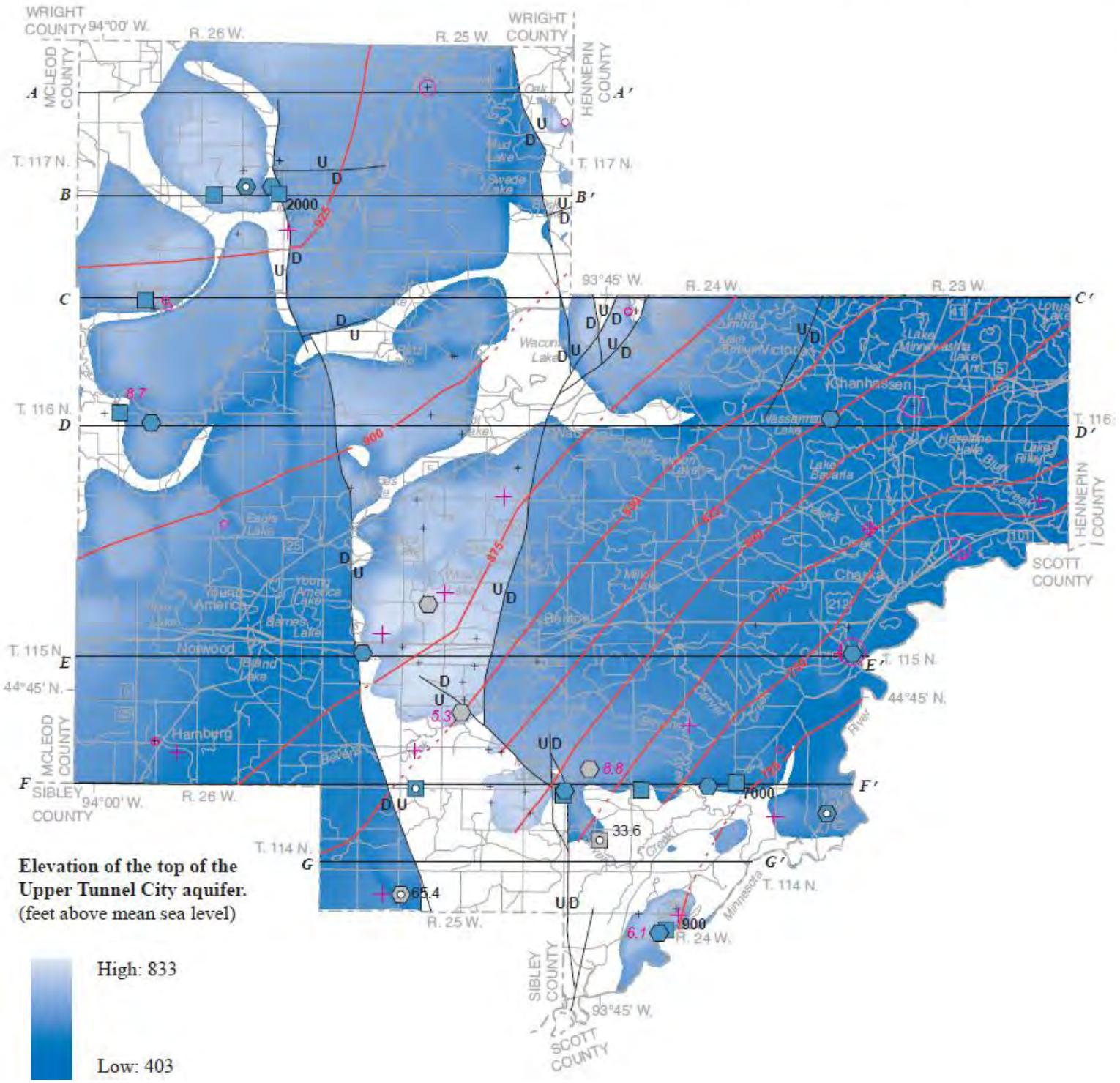


Figure 11. Potentiometric surface elevation contours of the Upper Tunnel City aquifer
Source: Carver County Geologic Atlas, Part B, Plate 8: Bedrock Hydrogeology:
http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate08.pdf

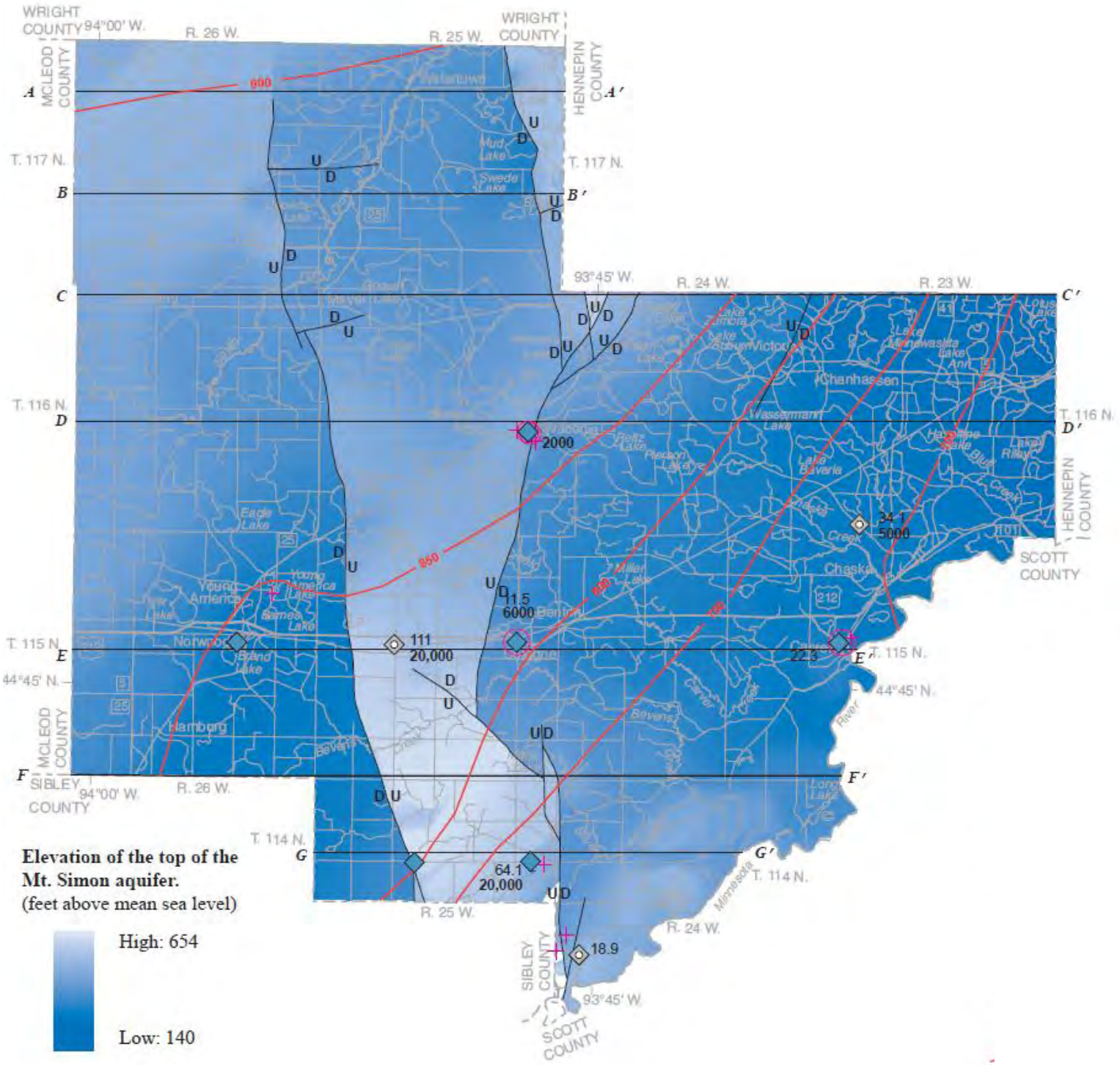


Figure 12. Potentiometric surface elevation contours of the Mt. Simon aquifer
Source: Carver County Geologic Atlas, Part B, Plate 8: Bedrock Hydrogeology:
http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate08.pdf

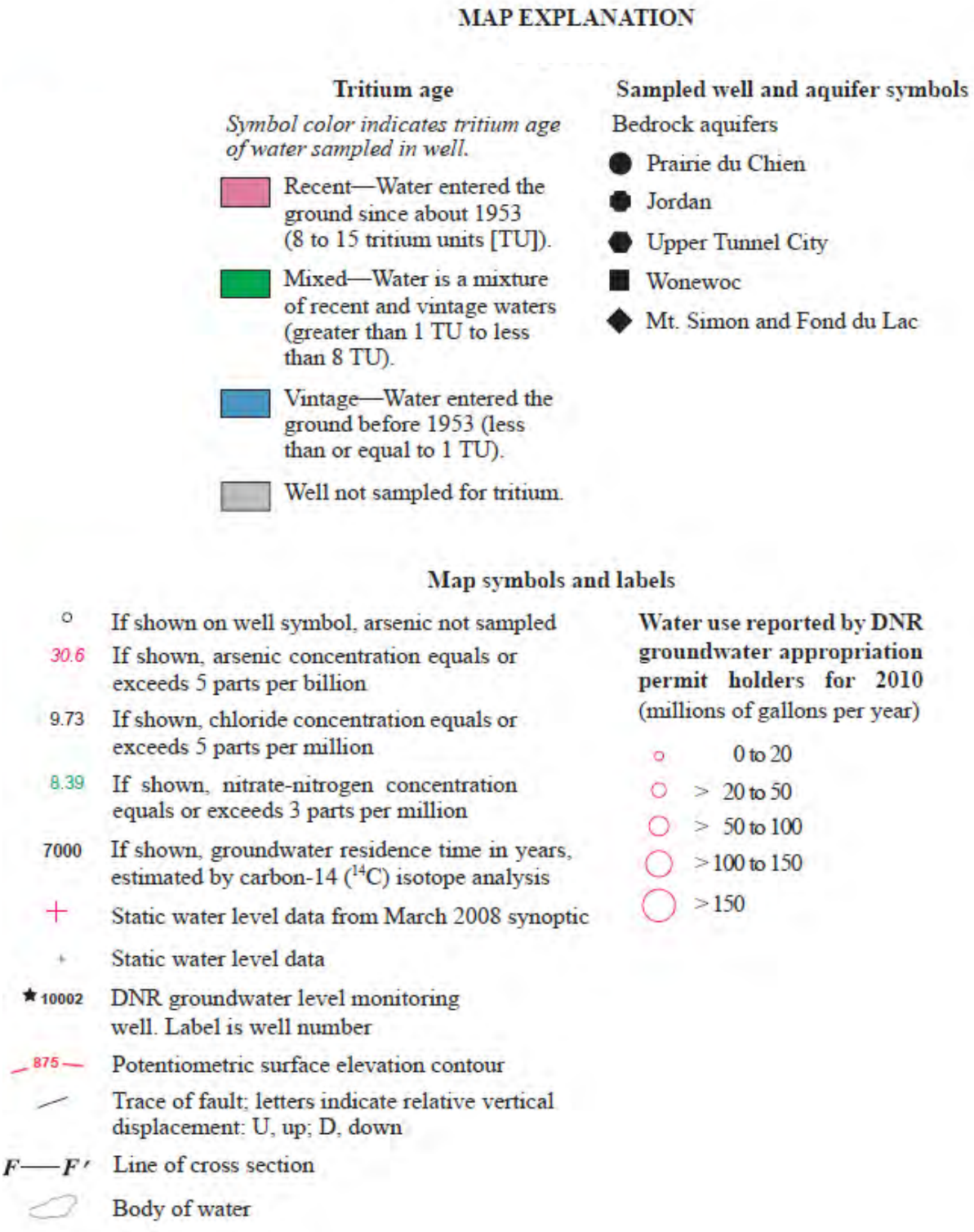


Figure 13. Map explanation, Figures 10-12

Source: Carver County Geologic Atlas, Part B, Plate 8: Bedrock Hydrogeology: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate08.pdf

Twin Cities Area Groundwater Flow Model (Metro Model 3)

Metro Model 3 is a regional model and is used to assess the impacts of possible management scenarios on projected groundwater levels based on land use changes, population growth, and water demand changes. The model highlights areas where the range of projected 2040 water demand may exceed safe yield amounts if current use patterns and water sources are used to meet that demand; this may be considered as a warning threshold to allow time for contingency plans to be in effect if water levels decline.

Maps are included for sensitive surface water and for each of the major aquifers found in the Twin Cities metropolitan area. Darker blue areas indicate greater amounts of projected drawdown. Yellow areas show where projected drawdown exceeds 50 percent of the available head, the level at which the ability of the aquifer to recharge may become compromised.

Model results are shown for all communities in the 7-County Twin Cities Metro Region in the following figures:

Figure 14	2040 Projected Groundwater Drawdown: Sensitive Surface Water
Figure 15	2040 Projected Groundwater Drawdown: Prairie du Chien-Jordan Aquifer
Figure 16	2040 Projected Groundwater Drawdown: Tunnel City-Wonewoc Aquifer
Figure 17	2040 Projected Groundwater Drawdown: Mt Simon-Hinkley Aquifer

For more information and the most updated drawdown maps, please see the Metropolitan Area Master Water Supply Plan 2015 Update (http://www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Master-Water-Supply-Plan.aspx?source=child).

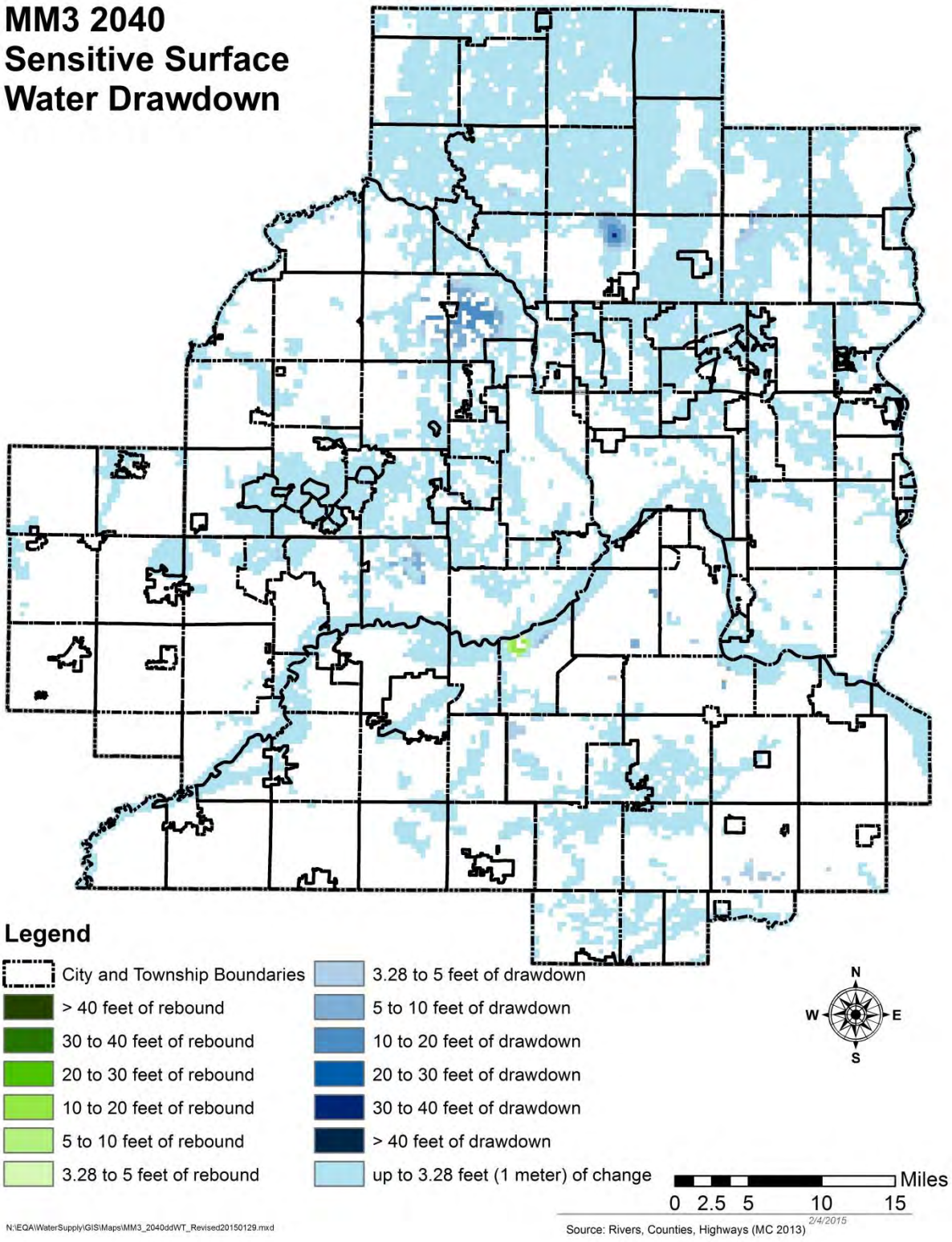


Figure 14. 2040 Projected Groundwater Drawdown: Sensitive Surface Water

Source: Metropolitan Council. Metropolitan Area Master Water Supply Plan 2015 Update: www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Master-Water-Supply-Plan.aspx?source=child .

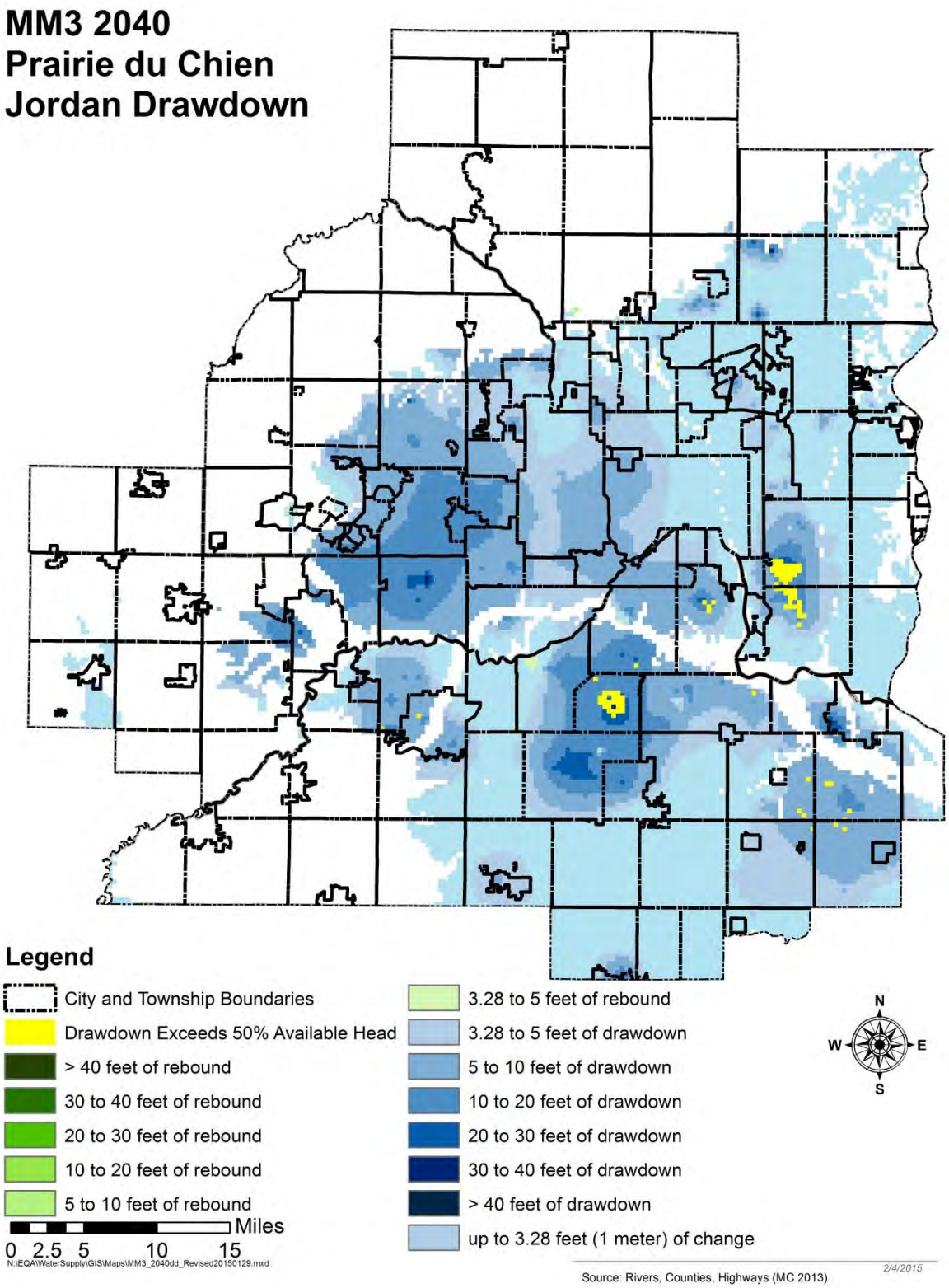


Figure 15. 2040 Projected Groundwater Drawdown: Prairie du Chien-Jordan Aquifer

Source: Metropolitan Council. Metropolitan Area Master Water Supply Plan 2015 Update: www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Master-Water-Supply-Plan.aspx?source=child .

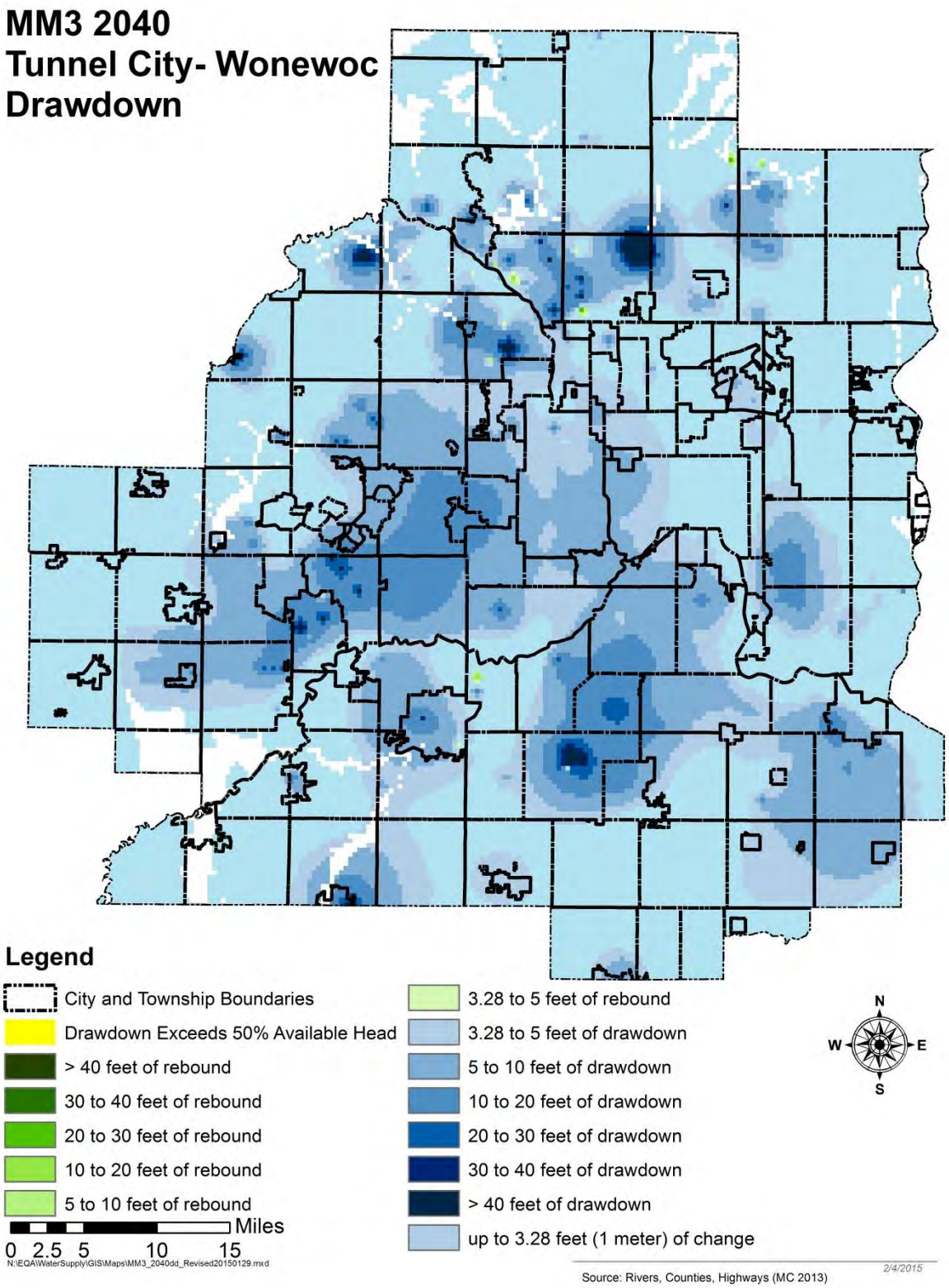


Figure 16. 2040 Projected Groundwater Drawdown: Tunnel City-Wonewoc Aquifer

Source: Metropolitan Council. Metropolitan Area Master Water Supply Plan 2015 Update: www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Master-Water-Supply-Plan.aspx?source=child .

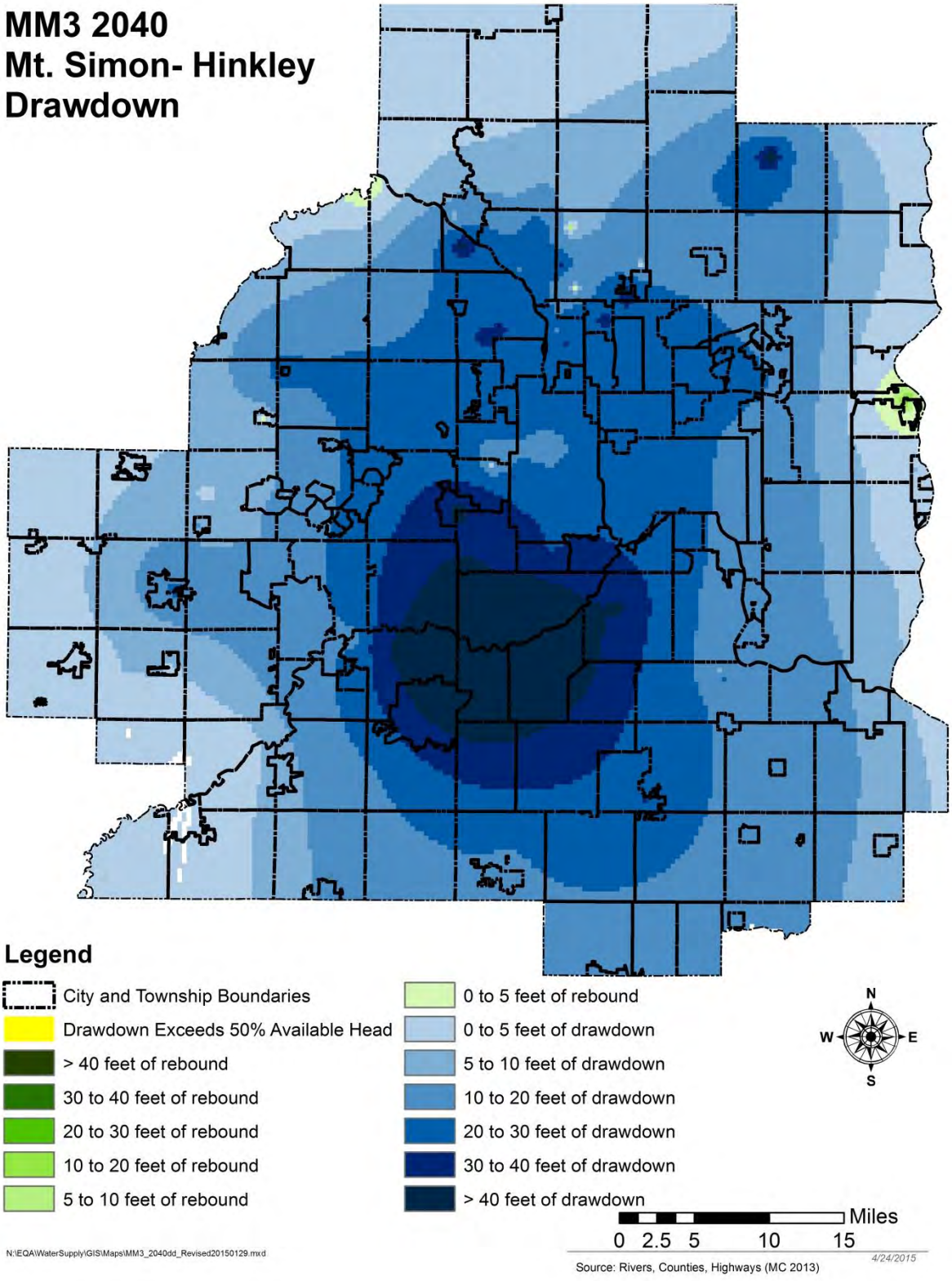


Figure 17. 2040 Projected Groundwater Drawdown: Mt Simon-Hinkley Aquifer

Source: Metropolitan Council. Metropolitan Area Master Water Supply Plan 2015 Update: www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Master-Water-Supply-Plan.aspx?source=child .

Groundwater Quality and Sensitivity to Pollution.

Groundwater Quality

Public water systems are tested regularly for a variety of contaminants; for private wells, regular testing is up to the well owner. The Minnesota Department of Health recommends that private wells be tested for the following contaminants: arsenic, nitrates, and bacteria.

Arsenic

Arsenic is commonly found in groundwater in aquifers in Carver County; many wells constructed in the county have tested positive for arsenic. The Environmental Protection Agency (EPA) requires that community water supplies not exceed 10 parts per billion (ppb) for arsenic. Long-term consumption of arsenic above the drinking water standard may increase the risk of health problems of the skin, circulatory system, nervous system, lungs, and bladder, including some forms of cancer.

As part of the development of the Carver County Geologic Atlas, 96 wells in the county were tested for arsenic. Arsenic in concentrations greater than or equal to 10 ppb was found in 26 of the 96 wells tested. 19 additional wells had arsenic concentrations greater than or equal to 5 ppb and less than 10 ppb.

Current science does not allow background concentrations of arsenic to be determined for these aquifers, therefore all wells constructed in one of the sand and gravel aquifers or in a shallow bedrock aquifer should be tested for arsenic at least once.

> For additional information on Arsenic in Carver County Wells see: Carver County Geologic Atlas, Part B, Plate 6: Hydrogeology of the Surficial Aquifer and the Buried Sand and Gravel Aquifers: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate06.pdf

Nitrate

Nitrate is a common contaminant found in many wells in Minnesota. Too much nitrate in drinking water can cause serious health problems for young infants. Nitrate (NO^3) is a naturally occurring chemical made of nitrogen and oxygen. Nitrate is found in air, soil, water, and plants. Much of the nitrate in our environment comes from decomposition of plants and animal wastes. People also add nitrate to the environment in the form of fertilizers.

Natural levels of nitrate in Minnesota groundwater are usually quite low (less than 1 milligram per liter [mg/L] of nitrate-nitrogen). However, where sources of nitrate such as fertilizers, animal wastes, or human sewage are concentrated near the ground surface, nitrate may seep down and contaminate the groundwater. Elevated nitrate levels in groundwater are often caused by run-off from barnyards or feedlots, excessive use of fertilizers, or septic systems.

Wells most vulnerable to nitrate contamination include shallow wells, dug wells with casing which is not watertight, and wells with damaged, leaking casing or fittings. Private wells in Carver County should have a routine nitrate test every two or three years, more frequently if nitrate has been detected in previous sampling.

For additional information on nitrates in well water, see the MDH website: www.health.state.mn.us/divs/eh/wells/waterquality/nitrate.html .

Bacteria

Waterborne infectious diseases are caused by a number of different bacteria, viruses, or protozoa (one-cell animals), which are spread through contaminated drinking water. Examples of these diseases include diarrheas, dysenteries, salmonellosis, hepatitis, and giardiasis.

Testing water directly for every possible disease-causing organism in not practical, so the water is tested instead for a group of indicator bacteria which measure the sanitary protection of the well and water system. This group of common bacteria, called the "total coliform group," is a good indicator of sanitary protection for two reasons:

1) Coliform bacteria are everywhere on the surface of the ground, but usually do not occur deeper than a few feet into the soil. Most coliform bacteria do not themselves usually cause disease, but if they show up in a water test, they can indicate that surface contamination has somehow gotten into the water, and disease organisms may also be present.

2) Coliform bacteria can be killed by disinfection (chlorination) the same way that most disease organisms are killed.

Private wells should be tested at least once a year for bacterial safety.

For additional information on bacteria in well water, see the MDH website: http://www.health.state.mn.us/divs/eh/wells/waterquality/bacteria.html.

Sensitivity to Pollution

The Carver County Geologic Atlas estimated the sensitivity to pollution of near-surface materials (Figure 18), buried sand and gravel aquifers, and the top of the bedrock (Figure 19). Pollution sensitivity was determined using a model that estimates the vertical travel time of a contaminant that moves conservatively with water. For near surface materials, areas with a high sensitivity to pollution are areas where it takes hours to a week for a contaminant to reach the aquifer; areas with very low sensitivity to pollution are areas where it takes months to years for a contaminant to reach the aquifer. For the bedrock aquifers, areas with a high sensitivity to pollution are areas where it takes hours to months for a contaminant to reach the aquifer; areas with very low sensitivity to pollution area areas where it takes a century or more for a contaminant to reach the aquifer.

Most aquifers in Carver County are rated very low sensitivity. The buried sand and gravel aquifer is relatively shallow and has many areas of moderate to high pollution sensitivity. The near surface materials and the top of the bedrock all have pollution sensitivity ratings of high to very high in southeast Carver County and ratings of very low elsewhere. The high sensitivity to pollution in the southeast part of the county is due to the high permeability of the surficial sand and gravel aquifer in this area, which is much more permeable than the clay loam and loam tills that overlies most of the rest of the county.

To validate the pollution sensitivity model, water samples were collected from several wells in each aquifer and analyzed for tritium-age and chloride. The results of these tests provide useful information for evaluating geologic sensitivity. Mixed tritium-age results indicate that at least a portion of the

groundwater has been recharged since the 1950s. Elevated chloride concentration in samples equal to or greater than 5 parts per million (ppm) often indicates a local anthropogenic source of chloride; this usually implies a moderate or higher sensitivity.

The results of the well chemistry analysis generally affirm the sensitivity model. Sample results show that in most areas of the county, groundwater is centuries to thousands of years old and has not been recharged recently. Along the Minnesota River Valley, where the pollution sensitivity model shows higher sensitivity to pollution, the results of the sampling show that the groundwater has been recharged recently (since the 1950s), reflecting relatively rapid recharge conditions.

> See the Carver County Geologic Atlas, Part B, Plate 9: Pollution Sensitivity of the Near-surface Materials, Buried Sand and Gravel Aquifers, and the Bedrock Surface for additional information on pollution sensitivity: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate09.pdf.

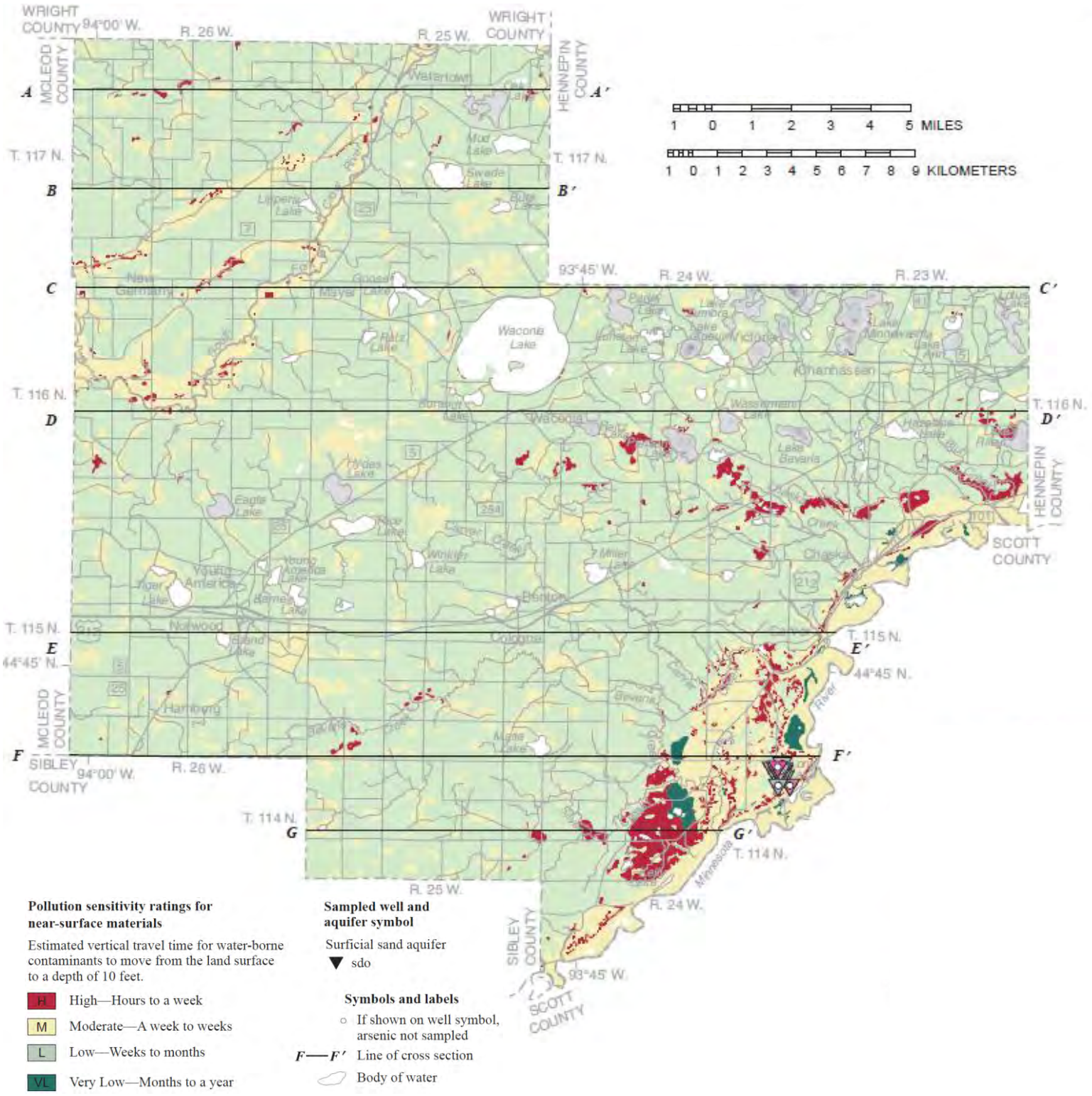


Figure 18. Pollution Sensitivity of the Near-Surface Materials

Source: Carver County Geologic Atlas, Part B, Plate 9: Pollution Sensitivity: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate09.pdf

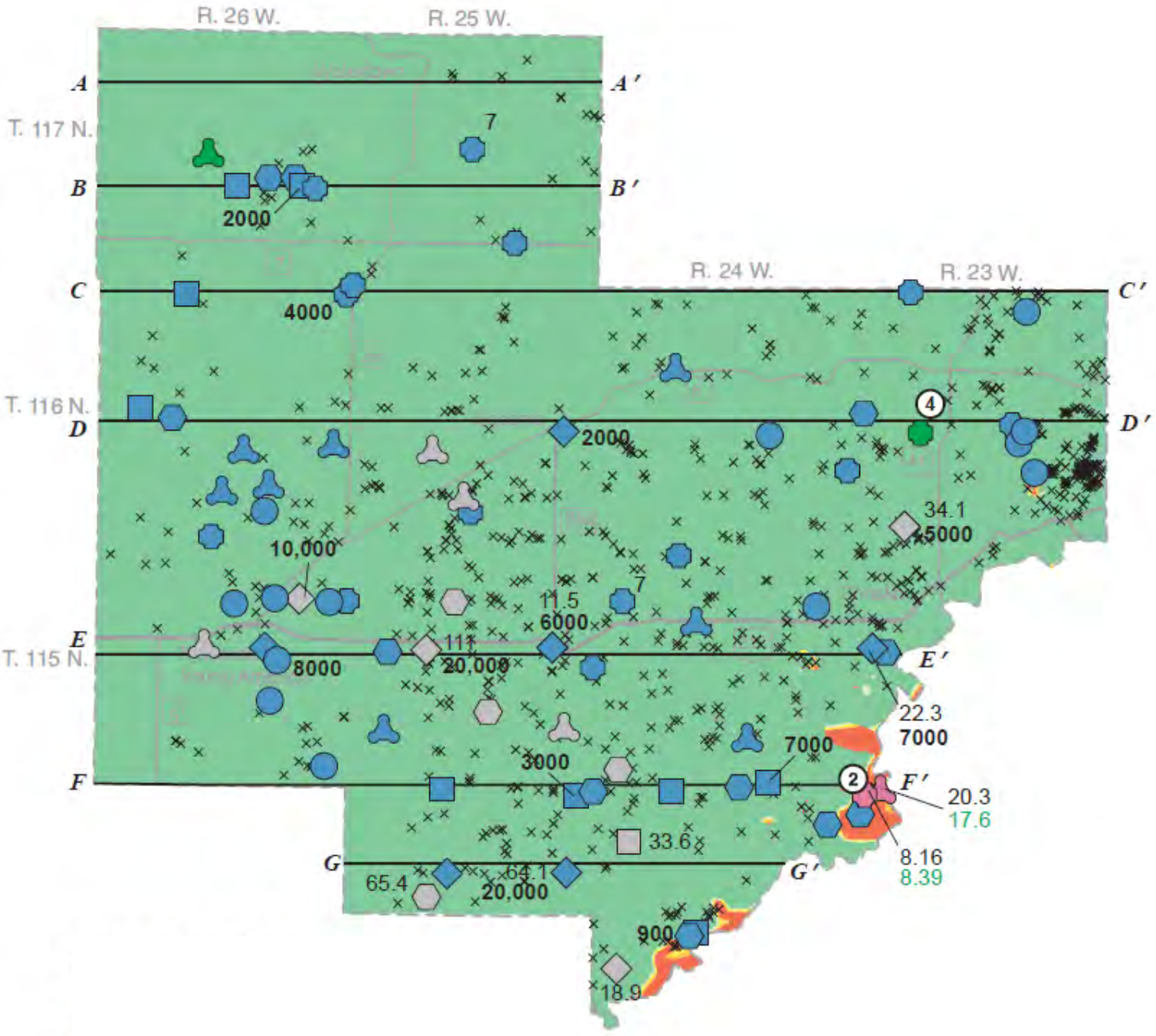


Figure 19. Pollution Sensitivity of the Bedrock Surface

Source: Carver County Geologic Atlas, Part B, Plate 9: Pollution Sensitivity: http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate09.pdf

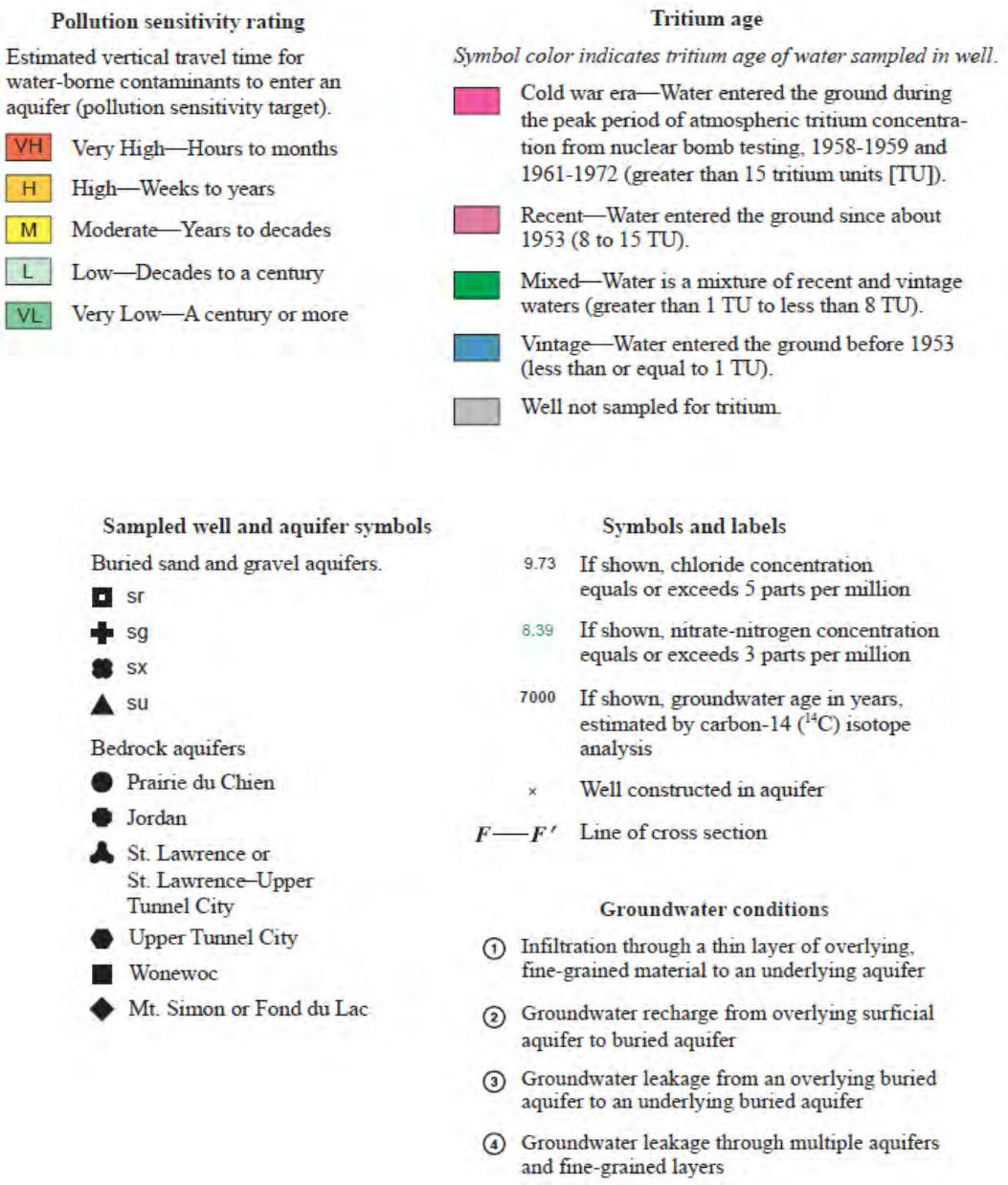


Figure 20. Map Explanation for Figures 19: Pollution Sensitivity of the Bedrock Surface
Source: Carver County Geologic Atlas, Part B, Plate 9: Pollution Sensitivity:
http://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c21_carver/pdf_files/carver_plate09.pdf

Groundwater Dependent Resources

Where groundwater discharges at the land surface, it supports unique types of wetlands and streams. Groundwater seepage provides a highly stable source of consistently cool, mineral rich water creating conditions suitable for unique plant and animal communities. These communities are highly susceptible to disruption in groundwater discharge and from land disturbances. Threats to these unique resources include loss of groundwater flow from over-pumping, increasing impervious surfaces, loss of recharge from water diversion, agricultural practices, and groundwater quality degradation.

In Carver County, Seminary Fen and Assumption Creek, both located in Chanhassen and Chaska as displayed in Figure 21, are two examples of unique, groundwater dependent natural resources.

Seminary Fen

Seminary Fen, a calcareous fen, is one of the rarest types of wetland in the United States. Calcareous fens are characterized by a substrate of peat and are dependent on a constant supply of cold, groundwater, oxygen-poor but rich in calcium and magnesium bicarbonates.

These fens have been reported from 10 states, mostly in the Midwest. Fewer than 500 calcareous fens survive in the world; about 200 are known in Minnesota. In addition to the rarity of the resource itself, calcareous seepage fens support a disproportionately large number of rare plant species in Minnesota. Calcareous fens have special protection under Minnesota state law and may not be drained, filled or otherwise altered or degraded.

Seminary Fen is protected as part of the Seminary Fen Scientific and Natural Area (SNA), operated by the Minnesota Department of Natural Resources (MN DNR) as displayed in Figure 21. This SNA also includes a portion of Assumption Creek, a designated trout stream, and is home to eight species of state-listed rare plants.

The quality of Seminary Fen varies spatially. Directly adjacent land use types include agriculture and residential, both of which can adversely affect calcareous fens. Historical drain tiling has affected how water is retained in the fen. Further, ravines that have formed on the north edge of the fen transport urban stormwater that ultimately finds its way to Seminary Fen. Efforts are being made by several organizations to address these issues.

The Seminary Fen Workgroup includes representatives from the City of Chanhassen, Chanhassen Environmental Commission, interested citizens and neighboring landowners, Carver County, Lower Minnesota River Watershed District, Metropolitan Council, and the DNR. This workgroup provides local leadership related to protecting and preserving Seminary Fen and Assumption Creek. The workgroup has identified strategies and seeks to collect data to inform management practices for Seminary Fen.

The effects of groundwater pumping on Seminary Fen are largely unknown. In 2015, CCWMO staff in partnership with the Lower Minnesota River Watershed district and the Minnesota Department of Natural Resources will be installing additional piezometer nests to gain more information regarding seasonal and annual water levels in Seminary Fen.

Assumption Creek

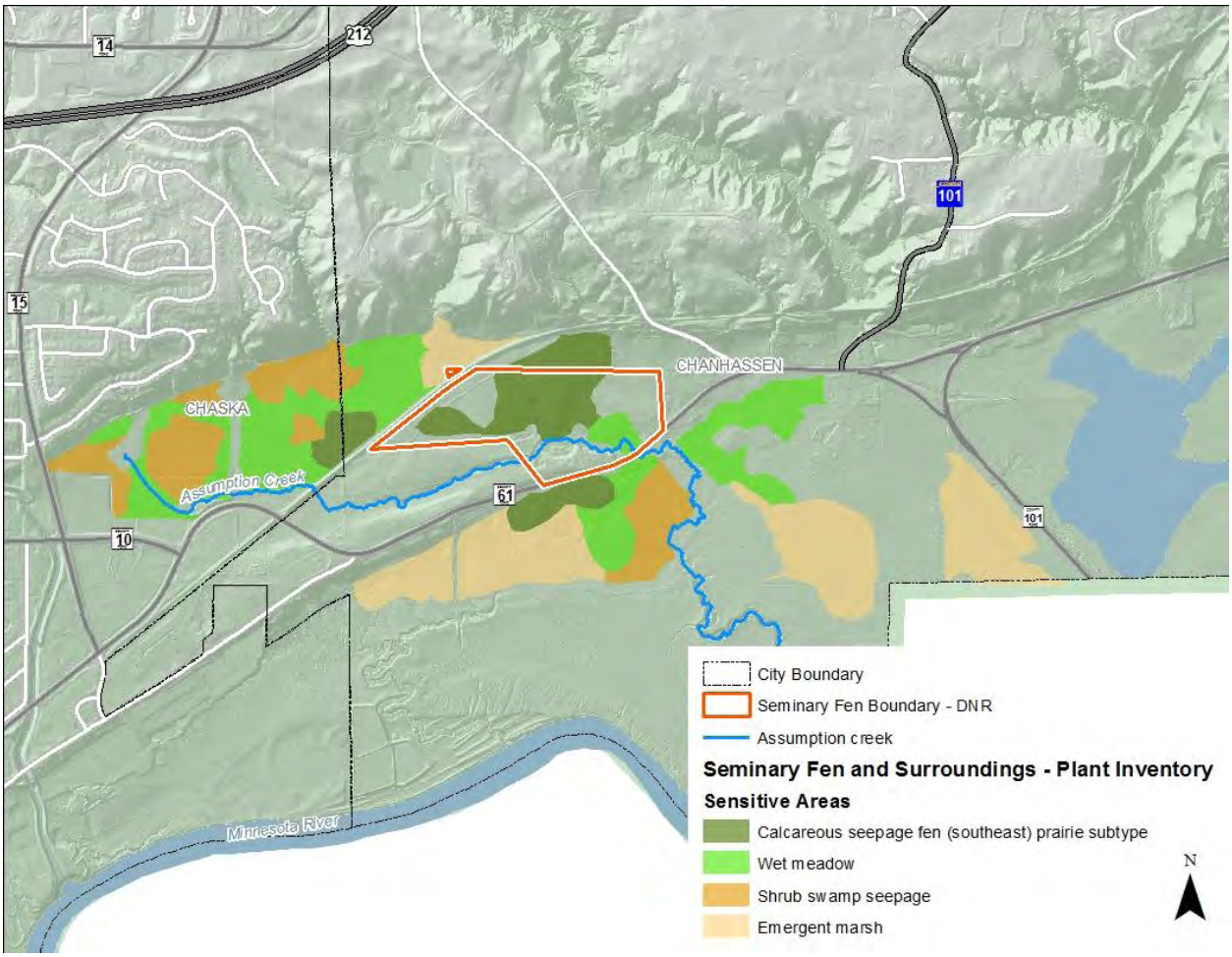
Seminary Fen discharges into Assumption Creek; the cold, clear waters discharging from the fen once supported trout, a fish species dependent on cold water for survival. Historically declining flow rates in Assumption Creek have compromised its ecological integrity. Today, much of the original channel of

Assumption Creek runs intermittently and can no longer support a population of trout, though it maintains excellent overall water quality. Like enhanced monitoring efforts to better understand water level fluctuations in Seminary Fen, the CCWMO is enhancing monitoring efforts to better catalog seasonal flow patterns in Assumption Creek that will aid in channel recharge stressor identification.

For additional information see:

- A Source of Health among Us and an Invaluable Resource: DNR Dedicates Seminary Fen (Lower Minnesota Watershed District): www.watersheddistrict.org/seminary%20fen.html
- Seminary Fen Scientific and Natural Area (MN DNR): www.dnr.state.mn.us/snas/detail.html?id=sna02018
- Seminary Fen Scientific and Natural Area (MNopedia): www.mnopedia.org/place/seminary-fen-scientific-and-natural-area
- Calcareous Fen Fact Sheet (MN DNR): http://files.dnr.state.mn.us/natural_resources/water/wetlands/calcareous_fen_fact_sheet_dec_2011.pdf

Figure 21: Seminary Fen and Assumption Creek



Source: Carver County .

Goals, Objectives, Strategies: Priorities of Groundwater Protection in Carver County

Goals, objectives, and strategies define Carver County's role related to groundwater management. Goals define high-level visions supported by the County which objectives and strategies aim to advance. Objectives define outcomes that the County will seek to achieve to advance the vision of the goals. Finally, strategies are action steps that the County will take to achieve the objectives. Importantly, the County recognizes that its groundwater management goals cannot be achieved acting alone. As stated in the County's 2030 Comprehensive Plan, successfully meeting goals depends on "the partnership and collaboration of all of Carver County's stakeholders, Cities and Townships, citizens, and decision-makers working in concert toward a common goal."

As explained in previous sections of this plan, many agencies are involved in managing water resources within the State of Minnesota. Various state agencies are actively involved in activities like groundwater monitoring, appropriation, regulation and quality assurance. Local governments are largely responsible for managing supply wells, and providing safe and reliable water to residents. Carver County intends to support established groundwater management stakeholders through limited and strategic involvement focused on addressing identified gaps. Accordingly goals, strategies, and objectives are scaled to the County's role in addressing issues identified through the public participation process. Namely, the County's strategies focus on four key roles: planning, education, cost share, and research and monitoring.

Goals, Objectives, Strategies

1. **Goal**: Prevent groundwater contamination to protect public health, avoid adverse environmental impacts, and provide high quality water resources that support current and future populations and economic activity.

    1.1. **Objective**: Coordinate groundwater quality data resources to improve access to data that describe County-wide sensitive areas and potential threats to groundwater sources.

        1.1.A. Strategy | Research/Monitoring: Coordinate with the DNR and other state agencies to build upon existing efforts or develop new approaches to make appropriations data and observation well network data available to suppliers and the public via the County website to support analysis and interpretation.

        1.1.B. Strategy | Research/Monitoring: Develop and maintain webmap applications that enable easy viewing of Carver County Geologic Atlas data.

        1.1.C. Strategy | Research/Monitoring: Compile and make available historical county-wide groundwater quality data from private wells on the County's website (data sources for historical data include MDH, MDA, DNR, and Carver County).

1.2. **Objective**: Monitor groundwater quality throughout Carver County to understand existing and emerging threats to drinking water from municipal and private sources, and to groundwater dependent natural systems like the Seminary Fen and Assumption Creek.

1.2.A. Strategy | Research/Monitoring: Partner with existing voluntary private well monitoring programs, like the Minnesota Department of Agriculture Township Testing Program (http://www.mda.state.mn.us/en/protecting/cleanwaterfund/gwdwprotection/townshiptesting.aspx), to gather water quality information on contaminants of concern including e. coli, nitrate, and arsenic levels and understand County-wide trends.

1.2.B. Strategy | Research/Monitoring: Explore partnering with state agencies to install "sentinel" wells to gather long term groundwater quality data. Locate sentinel wells in aquifers used by private well owners or locate sentinel wells in areas where contamination is a known concern.

1.2.C. Strategy | Research/Monitoring: Continue to conduct the existing monitoring program that includes observation well networks in the Seminary Fen and collaborations with the DNR.

1.3. **Objective**: Prevent adverse health impacts from known contamination and potential threats by administering the Well Sealing Cost Share Program, supporting Cities' wellhead protection programs, and educating residents about hazards and prevention strategies.

1.3.A. Strategy | Education: Focus marketing of the Well Sealing Cost Share Program on wellhead protection areas, areas sensitive to infiltration, and other areas of concern that arise based on future analysis and conditions to protect critical water sources and support City wellhead protection programs.

1.3.B. Strategy | Cost Share: Review the Well Sealing Cost Share Program's cost-share structure to determine the program's efficacy as an incentive, and consider changes to the program as necessary. The review may include analysis of historical aerial photos to identify abandoned home and farm sites in order to identify candidates for implementation.

1.3.C. Strategy | Education: Develop web resources to direct private well owners to resources that address concerns that are a priority in Carver County including well testing and treatment for contaminants including e. coli, nitrates, and arsenic. Targeting landowners in areas sensitive to groundwater contamination will be a focus.

1.3.D. Strategy | Research/Monitoring and Education: Use available data to inform annual groundwater quality education initiatives targeting both urban and rural residents.

2. **Goal**: Ensure the County's groundwater supply continues to meet current demand without compromising aquifer viability, economic growth and development, and the ability of future generations to meet their water supply needs.

   2.1. **Objective**: Coordinate groundwater quantity data resources by providing technical assistance, and fostering connections to data currently submitted to state agencies to understand the County-wide drinking water supply and likely impacts of forecasted population and employment growth.

      2.1.A. Strategy | Research/Monitoring: Coordinate with the DNR and other state agencies to build upon existing efforts or develop new approaches to make appropriations data and observation well network data available to suppliers and the public via the County website to support analysis and interpretation.

      2.1.B. Strategy | Research/Monitoring: Develop and maintain webmap applications that enable easy viewing of Carver County Geologic Atlas data.

      2.1.C. Strategy | Research/Monitoring and Planning: Coordinate conversations with the DNR to simplify data submission requirements for City suppliers.

   2.2. **Objective**: Monitor groundwater quantity, and participate in sub-regional workgroups to understand long-term ability to meet demand as the County's population increases.

      2.2.A. Strategy | Research/Monitoring and Planning: Develop a monitoring network plan to understand the existing observation well network, identify needs for additional wells to fill gaps, and establish baseline data ahead of population growth to support impacts analysis. The priority will be to maximize currently collected data prior to collecting new data.

      2.2.B. Strategy | Research/Monitoring: Support DNR priorities to emphasize installation of nested wells at new and existing observation well sites which allows multiple aquifers to be monitored at a location.

      2.2.C. Strategy | Research/Monitoring: Continue to conduct the existing monitoring program that includes observation well networks in the Seminary Fen and collaborations with the DNR.

      2.2.D. Strategy | Cost Share: Explore cost-sharing opportunities to establish DNR required observation wells, or to expand observation capabilities in critical locations.

   2.3. **Objective**: Preserve water supplies and groundwater dependent natural resources by promoting water conservation through policy and education initiatives.

      2.3.A. Strategy | Planning: Consider implementation of WMO appropriations permitting below DNR thresholds if water use conflicts arise.

      2.3.B. Strategy | Planning: Clarify stormwater reuse standards and policies to promote a full range of options, including combined reuse systems and surface water use, through WMO permits and cost-share programs to conserve aquifer water sources.

2.3.C. Strategy | Planning: Support watershed organizations by encouraging adequate topsoil placement to reduce municipal water usage.

2.3.D. Strategy | Education: Support City conservation education efforts required under DNR appropriations permits by coordinating messages and materials to inform customers about strategies for reusing and reducing water consumption and integrating groundwater conservation into existing WMO education programming.

3. **Goal:** Protect groundwater dependent natural resources like the Seminary Fen and Assumption Creek from the impacts of groundwater withdrawals and groundwater contamination.

3.1. **Objective:** Increase the County's understanding of groundwater and surface water interactions within the County to inform groundwater management decisions.

3.1.A. Strategy | Research/Monitoring: Work with DNR to expand the observation well network in Seminary Fen and analyze data already collected to better understand dynamics of groundwater/surface water interaction within and around the Fen along with Assumption Creek, as well as participation in workgroups.

3.1.B. Strategy | Research/Monitoring: Identify other natural areas of high groundwater/surface water interaction within the County where resources may be at risk of adverse impacts from current or future groundwater withdrawals and potential interaction with contaminated groundwater.

3.2. **Objective**: Increase public awareness about groundwater dependent natural resources to emphasize the benefits these resources provide and the risks they face.

3.2.A. Strategy | Education: Highlight the existence and benefits of groundwater dependent natural resources through education outreach events or media outlets like newspapers, the WMO water column, and the County website.

Plan Implementation

The Carver County Planning & Water Management (PWM) Department will hold primary responsibility for the coordination, management, and implementation of the Plan. As a ten year plan, work towards achieving the goals and objectives of this Plan will be ongoing. Strategies identified in this Plan will be implemented incrementally, and will be prioritized in the Department's work plan annually based on available resources and community needs. For example, dedicated grant funding, or environmental circumstances such as a drought may influence strategy implementation.

Although the PWM Department holds primary responsibility for the Plan, successfully meeting goals depends on partnerships and collaboration with all of Carver County's stakeholders, Cities and Townships, citizens, and decision-makers. As a result, goals and objectives identified in this plan should be used by the community to inform their efforts related to groundwater management as well.

Appendix C summarizes the goals, objectives, and strategies of this plan and identifies responsible parties, timeframes, and implementation measures.

Funding Sources

Successful implementation of this plan relies on a combination of funding and partnerships to support coordination of projects and initiatives identified by the strategies. The County recognizes that potential unforeseen changes to funding sources and priorities could impact plan implementation. Recognizing changes are likely over the course of this plan, a number of existing funding sources are important for successful implementation. Table 7 lists important funding sources and partnerships along with the general program areas they support.

Table 7: Existing and potential funding sources and partnerships for plan implementation

	Funding Source/Partnership	Program Area
Existing	Carver County Water Management Organization Funding	Stormwater Reuse, Well Sealing, Education, Monitoring
	DNR Agreement	Water Level Measurements of Observation Wells
	Lower MN Watershed District Agreement	Seminary Fen Testing
	Carver County Staff	Plan Coordination and Program Management
	Clean Water Legacy Fund	Stormwater Reuse
Potential	State and Metropolitan Council Grants & Partnerships	Monitoring, Conservation, Testing
	Partnerships with LGUs	Education, Data Coordination
	Water Management Organization and Watershed District Funding	Enhanced Monitoring and Data Coordination

Implementation measurement

Measurement will include both broader guiding measures and specific implementation measures. Specific implementation measures are outlined in Appendix C of this Plan. Broader guiding measures will focus on understanding the larger goals of this Plan; specifically groundwater quality, groundwater quantity, and the health of groundwater dependent natural resources.

Broader guiding measures will inform staff of the impacts of strategy implementation. For example, if data indicate groundwater levels are decreasing staff would need to reevaluate strategies related to preserving groundwater levels in order to improve the County's ability to meet its groundwater goals. Many of the strategies in this Plan relate to improving the County's ability to access and analyze groundwater monitoring data. Meeting these strategies will allow the County to develop accurate guiding measures.

Specific implementation measures have been assigned to each strategy in Appendix C. Implementation measures will be reviewed annually for the life of this Plan in order to inform annual program planning for PWM staff. As a part of the annual update process, measures will be assessed to determine whether new or better data sources should be incorporated into measuring implementation progress.

Appendix A: Procedures and Timelines for Amendment

The Groundwater Plan is a 10-year plan intended to extend through 2025. The Plan is intended to be updated at least every ten years. The County intends to thoroughly review this plan in about 5 years following planned Comprehensive Plan and Water Management Plan updates to ensure continuity with those guiding documents. Any amendments to the Plan will be conducted in accordance with the provisions found in Minnesota Statute section 103B.255, subdivisions 8, 9, and 10.

The County will prepare proposed amendments updating the Plan and give notice of the proposed Plan amendment as necessary. Notice of public hearing on proposed Plan amendment and a description of the amendment shall be published by the County in at least one legal newspaper in the County. Publication shall occur at least ten days before the hearing. Notice will also be mailed at least 30 days before the hearing to all the towns, and statutory home rule charter cities having territory within the County to the Metropolitan Council, Watershed Districts, Watershed Management Organizations, DNR, MPCA, MDH, and BWSR.

At the hearing the County will solicit comments on the proposed Plan amendment. Any person may submit a request to the BWSR not later than ten days following the close of the hearing, asking that the proposed Plan amendment be reviewed in accordance with the provisions of Minnesota statute section 103B.255, subdivision 8, 9, and 10.

The County will not adopt any proposed Plan amendment before the BWSR has decided whether the amendment is in accordance with the provisions found in section 103B.255, subdivisions 8, 9, and 10. If the BWSR has not made a decision within 45 days of the close of the hearing, unless the County agrees to a time extension, review in accordance with the provisions found in Minnesota Statute section 103B.255, subdivisions 8, 9, and 10 shall not be required.

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Appendix B: Committee Leadership

Groundwater Plan Stakeholder Committee Participants:

Bob Bean, Bolton & Menk, Inc.
Claire Bleser, Riley Purgatory Creek Watershed District
Lane Braaten, City of Waconia
Kevin Crooks, City of Chanhassen
Craig Eldred, City of Waconia
Joe Enfield, Carver County Environmental Services
Mark Janovec, Stantec
Terry Jeffery, City of Chanhassen
Doug Kammerer, City of Watertown
Maurice Leuthner, Leuther Well, Inc.
Linda Loomis, Lower Minnesota River Watershed District
Ann Mahnke, City of Victoria
Josh Maxwell, Riley Purgatory Creek Watershed District
Bill Monk, City of Chaska
Brian Skok, City of Carver
Matt Haefner, City of Chaska
Paul Scholtz, City of Carver

Carver County Water Management Advisory Committee Members:

John Siegfried (V Chair)	Citizen Rep Comm. District 1
Katie Mahannah	Citizen Rep Comm. District 2
Audrey Kramer	Citizen Rep Comm. District 3
Trevor Kruger	Citizen Rep Comm. District 4
Virgil Stender	Citizen Rep Comm. District 5
Vacant	Carver Creek watershed
Doug Kammerer	Crow River/Pioneer Creek watersheds
Warren Fluseman	Bevens Creek watershed
Scott Smith (Chair)	East/West Chaska Creek watersheds
Terry Jeffrey	City of Chanhassen
Bill Monk	City of Chaska
Jake Saulsbury	City of Waconia
Hilary Drees	Benton Township
Bill Bohnen	SWCD Board Member
Bob Burandt	SWCD Board Member Alternate

Carver County Board Members:

Gayle O. Degler (District 1)
Tom Workman (District 2)
Randy Maluchnik (District 3)
Tim Lynch (District 4)
James M. Ische (District 5)

Carver County Planning & Water Management Staff:

Nate Kabat, Planner
Kristen Larson, Water Resource Specialist
Paul Moline, Manager

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Appendix C: Implementation Strategy Summary Table

ID	Strategy	County Role				Existing Activity	Responsible Parties	Timeframe	Measure
		Planning	Education	Research & Monitoring	Cost Share				
1.1.A. & 2.1.A.	Coordinate with the DNR and other state agencies to build upon existing efforts or develop new approaches to make appropriations data and observation well network data available to suppliers and the public via the County website to support analysis and interpretation.			x		No	Planning & Water Management Dept., State Agencies	2016-2018	Completion of task
1.1.B. & 2.1.B.	Develop and maintain webmap applications that enable easy viewing of Carver County Geologic Atlas data.			x		No	Planning & Water Management Dept.	2016-2020	Completion of task
1.1.C.	Compile and make available historical county-wide groundwater quality data from private wells on the County's website (data sources for historical data include MDH, MDA, DNR, and Carver County).			x		No	Planning & Water Management Dept.	2018-2020	Completion of task
1.2.A.	Partner with existing voluntary private well monitoring programs, like the Minnesota Department of Agriculture Township Testing Program, to gather water quality information on contaminants of concern including e. coli, nitrate, and arsenic levels and understand County-wide trends.			x		No	Planning & Water Management Dept., State Agencies	2018-2020	# of private wells voluntarily providing quality data

ID	Strategy	County Role				Existing Activity	Responsible Parties	Timeframe	Measure
		Planning	Education	Research & Monitoring	Cost Share				
1.2.B.	Explore partnering with state agencies to install "sentinel" wells to gather long term groundwater quality data. Locate sentinel wells in aquifers used by private well owners or locate sentinel wells in areas where contamination is a known concern.			x		Yes	Planning & Water Management Dept., State Agencies	2020-2025	# of sentinel wells providing quality data
1.2.C. & 2.2.C.	Continue to conduct the existing monitoring program that includes observation well networks in the Seminary Fen and collaborations with the DNR.			x		Yes	Planning & Water Management Dept., State Agencies	Ongoing	Completion of task
1.3.A.	Focus marketing of the Well Sealing Cost Share Program on wellhead protection areas, areas sensitive to infiltration, and other areas of concern that arise based on future analysis and conditions to protect critical water sources and support City wellhead protection programs.		x			No	Planning & Water Management Dept., LGUs	Ongoing	% of annual well sealings within wellhead protection areas
1.3.B.	Review the Well Sealing Cost Share Program's cost-share structure to determine the program's efficacy as an incentive, and consider changes to the program as necessary. The review may include analysis of historical aerial photos to identify abandoned home and farm sites in order to identify candidates for implementation.				x	No	Planning & Water Management Dept.	2016-2018	Completion of task

ID	Strategy	County Role				Existing Activity	Responsible Parties	Timeframe	Measure
		Planning	Education	Research & Monitoring	Cost Share				
1.3.C.	Develop a webpage to direct private well owners to resources that address priority concerns in Carver County including well testing and treatment for contaminants like e. coli, nitrates, and arsenic. Targeting landowners in areas sensitive to groundwater contamination will be a focus.		x			Yes	Planning & Water Management Dept., Environmental Services Dept.	2016-2018	Completion of task
1.3.D.	Use available data to inform annual groundwater quality education initiatives targeting both urban and rural residents.		x			Yes	Planning & Water Management Dept.	Ongoing	Development of annual education plan
2.1.C.	Coordinate conversations with the DNR to simplify data submission requirements for City suppliers.	x		x		No	Planning & Water Management Dept., State Agencies	2016-2018	% of Cities using electronic data submission
2.2.A.	Develop a monitoring network plan to understand the existing observation well network, identify needs for additional wells to fill gaps, and establish baseline data ahead of population growth to support impacts analysis. The priority will be to maximize currently collected data prior to collecting new data.	x		x		No	Planning & Water Management Dept.	2016-2018	Completion of task
2.2.B.	Support DNR priorities to emphasize installation of nested wells at new and existing observation well sites which allows multiple aquifers to be monitored at a location.			x		Yes	Planning & Water Management Dept., State Agencies	2020-2025	% observation wells that are nested

ID	Strategy	County Role				Existing Activity	Responsible Parties	Timeframe	Measure
		Planning	Education	Research & Monitoring	Cost Share				
2.2.D.	Explore cost-sharing opportunities to establish DNR required observation wells, or to expand observation capabilities in critical locations.				x	Yes	Planning & Water Management Dept., State Agencies	2018-2020	# observation wells actively monitored
2.3.A.	Consider implementation of WMO appropriations permitting below DNR thresholds if water use conflicts arise.	x				No	Carver County WMO	Based on need	Based on need
2.3.B.	Clarify stormwater reuse standards and policies to promote a full range of options, including combined reuse systems and surface water use, through WMO permits and cost-share programs to conserve aquifer water sources.	x				Yes	Carver County WMO	2016-2018	Completion of task
2.3.C.	Support watershed organizations by encouraging adequate topsoil placement to reduce municipal water usage.	x				Yes	Planning & Water Management Dept., Carver County WMO	Ongoing	Annual summary of activities
2.3.D.	Support City conservation education efforts required under DNR appropriations permits by coordinating messages and materials to inform customers about strategies for reusing and reducing water consumption and integrating groundwater conservation into existing WMO education programming.		x			Yes	Planning & Water Management Dept., Carver County WMO	Ongoing	Annual summary of education activities

ID	Strategy	County Role				Existing Activity	Responsible Parties	Timeframe	Measure
		Planning	Education	Research & Monitoring	Cost Share				
3.1.A.	Work with DNR to expand the observation well network in Seminary Fen and analyze data already collected to better understand dynamics of groundwater/surface water interaction within and around the Fen along with Assumption Creek.			x		Yes	Planning & Water Management Dept., Watershed District	2018-2020	# of observation wells established
3.1.B.	Identify other natural areas of high groundwater/surface water interaction within the County where resources may be at risk of adverse impacts from current or future groundwater withdrawals and potential interaction with contaminated groundwater.			x		Yes	Planning & Water Management Dept.	2020-2025	Completion of task
3.2.A.	Highlight the existence and benefits of groundwater dependent natural resources through education outreach events or media outlets like newspapers, the WMO water column, and the County website.		x			Yes	Planning & Water Management Dept., Carver County WMO	Ongoing	Annual summary of education activities

Appendix D: Public Comment Summary Table

#	Name/Organization	Comment Date	Plan Area	Comment	Response
1	MN Board of Water and Soil Resources (BWSR)	10/2/2015	General	There were several places where a hyperlink was used to reference a source or where to find further information. We recommend providing the complete URL for users that are reading a hard copy.	The full URL text is now available for all hyperlinks.
2	MN Board of Water and Soil Resources (BWSR)	10/2/2015	General	Incorrect hyperlinks were used in multiple locations throughout the document.	Hyperlinks have been tested for accuracy and should direct to the correct location to the best of the County's knowledge.
3	MN Board of Water and Soil Resources (BWSR)	10/2/2015	Page 14, Neighboring Counties and Local Government Units	Hennepin County's groundwater plan was never adopted by the County and not implemented.	Text edits have been made to clarify the status of Hennepin County's groundwater plan.
4	MN Board of Water and Soil Resources (BWSR)	10/2/2015	General	The Groundwater Resource Overview is a strong basic summary of the geology and hydrogeology of the County. If you have not done so already, we recommend that someone with Minnesota Geological Survey review it.	The Minnesota Geologic Survey received a public comment notice, and did submit a comment.
5	MN Board of Water and Soil Resources (BWSR)	10/2/2015	Page 22, Aquifer Recharge and Discharge Conditions	The information provided within the Aquifer Recharge and Discharge Conditions section should have the source(s) cited.	A reference for the Aquifer Recharge and Discharge Conditions section has been added.
6	MN Board of Water and Soil Resources (BWSR)	10/2/2015	Page 39, Groundwater Dependent Resources	Location Maps would be beneficial for the Seminary Fen and Assumption Creek sections.	Location maps have been added.
7	MN Board of Water and Soil Resources (BWSR)	10/2/2015	Page 41, Goal 1.1.A.	Within the Goals, under 1.1.A. we encourage the County to take advantage of existing efforts to coordinate data – e.g. between Dakota County and MDH/DNR.	Carver County recognizes that implementation of the plan as a whole will require coordinated efforts. We appreciate the suggestion. Language has been edited to emphasize building on existing efforts for this goal.
8	MN Board of Water and Soil Resources (BWSR)	10/2/2015	Page 42, Goal 1.3.B.	We strongly support the focused marketing of the Well Sealing Cost Share Program on wellhead protection areas.	Comment Noted.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
9	MN Department of Natural Resources (DNR)	10/2/2015	Page 25, footnote 1	Page 25, First Paragraph, The State Water Use Data System (SWUDS) has been replaced by the Minnesota Permitting and Reporting System (MPARS). MPARS is a web based system that any permit holder can access and use.	"State Water Use Data System (SWUDS)" has been edited to "Minnesota Permitting and Reporting System (MPARS)"
10	MN Department of Natural Resources (DNR)	10/2/2015	Page 25, Table 5	It is good to see the ground water use of the County being discussed, but it is better to use the average use of 5 to 10 years rather than the data of a single year. Using the data from multiple years will prevent unusual weather events, such as drought or flood from skewing the data that is being used.	DNR staff provided information on groundwater usage by use category and aquifer for the years 2010-2014. Tables 4 and 5 have been updated to include this information.
11	MN Department of Natural Resources (DNR)	10/2/2015	Page 25, Table 5	Efforts should be made to estimate the volume of water that is being used in rural areas by well users that do not need DNR Water Appropriation Permits. The water use in Table 5 is currently skewed in favor of large urban areas and deeper aquifers. Including non-SWUDS well water use will present a truer picture of ground water use in Carver County.	Comment noted. We are currently unable to estimate water use of rural well users with reasonable amount of accuracy. A footnote indicating that residential well use volumes are not included has been added to the table.
12	MN Department of Natural Resources (DNR)	10/2/2015	Page 42, Goal 2	Goal: Ensure the County's groundwater supply – should also list "ground water dependent natural resources" as something that shouldn't be compromised.	Goal 3, along with the accompanying objectives and strategies, are focused on specifically protecting groundwater dependent natural resources.
13	MN Department of Natural Resources (DNR)	10/2/2015	Page 43, Objective 2.3	Objective: We recommend that the sentence be altered to read "Preserve water supplies and protect groundwater dependent natural resources by promoting water conservation…"	This change has been implemented.
14	MN Department of Natural Resources (DNR)	10/2/2015	Page 3, Physical Environment, Bullet 1	Note: 31.85 inches according to GA Part B. Consider: "Carver County receives an annual	This change has been implemented.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				average of 31.85 inches of precipitation. A portion of the precipitation comes in the form of snow with 43 inches being the average annual snow total."	
15	MN Department of Natural Resources (DNR)	10/2/2015	Page 15, Geology, second sentence	Consider removing the range of years to simplify statement.	The range of years is important as a reference for readers who are less familiar with the definition of the Paleozoic Era.
16	MN Department of Natural Resources (DNR)	10/2/2015	Page 15, Bedrock Formations, first sentence	Consider adding: and again during the Cretaceous Period 95 million years ago	This change has been implemented.
17	MN Department of Natural Resources (DNR)	10/2/2015	Page 17	A number of suggestions are made related to Figure 5. Map Explanation for Figure 4. Bedrock Geology	As cited in the Plan, Figure 5 comes directly from the Carver County Geologic Atlas, Part A, Plate 2: Bedrock Geology published by the Minnesota Geologic Survey and the Minnesota Department of Resources. Carver County does not have the ability to edit these visuals.
18	MN Department of Natural Resources (DNR)	10/2/2015	Page 18, Table 3 Carver County Bedrock Geology	Suggestion to relabel “Lone Rock Formation” to “Tunnel City Group.” Suggestion to combine the “Upper Cambrian” and “Middle Cambrian” groups in the Age column into a single group labeled “Cambrian.”	“Tunnel City Group” or “Upper Tunnel City”, depending on the layer referred to, are now used consistently throughout the plan. The first instance of “Tunnel City Group” now includes reference to the alternate name “Lone Rock” and the former name “Franconia”. The titles “Upper Cambrian” and “Middle Cambrian” were left as is.
19	MN Department of Natural Resources (DNR)	10/2/2015	Page 22; Page 23, Table 4; Page 34; Page	Suggests a number of specific text edits.	Suggested edits have been implemented.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
			47		
20	MN Department of Natural Resources (DNR)	10/2/2015	Page 25, Table 6	Notes footnote 2 is not defined.	Footnote 2 was included by error, and has been removed.
21	MN Department of Natural Resources (DNR)	10/2/2015	Page 27, Figure 8	Notes figure is missing	Figure 8. Potentiometric surface elevation contours of the buried sand and gravel aquifers has been added.
22	MN Department of Natural Resources (DNR)	10/2/2015	Page 43	Add 2.1.D. Additional future and replacement municipal production wells will be single aquifer wells to protect aquifer integrity and prevent cross contamination of aquifers. Existing multi-aquifer municipal wells will be phased out and replaced.	Comment noted. While supportive of this idea, because the County is not a municipal water provider nor do we have any authority over approval of future municipal wells, it does not seem appropriate to include this strategy in the plan.
23	MN Department of Natural Resources (DNR)	10/2/2015	Page 45, Table 8	Clarify the DNR Agreement with Carver County is for water level measurements of observation wells.	This change has been implemented.
24	MN Department of Agriculture (MDA)	10/2/2015	Page 10, Table 1	Consider adding MDA roles to include planning and education as well. To meet the degradation prevention goal of the Groundwater Protection Act, MDA is involved in planning and educational activities to address contamination of groundwater from agricultural chemicals. Details of planning and educational activities can be found in MDA's Pesticide Management Plan and Nitrogen Fertilizer Management Plan (links provided below).	MDA's roles in planning and education are now recognized in Table 1.
25	MN Department of Agriculture (MDA)	10/2/2015	Page 12, MDA Roles	In addition to what is noted, please consider adding the following: The below narrative can be used to replace the 3rd bullet item; "Regulation of pesticides and fertilizers related to implementation of the Comprehensive Groundwater Protection	This change has been implemented.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				Act of 1989." (This is a major role for MDA, so perhaps should be the 1st bullet item): The Minnesota Department of Agriculture (MDA) is the lead agency for all aspects of pesticide and fertilizer environmental and regulatory functions as directed in the Groundwater Protection Act (Minnesota Statute 103H). These include but are not limited to the following: • Serve as lead agency for groundwater contamination from pesticide and fertilizer nonpoint source pollution • Conduct monitoring and assessment of agricultural chemicals (pesticides and nitrates) in ground and surface waters • Oversee agricultural chemical remediation sites and incident response • Regulate use, storage, handling and disposal of pesticides and fertilizer MDA guidance documents for the prevention, evaluation and mitigation of occurrences of pesticides or pesticide breakdown products, and nitrate from nitrogen fertilizer are described in detail in the Pesticide Management and Nitrogen Fertilizer Management Plans. If a link is needed for the AgBMP loan program (first bullet item) use: http://www.mda.state.mn.us/grants/loans/agbmploan.aspx If a link is needed for Clean Water Fund research and technical assistance (second bullet item) use: http://www.mda.state.mn.us/protecting/clea	

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				nwaterfund/research.aspx and http://www.mda.state.mn.us/protecting/cleanwaterfund/gwdwprotection.aspx	
26	MN Department of Agriculture (MDA)	10/2/2015	Page 42, Strategy 1.2.A: (and in table on page 58)	Thank you for acknowledging the MDA Township Testing Program. The MDA has designed the Township Testing Program to determine current nitrate-nitrogen concentrations in private wells on a township scale. The MDA has identified townships throughout the state that are vulnerable to groundwater contamination and have significant row crop production. These are the areas that will be prioritized for Township Testing. For more information on township testing see; http://www.mda.state.mn.us/en/protecting/cleanwaterfund/gwdwprotection/townshiptesting.aspx. In Carver County, this includes San Francisco Township. This township was identified by the MDA as vulnerable to groundwater contamination in the map at the link provided above. Other townships and wellhead protection areas within counties that are not highlighted may also be considered if there is data to suggest there is a local groundwater problem. MDA has not currently scheduled testing of San Francisco Township, but we look forward to partnering with Carver County as we move forward with statewide township testing for nitrate.	Comment noted.
27	Carver County Soil and Water Conservation District	10/1/2015	Page 41	Goal 1: <u>Prevent groundwater contamination</u> ○ *Consider adding* a strategy that focuses the well sealing cost share program to abandoned home/farm sites using	○ Strategy 1.3.B has been clarified to state the Well Sealing Cost Share Program review may include analysis

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				historical aerial photos to identify such areas. ○ *Consider adding* focused education efforts to landowners in the sensitive groundwater pollution areas of Carver County.	of historical aerial photos to identify abandoned home and farm sites in order to identify candidates for implementation. ○ Strategy 1.3.A calls for focused marketing of the Well Sealing Cost Share Program on areas sensitive to infiltration. Strategy 1.3.C. has been clarified to state targeting landowners in areas sensitive to groundwater contamination will be a focus of education efforts related to the well sealing cost share program and preventing adverse health impacts from contamination.
28	Carver County Soil and Water Conservation District	10/1/2015	Page 42	Goal 2: <u>Ensure the County's groundwater supply…</u> ○ *Consider adding* specific language about the WMO's efforts to ensure adequate topsoil is placed in the greenspaces of new developments. This effort is critical to reducing municipal groundwater needs to water lawns during summer months. The plan states 88% of current groundwater use is for municipal waterworks and most cities experience huge spikes in water use during summer months for lawn irrigation.	○ Strategy 2.3.C added to state, "Support watershed organizations by encouraging adequate topsoil placement to reduce municipal water usage." ○ Strategy 2.3.B. directs staff to, "Clarify stormwater reuse standards and policies to promote a full range of options, including combined reuse systems and surface

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				○ *Consider adding* specific language about the WMO's efforts to encourage stormwater re-use – for the same reason as the comment above.	water use, through WMO permits and cost-share programs to conserve aquifer water sources."
29	Metropolitan Council	10/2/2015	General	Carver County is to be commended for its excellent efforts in planning for the protection of groundwater resources. The continued and future implementation of groundwater programs will ensure that the County residents will have a clean source of water for the future. The draft plan is well done.	Comment noted.
30	Metropolitan Council	10/2/2015	General	One area where additional information would be valuable is a brief discussion of the relationship and possible conflicts between the groundwater plan and the plans of other counties, local governments, and watershed management organizations.	Language has been added to summarize efforts to identify and mitigate conflicts as well as respond to conflicts that may arise in the future.
31	Metropolitan Council	10/2/2015	General	The plan includes many objectives, goals and management strategies that are proactive in nature. Many of the objectives presented, reflect the Council's own recommendations set forth in its long-term water supply plan.	Comment noted.
32	Metropolitan Council	10/2/2015	General	References to upper formation of Tunnel City-Wonewoc Bedrock Aquifer differ throughout the report. At different locations is referred to as Lone Rock, Tunnel City and Upper Tunnel City. Consider maintaining consistency of naming throughout report to avoid confusion.	"Tunnel City Group" or "Upper Tunnel City", depending on the layer referred to, are now used consistently throughout the plan. The first instance of "Tunnel City Group" now includes reference to the alt. name "Lone Rock" and the former name "Franconia".
33	Metropolitan Council	10/2/2015	General	There appears to be some errors in the numbering of tables and figures. Confirm table and figure numbers used in the text match up with the actual tables and figures.	Table and Figure numbers throughout the document have been reviewed and corrected.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
34	Metropolitan Council	10/2/2015	Page 11, Metropolitan Council	Given the plan's schedule for review and adoption, the county staff should consider updating pages 11-12 discussing the Metropolitan Council's Roles to include Thrive MSP 2040 and the Master Water Supply Plan in addition to the reference to the Water Resources Policy Plan. The Council has now adopted the Thrive MSP 2040 and the Master Water Supply Plan (replacing the 2010 version of the plan). County staff should consider replacing this section by a brief discussion of the Thrive MSP 2040 and the Master Water Supply Plan and how growth in the County may affect the groundwater system.	The description of the Metropolitan Council's role has been revised to include Thrive 2040 and the Master Water Supply Plan. Maps from the Metro Water Model are available in the plan to show predicted impacts to aquifer levels throughout the region including Carver County.
35	Metropolitan Council	10/2/2015	Page 1, Table of Contents.	Consider adding List of Tables and List of Figures with page numbers to the Table of Contents.	This change has been implemented.
36	Metropolitan Council	10/2/2015	Page 7, Planning Process, Public Review & County Board Adoption.	Insert DATE when plan is adopted when known.	Change will be made upon final adoption of the plan.
37	Metropolitan Council	10/2/2015	Page 10, Relationship to Other Plans and Potential Conflicts, State & Regional Agencies. Table 1.	The Council commends the County on a nice job at summarizing roles of the various agencies.	Comment Noted
38	Metropolitan Council	10/2/2015	Page 17, Figure 5. Map Explanation for Figure 4. Bedrock Geology.	Reference to Lone Rock and Wonewoc Bedrock Geology for this figure. In Table "6" the term "Upper Tunnel City" is used for what appears to be the same as the "Lone Rock" formation. Consider using the same terminology throughout the report to maintain consistency.	"Tunnel City Group" or "Upper Tunnel City", depending on the layer referred to, are now used consistently throughout the plan. The first instance of "Tunnel City Group" now includes reference to the alternate name "Lone Rock" and the former name

#	Name/Organization	Comment Date	Plan Area	Comment	Response
					"Franconia".
39	Metropolitan Council	10/2/2015	Page 18, Carver County Bedrock Geology Table.	Should this be Table 2 instead of Table 3?	Table and Figure numbers throughout the document have been reviewed and corrected.
40	Metropolitan Council	10/2/2015	Page 18, Carver County Bedrock Geology Table.	Consider adding old naming of Franconia Ironton Galesville formation in addition to new formation names in this table.	This change has been implemented.
41	Metropolitan Council	10/2/2015	Page 18, Carver County Bedrock Geology Table.	Maintain consistency of upper formation naming of Lone Rock-Wonewoc Bedrock Aquifer throughout report.	"Tunnel City Group" or "Upper Tunnel City", depending on the layer referred to, are now used consistently throughout the plan. The first instance of "Tunnel City Group" now includes reference to the alternate name "Lone Rock" and the former name "Franconia". The first instance of "Wonewoc" now includes reference to the former name "Ironton-Galesville".
42	Metropolitan Council	10/2/2015	Page 22, Bedrock Aquifers.	Consider presenting the former names of the aquifers when these aquifers are first mentioned in the report.	"Tunnel City Group" or "Upper Tunnel City", depending on the layer referred to, are now used consistently throughout the plan. The first instance of "Tunnel City Group" now includes reference to the alternate name "Lone Rock" and the former name "Franconia". The first instance of "Wonewoc" now includes reference to the former name "Ironton-Galesville".
43	Metropolitan Council	10/2/2015	Page 23, Carver County Bedrock	Should this be Table 3?	Table and Figure numbers throughout the document have

#	Name/Organization	Comment Date	Plan Area	Comment	Response
			Hydrostratigraphy Table.		been reviewed and corrected.
44	Metropolitan Council	10/2/2015	Page 23, Carver County Bedrock Hydrostratigraphy Table.	Description column includes what percent of groundwater use in the county comes from the specific aquifer. Maintain consistency of whether percent symbol or text is used. Consider pulling the percent data out from this table as percentages are shown in the table on Page 25 and readers can confirm the percentages because total and aquifer water use is also shown on Page 25.	The percent of groundwater use for each aquifer has been removed from the Carver County Bedrock Hydrostratigraphy table.
45	Metropolitan Council	10/2/2015	Page 23, Carver County Bedrock Hydrostratigraphy Table.	Maintain consistency of naming for Lone Rock-Wonewoc Formation.	"Tunnel City Group" or "Upper Tunnel City", depending on the layer referred to, are now used consistently throughout the plan. The first instance of "Tunnel City Group" now includes reference to the alternate name "Lone Rock" and the former name "Franconia". The first instance of "Wonewoc" now includes reference to the former name "Ironton-Galesville".
46	Metropolitan Council	10/2/2015	Page 24, Water use reported by DNR groundwater appropriation permit holders for 2010 by use category Table.	Should this be Table 4?	Table and Figure numbers throughout the document have been reviewed and corrected.
47	Metropolitan Council	10/2/2015	Page 24, Second paragraph.	Percent is spelled out here when the percent symbol (%) is used in the previous table. Maintain consistency throughout report.	Percent is now spelled out throughout the document, excluding Appendix C: Implementation Strategy Table,

#	Name/Organization	Comment Date	Plan Area	Comment	Response
					where the percent symbol (%) is used to save space.
48	Metropolitan Council	10/2/2015	Page 24, Third paragraph, First sentence.	Should this be Table 5?	Table and Figure numbers throughout the document have been reviewed and corrected.
49	Metropolitan Council	10/2/2015	Page 25, Water use reported by DNR groundwater appropriation permit holders for 2010 by aquifer Table.	Should this be Table 5?	Table and Figure numbers throughout the document have been reviewed and corrected.
50	Metropolitan Council	10/2/2015	Page 25, Water use reported by DNR groundwater appropriation permit holders for 2010 by aquifer Table.	Should the notes below the table be labeled 1 through 4 instead of 3 through 6?	Yes, they should. This change has been implemented.
51	Metropolitan Council	10/2/2015	Page 25, last sentence.	Should this be Table 6?	Table and Figure numbers throughout the document have been reviewed and corrected.
52	Metropolitan Council	10/2/2015	Page 26, Availability and Other Characteristics of Aquifers in Carver County table.	Should this be Table 6?	Table and Figure numbers throughout the document have been reviewed and corrected.
53	Metropolitan Council	10/2/2015	Page 27	Our copy of draft report did not include the actual figure on this page.	Figure 8. Potentiometric surface elevation contours of the buried sand and gravel aquifers has been added.
54	Metropolitan Council	10/2/2015	Page 29	Should this be Figure 10?	Table and Figure numbers throughout the document have been reviewed and corrected.
55	Metropolitan Council	10/2/2015	Page 30	Should this be Figure 11? Consider adding, “and Wonewoc Aquifers” to figure name.	Table and Figure numbers throughout the document have been reviewed and corrected.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
56	Metropolitan Council	10/2/2015	Page 31	Should this be Figure 12?	Table and Figure numbers throughout the document have been reviewed and corrected.
57	Metropolitan Council	10/2/2015	Page 32	Should this be Figure 13?	Table and Figure numbers throughout the document have been reviewed and corrected.
58	Metropolitan Council	10/2/2015	Page 34	Sensitivity to Pollution, first paragraph, Renumber figures as needed in the text.	Table and Figure numbers throughout the document have been reviewed and corrected.
59	Metropolitan Council	10/2/2015	Page 36, Pollution Sensitivity of the Near-Surface Materials Table.	Consider showing the boundaries of any Drinking Water Supply Management Areas on this figure.	Comment noted. Because we are using existing figures from the Carver County Geologic Atlas, we are unable to add layers to the figure.
60	Metropolitan Council	10/2/2015	Page 38	Should this be Figure 16 and be an explanation of Figure 15?	Table and Figure numbers throughout the document have been reviewed and corrected.
61	Metropolitan Council	10/2/2015	General	Additional information about the relationship and possible conflicts between the groundwater plan and the plans of other counties, LGUs, and watershed management organizations in the affected groundwater system are needed. The Council recommends that the County add information to the plan regarding the relationship and possible conflicts between the groundwater plan and the plans of other counties, LGUs, and watershed management organizations in the affected groundwater system. The Council recommends that BWSR approve the plan after the County has revised the plan to include the information discussed previously.	Language has been added to summarize efforts to identify and mitigate conflicts as well as respond to conflicts that may arise in the future.
62	Metropolitan Council	10/2/2015	General	There are several solid approaches to	Comment noted.

#	Name/Organization	Comment Date	Plan Area	Comment	Response
				addressing groundwater issues in Carver County. The Council encourages the County to implement these programs as needed and as a proactive and collaborative approach to protecting groundwater. The Council urges the County to work with the WMOs and LGUs to implement the plan.	
63	Minnesota Geologic Survey	10/13/2015	Page 23, Table 4	Bedrock Hydrostratigraphy is missing the Wonewoc Formation (formerly Ironton-Galesville). It's the 45-70 foot unit listed in the thickness column. The easiest fix would be to add "and Wonewoc Formation" to the Formation section; change 'Aquitard (lower)' Aquitard (middle)' and add 'Aquifer (lower)' to the Function section, and modify Description text to: "These formations function as a multiple aquifer with the lower Tunnel City Group acting as a confining unit separating the upper Tunnel City Group from the Wonewoc sandstone; in 2010, 17.5 percent of groundwater used in the county was withdrawn from this multiple aquifer. 1 The aquifer is present throughout the county and is absent only where dissected by bedrock valleys".	The Carver County Bedrock Hydrostratigraphy Table has been updated to reflect these comments.
64	Lois Maetzold, City of Mayer	8/20/2015	General	Supports pursuing methods to utilize stormwater and surface water for irrigation to preserve groundwater resources.	Comment Noted. The County plans to promote water conservation in education initiatives. County water rules are presently being updated to clarify stormwater reuse for irrigation purposes.