Wellhead Protection Plan

Part II

City of Mora, Minnesota

SEH No. MORAM 109696

~~August 2013~~ Revised April 2014

Part II
Wellhead Protection Plan
City of Mora, Minnesota

SEH No. MORAM 109696

August 2013

John Chlebeck, PE

Date: August 22, 2013

Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110-5196
651.490.2000

Public Water Supply Profile

The following persons are the contacts for the Mora Wellhead Protection Plan:

Wellhead Protection Manager/Public Water Supply Contact

Mike Kroon
Water / Wastewater Superintendent
Mora Municipal Utilities
101 Lake Street
Mora, Minnesota 55051

Telephone: 320.679.3630
E-mail: wwtpmora@cityofmora.com

City Engineer

Greg Anderson, PE
SEH, Inc.
3535 Vadnais Center Drive
St. Paul, Minnesota 55110

Telephone: 651.490.2000
Email: ganderson@sehinc.com

Wellhead Protection Consultant

John Chlebeck, PE
SEH Inc.
3535 Vadnais Center Drive
St. Paul, Minnesota 55110

Telephone: 651.765.2982
Email: jchlebeck@sehinc.com

Documentation List

Step	Date Performed
Scoping II Meeting	September 17, 2012
Scoping II Decision Notice	October 16, 2012
Plan Submitted to Local Units of Government	March 25, 2013
Comments Received from Local Units of Government	May 31, 2013
Public Hearing	July 16, 2013
Part II Wellhead Protection Plan Submitted to MDH	September 9, 2013

List of Abbreviations / Terms

CERCLA **COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT -** see Superfund.

CERCLIS **COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY INFORMATION SYSTEM** is a database maintained by the US Environmental Protection Agency. CERCLIS contains information such as the current status of cleanup efforts, cleanup milestones reached, and amounts of liquid and solid media treated at sites on the National Priorities List, which is a list of Superfund Sites with high priority for remediation activity.

CWI **COUNTY WELL INDEX** is a database maintained by MDH with location and summary information for wells and boreholes in Minnesota.

DWSMA **DRINKING WATER SUPPLY MANAGEMENT AREA** is the area delineated using identifiable land marks that reflects the scientifically calculated wellhead protection area boundaries as closely as possible. The boundaries of the DWSMA can be 1) the center lines of highways, streets, roads, or railroad right-of ways; 2) section, half-section quarter-section, quarter-quarter section, or other fractional section lines of the United State public land survey; or 3) property lines.

GIS **GEOGRAPHIC INFORMATION SYSTEMS** is a computerized mapping method utilized in the compilation of data for the Wellhead Protection Plan.

IWMZ **INNER WELLHEAD MANAGEMENT ZONE** is the area within 200 feet of a public water supply well.

LGU **LOCAL GOVERNMENT UNIT** is a statutory or home rule charter city, town, county, soil and water conservation district, water shed district, organization formed for the joint exercise of powers under Minnesota Statutes, section 471.59, local health board, or other special purpose district or authority with local jurisdiction in water and related land resources management.

MDA **MINNESOTA DEPARTMENT OF AGRICULTURE**

MDH **MINNESOTA DEPARTMENT OF HEALTH**

MN DNR **MINNESOTA DEPARTMENT OF NATURAL RESOURCES**

MPCA **MINNESOTA POLLUTION CONTROL AGENCY**

PCSI **POTENTIAL CONTAMINANT SOURCE INVENTORY** is a database being compiled as part of this Wellhead Protection Plan, including potential point sources of contamination of the public water supply.

SUPERFUND **THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT** of 1980, known as Superfund, was enacted to address abandoned hazardous waste sites in the U.S.

SWUDS	**STATE WATER USE DATA SYSTEM** is a database maintained by the MN DNR that includes location and summary information on high capacity wells (greater than 10,000 gallons per day) and other water withdrawal permits in Minnesota.
USGS	**UNITED STATES GEOLOGICAL SURVEY**
VIC	**VOLUNTARY INVESTIGATION AND CLEANUP** The Voluntary Investigation and Cleanup (VIC) Program allows buyers, sellers, developers or local governments to voluntarily investigate and, if necessary, clean up contaminated land to facilitate its sale, financing or redevelopment. Voluntary parties that complete investigation and/or cleanup activities under MPCA oversight can receive liability assurances that protect them from future Superfund liability.
WHPA	**WELLHEAD PROTECTION AREA** is the surface and subsurface area surrounding a well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field. This definition is the same for the federal Safe Drinking Water Act (40 Code of Federal Regulations, Section 1428) and the Minnesota Groundwater Protection Act (Minnesota Statute 103I).
WIMN	**WHAT'S IN MY NEIGHBORHOOD** refers to databases maintained by the MPCA and MDA that locate and provide summary information about potential contamination sources in Minnesota.

Executive Summary

This report is Part II of a Wellhead Protection Plan for Mora Municipal Utilties, and includes the following:

- A review of the data elements.
- The results of the potential contaminant source inventory.
- A review of changes, issues, problems, and opportunities related to the public water supply and the identified potential contaminant sources.
- A detailed discussion of the potential contaminant source management strategies and corresponding goals, objectives, and action plans.
- A review of the wellhead/source water protection evaluation program
- An alternative water supply contingency strategy.

Part I of the plan was completed in June 2012. In Part I of the plan, the Wellhead Protection Area (WHPA) and Drinking Water Supply Management Area (DWSMA) were delineated, and vulnerability assessments of the wells and corresponding DWSMA were amended based on updated data available on the source water aquifer used by the municipal wells. The source water aquifer within the DWSMA was determined to be vulnerable to contamination from the ground surface in some portions of the DWSMA due to the absence of overlying geologic confining units in those locations.

The information and data contained in Sections 1-4 of this plan provide support and a basis for the approaches taken in addressing and managing the identified potential contaminant sources. Section 5 of this plan is composed of actions that the City's Wellhead Protection Team intends to implement over the ten year life of this plan. The Mora wellhead protection program is designed to optimize the use of resources to prevent contamination of the City's water supply. Efforts include further collection of data related to aquifer water quality and surface water interaction, refinement of information known about potential sources of contamination, and public education to promote safe management of potential sources of contamination of the groundwater aquifer supplying the City's wells. The inclusion of these items in this plan, as well as the County Water Plan, could open up funding opportunities through existing programs to assist the City with activities to protect the water supply.

Table of Contents

Certification Page
Public Water Supply Profile
Documentation List
List of Abbreviations / Terms
Executive Summary
Table of Contents

Page

1.0 Data Elements and Assessment (4720.5200) 1
1.1 Physical Environment Data Elements 1
1.2 Land Use Data Elements 2
1.3 Water Quantity Data Elements 7
1.4 Water Quality Data Elements 7
2.0 Impact of Changes to the Public Water Supply Wells 9
2.1 Potential Changes Identified 9
2.2 Impact of Changes 10
3.0 Issues, Problems, and Opportunities 12
3.1 The Aquifer Serving the Public Water Supply Wells and the Well Water 12
3.2 The Drinking Water Supply Management Area 12
4.0 Wellhead Protection Goals 14
5.0 Objectives and Plans of Action 15
5.1 Establishing Priorities 15
5.2 Schedule 17
5.3 Water Supply Reliability 17
5.4 Data Collection 17
5.5 Include Wellhead and Source Water Protection into City's Planning Process 21
5.6 Potential Contaminant Source Management 22
5.7 Public Education 26
5.8 Inner Wellhead Management Zone Activities 27
6.0 Evaluation Program 29
7.0 Alternative Water Supply and Contingency Strategy 30

Table of Contents (Continued)

List of Figures

Figure 1 – WHPA and DWSMA
Figure 2 – Existing Zoning
Figure 3 – Existing Land Use
Figure 4 – Storm Sewer System
Figure 5 – Sanitary Sewer System
Figure 6 – Potential Contaminant Source Inventory
Figure 7 – Hazardous Waste Generators
Figure 8 – Private Wells

List of Appendices

Appendix A Implementation Schedule
Appendix B Potential Contaminant Source Inventory
Appendix C Mora Water Supply Plan
Appendix D Wellhead Protection Program Evaluation Template
Appendix E Detailed Storm Sewer System Mapping
Appendix F Wellhead Protection Plan – Part I
Appendix G Inner Wellhead Management Zone Inventories

Wellhead Protection Plan

Part II

Prepared for Mora Public Utility Commission

1.0 Data Elements and Assessment (4720.5200)

In accordance with Minnesota Rules Chapter 4720.5200 and the Second Scoping Decision Notice provided by MDH, the following subsections discuss the required data elements and their assessment as they relate to the Mora wellhead protection program.

1.1 Physical Environment Data Elements

1.1.1 Geology and Hydrogeology

For an in-depth discussion regarding the regional and local geologic and hydrogeologic conditions in Mora, please refer to Part I of the Wellhead Protection Plan.

The surficial geology of the Mora area consists generally of glacial till intermixed with sand and gravel deposits. The depth of unconsolidated deposits is approximately 165 feet. The City's three active wells are constructed in unconsolidated sand and gravel formations. Wells 4 and 5 are in a portion of the DWSMA where the sand and gravel aquifer is protected by substantial clay deposits. Well 6 is constructed in a localized area on the DWSMA where such clay deposits are absent. This information was used in the determination of DWSMA vulnerability as shown in Figure 1.

As shown in Figure 1, there is an area classified with high vulnerability surrounding Well 6. The delineation of this area reflects what is known about the local geologic conditions, and approximates the boundary of the area within the DWSMA where clay is not sufficient to offer protection to the aquifer below.

MDH has conducted initial water chemistry investigations to further refine the vulnerability assessment, and to examine the potential

influence of Lake Mora on the wells. To date, some data has been collected that may indicate that the municipal wells are drawing at least some of their water from Lake Mora. This study proposes additional investigation to evaluate the amount of lake water that is being drawn in to further evaluate the threat that is posed by lake contamination that could enter the aquifer.

1.2 Land Use Data Elements

1.2.1 Land Uses

1.2.1.1 Historical

The land use history of the DWSMA was discussed with City staff and other members of the Wellhead Protection Team during the development of this plan. Historical fire insurance maps were not available for Mora. Land use history was discussed in the context of the development and refinement of the Potential Contaminant Source Inventory for this plan. That inventory reflects what is known about historical land uses that might impact the municipal public water supply wells.

1.2.1.2 Current

The City of Mora is approximately 3,206 acres in size and is laid out in a traditional small town grid pattern with State Highways 23 and 65 bisecting the City. The City's predominant existing land use is residential. Based on past history and anticipated growth, there appears to be a sufficient amount of vacant single family residential property to meet needs for at least the next ten years. Multi-family residential land is nearing saturation and there may be a need for more multi-family vacant land in the next several years.

Commercial development straddles the State Highways 23 and 65 corridor, as well as the downtown area. Downtown businesses are located close to the sidewalk in a traditional "Main Street" pattern. Businesses include a variety of service and retail establishments.

There are several developed industrial properties in the northeast part of the City with vacant industrial lots still available in this area. Many of the vacant properties are located in the City's industrial park. The City believes there is a sufficient amount of vacant industrial land for the next 10 to 15 years.

Institutional uses, including City and County facilities, Kanabec Hospital, Allina Clinic and the schools, take up approximately 25% of the City's acreage.

Figures 2 and 3 show the current zoning and land use in the City of Mora. In the most vulnerable portion of the DWSMA, the land use is primarily highway commercial and low density residential, this

includes most of the Emergency Response Area for Well No. 6. The Emergency Response Areas for Wells 4 and 5 are northeast of that for Well No. 6, and contain primarily commercial with some residential land use along the south shore of Lake Mora.

Commercial land uses are most concentrated along the TH 65 and TH 23 corridors, and in the downtown business district on the south side of Lake Mora. Industrial land uses are present in the designated Industrial Park east of TH 65. While much of the commercial and industrial land use is outside of the highly vulnerable portion of the DWSMA, there remains some potential for contamination of the City's water source due to the potential of the City's wells to draw water from Lake Mora. For that reason, consideration is given to these land uses in the development of management strategies for protection of the water supply in this plan.

Commercial and industrial land uses often include fuel stations and other businesses that store or use chemicals that are hazardous to human health in drinking water. The potential contaminant source inventory discussed in more detail in Section 1.2.2 attempts to identify and locate those facilities that pose a potential threat to the water supply, in order to develop management strategies to prevent contamination events.

1.2.1.3 Future

According to the 2009 Comprehensive Plan for the City of Mora, development is expected to continue in a similar pattern to the current land use distribution. Commercial development is likely along the TH 23 and TH 65 corridors. Industrial development is planned for the current industrial park area, which is located north of TH 23 and east of TH 65. Residential expansion is projected primarily in the area north of Lake Mora, and in the southeast and southwest corners of the City. Populations are projected to grow from 2010 levels of 3792 to 4346 in 2030.

The goals of the City's land use plan include environmental considerations. One of the goals of this Wellhead Protection Plan is to raise awareness of the need to protect the City's source of drinking water. As such, the City's Community Development Planner has been involved in the process of creating this Plan. Information from this plan, including DWSMA vulnerability boundaries and the potential contaminant source inventory, will be provided to the City's Community Development Planner when the plan is finalized. The City will consider wellhead protection efforts in future community planning activities.

1.2.2 Potential Contaminant Source Inventory (PCSI)

The management strategies selected and documented in Section 5 of this plan focus on land use activities that have the highest potential to impact the aquifer the City is using for its drinking water supply.

The DWSMA for Mora has variable vulnerability, and the City's water supply is more vulnerable to contamination from the land surface where the DWSMA is classified as highly vulnerable. This includes the area surrounding Well No. 6 as shown in Figure 1. As required by the wellhead protection rule, all potential contaminant sources in this area need to be inventoried as part of this plan, and addressed through management strategies.

Outside of the highly vulnerable portion of the DWSMA around Well No. 6, the remainder of the DWSMA is classified as moderately vulnerable. In the moderately vulnerable portion of the DWSMA, only potential contaminant sources that pose high risk of contamination, or that penetrate the protective clay layer over the City's aquifer, need to be considered. These include chemical storage tanks, private wells, and Class V injection wells.

In addition, recent water chemistry investigations conducted by MDH indicate that the wells are likely drawing water from Lake Mora. Therefore, the Wellhead Protection Team has placed additional priority on understanding surface water runoff to Lake Mora, and the potential for contamination to enter the City's wells by that route.

Information and data pertaining to land uses and activities were compiled from various state agency databases, and reviewed with the Wellhead Protection Team. The Potential Contaminant Source Inventory was thereby refined based on local knowledge of land uses. Table 1 summarizes the types and numbers of various activities identified within the DWSMA. Figures 6, 7, and 8 depict the locations of these sites. Table 2 lists the data sources used for the potential contaminant source inventory. Tables summarizing the potential contaminant source information in greater detail are provided in Appendix B.

This plan attempts to prioritize potential contaminant sources based on their location or the threat posed by the source. For this reason, the potential contaminant sources summarized in Table 1 and in Appendix B are categorized by the type of activity, whether they are active sites, and whether they are located within the high vulnerability portion of the DWSMA or within the Emergency Response Areas for the City's wells. The prioritization of these sites is discussed in greater detail in Section 5.

The addresses affiliated with these sites have been cross-referenced with Parcel Identification Numbers where feasible to verify the locations of the potential contaminant sources. Those whose location could not be verified to date are identifiable in Appendix B as those that have not been assigned a Parcel Identification Number.

The MPCA defines the methodology for locating sites within their GIS files. There are a variety of methods that the MPCA employs to locate sites. Those used for sites within the search area for this report include: address matching house number, digitized map tool, digitized DOQ, digitized DRG, interpolation unknown, and GPS. The MPCA considers the reliability of all of the methods listed as good to very good with the exception of "interpolation unknown".

Table 1
Potential Contaminant Source Inventory Summary

Activity Type and Status	In High Vulnerability Area	In Emergency Response Area	Overall Count
Leak Sites - Active	1	0	1
Leak Sites - Inactive	0	1	13
Tanks - Active	1	3	14
Tanks - Inactive	0	0	4
Wells - Unsealed	3	11	63
Wells - Sealed	0	0	2
Hazardous Waste Generators - Active	3	2	3[1]
Hazardous Waste Generators - Inactive	7	4	7[2]
Landfills, Permitted by Rule - Inactive	0	0	1
Agricultural Chemical Emergency Response Site - Inactive	0	0	1

[1] Only Hazardous Waste Generators in High Vulnerability Area are included in Overall Count
[2] Only Hazardous Waste Generators in High Vulnerability Area are included in Overall Count

Table 2
Data Sources for Potential Contaminant Source Inventory

Data Source	Potential Contaminant Source Types
MPCA, What's In My Neighborhood (WIMN)	CERCLIS Site VIC Site Hazardous Waste Small Quantity Generator Landfill, Permitted Dump Site, Unpermitted Tank Site Leak Site Wastewater Discharger
MDH, County Well Index (CWI)	Municipal Wells Private Wells Well Sealing Records Observation Wells and Borings
MDA, Ag Chem Incidents and Spills MDA, Ag Chem Old Emergency Incidents	Agricultural Chemical Spills

1.2.3 Pipelines

No pipelines are present within the DWSMA.

1.2.4 Public Utilities

Public utilities impact the management of the DWSMA in the highly vulnerable area around Well 6 since there is a hydraulic connection between the land surface and the source water aquifer.

Storm sewers can provide a conduit for surface contaminants, and therefore infiltration and ponding areas are potential sources of contamination to the aquifer. There is also an indication of surface water interaction with groundwater used for the City's wells based on preliminary monitoring by MDH. The City's wells are likely pulling water from Lake Mora in some proportion. Therefore, storm water discharges to the lake could influence future water quality in the aquifer. The Mora storm sewer system is mapped in Figure 4. More detailed storm sewer mapping is provided in Appendix E.

Sanitary sewer leakage in close proximity to the wells could also be a concern in the high vulnerability area near Well 6, where contamination could infiltrate from aging sanitary sewer infrastructure to the City's wells. The Mora sanitary sewer system is mapped in Figure 5. The City will prioritize the assessment of sanitary sewer in the Emergency Response Area for Well No. 6 due to this potential concern.

The location of water and sanitary sewer systems are also often used to identify likely locations for private wells and septic systems that can be sources of groundwater contamination. The water distribution system for Mora is mapped in Figure 9. There are known to be 6 - 8 homes on Central Avenue E, north of Lake Mora, that remain on private septic systems.

Municipal water supply wells that are no longer in use have also been reviewed for this plan. MDH provided a list of inactive municipal wells from their records as a starting point for discussion. The only old municipal well for which MDH did not have a sealing record was Well No. 2. The City will be locating records related to the sealing of Well No. 2 as part of the implementation of this plan.

1.3 Water Quantity Data Elements

1.3.1 Groundwater Quantity

The sand and gravel aquifer used by the City's wells has high transmissivity as indicated in Part I of this plan. Groundwater pumping data from high capacity wells was used in the delineation of the DWSMA. As assessed in Part I of this plan, the sand and gravel aquifer appears adequate to meet the current and future needs of the City.

There are no known water use conflicts or well interference issues for the City. There are no private high-capacity wells within the DWSMA.

1.4 Water Quality Data Elements

1.4.1 Groundwater Quality

The public water supply for Mora is tested routinely as required under the federal Safe Drinking Water Act. The public water supply is in compliance with all applicable rules, regulations, standards, and limits.

The City treats the groundwater from Wells 4, 5, and 6 at a filtration plant due to high iron and manganese concentrations.

There is evidence of a hydraulic connection between the sand and gravel aquifer used by the City's wells and Lake Mora. MDH has conducted preliminary sampling for chloride and bromide salts, stable isotopes, and total organic carbon, which supports that conclusion. This preliminary data was taken into consideration during the creation of this plan, and action items were created to continue to investigate the surface water influence on the aquifer.

There are several known petroleum spill sites in the DWSMA, and one agricultural chemical spill site documented in the Minnesota Department of Agriculture WIMN database. One particular spill site,

listed as PC17, Town and Country Oil, in Appendix B, may potentially be contaminating the City's water supply aquifer in the vicinity of Well No. 5. More effort is needed to further monitor and prevent potential impacts to the aquifer. More detailed information about the other spill sites in Appendix B needs to be gathered as part of the implementation of this plan in order to assess the threat to the City's water supply posed by any of these sites. There are no other known groundwater impacts that are currently threatening the City's wells.

2.0 Impact of Changes to the Public Water Supply Wells

2.1 Potential Changes Identified

2.1.1 Physical Environment

No significant or large-scale changes in the physical environment of the municipal wells or corresponding DWSMA are anticipated in the next 10 years.

2.1.2 Land Use

As discussed in Section 1, development is expected to continue in a similar pattern to the current land use distribution. Commercial development is likely along the TH 23 and TH 65 corridors. Industrial development is planned for the current industrial park area, which is located north of TH 23 and east of TH 65. Residential expansion is projected primarily in the area north of Lake Mora, and in the southeast and southwest corners of the City.

2.1.3 Surface Water

The City's Comprehensive Plan lists maintaining or improving the quality of water in Lake Mora as a goal, and identifies Lake Mora as a valuable natural resource to the community. Due to planning efforts, it is hoped that water quality in the lake continues to improve over time. Due to the potential for lake water to be drawn into the City's wells, the management strategies in this Wellhead Protection Plan will include measures aimed at preventing contamination of the lake. There is a potential for chemical spills to reach Lake Mora via the storm sewer system or from major transportation corridors that are near the lake.

2.1.4 Groundwater

Currently, the groundwater supply for the municipal water system is adequate. Static and pumping levels of the municipal wells are monitored monthly by the city staff. The levels appear to be steady over time.

As additional businesses and industries are developed within the DWSMA, privately-owned, high-capacity wells could be constructed. However, the City does not currently know of any high-capacity wells scheduled to be constructed in the near future.

Continued growth in the City will result in additional demand on the groundwater source and additional municipal production wells to meet that demand. The City may seek alternate locations for wells in the future, though none are planned at the current time. The sand and gravel aquifer used by the City's wells appears capable of supporting the City's projected water use into the foreseeable future.

Groundwater is known to have been impacted by past petroleum spills in the DWSMA. The extent of this contamination needs to be determined, and plans put in place to contain it to prevent contamination of the City's wells. It is apparent that existing and potential future spill events can have an impact on the water supply aquifer.

2.2 Impact of Changes

2.2.1 Land Use Changes

While land use patterns are not expected to substantially change in the City, there is some growth expected to occur. This could add new potential sources of groundwater contamination to the DWSMA. The City will need to monitor proposed developments to prevent future land uses from negatively impacting the municipal water supply.

2.2.2 Surface Water

It is hoped that through efforts to protect Lake Mora, contamination of the lake and thus the aquifer can be prevented. The City recognizes the importance of Lake Mora as an asset to the community that improves the quality of life and attracts investment and tourism. The City's comprehensive plan lists the improvement of Lake Mora as a goal, to return its full potential for public use and enjoyment. Because of the growing evidence that the lake serves as a recharge point for the aquifer used by the City's water supply wells, Lake Mora is also recognized as a component of the water supply for the City. This knowledge makes the protection and improvement of Lake Mora all the more critical to the wellbeing of the community.

2.2.3 Groundwater

Future planned use of groundwater in Mora is not expected to have a negative impact on the City's water supply. However, contamination events that reach the aquifer could pose a serious threat to the water supply. Liquid chemical storage tanks will need to be properly managed in the DWSMA to prevent future spills.

2.2.4 Influence of Existing Water and Land Government Programs and Regulation

Regulation of liquid chemical storage tanks, private wells, and other potential contaminant sources is currently under the control of MPCA, MDH, and other state or federal agencies. The City will be dependent upon the enforcement of these regulations by outside entities. The City will need to maintain communication with agencies to ensure that enforcement is being carried out where there is a potential for impact to the water supply.

2.2.5 Administrative, Technical, and Financial Considerations

The implementation of protection activities for Lake Mora and the City's water supply aquifer will result in costs to the City. The magnitude of these costs are not well defined at this time, though an attempt has been made to estimate costs of implementation in the implementation schedule presented in Appendix A.

The City does not currently have a budget for these costs, and it is understood that City staff are currently fully utilized. The City intends to team with other local government entities such as the Snake River Watershed District and Kanabec County to offset some of these costs. Grant money will also be pursued that could be used to hire consultants to assist with some implementation activities.

MDH currently administers a grant program for implementation of wellhead protection plans in the Minnesota. This grant program is funded through the Clean Water, Land, and Legacy Amendment to the State Constitution, and funding is expected to continue into the future. Some of the management actions put forward by this plan are contingent on funding through this program.

Many of the activities set forth in Section 5 of this plan, for which the City will be responsible for implementing, involve collection of data and public education. Much of the data collection will be done in coordination with MDH, and MDH has offered assistance with sample analysis.

3.0 Issues, Problems, and Opportunities

A number of potential issues related to the protection of the City's source water have been raised during the drafting of this plan, and Section 5 of this plan includes action items to address the most important of those. In addition, opportunities exist for the City to tap into existing resources to assist in the implementation of this plan. Broader issues addressed by this plan, along with related opportunities and resources for the City to utilize in plan implementation, are discussed in this section.

3.1 The Aquifer Serving the Public Water Supply Wells and the Well Water

3.1.1 Potential Surface Water Interaction with Municipal Wells

Recent sampling by MDH detected chloride and bromide salts, and organic carbon in the City's wells, and it is thought that surface water interaction with Lake Mora could be a source of those constituents. While the chlorides, bromides, and organic carbon in themselves are not at levels that are hazardous in drinking water, it may be an indication that other chemicals could enter the aquifer by similar pathways.

3.1.2 Ongoing Study by MDH

MDH has stated their interest in continuing to evaluate water quality in the wells and neighboring surface water bodies in order to better understand the interaction of surface waters and groundwater used by the municipal wells. The City has the opportunity to use MDH resources such as laboratory analysis and evaluation of data collected to improve understanding of potential risks from surface water infiltration to the aquifer. This understanding could lead to better protection of the City's water supply.

3.2 The Drinking Water Supply Management Area

3.2.1 Coordination with County Water Plan to Fund Potential BMPs to Reduce Impacts to Lake Mora from Storm Water Runoff

Coordinating management activities between wellhead protection and the County Water Plan may allow the City to tap into additional funding sources related to storm water management. These funds could potentially be used to reduce groundwater infiltration from the ground surface in the vicinity of the municipal wells. Examples of funding sources for items in the County Water Plan include the Board of Water and Soil Resources (BOWSR) and the Clean Water Fund.

3.2.2 Existing Residential and Private Wells in the DWSMA

It is known that some properties in the DWSMA have wells that may or may not currently be used or sealed. These wells can serve as a

potential conduit for groundwater contamination if not properly maintained or sealed.

3.2.3 Existing Well Sealing Programs through SWCD

The Kanabec SWCD has cost sharing programs that can be used by residents and businesses for the purpose of sealing abandoned wells. The City can share information on this program with potential well owners in the DWSMA to help minimize the threat posed by abandoned and poorly maintained wells.

3.2.4 Kanabec County Geologic Atlas

Kanabec County has discovered new undocumented wells in the process of compiling the County Geologic Atlas. These well records have been submitted to the Minnesota Geological Survey and will be available for review in the continued development of the City's potential contaminant source inventory.

4.0 Wellhead Protection Goals

Mora has historically had a sufficient and safe water supply. Through the implementation of this plan the City intends to continue supplying safe, potable water for its residents and businesses into the future.

The City has identified the following goals for implementing its plan:

- The City will work to maintain or improve the current level of water quality that will continue to meet or exceed all state and federal standards.

- The City will collaborate with the Snake River Watershed District, Kanabec County Environmental Services, and other partners identified in this plan to promote wellhead protection strategies. This will include increased public awareness of the Wellhead Protection Program and groundwater related issues.

- The City will assist with the ongoing collection of data to support future wellhead and source water protection efforts.

5.0 Objectives and Plans of Action

5.1 Establishing Priorities

The DWSMA for Mora has variable vulnerability as described in Section 1.2.2, with both highly vulnerable and moderately vulnerable areas due to local geology. In prioritizing wellhead protection activities, vulnerability will be used as one criteria - with potential contaminant sources within the highly vulnerable portion of the DWSMA receiving higher priority.

In addition, priority will be based on proximity to the municipal wells. The Emergency Response Area for each well represents a 1-year time of travel for groundwater to reach the well. Potential contaminant sources within these Emergency Response Areas will be given special consideration due to the potential for contamination to reach the wells undetected in a short period of time.

The highly vulnerable portion of the DWSMA includes the area surrounding Well No. 6 as shown in Figure 1. As required by the wellhead protection rule, all potential contaminant sources in this area need to be inventoried as part of this plan, and addressed through management strategies.

Outside of the highly vulnerable portion of the DWSMA around Well No. 6, the remainder of the DWSMA is classified as moderately vulnerable. In the moderately vulnerable portion of the DWSMA, only potential contaminant sources that pose high risk of contamination, or that penetrate the protective clay layer over the City's aquifer, need to be considered. These include chemical storage tanks, private wells, and Class V injection wells.

In addition, recent water chemistry investigations conducted by MDH indicate that the wells are likely drawing water from Lake Mora. Therefore, the Wellhead Protection Team has placed additional priority on understanding surface water runoff to Lake Mora, and the potential for contamination to enter the City's wells by that route.

The following table lists prioritization in terms of rank for potential contaminant source management activities.

Table 3
Potential Contaminant Source Priorities Matrix

Potential Contaminant Source Type	Within High Vulnerability Area	Within Emergency Response Area	Within Moderate Vulnerability Portion of DWSMA	Within Watershed for Lake Mora
High Risk Leaking Storage Tanks Other Spill Sites	1	1	2	2
Medium Risk Storage Tanks Private Wells Major Transportation Corridors	2	2	3	4
Low Risk Small Quanitity Hazardous Waste Generators	3	3	4	5

Priority is also being placed on specific activities in this management plan. The following list prioritizes activity types and provides a reason for prioritization.

Table 4
Activity Type Prioritization

Activity Type	Priority	Explanation
Research of Spill Sites within Emergency Response Areas and High Vulnerability Area	1	These sites could pose an imminent threat to the water supply wells if not properly contained and/or remediated. Research needs to be completed to determine next steps for addressing each site.
Activities Related to Addressing Town and Country Oil LUST Site	1	This site is known to have a plume that has migrated to the aquifer used by the City's wells, and is located in close proximity to Well No. 5.
Activities Related to Study of Groundwater / Surface Water Interaction	2	These monitoring activities will help to understand the risks posed by Lake Mora to the City's water supply should the lake become contaminated.
Activities Related to Stormwater Monitoring	2	These monitoring activities will help to protect Lake Mora from contamination, and to develop an understanding of what type of stormwater treatment may be needed and where to prioritize stormwater treatment.

Table 4
Activity Type Prioritization

Refinement of City Emergency Response Procedures	2	These activities are given relatively high priority due to risk posed by a catastrophic spill as might happen along a transportation corridor or at an industrial site with chemical storage.
Activities Related to Public Education	4	These activities are focused on long-term contamination prevention.
Update of Potential Contaminant Source Inventory Databases	4	The databases have just been updated for this plan, and updates should be periodic to ensure the City has knowledge of potential threats that may develop.
County Water Plan Collaboration	3	Collaboration with the county and watershed district on surface water plan development will assist the City with additional staff and funding resources for implementation of wellhead protection activities, especially those related to stormwater monitoring / treatment and the protection of Lake Mora

5.2 Schedule

The activities to be implemented as part of this plan are scheduled as shown in Appendix A.

5.3 Water Supply Reliability

5.3.1 Add Emergency Generator to Well 5

The City's wells currently have no backup power supply in the event of a City power outage. This puts the reliable supply of water, and thus public health, at risk in the City. The City would like to add an emergency generator to Well 5 to add reliability to their system. This is contingent on funding availability.

Source of Action

Wellhead Protection Manager

Cooperators

City Engineer

5.4 Data Collection

The City will continue to participate in studies of local geologic and hydrogeologic conditions in order to improve and augment current information, and better understand vulnerabilities of the water supply aquifer.

5.4.1 Monitoring Static Levels in Municipal Wells

The City will continue to routinely monitor the static and pumping levels of the groundwater in the municipal wells. Water levels in all the municipal wells will be recorded monthly. Static and pumping water level records will be kept in the City's wellhead protection file, in order to facilitate sharing of this information with MDH or other agencies as requested.

Source of Action

City staff

Cooperators

None

5.4.2 Assess Interaction Between the Water Supply Aquifer and Lake Mora / Spring Lake

MDH has conducted preliminary sampling of the municipal wells and Lake Mora for chlorides, bromides, total organic carbon, tritium, and stable isotopes to begin to assess the interaction of the water supply aquifer with surface water. Initial results indicate some contribution to the wells from Lake Mora, but the degree of connection remains ambiguous. MDH would like to continue this effort to get a more accurate assessment of the surface water - groundwater interaction.

MDH has recommended several data collection measures as presented here, with the following goals:

Improve understanding of the surface-groundwater interaction

Assess the contribution of Spring Lake to Lake Mora and potentially the well capture zones

Assess potential stormwater impacts to the City's drinking water, if any

5.4.2.1 Groundwater / Surface Water Monitoring Plan

Contact MDH Hydrologist to prepare a groundwater and surface water monitoring plan to assess the relationship between the aquifer used by the City's wells and potential sources of surface water recharge, including Lake Mora and Spring Lake. The monitoring plan should consider water quality, and the connectivity between the two lakes and the City's wells. The monitoring planning team should also assess whether additional funding or resources are needed to implement the monitoring plan.

Source of Action

Wellhead Protection Manager

Cooperators

MDH Hydrologist, SWCD, County Environmental Services, Snake River Watershed District, City Engineer

5.4.2.2 Implementation of Groundwater / Surface Water Monitoring Plan

Pending availability of funding, the long-term monitoring plan will be implemented, with the sampling intervals and parameters defined in the monitoring plan. The scope of this work would typically include collection and analysis of water samples, and assessment of results.

Source of Action

Wellhead Protection Manager

Cooperators

MDH, SWCD, County Environmental Services, Snake River Watershed District, City Engineer

5.4.2.3 Coordinate a meeting with the Wellhead Protection Team, MDH Hydrologist, and MDH Sourcewater Protection Planner

Meeting to assess the results of the groundwater and surface water monitoring study. The purposes of the meeting would be to identify how the results can be applied to help further protect the City's water supply aquifer. This may include activities that can be prioritized in the current wellhead protection plan implementation, and activities that should be included in the City's next wellhead protection plan amendment in 2023.

Source of Action

Wellhead Protection Manager

Cooperators

MDH, SWCD, County Environmental Services, Snake River Watershed District, City Planner, City Engineer

5.4.3 Storm Water Management

Storm sewer catchment areas draining to Lake Mora were also incorporated into the final wellhead protection area boundaries for Mora. However, confirmation of storm water drainage areas is needed to better assess potential land use impacts to storm water quality and potentially the water supply aquifer.

5.4.3.1 Refine Existing Storm Sewer System Mapping

City staff will review existing storm sewer maps and update them to reflect the locations of sewer drains, and drainage and catchment areas relative to Lake Mora. Also, a detailed storm sewer catchment area map will be developed to relate land areas and land uses to storm sewer outfalls.

Source of Action

Wellhead Protection Manager

Cooperators

City Engineer

5.4.3.2 Work with MDH and Local Partners to Develop a Storm Water Monitoring Plan

City staff will request assistance from MDH and local resource partners to develop a monitoring plan related to storm water discharge to Lake Mora

Source of Action

Wellhead Protection Manager

Cooperators

MDH, SWCD, County Environmental Services, Snake River Watershed District

5.4.3.3 Implement Storm Water Monitoring Plan

Pending resources and available funding, the Wellhead Protection Manager will coordinate the implementation of the monitoring plan in conjunction with local partners. The first step in this process could include application for funding from the Board of Water and Soil Resources (BOWSR), the Clean Water Fund, and the Sourcewater Protection Implementation Grant Program administered through MDH.

Source of Action

Wellhead Protection Manager

Cooperators

MDH, SWCD, County Environmental Services, Snake River Watershed District

5.4.3.4 Coordinate a meeting with the Wellhead Protection Team, MDH Hydrologist, and MDH Sourcewater Protection Planner

Meeting to discuss the results of storm water monitoring plan implementation to identify how best to apply the results for wellhead

protection. This could include identification of priority storm water areas and BMPs that help protection Lake Mora and the City's water supply aquifer, prioritizing activities in the current wellhead protection plan, and planning for future implementation activities to be incorporated into the 2023 wellhead protection plan amendment.

Source of Action

Wellhead Protection Manager

Cooperators

MDH, SWCD, County Environmental Services, Snake River Watershed District

5.5 Include Wellhead and Source Water Protection into City's Planning Process

5.5.1 Review City's Emergency Response Plan as it Relates to Spills

The City currently has a protocol to contact MNWARN in the event of a spill that threatens the water supply. The overall Emergency Response Plan for the City will be reviewed and discussions held with emergency response personnel regarding improvements that may be warranted specific to protection of drinking water in the event of a spill.

In particular, the City will evaluate and improve upon response procedures for spills along transportation corridors that could impact Mora Lake or the water supply aquifer. This includes Hwy. 65 where is crosses Lake Mora. A meeting will be held with emergency responders to develop ideas for improving spill response with the goal of protecting the water supply. Spill containment technology will be evaluated, such as absorbent booms or socks that could be used in an emergency spill response to contain contaminants.

The water utility will request to be notified by emergency responders in the event of a spill within the DWSMA.

Source of Action

Wellhead Protection Manager

Cooperators

City Fire Department

5.5.2 Purchase of Spill Containment Technology

Contingent on grant funding, and based on review and discussions from Item 5.5.1, the Utility will purchase spill containment booms or related equipment as deemed necessary to ensure that emergency

responders are equipped to protect Lake Mora and the water supply aquifer.

Source of Action

Wellhead Protection Manager

Cooperators

City Fire Department

5.5.3 Land Use Planning

The City of Mora will include a review of its Wellhead Protection Plan as a part of its normal zoning and planning review process. Copies of this report and DWSMA boundary and vulnerability GIS layers will be supplied to the City's Planning Department.

Source of Action

Wellhead Protection Manager

Cooperators

City Planner, Wellhead Protection Consultant

5.5.4 Review the County Water Plan

The wellhead protection team will review the County Water Plan, and participate in upcoming amendments to that plan to identify opportunities to include activities that protect groundwater. Potential activities include BMPs to reduce infiltration near the municipal wells or to reduce runoff to Lake Mora.

Source of Action

Wellhead Protection Manager

Cooperators

Kanabec County Environmental Services

5.6 Potential Contaminant Source Management

5.6.1 Follow Up on Town and Country Oil Spill Site

During the course of generating this plan, the Wellhead Protection Team became aware of a potential threat for aquifer contamination from the Town and Country Oil site neighboring Jerry's Bait. There is some indication that petroleum contamination from this site has penetrated to the buried sand and gravel aquifer used by the City's wells. The extent of contamination in the lower aquifer is unknown currently. It is thought that a private well used by Jerry's Bait could be serving as a conduit for contamination to reach the City's aquifer. This well has tested positive for benzene.

The follow up activities on this site will include the following:

5.6.1.1 Coordinate a meeting between City Staff, MPCA, MDH, and Wellhead Protection Consultant

Meeting to discuss clean-up of the Town & Country leak site and high benzene levels found in Jerry's Bait well. From the meeting, request the MDH SWP Hydrologist assistance to evaluate the remedial investigation and cleanup work relative to potential impacts to Well #5 and the drinking water aquifer serving the City's water supply. (Hold Mtg. within 3 months or sooner of WHP Plan Approval).

5.6.1.2 Identify Monitoring Needs

Based on the results of Measure 5.6.1.1, request MDH Hydrologist to identify additional monitoring needs warranted to provide early detection of contaminants to the City's well field. If MPCA is unable to fund the additional monitoring, then the City will apply for a SWP Grant to support these efforts. (Begin activity within 6 months or sooner of plan approval).

5.6.1.3 Request MPCA to keep the Town and Country Leak Site as an active monitoring site.

Request an annual update on any changes in water quality monitoring, movement of the plume and status of clean-up efforts from MPCA.

5.6.1.4 Evaluate Private Well Influence on Contaminant Plume

Work with the MPCA and the owners of the Jerry's Bait Shop to evaluate whether use of the existing well is impacting the movement of the contamination plume and potentially threatening the deeper aquifer serving the City's wells. At the same time, evaluate and explore options that support the use of City water for the bait business. If it is determined the well is impacting the movement of the contaminant plume, request MPCA assistance to fund sealing of the well. If needed, apply for a SWP Grant to cover costs to seal the well.

5.6.1.5 Identify Other Possible Routes for Contaminant to Reach Water Supply Aquifer

Evaluate the Town and Country Leak Site area for potentially other wells and any unused, unsealed wells that may be creating a pathway for contaminants to migrate down deeper into the aquifer. As needed, apply for a SWP Grant to help seal any wells that may be identified.

5.6.2 Collect Additional Details on All Leak Sites

MPCA project managers will be contacted for each leak site identified within the DWSMA, prioritizing those in proximity to the municipal wells and inside the high vulnerability area, those that are known to have groundwater impacts, and those that are active. Details will be

sought on the status of remediation activities, what types of impacts were incurred to soil and groundwater at the site, and the nature of residual product at the site. Where necessary, sites files will be obtained from MPCA and / or MDA records for review.

In addition, the City will attempt to discuss the spills with land owners and others in the community that may have knowledge of the spill. The City will meet with the SWP Hydrologist to create a plan for further follow up where it is determined that there is a potential threat to the City's water supply. This follow up could look similar to that conducted in Item 5.6.1, but will depend on site-specific details.

Source of Action

Wellhead Protection Manager

Cooperators

Wellhead Protection Consultant, MPCA, MDA

5.6.3 Promotion of Well Sealing in Proximity to High Risk Spills

In addition to general education of private well owners as discussed in Item 5.6.6, the City will target activities aimed at sealing private wells that are located near leak sites that are determined to be a potentially high risk for contaminating the water supply. This will include contacting well owners with information on well sealing assistance programs that are facilitated by the SWCD.

Source of Action

Wellhead Protection Manager

Cooperators

SWCD, MDH

5.6.4 Research the Status of Old Municipal Well No. 2

MDH has indicated that they do not have records related to the sealing of Old Municipal Well No. 2. The City believes it to be sealed. City staff will contact Thein Well to obtain records that are available related to the sealing of Well No. 2, and convey those records to MDH SWP staff.

Source of Action

Wellhead Protection Manager

Cooperators

Thein Well, MDH

5.6.5 Continued Refinement of Potential Contaminant Source Inventory

Available databases of potential contaminant sources such as the MPCA What's in My Neighborhood and MDA What's in My Neighborhood will be reviewed every 5 years to identify any significant new potential contaminant sources that could pose a threat to the water supply. The City's database will be updated with any changes in order to keep the database current.

Source of Action

Wellhead Protection Manager

Cooperators

Wellhead Protection Consultant, MPCA, MDA

5.6.6 Continued Refinement of Private Well Inventory

The County Well Index will be reviewed as newly located wells are entered into the database. The entry of these newly located wells, found during the compilation of the County Geologic Atlas, is expected to occur in the next couple of years.

Source of Action

Wellhead Protection Manager

Cooperators

Wellhead Protection Consultant, MDH, MGS

5.6.7 Ongoing Promotion of Wellhead Protection and Management Information among Private Well Owners

Every five years, the City will send reminders in the mail to private well owners within the DWSMA to promote proper well maintenance, and to distribute information about cost-sharing opportunities for sealing abandoned wells.

Similar information will be kept up to date on the City's website. Information will be obtained from MDH, MRWA, MPCA, MDA, and Kanabec SWCD that can be shared via the website.

Source of Action

Wellhead Protection Manager

Cooperators

MDH, MRWA, Kanabec SWCD

5.6.8 Ongoing Promotion of Wellhead Protection and Management Information among Above-Ground Storage Tank Owners

Every five years, the City will send reminders in the mail to above-ground storage tank owners within the DWSMA to promote proper tank maintenance. All above-ground storage tank owners inventoried in the DWSMA will receive a copy of the MPCA Factsheet, "Monitoring Requirements for Aboveground Storage Tanks".

Similar information will be kept up to date on the City's website.

Source of Action

Wellhead Protection Manager

Cooperators

MRWA, MPCA

5.6.9 Ongoing Promotion of Wellhead Protection and Management Information among Below-Ground Storage Tank Owners

Every five years, the City will send reminders in the mail to below-ground storage tank owners within the DWSMA to promote proper tank maintenance. All below-ground storage tank owners inventoried in the DWSMA will receive copies of the MPCA Factsheets, "Underground Storage Tanks: Are you Doing the Big Five" and "What Tank Owners Need to Know About the Underground Storage Tank Rules."

Similar information will be kept up to date on the City's website.

Source of Action

Wellhead Protection Manager

Cooperators

MRWA, MPCA

5.7 Public Education

5.7.1 Development of a Webpage Dedicated to Drinking Water Protection and Wellhead Protection

The City will have a webpage developed on the Mora Public Utilities or City of Mora website that will include information to share information with the general public about the wellhead protection program. Information from the wellhead protection plan as well as information gathered from MN Rural Water, MDH, MPCA, and MDA could be shared on the site to educate the public about strategies the public can use to assist with protection of the water supply.

Source of Action

Wellhead Protection Manager

Cooperators

MRWA, MDH, MPCA, MDA

5.7.2 News Release About Adoption of Wellhead Protection Plan

A news release will be issued in the City's newsletter regarding the adoption of the wellhead protection plan. This news release will include information about the DWSMA vulnerability and the purpose of the wellhead protection program.

Source of Action

Wellhead Protection Manager

Cooperators

N/A

5.7.3 Brochure on Wellhead Protection Distributed with Utility Bills

A brochure will be created that provides information on the Mora Wellhead Protection Plan. This brochure will be made available at the PUC office and will be distributed once annually with utility bills.

Source of Action

Wellhead Protection Manager

Cooperators

N/A

5.8 Inner Wellhead Management Zone Activities

5.8.1 Repair of Secondary Containment for Diesel Fuel Storage Near Well No. 4

MDH identified a breach in the secondary containment basin for two 30,000-gallon diesel storage tanks located in close proximity to Well No. 4, as noted in the IWMZ inventory in Appendix G. The Utility will correct this issue to prevent accidental release of diesel fuel that could impact ground water.

Source of Action

Wellhead Protection Manager

Cooperators

N/A

5.8.2 Investigate Electrical Transformer Near Well No. 4 and Provide Protective Measures as Necessary

MDH identified a transformer owned by the Mora electric utility in proximity to Well No. 4 as noted in the IWMZ inventory in Appendix G. The water utility will discuss this with the electric utility in order to assess the risk posed by the transformers (e.g. if they are oil filled), and discuss potential containment or spill prevention measures to prevent the release of transformer oil to the ground water supply.

Any needed spill prevention measures identified by investigation will be implemented.

Source of Action

Wellhead Protection Manager

Cooperators

Electric Utility Staff

5.8.3 Update Inventory of Inner Wellhead Management Zone

The inventory of potential contaminant sources in the IWMZ will be updated every 3 years. Any identified potential threats to the water supply aquifer will be addressed to prevent future contamination.

Source of Action

Wellhead Protection Manager

Cooperators

Electric Utility Staff

6.0 Evaluation Program

The success of the Mora Wellhead Protection program must be routinely evaluated in order to determine whether the plan is actually accomplishing the intentions of the City. Wellhead protection plan evaluation must be completed every 2.5 years as described in Minnesota Rules Chapter 4720.5270, subpart 4.

Some of the goals of evaluations are to:

Track the implementation of the management strategies identified in Section 5.0 of this plan

Evaluate the effectiveness of specific management strategies regarding the protection of the public water supply

Identify possible changes to these strategies which may improve their effectiveness

Determine the adequacy of financial resources and staff availability to carry out the management strategies planned for the coming year

In order to meet these evaluation goals, the following activities will be implemented:

1. Require the Wellhead Protection Team to meet on an as-needed basis, with a minimum of one meeting per year, to review the results of each strategy implemented during the previous plan year. The Wellhead Protection Team will identify and discuss whether modifications are needed for those strategies, and whether additional strategies are necessary for the coming year.

2. The Wellhead Protection Manager will make an annual written report to the Wellhead Protection Team regarding progress in implementing the wellhead protection management objectives of this plan. The annual reports will be compiled and used to review the overall progress in implementing management strategies when the Mora Wellhead Protection Plan is updated in 10 years. A copy of the annual report will be sent to the MDH Source Water Protection Unit in St. Paul (to satisfy minimum 2.5 year evaluation) and another copy will be placed in the City's wellhead and source water protection file. A template for the evaluation report is provided in Appendix D.

7.0 Alternative Water Supply and Contingency Strategy

Mora has a *Water Supply Plan* that was submitted and approved by the MN DNR, Division of Waters in 2010. This approved plan contains the required elements of the Minnesota Wellhead Protection Rule and is accepted as an equivalent to an Alternative Water Supply/Contingency Plan as defined in MN Rules 4720.5280. Implementation of the plan has begun with the aid and assistance of local emergency management agencies. A copy of the plan along with the MN DNR approval letter, are provided in Appendix C.

List of Figures

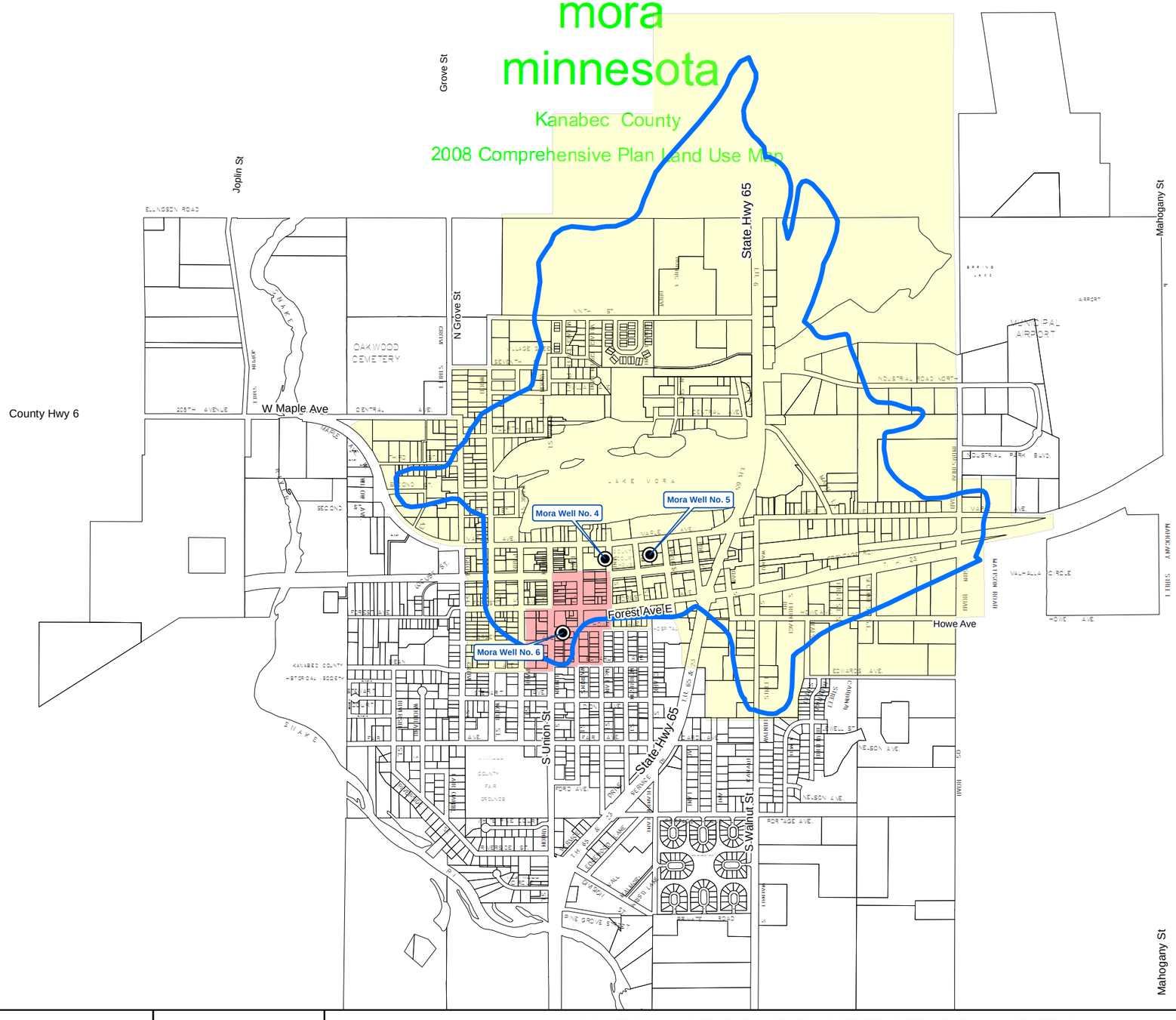
Figure 1 – WHPA and DWSMA
Figure 2 – Existing Zoning
Figure 3 – Existing Land Use
Figure 4 – Storm Sewer System
Figure 5 – Sanitary Sewer System
Figure 6 – Potential Contaminant Source Inventory
Figure 7 – Hazardous Waste Generators
Figure 8 – Private Wells

City Of

mora minnesota

Kanabec County

2008 Comprehensive Plan Land Use Map



Legend

- Public Water Supply Sources
- Wellhead Protection Area (WHPA)
- Parcels

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

0 750 1,500 3,000 Feet

Path: S:\KOM\Moram\109696\99_GIS\Maps\Fig01_Wellhead_Protection_Area_031113.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MORAM 109696
Print Date: 3/11/2013

Map by: SrH
Projection: Kanabec County, NAD
Source: City of Mora and SEH Inc.

WELLHEAD PROTECTION AREA
Phase II
Mora, Minnesota

Wellhead Protection Area

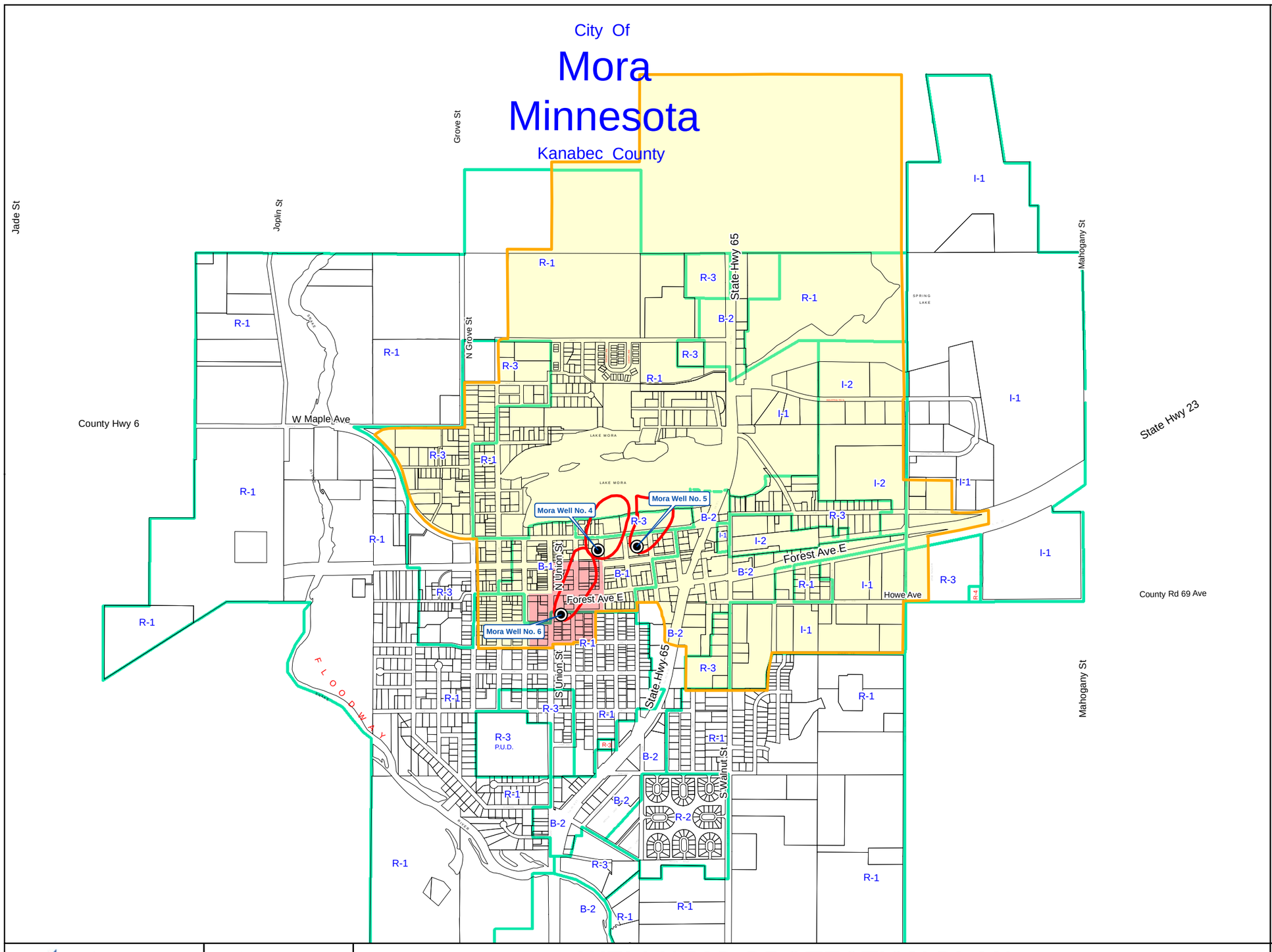
Figure 1

City Of

Mora

Minnesota

Kanabec County



Legend

- Public Water Supply Sources
- Emergency Response Area
- Drinking Water Supply Management Area
- Zoning Boundary
- Parcels

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

R-1 - Single Family Residential District
R-2 - Manufactured Home Park District
R-3 - Multiple Dwelling District
R-4 - Low Density Residential District
B-1 - Central Business District
B-2 - General Business District
I-1 - Limited Industrial District
I-2 - General Industrial Dist

N

0 750 1,500 3,000 Feet

Path: S:\KOM\Moram\109696\99_GIS\Maps\Fig02_ZoningMap_031113.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MORAM 109696
Print Date: 3/11/2013

Map by: SrH
Projection: Kanabec County, NAD
Source: City of Mora and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Zoning

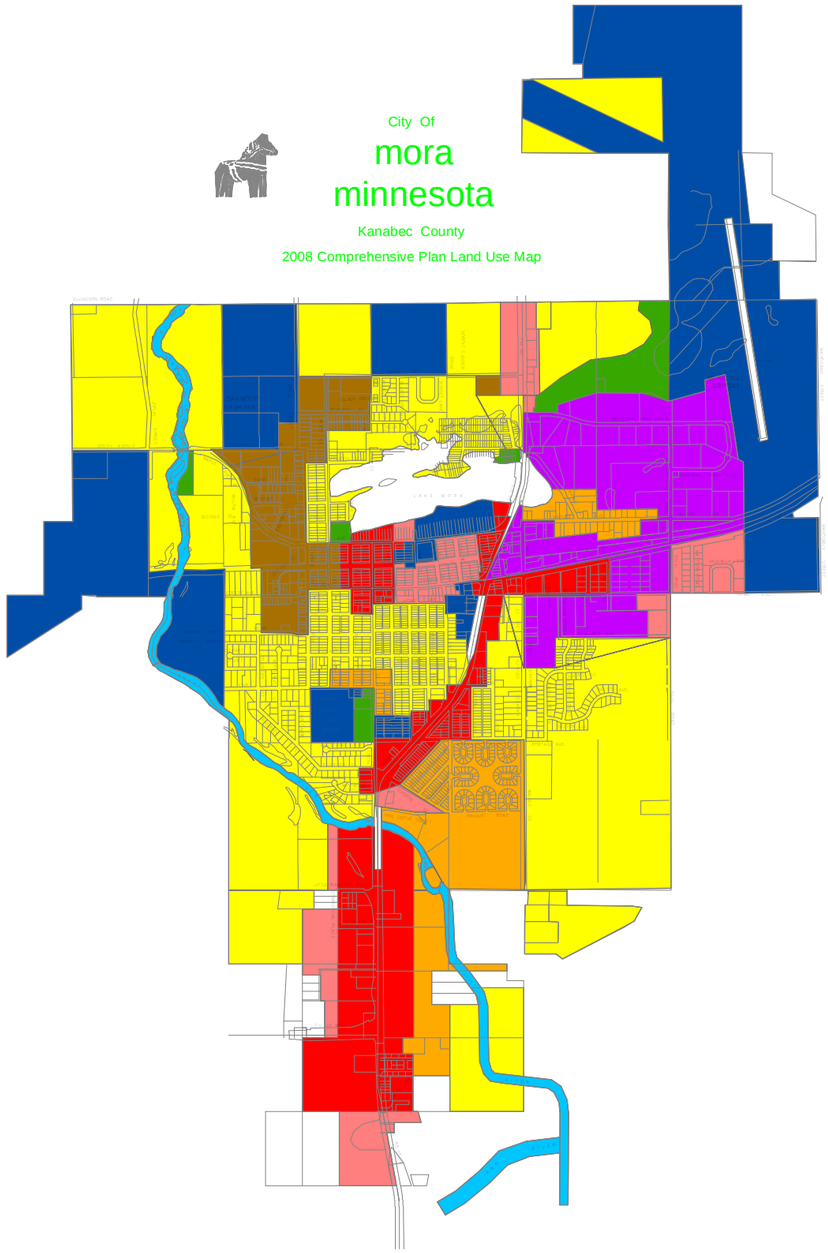
Figure 2

City Of

mora
minnesota

Kanabec County

2008 Comprehensive Plan Land Use Map



Legend

Land Use

- Commercial
- Residential / Commercial (tranistion)
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Industrial
- Park or Open Space
- Public / Semi-Public / Insitutional
- River

0 1,500 3,000 6,000 Feet

Path: S:\KOM\Moram\109696\99_GIS\Maps\Fig03_ExistingLandUseMap_031113.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MORAM 109696
Print Date: 3/14/2013

Map by: SrH
Projection: Kanabec County, NAD
Source: City of Mora and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Existing Landuse

Figure 3

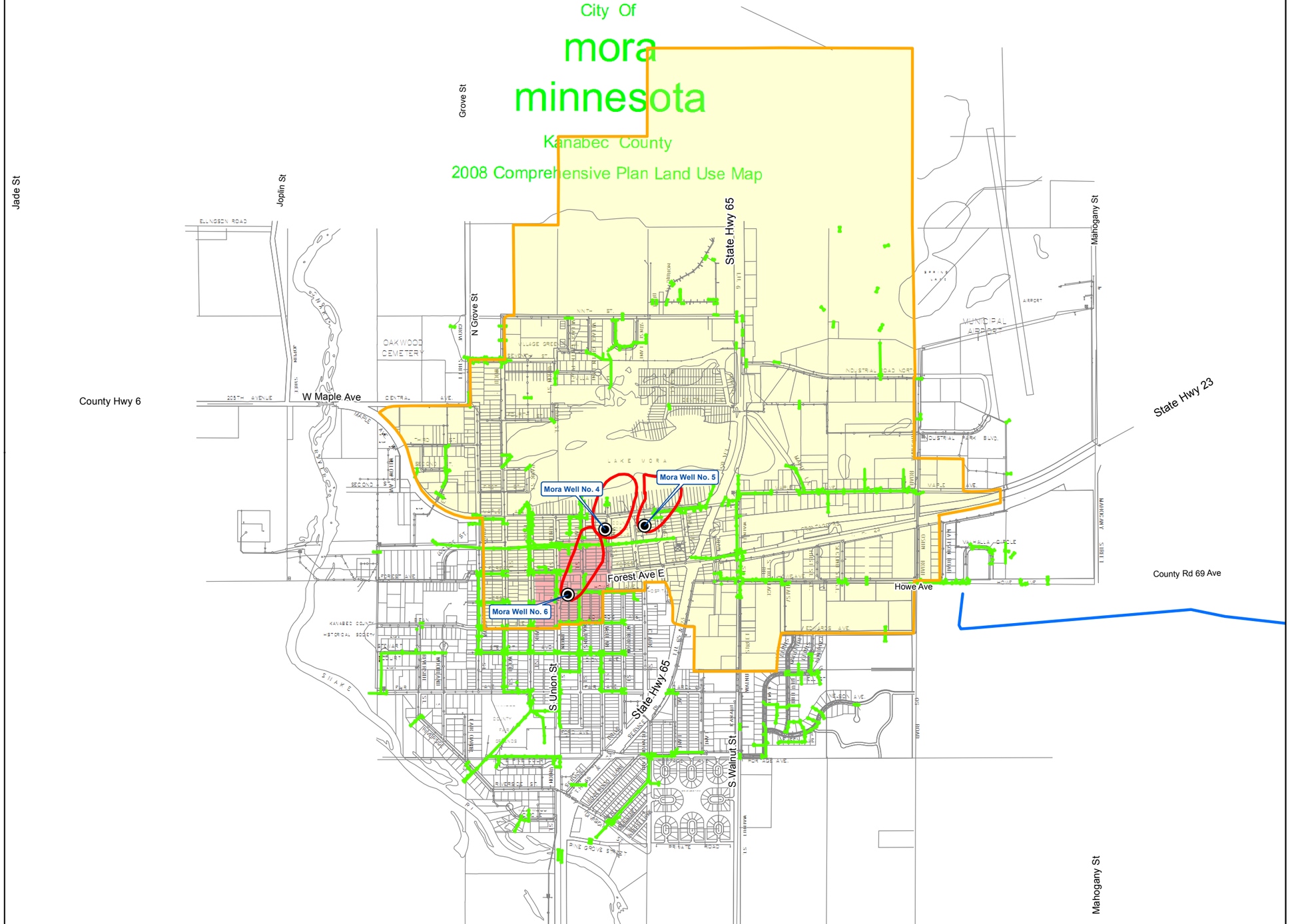
City Of

mora

minnesota

Kanabec County

2008 Comprehensive Plan Land Use Map



Legend

- Public Water Supply Sources
- Emergency Response Area
- Drinking Water Supply Management Area
- Storm Utilities
- Gas Pipe Line
- Parcel Data

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

0 750 1,500 3,000 Feet

Path: S:\KO\M\Moram\109696\99_GIS\Maps\Fig04_StormSewerMap_031113.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MORAM 109696
Print Date: 03/14/2013

Map by: SrH
Projection: Kanabec County, NAD
Source: City of Mora and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Storm Sewer Utilities

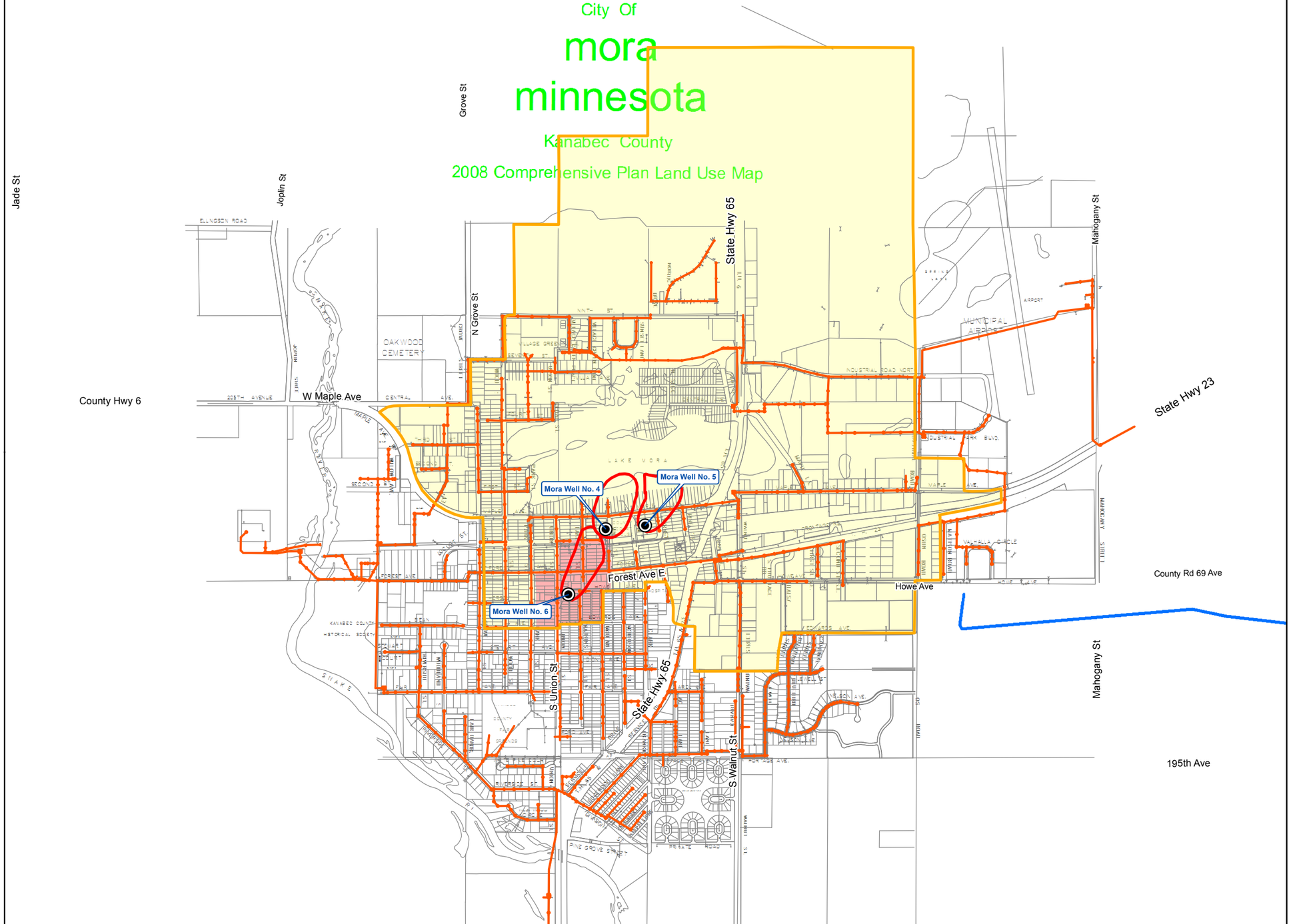
Figure 4

City Of

mora minnesota

Kanabec County

2008 Comprehensive Plan Land Use Map



Legend

- Public Water Supply Sources
- Emergency Response Area
- Drinking Water Supply Management Area
- Sanitary Utilities
- Gas Pipe Line
- Parcel Data

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

0 750 1,500 3,000 Feet

Path: S:\KO\M\Moram\109696\99_GIS\Maps\Fig05_SanitarySewerMap_031113.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

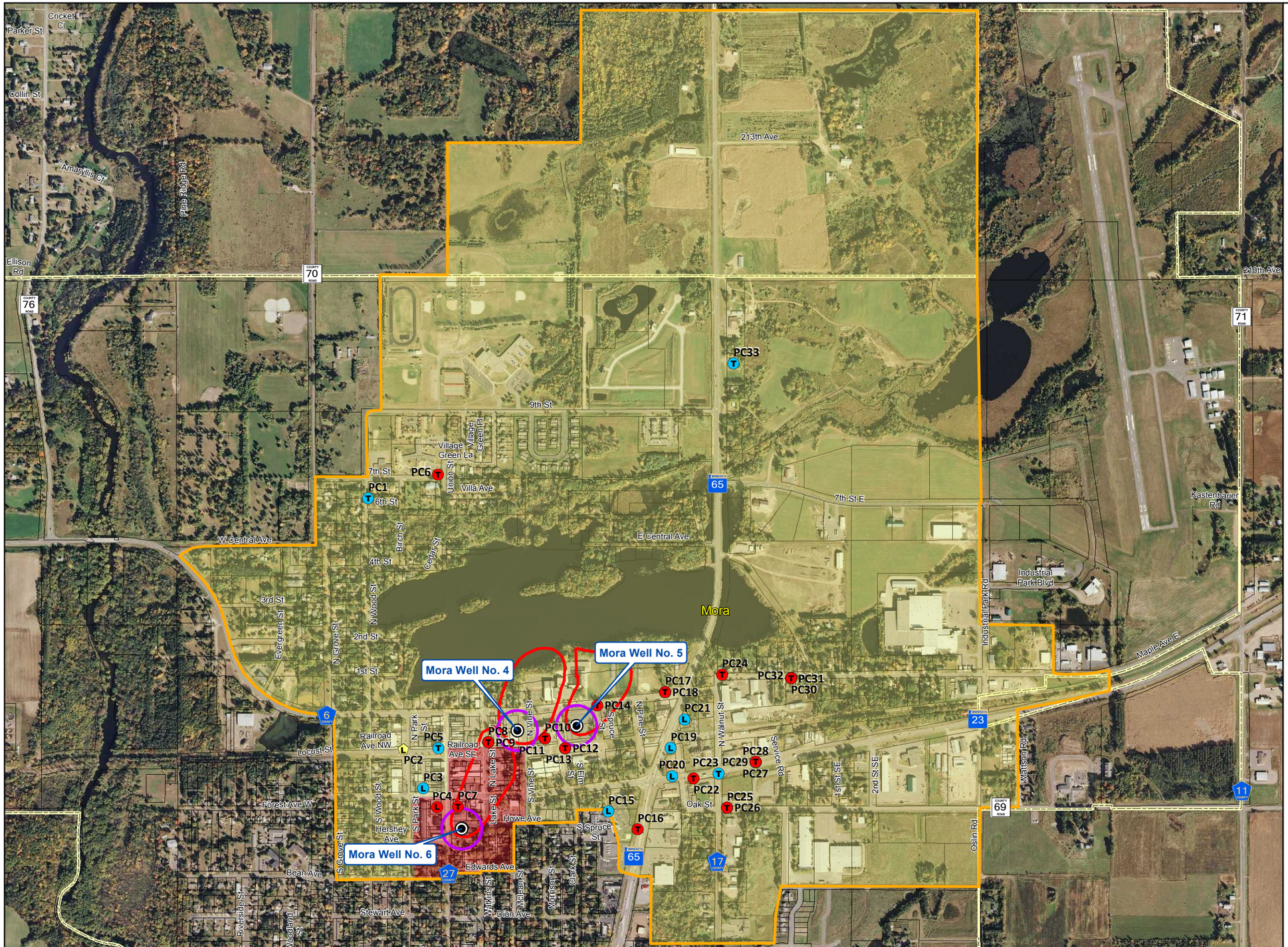
Project: MORAM 109696
Print Date: 03/14/2013

Map by: SrH
Projection: Kanabec County, NAD
Source: City of Mora and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Sanitary Sewer Utilities

Figure 5



Legend

- Landfill, Permitted By Rule, Inactive
- Leak Site, Active
- Leak Site, Inactive
- Tank Site, Active
- Tank Site, Inactive
- Public Water Supply Sources
- Inner Wellhead Management Zone
- Emergency Response Area
- Drinking Water Supply Management Area
- Municipalities
- Parcels

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

0 500 1,000 2,000 Feet

Path: S:\KO\M\Moram\109696\99_GIS\Maps\Fig06_PotentialContaminantMap.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

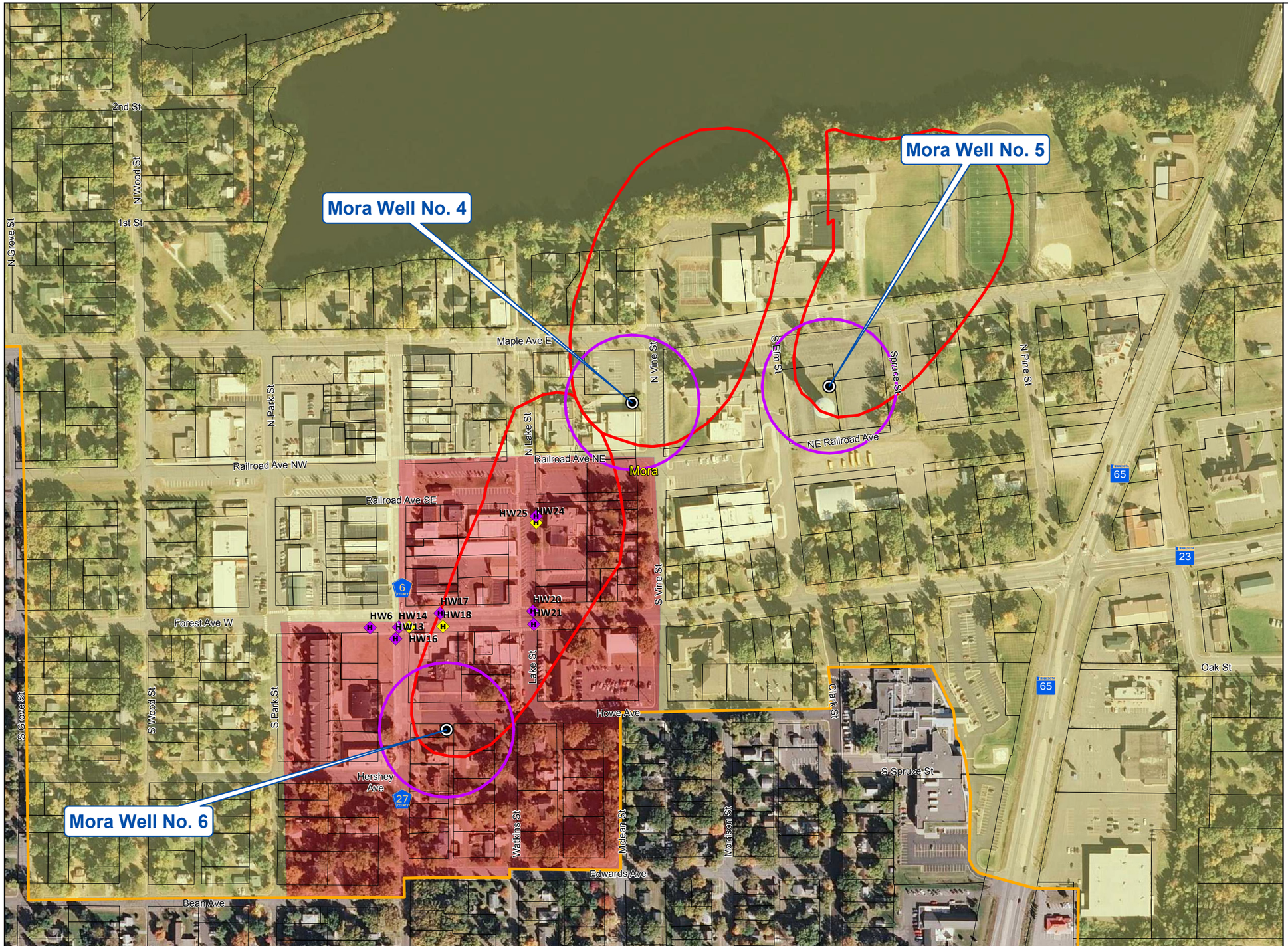
Project: MORAM 109696
Print Date: 04/23/2014

Map by: SrH
Projection: Kanabec County, NAD
Source: MnGEO Aerial 2011, MnDOT, MnDNR, MDH, MPCA, MDA, and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Potential Contaminant Sources

Figure 6



Legend

- Hazardous Waste Generator, Active
- Hazardous Waste Generator, Inactive
- Public Water Supply Sources
- Inner Wellhead Management Zone
- Emergency Response Area
- Drinking Water Supply Management Area
- Municipalities
- Parcels

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

NOTE:
Only Site within High Vulnerability DWSMA area are shown

N

0 150 300 600 Feet

Path: S:\KOM\Moram\109696\99_GIS\Maps\Fig07_HazardousWasteGenMap.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

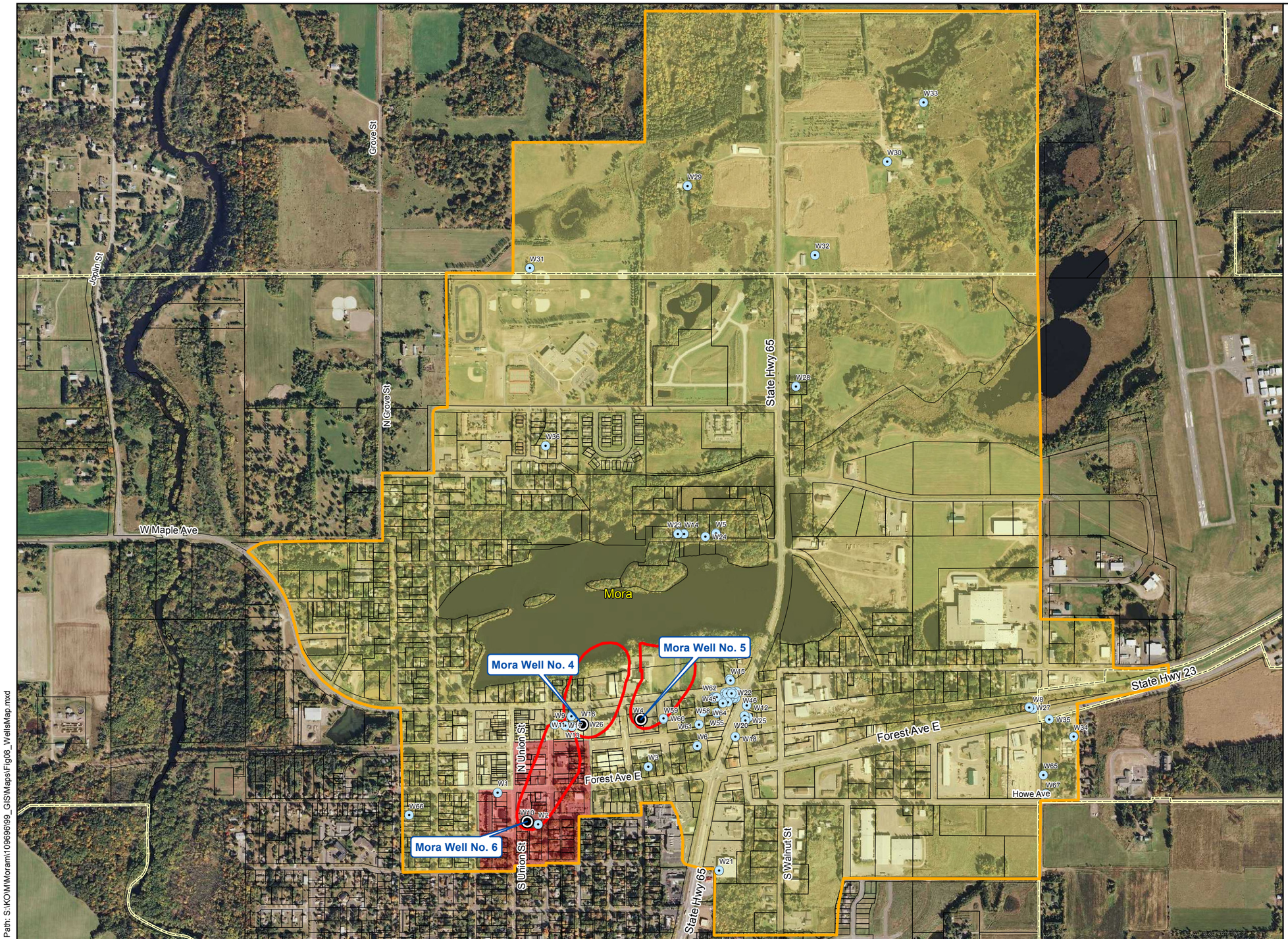
Project: MORAM 109696
Print Date: 04/23/2014

Map by: SrH
Projection: Kanabec County, NAD
Source: MnGEO Aerial 2011, MnDOT, MnDNR, MDH, MPCA, MDA, and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

Hazardous Waste Generators

Figure 7



Legend

- County Well Index (CWI)
- Public Water Supply Sources
- Emergency Response Area
- Drinking Water Supply Management Area
- Municipalities
- Parcels

DWSMA Vulnerability

- Moderate Vulnerability
- High Vulnerability

0 500 1,000 2,000 Feet

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

Path: S:\KO\M\Moram\109696\99_GIS\Maps\Fig08_WellsMap.mxd

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: MORAM 109696
Print Date: 04/24/2014

Map by: SrH
Projection: Kanabec County, NAD
Source: MnGEO Aerial 2011, MnDOT, MnDNR, and SEH Inc.

WELLHEAD PROTECTION PLAN
Phase II
Mora, Minnesota

County Well Index (CWI)

Figure 8

Appendix A

Implementation Schedule

Wellhead Protection Plan
Part II
Implementation Schedule
City of Mora, Minnesota

Item No.	Item Description	Priority	Estimated Cost Impacts over Ten Years	Summary	2014	2015	2016	2017	2018	2019	2020	2021	2022
Water Supply Reliability													
5.3.1	Add Emergency Generator to Well 5	Medium	Design and Construction Costs, Staff Time, Estimated at $50,000	Contingent on Grant Funding					x				
Data Collection													
5.4.1	Monitoring Static Levels in Municipal Wells	Low	Staff Time, Estimated at 20 work hours	Keep Water Level Reports in Wellhead Protection File	x	x	x	x	x	x	x	x	x
5.4.2.1	Develop Groundwater / Surface Water Monitoring Plan	High	Staff Time, Consultant Fees, Estimated at 40 work hours	Develop Sampling Plan with MDH	x								
5.4.2.2	Implement Groundwater / Surface Water Monitoring Plan	Medium	Staff Time, Consultant Fees, Estimated at 300 work hours	Participate in Ongoing Sampling	x	x	x	x	x	x			
5.4.2.3	Coordinate Meetings with Wellhead Protection Team and MDH to discuss results of monitoring	Medium	Staff Time, Consultant Fees, Estimated at 20 work hours	One Meeting After Two Years of Sampling			x			x			
5.4.3.1	Refine existing storm sewer system mapping	Medium	Staff Time, Consultant Fees, Estimated at 60 work hours	Develop Storm Sewer Catchment Mapping					x				
5.4.3.2	Develop Storm Water Monitoring Plan	Medium	Staff Time, Consultant Fees, Estimated at 40 work hours	Develop Sampling Plan with MDH			x						
5.4.3.3	Implement Storm Water Monitoring Plan	Medium	Staff Time, Consultant Fees, Estimated at 300 work hours	Participate in Ongoing Sampling			x	x	x	x	x	x	x
5.4.3.4	Coordinate meeting with Wellhead Protection Team and MDH to discuss results of monitoring	Medium	Staff Time, Consultant Fees, Estimated at 20 work hours							x			
Include Wellhead and Source Water Protection in City's Planning Process													
5.5.1	Review the City's Emergency Response Plan	High	Staff Time / Consultant Fees, Estimated at 40 work hours	Review Existing Plan Discuss with Emergency Responders Request to be Notified	x								
5.5.2	Purchase of Spill Containment Technology	Medium	Staff Time / Equipment Purchase, Estimated at $10,000	Spill Containment Boom(s)		x							

Item No.	Item Description	Priority	Estimated Cost Impacts over Ten Years	Summary	2014	2015	2016	2017	2018	2019	2020	2021	2022
5.5.3	Land Use Planning	Low	Staff Time / Consultant Fees, Estimated at 20 work hours	Involvement of City Planner in Wellhead Protection Program Sharing of GIS Layers with City Planner for Future Land Use Planning Efforts	x								
5.5.4	Review the County Water Plan and Participate in Amendments	Low	Staff Time / Consultant Fees, Estimated at 16 work hours	Review County Water Plan Discuss with Planners and Identify Opportunities for Collaboration Include Wellhead Protection Measure in those Plans for Future Funding			x						
Potential Contaminant Source Management													
5.6.1.1	Coordinate a Meeting Between City Staff, MPCA, MDH, and Wellhead Protection Consultant	High	Staff Time / Consultant Fees, Estimated at 20 work hours		x								
5.6.1.2	Identify Monitoring Needs	High	Staff Time / Consultant Fees, Estimated at 4 work hours	Request MPCA to Add Monitoring for Early Detection of Plume Migration Toward City Wells MDH SWP Planner will Assist with Idenifying Monitoring Needs	x								
5.6.1.3	Request MPCA Keep Town and Country Site Open for Monitoring	High	Staff Time / Consultant Fees, Estimated at 4 work hours	Request Annual Updates on Changes in Monitoring or Clean-up Efforts	x								
5.6.1.4	Evaluate Private Well Influence on Contaminant Plume	High	Staff Time / Consultant Fees, Estimated at 40 work hours	Work with MPCA and Owners of Jerry's Bait to Evaluate whether use of the Private Well is Impacting the Movement of the Plume, and Identify Options for Sealing the Well and Allowing City Water for Bait Tanks	x								
5.6.1.5	Identify Other Possible Routes for Contaminant to Reach Water Supply Aquifer	High	Staff Time / Consultant Fees, Estimated at 6 work hours	Survey other Wells around Plume to Evaluate any Potential for Plume Migration to Lower Aquifer	x								
5.6.2	Collect Additional Details on All Leak Sites	High - Inside ERA and High Vulnerability Area Medium - Elsewhere	Staff Time / Consultant Fees, Estimated at 40 work hours	Discuss with MPCA Project Managers Discuss with Property Owners and Others with Historical Knowledge Pull Files from MPCA where Necessary Discuss Follow-up Plans with MDH Source Water Protection Hydrologist		x							
5.6.3	Promotion of Well Sealing in Proximity to High Risk Spills	Medium	Staff Time / Consultant Fees, Estimated at 8 work hours	Provide Information on Well Sealing and Financial Assistance Programs to Private Well Owners		x							
5.6.4	Research Status of Old Municipal Well No. 2	Low	Staff Time / Consultant Fees, Estimated at 4 work hours	Provide Records to MDH	x								

Item No.	Item Description	Priority	Estimated Cost Impacts over Ten Years	Summary	2014	2015	2016	2017	2018	2019	2020	2021	2022
5.6.5	Continued Refinement of Potential Contaminant Source Inventory	Low	Staff Time / Consultant Fees, Estimated at 16 work hours	Review of Regulatory Databases					x				
5.6.6	Continued Refinement of Private Well Inventory	Low	Staff Time / Consultant Fees, Estimated at 16 work hours	Review of Regulatory Databases					x				
5.6.7	Ongoing Promotion of Wellhead Protection and Management Information among Private Well Owners	Low	Staff Time / Consultant Fees, Estimated at 20 work hours	Mailings, Website Updates					x				
5.6.8	Ongoing Promotion of Wellhead Protection and Management Information among Above Ground Storage Tank Owners	Low	Staff Time / Consultant Fees, Estimated at 10 work hours	Mailings, Website Updates					x				
5.6.9	Ongoing Promotion of Wellhead Protection and Management Information among Below Ground Storage Tank Owners	Low	Staff Time / Consultant Fees, Estimated at 10 work hours	Mailings, Website Updates					x				
Public Education													
5.7.1	Development of a Webpage Dedicated to Drinking Water Protection and Wellhead Protection	Low	Staff Time / Consultant Fees, Estimated at 40 work hours	Post information on wellhead protection to website, along with well and tank management information as obtained from MRWA, MDH, MPCA, and MDA.			x						
5.7.2	News Release about Adoption of Wellhead Protection Plan	Low	Staff Time, Estimated at 4 work hours	Include information about DWSMA vulnerability and wellhead protection goals.	x								
5.7.3	Brochure on Wellhead Protection Distributed with Utility Bills	Low	Staff Time, Estimated at 40 work hours	Once annually sent out with utlity bills. Examples available from MDH.	x	x	x	x	x	x	x	x	x
Inner Wellhead Management Zone Activities													
5.8.1	ondary Containment for Diesel Fuel Storage Ne	High	Staff Time, Construction Costs, Estimated at $5,000	Refer to IWMZ Inventory Form for Well No. 4	x								
5.8.2	Investigate Electrical Transformer Near Well No. 4 and Provide Protective Measures as Necessary	Medium	Staff Time, Potential Equipment Costs, Estimated at $10,000	Refer to IWMZ Inventory Form for Well No. 4		x							
5.8.3	Update Inventory of Inner Wellhead Management Zone	Low	Staff Time, Estimated at 20 work hours	Every 3 years, Work with MDH and with Electric Utility			x			x			x

Item No.	Item Description	Priority	Estimated Cost Impacts over Ten Years	Summary	2014	2015	2016	2017	2018	2019	2020	2021	2022
Evaluation													
6.0	Evaluation Report	N/A	Staff Time / Consultant Fees, Estimated at 8 work hours	Complete evaluation report, based on template, every 2 years		x		x		x		x	

Total Labor Hours Estimate	**1,186**
Total Labor Cost Impact Estimate, Assuming $100/hr Average Labor Rate	**$118,600**
Total Estimated Equipment Costs or Other Costs	**$75,000**
Total Estimated Cost Impacts	**$193,600**
Estimated Average Annual Cost of Wellhead Protection Implementation	**$19,360**

Appendix B

Potential Contaminant Source Inventory

Appendix C

Mora Water Supply Plan

Water Supply Plan

City of Mora, Minnesota

SEH

Multidisciplined. Single Source.
Trusted solutions for more than 75 years.

DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS and METROPOLITAN COUNCIL
WATER SUPPLY PLANS

These guidelines are divided into four parts. The first three parts, Water Supply System Description and Evaluation, Emergency Response Procedures and Water Conservation Planning apply statewide. Part IV, relates to comprehensive plan requirements that apply only to communities in the Seven-County Twin Cities Metropolitan Area. If you have questions regarding water supply plans, please call (651) 259-5703 or (651) 259-5647 or e-mail your question to wateruse@dnr.state.mn.us. Metro Communities can also direct questions to the Metropolitan Council at watersupply@metc.state.mn.us or (651) 602-1066.

DNR Water Appropriation Permit Number(s)	63-1039
Name of Water Supplier	Mora Municipal Utilities
Address	101 Lake Street South
Contact Person	Mike Kroon
Title	Utilities Supervisor
Phone Number	763.219.7305 (cell), 320.679.3630 (office)
E-Mail Address	wwtpmora@cityofmora.com

PART I. WATER SUPPLY SYSTEM DESCRIPTION AND EVALUATION

The first step in any water supply analysis is to assess the current status of demand and supplies. Information in Part I, can be used in the development of Emergency Response Procedures and Conservation Plans.

A. ANALYSIS OF WATER DEMAND.

Fill in Table 1 for the past 10 years water demand. If your customer categories are different than the ones listed in Table 1, please note the changes below.

TABLE 1 Historic Water Demand

Year	Total Population	Population Served	Total Connections	Residential Water Sold (MG)	C/I/I Water Sold (MG)	Wholesale Deliveries (MG)	Total Water Sold (MG)	Total Water Pumped (MG)	Percent Unmetered/ Unaccounted	Average Demand (MGD)	Maximum Demand (MGD)	Residential gallons/ capita/day	Total gallons/ capita/day
1999	2,950	2,950	978			0		132		0.361	0.524		
2000	3,000	3,000	987	67	44	0	116	130	11	0.356	0.590	61	119
2001	3,193	3,193	999	68	40	0	107	130	18	0.356	0.640	58	112
2002	3,193	3,193	1044	65	39	0	100	137	27	0.375	0.637	56	86
2003	3,235	3,235	1061	64	36	0	100	144	31	0.395	0.833	54	122
2004	3,421	3,421	1382	64	48	0	113	130	13	0.356	0.666	51	104
2005	3,560	3,560	1143	64	35	0	99	126	21	0.345	0.595	49	97
2006	3,568	3,568	1150	65	35	0	102	126	19	0.345	0.645	50	97
2007	3,560	3,560	1151	67	35	0	107	128	16	0.351	0.565	50	95
2008	3,699	3,699	1160	63	35	0	102	135	24	0.370	0.703	47	100

MG – Million Gallons **MGD** – Million Gallons per Day **C/I/I**- Commercial, Industrial, Institutional

Residential. Water used for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.

Institutional. Hospitals, nursing homes, day care centers, and other facilities that use water for essential domestic requirements. This includes public facilities and public metered uses. You may want to maintain separate institutional water use records for emergency planning and allocation purposes.

Commercial. Water used by motels, hotels, restaurants, office buildings, commercial facilities, both civilian and military.

Industrial. Water used for thermoelectric power (electric utility generation) and other industrial uses such as steel, chemical and allied products, food processing, paper and allied products, mining, and petroleum refining.

Wholesale Deliveries. Bulk water sales to other public water suppliers.

Unaccounted. Unaccounted for water is the volume of water withdrawn from all sources minus the volume sold.

Residential Gallons per Capita per Day = total residential sales in gallons/population served/365 days **Total Gallons per Capita per Day** = total water withdrawals/population served/365 days

NOTE: Non-essential water uses defined by Minnesota Statutes 103G.291, include lawn sprinkling, vehicle washing, golf course and park irrigation and other non-essential uses. Some of the above categories also include non-essential uses of water.

Water Use Trends. Discuss factors that influence trends in water demand (i.e. growth, weather, industry, conservation). If appropriate, include a discussion of other factors that affect daily water use, such as use by non-resident commuter employees or large water consuming industry.
The City of Mora has experienced slow growth during the past 10 years. However, average daily water demand has remained relatively stable during the past ten years, with residential per capita water use decreasing to approximately 50 gpcd for the past 4 years. The maximum day water use is generally attributed to filling of the municipal swimming pool. (360,000 gallons)

TABLE 2 Large Volume Users - List the top 10 largest users.

Customer	Gallons per year	% of total annual use
Regency	9,770,000	9.13
Edgewood	9,064,000	8.47
EPC	5,256,000	4.91
Kanabec Hospital	3,377,000	3.16
Villa Health Care	2,754,000	2.57
Holiday Companies	2,688,000	2.51
School District	2,521,000	2.36
B & J Launderer	2,070,000	1.93
Park Forest Apts.	1,780,000	1.66
Housing Alt	1,580,000	1.48

B. TREATMENT AND STORAGE CAPACITY.

TABLE 3(A) Water Treatment

Water Treatment Plant Capacity	2,600,000 Gallons per day
Describe the treatment process used (i.e., softening, chlorination, fluoridation, Fe/Mn removal, reverse osmosis, coagulation, sedimentation, filtration, others). Also, describe the annual amount and method of disposal of treatment residuals, if any.	
Fe/Mn Removal through filtration followed by addition of chloramines and flouridation. Backwash water is sent to reclaim and recycled. Sludge is disposed of to sanitary sewer.	

TABLE 3(B) Storage Capacity - List all storage structures and capacities.

Total Storage Capacity	**Average Day Demand** (average of last 5 years)
700,000 Gallons	353,000 Gallons per day

Type of Structure	Number of Structures	Gallons
Elevated Storage	2	650,000
Ground Storage	1	50,000
Other:		

C. WATER SOURCES. List all groundwater, surface water and interconnections that supply water to the system. Add or delete lines to the tables as needed.

TABLE 4(A) Total Water Source Capacity for System (excluding emergency connections)

Total Capacity of Sources	2,200	Gallons per minute
Firm Capacity (largest pump out of service)	1,400	Gallons per minute

TABLE 4(B) Groundwater Sources - Copies of water well records and well maintenance information should be included with the public water supplier's copy of the plan in Attachment . If there are more wells than space provided or multiple well fields, please use the List of Wells template (see Resources) and include as Attachment .

Well # or name	Unique Well Number	Year Installed	Well & Casing Depth (ft)	Well Diameter (in)	Capacity (GPM)	Geologic Unit	Status
4	217385	1965	195	12	650	Glacial Drift	Active
5	112239	1978	203	16	750	Glacial Drift	Active
6	433279	1988	210	16	800	Glacial Drift	Active

Status: Active use, Emergency, Standby, Seasonal, Peak use, etc. GPM – Gallons per Minute
Geologic Unit: Name of formation(s), which supplies water to the well

TABLE 4(C) Surface Water Sources

Intake ID	Resource name	Capacity (GPM/MGD)
N/A	N/A	N/A

GPM – Gallons per Minute MGD – Million Gallons per Day

TABLE 4(D) Wholesale or Retail Interconnections - List interconnections with neighboring suppliers that are used to supply water on a **regular basis** either wholesale or retail.

Water Supply System	Capacity (GPM/MGD)	Wholesale or retail
N/A	N/A	N/A

GPM – Gallons per Minute MGD – Million Gallons per Day

TABLE 4(E) Emergency Interconnections - List interconnections with neighboring suppliers or private sources that can be used to supply water on an emergency or occasional basis. Suppliers that serve less than 3,300 people can leave this section blank, but must provide this information in Section II C.

Water Supply System	Capacity (GPM/MGD)	Note any limitations on use
N/A	N/A	N/A

GPM – Gallons per Minute MGD – Million Gallons per Day

D. DEMAND PROJECTIONS.

TABLE 5 Ten Year Demand Projections

Year	Population Served	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Projected Demand (MGY)
2010	3,792	0.379	0.796	138.4
2011	3,820	0.382	0.802	139.4
2012	3,859	0.386	0.811	141.2
2013	3,897	0.390	0.819	142.2
2014	3,936	0.394	0.827	143.7
2015	3,985	0.399	0.838	145.5
2016	4,016	0.401	0.842	147.0
2017	4,047	0.405	0.851	147.7
2018	4,078	0.408	0.857	148.8
2019	4,109	0.411	0.863	150.0

MGD – Million Gallons per Day MGY – Million Gallons per Year

Projection Method. Describe how projections were made, (assumptions for per capita, per household, per acre or other methods used).
Assumed 100 gpcd for average day demand. Maximum day demand based on peaking factor for 2003 which was approximately 2.10.

E. RESOURCE SUSTAINABILITY

Sustainable water use: use of water to provide for the needs of society, now and in the future, without unacceptable social, economic, or environmental consequences.

Monitoring. Records of water levels should be maintained for all production wells and source water reservoirs/basins. Water level readings should be taken monthly for a production well or observation well that is representative of the wells completed in each water source formation. **Water well records are included in Attachment A.**

TABLE 6 Monitoring Wells - List all wells being measured.

Unique well number	Type of well (production, observation)	Frequency of Measurement (daily, monthly etc.)	Method of Measurement (steel tape, SCADA etc.)
217385	Production	Monthly	Electronic Tape
112239	Production	Monthly	Electronic Tape
433279	Production	Monthly	Electronic Tape

Water Level Data. Summarize water level data including seasonal and long-term trends for each ground and/or surface water source. If water levels are not measured and recorded on a routine basis then provide the static water level (SWL) when the well was constructed and a current water level measurement for each production well. Also include all water level data taken during well and pump maintenance.
Attachment B includes tables of static water levels measured annually for the current production wells. There does not appear to be any discernible long term trend in water levels. There are expected seasonal fluctuations during recharge in the spring and reduced levels as the season progresses through the summer. The Utility plans to continue to monitor water levels on a monthly on-going basis.

Ground Water Level Monitoring – DNR Waters in conjunction with federal and local units of government maintain and measure approximately 750 observation wells around the state. Ground water level data are available online www.dnr.state.mn.us/waters. Information is also available by contacting the Ground Water Level Monitoring Manager, DNR Waters, 500 Lafayette Road, St. Paul, MN 55155-4032 or call (651) 259-5700.

Natural Resource Impacts. Indicate any natural resource features such as calcareous fens, wetlands, trout streams, rivers or surface water basins that are or could be influenced by water withdrawals from municipal production wells. Also indicate if resource protection thresholds have been established and if mitigation measures or management plans have been developed.
There are relatively few natural resources that could be affected by the existing municipal wells. The Snake River, located to the west of the City is a fair distance from the Utility's existing well fields and is likely not impacted by the minor changes in pumping levels that occur seasonally.

Sustainability. Evaluate the adequacy of the resource to sustain current and projected demands. Describe any modeling conducted to determine impacts of projected demands on the resource.
Based on evaluation of the pumping levels in the wells, there does not appear to be a negative trend affecting the long term sustainability of the groundwater resource. The Utility plans to continue to collect data on static levels to verify that no trend develops.

Source Water Protection Plans. The emergency procedures in this plan are intended to comply with the contingency plan provisions required in the Minnesota Department of Health's (MDH) Wellhead Protection (WHP) Plan and Surface Water Protection (SWP) Plan.	
Date WHP Plan Adopted:	
Date for Next WHP Update:	October 1, 2012
SWP Plan:	☐ In Process ☐ Completed ☒ Not Applicable

F. CAPITAL IMPROVEMENT PLAN (CIP)

Adequacy of Water Supply System. Are water supply installations, treatment facilities and distribution systems adequate to sustain current and projected demands? ☐ Yes ☒ No If no, describe any potential capital improvements over the next ten years and state the reasons for the proposed changes.

While the existing WTP has capacity to meet both existing and future demands, the age of the facility has required increased maintenance recently and much of the equipment has reached its useful life. The WTP is planned to be rehabilitated in the near future.

Proposed Water Sources. Does your current CIP include the addition of new wells or intakes? ☐ Yes ☒ No If yes, list the number of new installations and projected water demands from each for the next ten years. Plans for new production wells must include the geologic source formation, well location, and proposed pumping capacity.

Water Source Alternatives. If new water sources are being proposed, describe alternative sources that were considered and any possibilities of joint efforts with neighboring communities for development of supplies.

None

Preventative Maintenance. Long-term preventative programs and measures will help reduce the risk of emergency situations. Identify sections of the system that are prone to failure due to age, materials or other problems. This information should be used to prioritize capital improvements, preventative maintenance, and to determine the types of materials (pipes, valves, couplings, etc.) to have in stock to reduce repair time.

Water mains are evaluated prior to any street reconstruction projects. The two areas that previously were prone to failure were repaired aproximatley 4 years ago, along with a recent reconstruction project that is addressing the last remaining area of known failures. Existing wells are inspected every 10 years.

PART II. EMERGENCY RESPONSE PROCEDURES

Water emergencies can occur as a result of vandalism, sabotage, accidental contamination, mechanical problems, power failures, drought, flooding, and other natural disasters. The purpose of emergency planning is to develop emergency response procedures and to identify actions needed to improve emergency preparedness. In the case of a municipality, these procedures should be in support of, and part of, an all-hazard emergency operations plan. If your community already has written procedures dealing with water emergencies we recommend that you use these guidelines to review and update existing procedures and water supply protection measures.

Federal Emergency Response Plan

Section 1433(b) of the Safe Drinking Water Act as amended by the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (Public Law 107-188, Title IV – Drinking Water Security and Safety) requires community water suppliers serving over 3,300 people to prepare an Emergency Response Plan. **Community water suppliers that have completed the Federal Emergency Response Plan and submitted the required certification to the U.S. Environmental Protection Agency have satisfied Part II, Sections A, B, and C of these guidelines and need only provide the information below regarding the emergency response plan and source water protection plan and complete Sections D (Allocation and Demand Reduction Procedures), and E (Enforcement).**

Provide the following information regarding your completed Federal Emergency Response Plan:

Emergency Response Plan	Contact Person	Contact Number
Emergency Response Lead	Joel Dhein	320.225.4806
Alternate Emergency Response Lead	Mike Kroon	763.219.7305
Emergency Response Plan Certification Date		

Operational Contingency Plan. An operational contingency plan that describes measures to be taken for water supply mainline breaks and other common system failures as well as routine maintenance is recommended for all utilities. Check here ☒ if the utility has an operational contingency plan. At a minimum a contact list for contractors and supplies should be included in a water emergency telephone list.

Communities that have completed Federal Emergency Response Plans should skip to Section D.

EMERGENCY RESPONSE PROCEDURES

A. Emergency Telephone List. A telephone list of emergency contacts must be included as Attachment B to the plan (complete template or use your own list). The list should include key utility and community personnel, contacts in adjacent communities, and appropriate local, state and federal emergency contacts. Please be sure to verify and update the contacts on the emergency telephone list on a regular basis (once each year recommended). In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the warning point for that community. Responsibilities and services for each contact should be defined.

B. Current Water Sources and Service Area. Quick access to concise and detailed information on water sources, water treatment, and the distribution system may be needed in an emergency. System operation, water well and maintenance records should be maintained in a central secured location so that the records are accessible for emergency purposes and preventative maintenance. A detailed map of the system showing the treatment plants, water sources, storage facilities, supply lines, interconnections, and other information that would be useful in an emergency should also be readily available. Check here ☒ if these records and maps exist and staff can access the documents in the event of an emergency.

C. Procedure for Augmenting Water Supplies. List all available sources of water that can be used to augment or replace existing sources in an emergency. In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the warning point for that community. Copies of cooperative agreements should be maintained with your copy of the plan and include in Attachment. Be sure to include information on any physical or chemical problems that may limit interconnections to other sources of water. Approvals from the MN Department of Health are required for interconnections and reuse of water.

TABLE 7 (A) Public Water Supply Systems – List interconnections with other public water supply systems that can supply water in an emergency.

Water Supply System	Capacity (GPM/MGD)	Note any limitations on use
N/A	N/A	N/A

GPM – Gallons per Minute MGD – Million Gallons per Day

TABLE 7 (B) - Private Water Sources – List other sources of water available in an emergency.

Name	Capacity (GPM/MGD)	Note any limitations on use
N/A	N/A	N/A

GPM – Gallons per Minute MGD – Million Gallons per Day

D. Allocation and Demand Reduction Procedures. The plan must include procedures to address gradual decreases in water supply as well as emergencies and the sudden loss of water due to line breaks, power failures, sabotage, etc. During periods of limited water supplies public water suppliers are required to allocate water based on the priorities established in Minnesota Statutes 103G.261.

Water Use Priorities (Minnesota Statutes 103G.261)

First Priority. Domestic water supply, excluding industrial and commercial uses of municipal water supply, and use for power production that meets contingency requirements.

NOTE: Domestic use is defined (MN Rules 6115.0630, Subp. 9), as use for general household purposes for human needs such as cooking, cleaning, drinking, washing, and waste disposal, and uses for on-farm livestock watering excluding commercial livestock operations which use more than 10,000 gallons per day or one million gallons per year.

Second Priority. Water uses involving consumption of less than 10,000 gallons per day.

Third Priority. Agricultural irrigation and processing of agricultural products.

Fourth Priority. Power production in excess of the use provided for in the contingency plan under first priority.

Fifth Priority. Uses, other than agricultural irrigation, processing of agricultural products, and power production.

Sixth Priority. Non-essential uses. These uses are defined by Minnesota Statutes 103G.291 as lawn sprinkling, vehicle washing, golf course and park irrigation, and other non-essential uses.

List the statutory water use priorities along with any local priorities (hospitals, nursing homes, etc.) in Table 8. Water used for human needs at hospitals, nursing homes and similar types of facilities should be designated as a high priority to be maintained in an emergency. Local allocation priorities will need to address water used for human needs at other types of facilities such as hotels, office buildings, and manufacturing plants. The volume of water and other types of water uses at these facilities must be carefully considered. After reviewing the data, common sense should dictate local allocation priorities to protect domestic requirements over certain types of economic needs. In Table 8, list the priority ranking, average day demand and demand reduction potential for each customer category (modify customer categories if necessary).

Table 8 Water Use Priorities

Customer Category	Allocation Priority	Average Day Demand (GPD)	Demand Reduction Potential (GPD)
Residential	1	173,400	0
Institutional	1	23,700	0
Commercial	2	62,500	62,500
Industrial	3	10,200	10,200
Irrigation	6	10,800	10,800
Wholesale	6	100	100
Non-essential	6	0	0
	TOTALS	280,700	83,600

GPD – Gallons per Day

Demand Reduction Potential. The demand reduction potential for residential use will typically be the base demand during the winter months when water use for non-essential uses such as lawn watering do not occur. The difference between summer and winter demands typically defines the demand reduction that can be achieved by eliminating non-essential uses. In extreme emergency situations lower priority water uses must be restricted or eliminated to protect first priority domestic water requirements. Short-term demand reduction potential should be based on average day demands for customer categories within each priority class.

Triggers for Allocation and Demand Reduction Actions. Triggering levels must be defined for implementing emergency responses, including supply augmentation, demand reduction, and water allocation. Examples of triggers include: water demand >100% of storage, water level in well(s) below a certain elevation, treatment capacity reduced 10% etc. Each trigger should have a quantifiable indicator and actions can have multiple stages such as mild, moderate and severe responses. Check each trigger below that is used for implementing emergency responses and for each trigger indicate the actions to be taken at various levels or stages of severity in Table 9.

- ☒ Water Demand
- ☐ Treatment Capacity
- ☐ Storage Capacity
- ☐ Groundwater Levels
- ☐ Surface Water Flows or Levels
- ☒ Pump, Booster Station or Well Out of Service
- ☐ Governor's Executive Order – Critical Water Deficiency (required by statute)
- ☐ Water Main Break
- ☐ Loss of Production
- ☐ Security Breach
- ☐ Contamination
- ☐ Other (list in Table 9)

Table 9 Demand Reduction Procedures

Condition	Trigger(s)	Actions
Stage 1 (Mild)	1 HSP running 24 hrs or at 50 % firm capacity	Request non-essential water use reduced
Stage 2 (Moderate)	2nd HSP running for 12 hrs constant or at 75 % firm capacity	Require elimination of 6th priority allocation, request reduction in 3rd priority allocation
Stage 3 (Severe)	2 HSPs running at 24 hrs. constant or at 85 % firm capacity	Require elimination of 3rd priority allocation
Critical Water Deficiency (M.S. 103G.291)	Executive Order by Governor & as provided in above triggers	Stage 1: Restrict lawn watering, vehicle washing, golf course and park irrigation and other nonessential uses Stage 2: Suspend lawn watering, vehicle washing, golf course and park irrigation and other nonessential uses

Note: The potential for water availability problems during the onset of a drought are almost impossible to predict. Significant increases in demand should be balanced with preventative measures to conserve supplies in the event of prolonged drought conditions.

Notification Procedures. List methods that will be used to inform customers regarding conservation requests, water use restrictions, and suspensions. Customers should be aware of emergency procedures and responses that they may need to implement.
Stage 1: a radio announcement will be made., Stage 2: A radio announcement will be made along with notification of users for non-compliance. Stage 3: Personal visits to the large industrial/commercial customers will occur

D. Enforcement. Minnesota Statutes require public water supply authorities to adopt and enforce water conservation restrictions during periods of critical water shortages.

Public Water Supply Appropriation During Deficiency.
Minnesota Statutes 103G.291, Subdivision 1.

Declaration and conservation.
(a) If the governor determines and declares by executive order that there is a critical water deficiency, public water supply authorities appropriating water must adopt and enforce water conservation restrictions within their jurisdiction that are consistent with rules adopted by the commissioner.
(b) The restrictions must limit lawn sprinkling, vehicle washing, golf course and park irrigation, and other nonessential uses, and have appropriate penalties for failure to comply with the restrictions.

An ordinance that has been adopted or a draft ordinance that can be quickly adopted to comply with the critical water deficiency declaration must be included in the plan (include with other ordinances in Attachment 7 for Part III, Item 4). Enforcement responsibilities and penalties for non-compliance should be addressed in the critical water deficiency ordinance.
Sample regulations are available at www.dnr.state.mn.us/waters

Authority to Implement Water Emergency Responses. Emergency responses could be delayed if city council or utility board actions are required. Standing authority for utility or city managers to implement water restrictions can improve response times for dealing with emergencies. Who has authority to implement water use restrictions in an emergency?

☒ Utility Manager ☒ City Manager ☐ City Council or Utility Board
☐ Other (describe):

Emergency Preparedness. If city or utility managers do not have standing authority to implement water emergency responses, please indicate any intentions to delegate that authority. Also indicate any other measures that are being considered to reduce delays for implementing emergency responses.

PART III. WATER CONSERVATION PLAN

Water conservation programs are intended to reduce demand for water, improve the efficiency in use and reduce losses and waste of water. Long-term conservation measures that improve overall water use efficiencies can help reduce the need for short-term conservation measures. Water conservation is an important part of water resource management and can also help utility managers satisfy the ever-increasing demands being placed on water resources.

> Minnesota Statutes 103G.291, requires public water suppliers to implement demand reduction measures before seeking approvals to construct new wells or increases in authorized volumes of water. Minnesota Rules 6115.0770, require water users to employ the best available means and practices to promote the efficient use of water. Conservation programs can be cost effective when compared to the generally higher costs of developing new sources of supply or expanding water and/or wastewater treatment plant capacities.

A. Conservation Goals. The following section establishes goals for various measures of water demand. The programs necessary to achieve the goals will be described in the following section.

Unaccounted Water (calculate five year averages with data from Table 1)	
Average annual volume unaccounted water for the last 5 years	24,400,000 gallons
Average percent unaccounted water for the last 5 years	18.6 percent
AWWA recommends that unaccounted water not exceed 10%. Describe goals to reduce unaccounted water if the average of the last 5 years exceeds 10%.	
A leak survey is planned for 2010 to go through the entire system. Better tracking of unmetered municipal uses will also aid in helping reduce the amount of unaccounted for water. Current unmetered uses of water include the following: filling of the municipal pool, WWTP operation, fairgrounds use, flushing, fire fighting, etc. In future years the City will estimate these uses so that they can be accounted for in the annual report.	

Residential Gallons Per Capita Demand (GPCD)	
Average residential GPCD use for the last 5 years (use data from Table 1)	49 GPCD
In 2002, average residential GPCD use in the Twin Cities Metropolitan Area was 75 GPCD. Describe goals to reduce residential demand if the average for the last 5 years exceeds 75 GPCD.	
Average gpcd is below recommended levels.	

Total Per Capita Demand: From Table 1, is the trend in overall per capita demand over the past 10 years ☐ increasing or ☒ decreasing? If total GPCD is increasing, describe the goals to lower overall per capita demand or explain the reasons for the increase.

Peak Demands (calculate average ratio for last five years using data from Table 1)	
Average maximum day to average day ratio	1.79
If peak demands exceed a ratio of 2.6, describe the goals for lowering peak demands.	

B. Water Conservation Programs. Describe all short-term conservation measures that are available for use in an emergency and long-term measures to improve water use efficiencies for each of the six conservation program elements listed below. Short-term demand reduction measures must be included in the emergency response procedures and must be in support of, and part of, a community all-hazard emergency operation plan.

1. **Metering.** The American Water Works Association (AWWA) recommends that every water utility meter all water taken into its system and all water distributed from its system at its customer's point of service. An effective metering program relies upon periodic performance testing, repair, repair and maintenance of all meters. AWWA also recommends that utilities conduct regular water audits to ensure accountability. Complete Table 10 (A) regarding the number and maintenance of customer meters.

TABLE 10 (A) Customer Meters

	Number of Connections	Number of Metered Connections	Meter testing schedule (years)	Average age/meter replacement schedule (years)
Residential	965	965	As needed/Upon request	17 years/ As opportunity presents
Institutional				
Commercial	192	192	As needed/Upon request	17 years/ As opportunity presents
Industrial	3	3	As needed/Upon request	17 years/ As opportunity presents
Public Facilities	7	4		/
Other	22	22	As needed/Upon request	17 years/ As opportunity presents
TOTALS	1189	1186		

Unmetered Systems. Provide an estimate of the cost to install meters and the projected water savings from metering water use. Also indicate any plans to install meters.
Only municipal water uses are currently unmetered. Therefore, there is no lost revenue form not metering. While the additional water accounting would benefit trending, the added value is cost prohibitive.

TABLE 10 (B) Water Source Meters

	Number of Meters	Meter testing schedule (years)	Average age/meter replacement schedule (years)
Water Source (wells/intakes)	4	4	10 / 25, calibrated every two years
Treatment Plant	2	2	25 / 25, to be replaced when WTP is rehabilitated

2. **Unaccounted Water.** Water audits are intended to identify, quantify, and verify water and revenue losses. The volume of unaccounted-for water should be evaluated each billing cycle. The AWWA recommends a goal of ten percent or less for unaccounted-for water. Water audit procedures are available from the AWWA and MN Rural Water Association.

Frequency of water audits: ☐ each billing cycle ☒ yearly ☐ other:

Leak detection and survey: ☐every year ☐ every years ☒ periodic as needed
Year last leak detection survey completed: Scheduled for 2010

Reducing Unaccounted Water. List potential sources and efforts being taken to reduce unaccounted water. If unaccounted water exceeds 10% of total withdrawals, include the timeframe for completing work to reduce unaccounted water to 10% or less.
Unaccounted water was previously discussed on page 14. Some estimated water uses are as follows: Pool Filling (Once per year): 360,000 gallons Pool On-going (4 months @ 10 gpm) = 1,752,000 gallons WWTP (15 gpm on-going operational use) = 7,884,000 gallons Flushing (212 hydrants flushed 5 minutes at 1000 gpm each) = 1,060,000 gpm Remaining unaccounted for water uses will be estimated as they are identified. In addition, a leak survey is budgeted for 2010 and will include repair of leaks identified.

3. **Conservation Water Rates.** Plans must include the current rate structure for all customers and provide information on any proposed rate changes. Discuss the basis for current price levels and rates, including cost of service data, and the impact current rates have on conservation.

Billing Frequency: ☒ Monthly ☐ Bimonthly ☐ Quarterly ☐ Other (describe):

Volume included in base rate or service charge: 0 gallons

Conservation Rate Structures
- ☐ Increasing block rate: rate per unit increases as water use increases
- ☐ Seasonal rate: higher rates in summer to reduce peak demands
- ☐ Service charge or base fee that does not include a water volume

Conservation Neutral Rate Structure
- ☒ Uniform rate: rate per unit is the same regardless of volume

Non-conserving Rate Structures
- ☐ Service charge or base fee that includes a large volume of water
- ☐ Declining block rate: rate per unit decreases as water use increases
- ☐ Flat rate: one fee regardless of how much water is used (unmetered)

Other (describe):

Water Rates Evaluated: ☒ every year ☐ every years ☐ no schedule
Date of last rate change: January 1, 2009

Declining block (the more water used, the cheaper the rate) and flat (one fee for an unlimited volume of water) rates should be phased out and replaced with conservation rates. Incorporating a seasonal rate structure and the benefits of a monthly billing cycle should also be considered along with the development of an emergency rate structure that could be quickly implemented to encourage conservation in an emergency.

Current Water Rates. Include a copy of the actual rate structure in Attachment C or list current water rates including base/service fees and volume charges below.
See Attachment C

Non-conserving Rate Structures. Provide justification for the rate structure and its impact on reducing demands or indicate intentions including the timeframe for adopting a conservation rate structure.
The last rate study was completed in 2007. A new rate structure is planned for 2013 that will include a conservation rate structure on the water side.

4. **Regulation.** Plans should include regulations for short-term reductions in demand and long-term improvements in water efficiencies. Sample regulations are available from DNR Waters. Copies of adopted regulations or proposed restrictions should be included in Attachment D of the plan. Indicate any of the items below that are required by local regulations and also indicate if the requirement is applied each year or just in emergencies.

☐ Time of Day: no watering between am/pm and am/pm
(reduces evaporation) ☐ year around ☐ seasonal ☐ emergency only
☐ Odd/Even: (helps reduce peak demand) ☐ year around ☐ seasonal ☐ emergency only
☐ Water waste prohibited (no runoff from irrigation systems)
Describe ordinance:
☐ Limitations on turf areas for landscaping (reduces high water use turf areas)
Describe ordinance:
☐ Soil preparation (such as 4”-6” of organic soil on new turf areas with sandy soil)
Describe ordinance:
☐ Tree ratios (plant one tree for every square feet to reduce turf evapotranspiration)
Describe ordinance:
☐ Prohibit irrigation of medians or areas less than 8 feet wide
Describe ordinance:
☐ Permit required to fill swimming pool ☐ every year ☐ emergency only
☐ Other (describe):

State and Federal Regulations (mandated)

☒ Rainfall sensors on landscape irrigation systems. Minnesota Statute 103G.298 requires "All automatically operated landscape irrigation systems shall have furnished and installed technology that inhibits or interrupts operation of the landscape irrigation system during periods of sufficient moisture. The technology must be adjustable either by the end user or the professional practitioner of landscape irrigation services."

☒ Water Efficient Plumbing Fixtures. The 1992 Federal Energy Policy Act established manufacturing standards for water efficient plumbing fixtures, including toilets, urinals, faucets, and aerators.

Enforcement. Are ordinances enforced? ☐ Yes ☒ No If yes, indicate how ordinances are enforced along with any penalties for non-compliance.
The City is currently looking at adopting a set of water/wastewater ordinances that will encompass water use regulations, along with enforcement. At this time, draft ordinances are not yet available, but the City has been compiling sample ordinances from which to assemble their drafts.

5. **Education and Information Programs**. Customers should be provided information on how to improve water use efficiencies a minimum of two times per year. Information should be provided at appropriate times to address peak demands. Emergency notices and educational materials on how to reduce water use should be available for quick distribution during an emergency. If any of the methods listed in the table below are used to provide water conservation tips, indicate the number of times that information is provided each year and attach a list of education efforts used for the last three years.

Current Education Programs	**Times/Year**
Billing inserts or tips printed on the actual bill	
Consumer Confidence Reports	1
Local news papers	
Community news letters	4
Direct mailings (water audit/retrofit kits, showerheads, brochures)	
Information at utility and public buildings	On-Going
Public Service Announcements	
Cable TV Programs	
Demonstration projects (landscaping or plumbing)	
K-12 Education programs (Project Wet, Drinking Water Institute)	
School presentations	1
Events (children's water festivals, environmental fairs)	2
Community education	
Water Week promotions	1
Information provided to groups that tour the water treatment plant	2
Website (include address:)	On-Going
Targeted efforts (large volume users, users with large increases)	
Notices of ordinances (include tips with notices)	

Emergency conservation notices (recommended)	
Other:Home show hand outs and promotional items (rain gauges, soil moisture meters, etc.)	1

List education efforts for the last three years in Attachment of the plan. Be sure to indicate whether educational efforts are on-going and which efforts were initiated as an emergency or drought management effort.

Proposed Education Programs. Describe any additional efforts planned to provide conservation information to customers a minimum of twice per year (required if there are no current efforts).
The City plans to update their website to include conservation tips along with links to DNR and AWWA websites. The City uses the local home show as an opportunity to provide promotional items to get the word out on irrigation/conservation. However, based on the current peaking factors and per capita water use, excess water use is not currently a problem.

A packet of conservation tips and information can be obtained by contacting DNR Waters or the Minnesota Rural Water Association (MRWA). The American Water Works Association (AWWA) www.awwa.org or www.waterwiser.org also has excellent materials on water conservation that are available in a number of formats. You can contact the MRWA 800/367-6792, the AWWA bookstore 800/926-7337 or DNR Waters 651/259-5703 for information regarding educational materials and formats that are available.

6. **Retrofitting Programs.** Education and incentive programs aimed at replacing inefficient plumbing fixtures and appliances can help reduce per capita water use as well as energy costs. It is recommended that communities develop a long-term plan to retrofit public buildings with water efficient plumbing fixtures and that the benefits of retrofitting be included in public education programs. You may also want to contact local electric or gas suppliers to see if they are interested in developing a showerhead distribution program for customers in your service area.

A study by the AWWA Research Foundation (Residential End Uses of Water, 1999) found that the average indoor water use for a non-conserving home is 69.3 gallons per capita per day (gpcd). The average indoor water use in a conserving home is 45.2 gpcd and most of the decrease in water use is related to water efficient plumbing fixtures and appliances that can reduce water, sewer and energy costs. In Minnesota, certain electric and gas providers are required (Minnesota Statute 216B.241) to fund programs that will conserve energy resources and some utilities have distributed water efficient showerheads to customers to help reduce energy demands required to supply hot water.

Retrofitting Programs. Describe any education or incentive programs to encourage the retrofitting of inefficient plumbing fixtures (toilets, showerheads, faucets, and aerators) or appliances (washing machines).
As required by plumbing code.

Plan Approval. Water Supply Plans must be approved by the Department of Natural Resources (DNR) every ten years. Please submit plans for approval to the following address:

DNR Waters
Water Permit Programs Supervisor
500 Lafayette Road
St. Paul, MN 55155-4032

or Submit electronically to wateruse@dnr.state.mn.us.

Adoption of Plan. All DNR plan approvals are contingent on the formal adoption of the plan by the city council or utility board. Please submit a certificate of adoption (example available) or other action adopting the plan.

Metropolitan Area communities are also required to submit these plans to the Metropolitan Council. Please see PART IV. ITEMS FOR METROPOLITAN AREA PUBLIC SUPPLIERS.

Attachment A
Well Records

COPY

MN Unique # 433279

WELL RECORD

KEYS WELL DRILLING COMPANY

WATER PRODUCERS

Well #6

SAINT PAUL, MINNESOTA

Owner City of Mora Date Completed 8/19/88

Location Union St. & Howe Avenue, Mora, MN Driller Sylvester Unertl

Well No. 6 Size 30x24x16 Total Depth 210' Type Screen

DRILLERS LOG

0	to	10		Sand & Clay
10	to	18		Sand & Boulders
18	to	30		Sand & Gravel
30	to	75		Sand
75	to	115		Sand, Gravel & Rock
115	to	145		Sand & Clay
145	to	150		Sand & Gravel
150	to	155		Sand & Clay
155	to	210		Sand & Gravel
	to			
	to			
	to			
	to			
	to			

PERMANENT PUMP DATA – Later

Mfg. _____ Type _____ Serial No. _____

Capacity _____ GPM _____ TDH

Motor Make _____ Type _____

_____ H. P. _____ Volts _____ Ph. _____ RPM

_____ ft. _____ in Col. pipe _____ in. Shaft

_____ ft. _____ in Bowls _____ Stages _____ Type

_____ ft. _____ in suction pipe & _____

_____ ft. Total Length of Pump

_____ ft. _____ in. drop pipe & _____ No. _____ Cable

_____ ft. _____ in. air line

_____ in. Pitless _____ ft. bury _____ in outlet

WELL MATERIALS

40 ' of 30 " diameter of Outer Casing

145 ' of 24 " diameter of inner Open Hole

150 ' of 16 " diameter of Inner Casing

' of " diameter of Open Hole

0 ' to 145 Mix grout 12 (yds.) (Sacks)

60 ' 16 " diameter s.s. Screen

RECORD OF TEST PUMPING

Static Water Level 35' ft. from Top of pipe

743	GPM	11'8"	D.D.	2	Hours
956	GPM	14'9"	D.D.	2 ½	Hours
1064	GPM	16'7"	D.D.	2	Hours
1235	GPM	19'2½"	D.D.	2	Hours
1341	GPM	21'8½"	D.D.	2	Hours

Remarks:

1401	GPM	22'10"	D.D.	2
1446	GPM	23'2"	D.D.	3
1431	GPM	23'5"	D.D.	4½
1200	GPM	19'6"	D.D.	2
1000	GPM	16'5"	D.D.	2

24 hours

copy

THEIN WELL CO.

Turbine Pump Installation Record

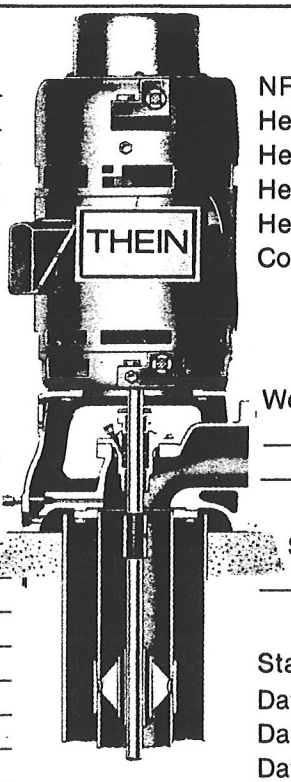
P. O. Box 429
Clara City, MN 56222
Phone (612) 847-3207

Jct. Hwy. 71 & Cty. Rd. 10
Spicer, MN 56288
Phone (612) 796-2111

7025 North Highway 63
Rochester, MN 55901
Phone (507) 288-5554

Owner MORA Location _____ Well No. 6

Motor: Mfg. US
Serial No. B408 - R10R194R019R-4
H.P. 60 R.P.M. 1800
Phase 3 Volt 230/460
Code _____ Type RVE
FRAME - 364TP
BASE - 16 1/2"



NRR X Yes _____ No
Headshaft Dia. 1 1/2
Headshaft Length 60"
Headshaft Flush—Sleeve Type (circle)
Headshaft One—Two Piece (circle)
Coupling Above—Below Stuffing Box (circle)

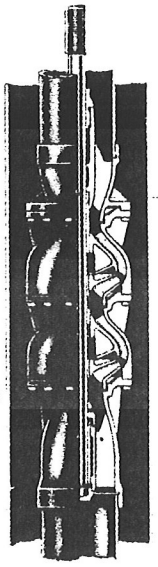
Well Data _____

Screen Data _____

Discharge Head Mfg. SIMMONS
Flange Size _____

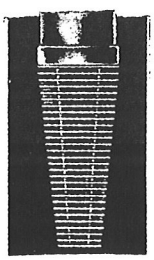
Column Dia. 8
No. 10' Column Lengths 9
No. 5' Column Lengths 2
10' Actual Length 9' 11 1/4"
5' Actual Length 4' 11 1/4"
Retainer Type DROP IN
Depth of Retainer Ring 3/4
Bearing Size & Type RUBBER 1 11/16"
Shafting Dia. 1 1/2"
Threads Per Inch 10
10' Shaft Lengths 9
5' Shaft Lengths 1
10' Actual Length 10'
5' Actual Length 5'
Sleeve O.D. 1 11/16"
Sleeve Length _____
Bowl Mfg. & Type SIMMONS SJ12M
Design Condition 1000 gpm@ 179 TDH
Serial No. _____
No. of Stages 3
Bowl Projection 10"
Shaft Dia. & Thread 1 11/16 w/1 1/2" IOTD
Type Impeller ENCLOSED WITH BRONZE WEAR RINGS

Static Water Level _____
Date _____ P.L. _____ @ gpm = _____ S.C.
Date _____ P.L. _____ @ gpm = _____ S.C.
Date _____ P.L. _____ @ gpm = _____ S.C.
Date _____ P.L. _____ @ gpm = _____ S.C.
Date _____ P.L. _____ @ gpm = _____ S.C.



General Comments _____

Suction Pipe Dia. 8
Length 10'



Strainer Type NONE
Strainer Length _____

Total Pump Depth _____

Attachment B

Well Level Data

SMITH WELL 3	DATE	DEPTH TO WATER	DATE	DEPTH TO WATER	DATE	DEPTH TO WATER	DATE	DEPTH TO WATER
	7-24-00	46.85	4-24-01	44.00	2-6-02	43.25	1-15-04	41.85
	8-1-00	47.20	4-27-01	41.84	New meter 2-15-02	43.30	1-29-04	41.18
	8-9-00	47.15	5-4-01	39.80	02-22-02	43.55	2-23-04	42.2
	8-25-00	47.05	5-11-01	38.05	3-5-02	43.50	3-3-04	42.50
	8-31-00	47.05	5-14-01	37.80	3-19-02	44.05	3-19-04	42.8
	9-5-00	47.05	5-25-01	38.00	3-28-02	43.80	3-22-04	42.81
	9-12-00	46.50	6-8-01	38.10	4-1-02	43.90		
	9-19-00	45.65	6-13-01	38.00	4-12-02	43.18	sealed 6-24-04	
	9-28-00	47.50	6-25-01	37.75	4-22-02	40.00		
	10-6-00	47.20	7-10-01	37.80	4-29-02	39.30		
	10-11-00	48.15	7-20-01	38.00	5-20-02	38.43		
	10-17-00	48.20	7-27-01	38.30	5-28-02	38.37		
	10-24-00	47.80	8-20-01	39.20	6-4-02	38.90		
	10-31-00	47.75	8-27-01	39.60	6-19-02	39.00		
	11-20-00	47.60	9-7-01	39.80	6-24-02	39.05		
	12-5-00	47.95	9-14-01	40.20	7-10-02	39.10		
	12-11-00	48.15	9-25-01	40.35	7-17-02	38.30		
	12-18-00	47.80	10-4-01	40.75	7-31-02	37.65		
	1-3-01	47.50	10-12-01	40.80	8-22-02	37.00		
	1-8-01	47.85	10-22-01	41.13	9-9-02	36.50		
	1-23-01	47.30	11-9-01	41.65	9-18-02	36.05		
	1-30-01	47.25	11-16-01	41.80	9-30-02	36.93		
	2-6-01	47.60	11-30-01	41.90	10-4-02	36.10		
	2-14-01	47.85	12-4-01	41.95	11-21-02	37.40		
	2-20-01	48.10	12-21-01	42.25	12-02-02	37.65		
	2-27-01	48.20	12-27-01	42.10	12-17-02	37.82		
	3-9-01	48.25	12-31-01	42.45	1-10-03	39.00		
	3-20-01	48.20	1-4-01	42.70	2-4-03	39.90		
	4-2-01	48.80	1-11-01	42.85	2-10-03	39.33		
	4-10-01	47.70	1-25-02	43.10	3-26-03	41.07		
	4-17-01	46.20	1-29-02	43.40	1-7-03	41.93		

WELL #	DATE	TO WATER
4	1999	last year tested - Probe will not slid down
	1998	
	1997	47.50
	1996	44.75
	1995	40.58
	1994	46.75
	1993	49.50
	1992	47.33
	1991	52.33
	1990	53.50
	1989	53.58

4 years then wells is

Well #5	
2007	
2006	
2005	
2004	41.58
2003	38.00
2002	41.00
2001	48.33
2000	46.58
~~1999~~	47.00
1998	
1997	41.02
1996	40.00

#5 monthly	2001	2002	2003	2004	2005
Jan	47.60		38.85	41.95	
feb			39.06	42.00	43.65
march	48.40	43.65	40.35	42.95	43.90
April		43.23	40.58	41.60	
may	38.50	38.50	38.00		
June		38.50	37.60	41.58	40.95
July		39.16	35.83		41.50
august		38.07	36.42	42.63	
Sept		36.85	37.85	42.65	42.85
oct		36.10	39.30	42.74	
nov			39.62	42.82	41.18
Dec		37.20	40.82		

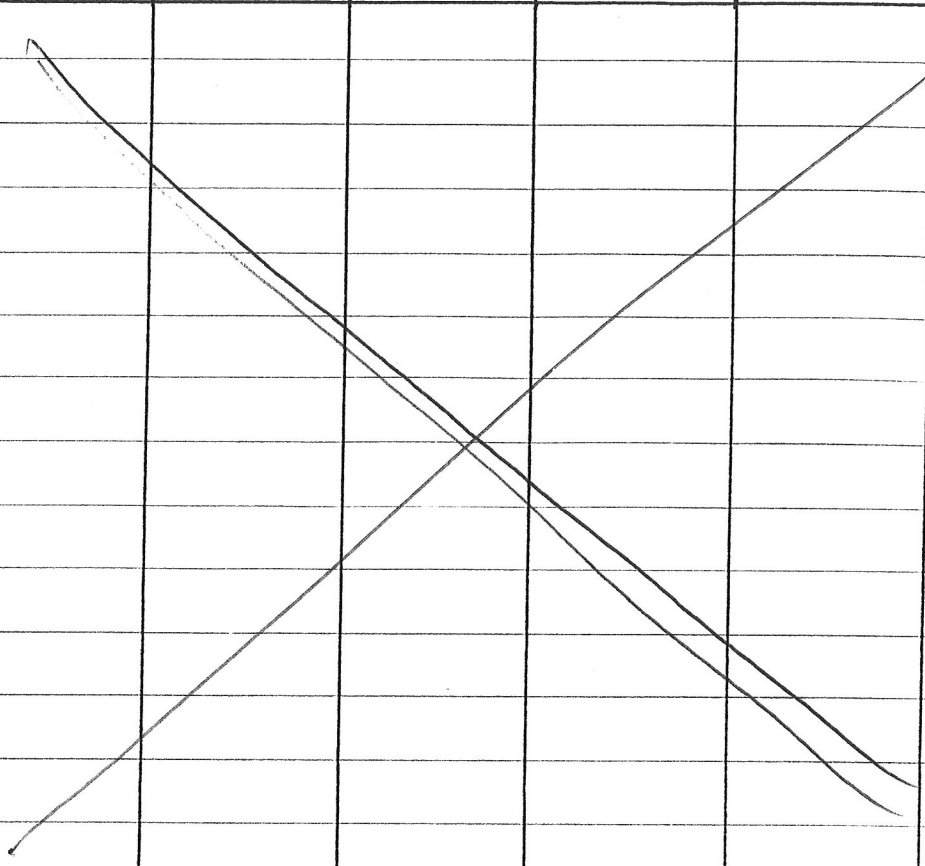
MMU

2000	46.70

tested once

2006			2007	
J 42.30	J 42.16	N 42.03	J 42.19	J 43.6
F 42.60	July 41.82	D 43.95	F	July 44.81
m 42.60	A 40.89		m 44.48	
A 42.17	S 41.79		43.82	
m 41.82	O 40.62		m 42.43	

WELL	DATE	TO WATER
Well #6		
These wells 1 once a year	2007	
	2006	
	2005	
	2004	30.33
	2003	28.00
	2002	31.17
	2001	36.33
	2000	34,58
	1999	35.08
	1998	
	1997	30.88
	1996	29.25
mmm	2000 tested once	34.70



#6 month/	2001	2002	2003	2004	2005	2006	2007
Jan	35.70		29,50	31,02		31.44	33,40
Feb			28,95	31,75	32,40	31,24	
march	36.40	32.53	30.00	well pulled	32,68	31,57	33.82
April		32,70	30,09			30,46	32,73
May		28,45	28.00			31,39	31,13
June		28,00	27,60	30,33	29,69	31,79	32,30
July		28,60	26,13		30,62	32,81	33,21
august		26,73	27,20	32,75	31,50	32,03	
Sept		26,55	27,81	31,32	31,54	30,56	
oct		26,10	29,05	31,70		31,87	
Nov			30,00	31,50	28,50	31,42	
Dec		27,50	31,15			33,17	

Drawdowns 2008

	Well #4	Well #5	Well #6
	pump level Static	pump level Static	pump lvl Static
Jan	None	50.49 - 46.30	44.66 - 33.23
	D.D.	Draw D. - 4.19	Draw D. 11.43
Feb	none	53.89 - 45.31	45.14 - 33.91
		- 8.58	- 11.23
mar	none	54.46 - 45.76	45.67 - 34.31
		- 8.70	- 11.38
April	none	53.73 - 45.10	44.99 - 33.53
		- 8.63	- 11.43
May	none	49.13 - 40.00	40.95 - 29.41
		- 9.13	- 11.54
Jne	none	47.43 - 37.97	43.21 - 27.49
		- 9.46	- 15.72
July	none	49.68 - 38.62	39.11 - 27.61
		- 11.06	- 11.50
Aug	82.00 - 44.00	47.87 - 38.58	39.72 - 28.38
	- 38.00	- 9.29	- 11.34
Sept	81.45 - 44.11	47.93 - 39.22	38.97 - 28.75
	- 37.34	- 8.71	- 10.22
Oct	81.75 - 47.54	33.93 - 43.14	39.66 - 29.68
	- 34.21	- 9.21	- 9.98
Nov	82.24 - 45.12	49.23 - 39.87	40.24 - 29.12
	- 37.12	- 9.36	- 11.09
Dec	80.75 - 42.88	46.11 - 36.54	39.84 - 29.98
	- 37.87	- 9.57	- 9.87

Drawdowns 2009

	Well #4 pump level - Static Draw Down	Well #5 PL - Static DD	Well #6 PL - Static D.D.
Jan	82.26 - 43.33 -38.93	47.83 - 37.60 -10.23	37.21 - 26.32 -10.89
Feb	80.99 - 46.28 -34.71	49.41 - 40.18 -9.23	39.70 - 30.49 -9.21
March	83.16 - 47.02 -36.14	50.43 - 41.93 -8.50	43.17 - 31.04 -12.13
April	79.23 - 41.93 -37.30	46.23 - 36.81 -9.42	38.82 - 26.92 -11.90
May	78.58 - 41.58 -37.00	46.08 - 36.50 9.58	38.00 - 26.67 -11.33

Attachment C

Emergency Telephone List

Attachment

Emergency Telephone List

Emergency Response Team	Name	Work Telephone	Alternate Telephone
Emergency Response Lead	Joel Dhein	320-225-4806	612-290-2238
Alternate Emergency Response Lead	Mike Kroon	763-219-7305	612-290-4456
Water Operator	Rodney Knudsen	612-290-5236	320-679-2920
Alternate Water Operator	Joe Kohlgraf	612-390-1781	320-679 2078
Public Communications	Kelly Erickson	320-225-4802	320-679-1511

State and Local Emergency Response Contacts	Name	Work Telephone	Alternate Telephone
State Incident Duty Officer	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
County Emergency Director			
National Guard	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
Mayor/Board Chair	Greg Ardner	320-679-1511	320 679 4890
Fire Chief	Robert Jensen	320-629-8413	320 679-5060
Sheriff	Steve Shultz	320-679-8400	320-679-3930
Police Chief	Chris Olsen	320-225-4813	320-291-3217
Ambulance	Kanabec Hospital	320-679-1212	
Hospital	Kanabec Hospital	320-679-1212	
Doctor or Medical Facility	Allina Medical	320-679-1313	

State and Local Agencies	Name	Work Telephone	Alternate Telephone
MDH District Engineer	Greg Nikodym	320-679-6300	
MDH	Drinking Water Protection	651-201-4700	
State Testing Laboratory	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
MPCA	Hershel Blaising	218-316-3860	
DNR Area Hydrologist	DNR	763-689-7100	
County Water Planner	Snake River watershed	320-679-6310	

Utilities	Name	Work Telephone	Alternate Telephone
Electric Company	Mora Municipal	320-679-1451	320-679-1511
Gas Company	MN Energy	800-303-0752	320-980-6379
Telephone Company	North Star Access	320 225 4672	763-633-9199
Gopher State One Call	Utility Locations	800-252-1166	651-454-0002
Highway Department	Dept of Transportation		763-689-7086

Mutual Aid Agreements	Name	Work Telephone	Alternate Telephone
Neighboring Water System	Cambridge Public Works	763 689 1800	
Emergency Water Connection	Nine		
Materials	Cambridge Public W	763 689 1800	

Technical/Contracted Services/Supplies	Name	Work Telephone	Alternate Telephone
MRWA Technical Services	MN Rural Water Association	800-367-6792	
Well Driller/Repair	Thein Well	320-796-2111	320 847-3207
Pump Repair	North Star Pump	651-398-1049	1 612 382 3717
Electrician	Mattson Electric	320-679-2652	320-679-9654
Plumber	BB Plumbing	320-679-3730	320-629-8199
Backhoe	Kadlec Excavating	320-679-1385	612-423-6735
Chemical Feed	Hawkins Chemical	612-904-5287	1-612-617-8658

Meter Repair	Sensus	715-339-3956	
Generator	Ziegler	888 320 4292	
Valves	Granite Waterworks	320-253-8587	
Pipe & Fittings	Henry's waterworks	1800 950 2119	
Water Storage	Maguire Iron, Inc.	605 310 7661	
Laboratory	MVTL	1800-782-3557	
Engineering firm	SEH	800 325 2055	651 490 2000

Communications	Name	Work Telephone	Alternate Telephone
News Paper	Kanabec Times	320-679-2662	
Radio Station	KBEK	320-679-6955	763-689-5500
School Superintendent			
Property & Casualty Insurance	Joe Heggerness	320-679-5044	

Critical Water Users	Name	Work Telephone	Alternate Telephone
Hospital Critical Use:	Kanabec Hosp	320-679-1212	
Nursing Home Critical Use:	Villa Health Care	320-679-1411	
Public Shelter Critical Use:			

Attachment D
2009 Water Rates

WATER

WATER RATES

Monthly Service Charge	$13.30
Usage Charge Per 1,000 Gallons	$3.16
Bulk Water per 1,000 Gallons	$30.00

AVAILABILITY CHARGE

Water Availability Charges (WAC)	$1,500

LABOR RATES

Regular-time (per hour)	$50
Over-time (per hour)	$75

EQUIPMENT RATES

Per hour plus operator	$25

MATERIALS

Cost plus	10%

OTHER FEES

Disconnect/Reconnect Fees	
Customer Request	$25
For Non-Payment	$75
After Hours	$150

WATER TOWER SPACE RENTAL (monthly rate)

Single User	$273.42
Community Repeater	$364.65
Multi-Use Antenna	
Radio Common Carrier	$425.43
800 MHz Trunking System & E-SMR	
Each Transmitter	$79.00
Each Receiver	$79.00
Each Antenna	$79.00
2' x 2' Floor Space	$79.00
Microwave Satellite Dish	$546.98
PCS/Cellular/Wireless ISP	
1-5 Antennas	$850.85
Each Additional Antenna	$151.94

Attachment E
Sample Ordinance

RESOLUTION ESTABLISHING LAWN WATERING RESTRICTIONS

WHEREAS, the City Municipal Water Supply may reach critical levels due to summer peak usage, and

WHEREAS, a possibility of water shortage is made more critical by hot, dry springs weather conditions, and

WHEREAS, lack of adequate water pressure could cause serious fire protection problems, and

WHEREAS, it has been determined that a watering ban must be implemented in order to assure the safety and well being of citizens of the city.

NOW, THEREFORE, BE IT RESOLVED that the Mayor and Council of the City of _____ hereby establish restrictions for all residents, commercial, and industry that use municipal water as follows:

1. Residents with an odd house number shall water lawns or wash cars when necessary only only on odd-numbered calendar days, and those with even-even numbered addresses shall water lawns or wash cars only on even-numbered days.

2. On those days, properties shall not water between the hours of 10:00 a.m. and 6:00 p.m..

3 An exception shall be granted for recently established lawns. Those lawns may be watered daily for up to one months after installation, but only during the hours listed above.

4. Municipal water customers who have been notified of the said restrictions, and who violate the watering ban, shall be fined _____ on the first day and _____ each additional day.

5, The violation ticket will be issued immediately.

Adopted by the Mayor and the City Council for the City of _____ , on this day of _____ 1996.

Attest:

_____

City Administrator

_____

City Mayor

Motion by _____

Second by _____

SPRINKLING BAN

If the storage level gets to _____ feet:

Odd/Even numbered days-
6:00 a.m. to 9:00 a.m. and 6:00 p.m. to 9:00 p.m.

If the storage level gets to _____ feet:

Odd/Even numbered days-
6:00 a.m. to 9:00 a.m. only

If the storage level gets to _____ feet:

Total Sprinkling Ban

RESTRICTED HOURS FOR SPRINKLING

Whenever the City Council determines that a shortage of water supply threatens the City, it may, by resolution, limit the times and hours during which city water may be used for sprinkling, irrigation, car washing, air conditioning, or other specified uses. Such directive shall be posted in the City Hall and published once in the official newspaper of the City. After such posting and publication , any person who violates this restriction will be guilty of a petty misdemeanor and subject to fines in excess of _____ . Violation tickets will be issued immediately by the local Police Department and Water Utility personal. Such emergency directive shall remain in effect until the City Council terminates such water usage limitation.

ODD-EVEN SPRINKLING BAN

The City of _____ has an voluntary/mandatory odd-even sprinkling ban in conjunction with a 10:00 a.m. and 6:00 p.m. ban effective May 1, through September 1. Customers whose house number ends in an odd number may water after 6:00 p.m. and before 10:00 a.m. on odd numbered calendar days, and those whose house number ends in an even number may water in accordance to above hour restrictions on an even numbered calendar day. This applies to all municipal water users.

EXAMPLE

1. First Violation - written warning.

2. Second Violation - A fine of _____ will be given on the first day and _____ given on each additional day.

3. Third Violation - The Water Utility will disconnect service at the street until the resident agrees to comply with the restrictions. .A separate _____ fee will be assessed to reconnect service.

4. Violation ticket will be issued immediately.

Minnesota Department of Natural Resources

DNR Waters, 1200 Warner Road, St. Paul, MN 55106
Telephone: (651) 259-5845 Fax: (651) 772-7977

July 31, 2009

The Honorable Greg Ardner
Mayor, City of Mora
101 Lake Street South
Mora, MN 55006

RE: PUBLIC WATER SUPPLY PLAN APPROVAL, CITY OF MORA, KANABEC COUNTY

Dear Mayor Ardner :

The Department of Natural Resources (DNR) Waters has completed the review of City of Mora's Public Water Supply Plan. I am pleased to advise you that in accordance with Minnesota Statutes, Section 103G.291, Subdivision 3, and on behalf of the Commissioner of Natural Resources, I hereby approve your Plan.

Your City should be commended for its water use. Mora's per capita use of 49 gallons per day is below state averages and has declined over time. Your summertime peaking ratio is also well below state averages

The Water Supply Plan states that the City of Mora does not currently have a water use ordinance, though you are looking into adoption of such ordinances. We encourage Mora to develop and adopt an ordinance that clearly states which positions have the authority to call for, and enforce, water use restrictions during droughts, system failures, or other emergencies. The ordinance should also include, or make reference to, appropriate trigger points for the implementation of restrictions.

During our review of the Plan, we noted that there is very little groundwater level data from the Mora area. Your Plan states that the City takes monthly readings from all three city wells, and it included monthly static water level readings from your municipal wells. We are requesting that you submit those water level readings to the Department annually with your water use report. At a minimum, we are requesting monthly static readings from each well. More frequent readings are recommended during periods of high water use. Information on recording and submitting water level information is attached. An Excel spreadsheet for recording data will be sent to city staff shortly.

Your Plan states that the City will adopt a conservation rate structure prior to 2013. As you know, public water suppliers serving more than 1,000 residents will need to adopt a conservation rate structure before January 1, 2013, or before requesting an increase in the permitted pumping volume. I have attached an information sheet that describes and gives examples of water rate structures that encourage conservation.

If you have any questions, please contact your Area Hydrologist Mike Mueller in our Cambridge Area Office, at 763-689-7105.

Thank you for your efforts in planning for the future of Mora's water supply and for conserving the water resources of the State of Minnesota.

Sincerely,

Dale E. Homuth
Regional Hydrologist

Enclosures – Conservation Rate fact sheet, Monitoring information

c: Doug Klamerus, SEH
Mike Kroon, Mora Utilities
Laurel Reeves, Water Appropriation Program Manager
Mike Mueller, Area Hydrologist
Marshall Deters, Staff Hydrologist
Michael MacDonald, Ground Water Level Monitoring Coordinator

Appendix D

Wellhead Protection Program Evaluation Template

(YOUR CITY/SYSTEM NAME HERE)

Wellhead Protection Program Evaluation

Evaluation Completed By (Wellhead Protection Manager): _____

Date Evaluation Completed: _____

Plan Evaluation Frequency (according to WHP Plan): □ 1 year □ 2.5 years

Copies of Evaluation Presented or Sent To:

□ Minnesota Department of Health
Environmental Health Division
Drinking Water Protection Section
Sourcewater Protection Unit
625 North Robert St.
P.O. Box 64975
St. Paul, MN 55164-0975

□ (Your City's Name) City Council
(Date Presented)

□ City's Wellhead Protection File

□ MRWA Planner

Signed: _____ WHP Manager Date: _____

I. Changes to Water System, Delineations, or Contaminant Sources

A. List the unique number and locations of new wells installed since the last Plan evaluation:

1. _____Date online:_____Delineation completed?____

2. _____Date online:_____Delineation completed?____

B. List any new facilities or changes in current facilities in the DWSMA(s) that may be of concern with regard to groundwater quality? List the facility name, and nature of concern:

Name of Facility	Change	Distance to Well	Well #	Date Change Made
1.				
2.				
3.				
4.				

C. Was any component of the contingency plan implemented by your system at any time since the last program evaluation?

☐ Yes (What was the reason?_____)
☐ No

List changes that are needed in the contingency plan and **update the plan accordingly**.

1.

2.

II. WHP PLAN EVALUATION APPROACHES

In letter A – D below, complete the sections that apply to the evaluation approaches that were specified in your WHP Plan, Chapter 6.

A. Sampling the quality of groundwater throughout the DWSMA:
(Summarize efforts or attach report of sampling results and conclusions.)

B. Documenting inventory control of potential contaminants.
(Summarize efforts.)

C. Documentation of the implementation of wellhead protection measures.
(Summarize efforts.)

D. Using monitoring data that is required by existing laws and rules in effect at the time of plan adoption.
(List data used and summarize conclusions made from data.)

III. New WHP Data

A. List any new data that relates to WHP delineations or source management (i.e., groundwater study results, water quality monitoring data, well construction logs, etc…) that may be used during the next update of the WHP Plan.

Nature of Data	Source of Data
1.	
2.	
3.	
4.	

IV. Plan Implementation Administrative and Financial Concerns

A. Estimate the annual cost of plan implementation for each plan year including staff time and actual dollar amount spent.

Year 1--_____ Year 6--_____

Year 2--_____ Year 7--_____

Year 3--_____ Year 8--_____

Year 4--_____ Year 9--_____

Year 5--_____ Year 10--_____

B. Estimate full time equivalency (FTE) spent on WHP implementation in term of percentage of FTE.

FTE=_____%

C. Has the WHP budget been adequate to conduct WHP implementation activities during the last evaluation period?

☐ **Yes** ☐ **No**

If no, where could it improve?

D. Itemize difficulties incurred during your plan implementation.

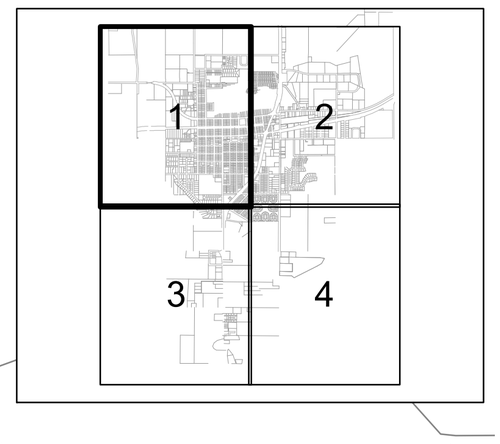
Appendix E

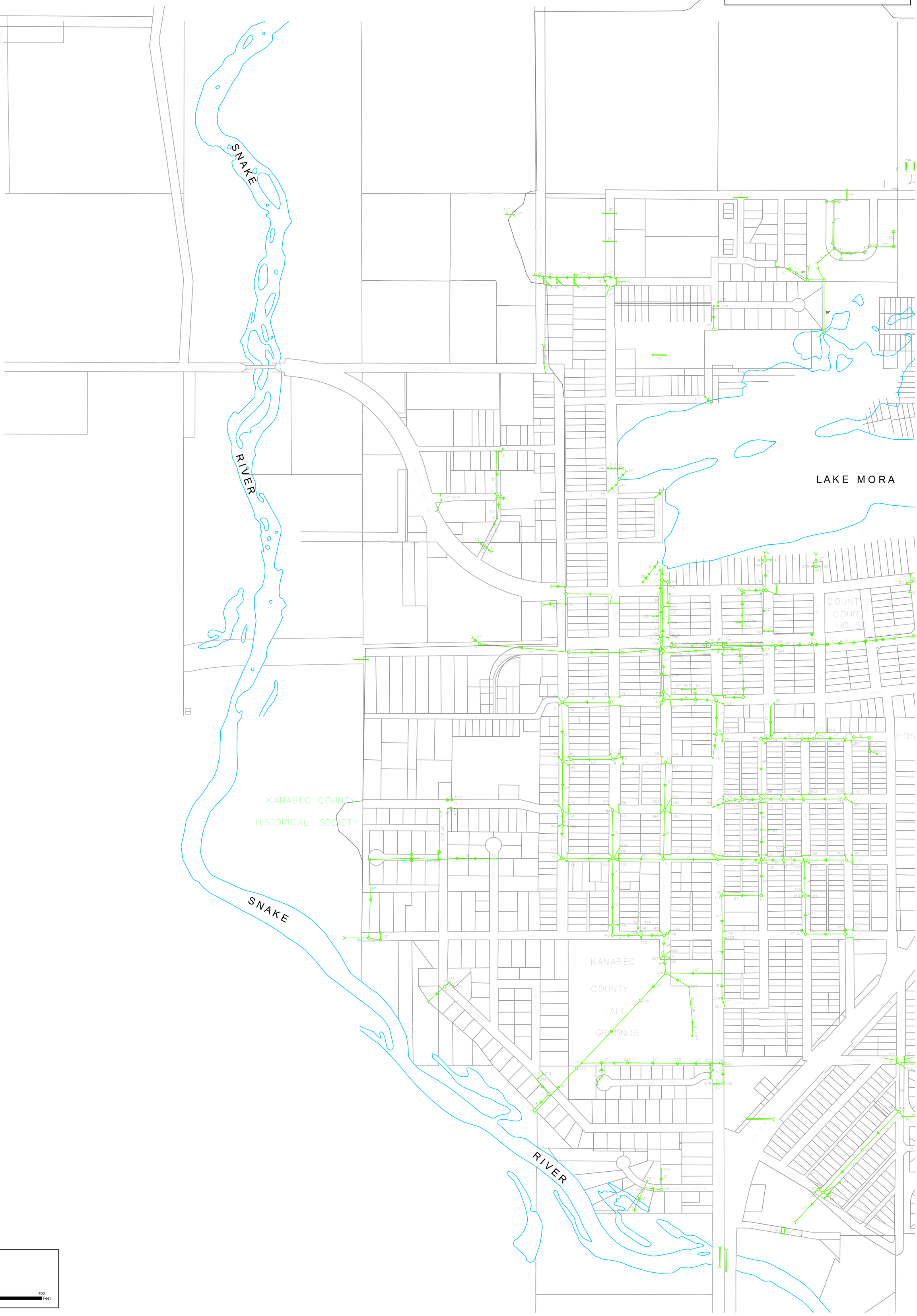
Detailed Storm Sewer System Mapping

Legend

CAD Data

- Storm System
- Manhole
- Apron
- Airport
- Curb
- Sidewalk
- Lotline
- ROW
- Trails
- Road
- Water





Path: S:\KOM\Mora0\Common\GIS\BaseMaps\Storm.mxd

0 175 350 700 Feet

Project: MORA0 000000
Print Date: 01/23/2013

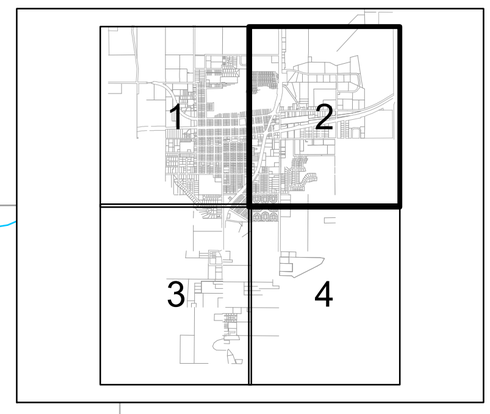
Map by: SRH
Projection: NAD 1983 HARN Adj MN Kanabec Feet
Source: City of Mora and SEH.

STORM UTILITIES
Mora, Minnesota

Legend

CAD Data

- Storm System
- Manhole
- Apron
- Airport
- Curb
- Sidewalk
- Lotline
- ROW
- Trails
- Road
- Water



SPRING LAKE

AIRPORT

INDUSTRIAL ROAD NORTH

INDUSTRIAL PARK BLVD.

MAPLE AVE.

HOSPITAL

FOREST AVE.

EDWARDS AVE.

MORILE HOME PARK

PRIVATE ROAD

Path: S:\KOM\Mora0\Common\GIS\BaseMaps\Storm.mxd

0 175 350 700 Feet

Project: MORA0 000000
Print Date: 01/23/2013

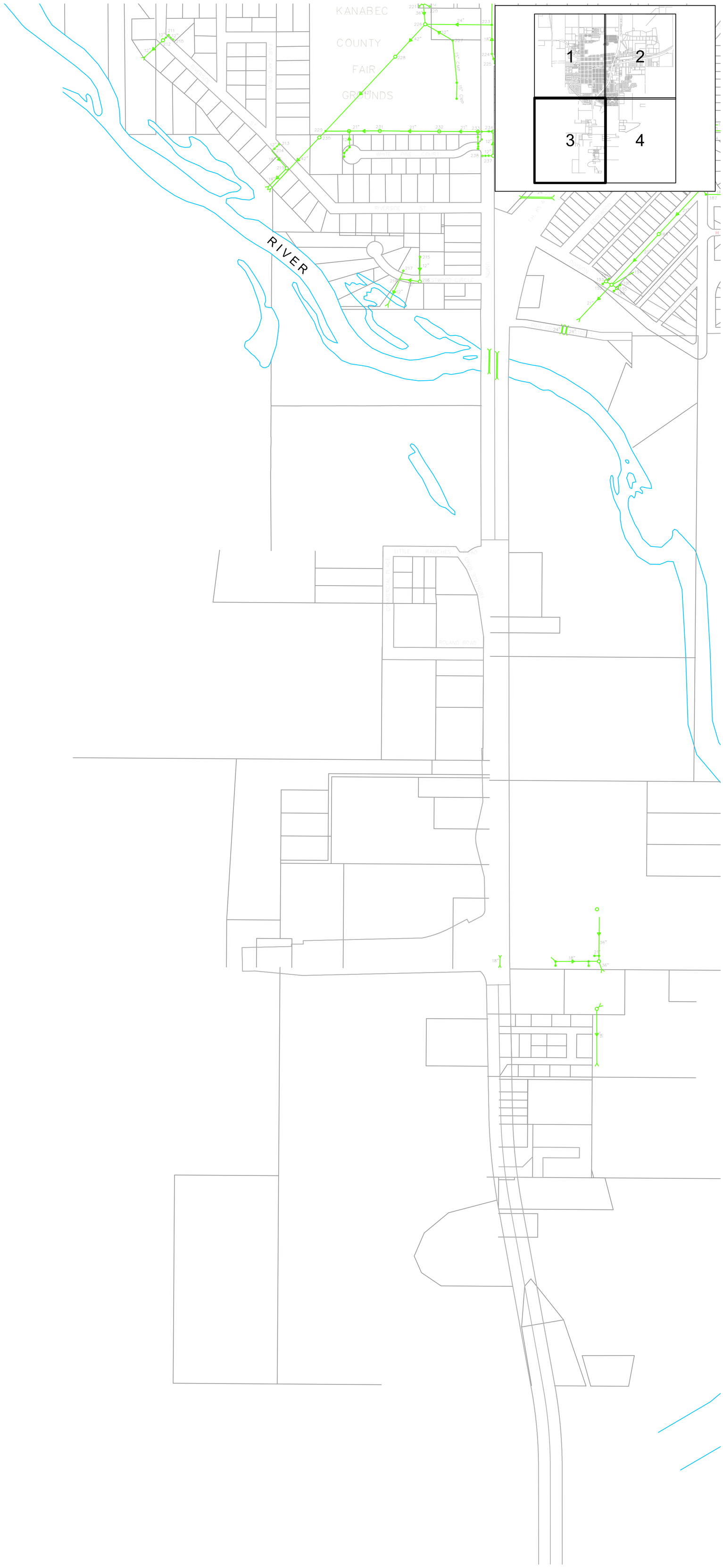
Map by: SRH
Projection: NAD 1983 HARN Adj MN Kanabec Feet
Source: City of Mora and SEH.

STORM UTILITIES
Mora, Minnesota

Legend

CAD Data

- Storm System
- Manhole
- Apron
- Airport
- Curb
- Sidewalk
- Lotline
- ROW
- Trails
- Road
- Water



Path: S:\KOM\Mora0\Common\GIS\BaseMaps\Storm.mxd

0 175 350 700 Feet

Project: MORA0 000000
Print Date: 01/23/2013

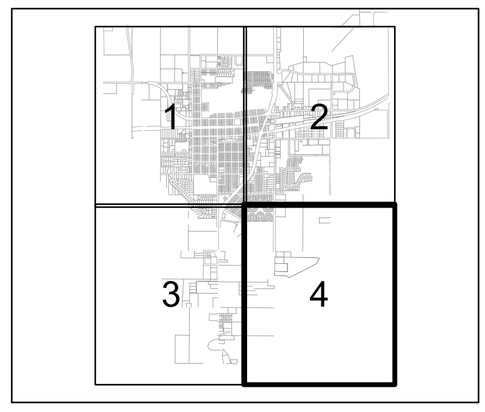
Map by: SRH
Projection: NAD 1983 HARN Adj MN Kanabec Feet
Source: City of Mora and SEH.

STORM UTILITIES
Mora, Minnesota

Legend

CAD Data

- Storm System
- Manhole
- Apron
- Airport
- Curb
- Sidewalk
- Lotline
- ROW
- Trails
- Road
- Water



MOBILE HOME PARK

PRIVATE ROAD

SNAKE

RIVER

RIVER

ANN

0 175 350 700 Feet

Path: S:\KOM\Mora0\Common\GIS\BaseMaps\Storm.mxd

Project: MORA0 000000
Print Date: 01/23/2013

Map by: SRH
Projection: NAD 1983 HARN Adj MN Kanabec Feet
Source: City of Mora and SEH.

STORM UTILITIES
Mora, Minnesota

Appendix F

Wellhead Protection Plan – Part I

Part I Wellhead Protection Plan

Wellhead Protection Area Delineation
Drinking Water Supply Management Area Delineation
Well and Drinking Water Supply Management Area Vulnerability Assessments

City of Mora, Minnesota
SEH No. MORA 109696

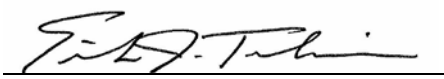
July 2012

DRAFT Part I Wellhead Protection Plan
City of Mora, MN

SEH No. MORA 109696

July 2012

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Geologist under the laws of the State of Minnesota.



Erik J. Tomlinson, PG, LEED AP

Date: 7/23/2012 Lic. No.: 46739

Reviewed by: _____ _____
Gail Haglund, MDH Date

Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
Saint Paul, MN 55110

Source Water Solutions, LLC
213 4th St. E, Suite 418
St. Paul, MN 55101

Distribution List

No. of Copies	Sent to
1	Ms. Gail Haglund Minnesota Department of Health Freeman Building 625 Robert St. N. P.O. Box 64975 St. Paul, MN 55164-0975

Table of Contents

Table of Contents

		Page
1.0	**Public Water Supply Profile**	**1**
1.1	Wellhead Protection Manager	1
1.2	Wellhead Protection Plan Consultant	1
2.0	**Introduction**	**2**
2.1	Data Elements	2
2.2	Geological Setting	5
2.3	Hydrogeologic Setting	7
3.0	**Delineation of the Wellhead Protection Area**	**8**
3.1	Criteria Used to Delineate the Wellhead Protection Area	8
3.2	Method Used to Delineate the Wellhead Protection Area	10
3.3	Conjunctive Delineation	13
3.4	Results of Model Calibration and Sensitivity Analysis	11
4.0	**Delineation of the Drinking Water Supply Management Area**	**13**
5.0	**Vulnerability Assessments**	**14**
5.1	Assessment of Well Vulnerability	14
5.2	Vulnerability Assessment for the Drinking Water Supply Management Area	15
6.0	**Recommendations**	**15**
7.0	**Standard of Care**	**16**
8.0	**References**	**16**

Table of Contents (Continued)

List of Tables

Table 1 – Municipal Well Details
Table 2 – Municipal Well Production and Use
Table 3 – Local and Regional High Capacity Wells
Table 4 – Precipitation Data
Table 5 – Groundwater Flow Model Parameters

List of Figures

Figure 1 – Mora Wellhead Protection Area
Figure 2 – Mora DWSMA
Figure 3 – Surficial Geology
Figure 4 – Bedrock Geology
Figure 5 – Water Resources
Figure 6 – Land Cover
Figure 7 – SSURGO Soils
Figure 8 – Model Boundary Conditions
Figure 9 – Recharge Zones
Figure 10 – Layer 1 Hydraulic Conductivity
Figure 11 – Layer 2 Hydraulic Conductivity
Figure 12 – Modeled Head (2 Meter Contours)
Figure 13 – Modeled Head and Pathlines
Figure 14 – DWSMA Vulnerability

List of Appendices

Appendix A - MDH Scoping 1 Decision Notice
Appendix B - Geologic Cross Sections
Appendix C - MDH Water Quality Data
Appendix D- Aquifer Test Plan and Pump Test Data
Appendix E- Model Files (CD)
Appendix F - GIS Files (CD)
Appendix G - MDH Well Vulnerability Sheets

Part I Wellhead Protection Plan

Prepared for the City of Mora, Minnesota

1.0 Public Water Supply Profile

The following persons are the contacts for the Mora Wellhead Protection Plan.

1.1 Wellhead Protection Manager

Mike Kroon
Water Superintendant
City of Mora
101 Lake Street South
Mora, Minnesota 55051

Telephone: 320.679.1511
Fax: 320.679.3862

1.2 Wellhead Protection Plan Consultant

Erik J. Tomlinson, PG
Source Water Solutions, LLC
213 4th St. E., Suite 418
St. Paul, MN 55101

Telephone: 612.354.2549
Email: erik@sourcewater-solutions.com

2.0 Introduction

This Part I Wellhead Protection Plan (WHPP) presents the technical discussion of the delineation of the Wellhead Protection Area (WHPA) and Drinking Water Supply Management Area (DWSMA) and the assessments of well and DWSMA vulnerability. This work was performed by Source Water Solutions, LLC and Short Elliott Hendrickson, Inc. (SEH) at the request of the City of Mora (the City) and meets WHP planning requirements that are specified in Minnesota Rules 4720.5100-4720.5590.

A computer groundwater model was created using the MODFLOW finite-difference flow model and was used to calculate the subsurface capture area for the primary water supply wells used by the City of Mora. Municipal well details are provided in **Table 1**. The WHPA delineation is provided in **Figure 1**. Discussion of the WHPA delineation is presented in Section 2 of this Plan.

The DWSMA boundaries (**Figure 2**) were determined using geographic features, such as roads, fence lines, or property boundaries that the public can visualize. The actual features that were used and the process for defining the DWSMA boundaries are discussed in Section 3 of this Plan.

The wells used by the Public Water Supplier were assessed for their intrinsic vulnerability. The methodology for conducting the well vulnerability assessments is presented in Section 4 of this Plan, as is the methodology that was used to determine the DWSMA vulnerability.

2.1 Data Elements

In accordance with Minnesota Rule Chapter 4720.5400 and the January 4, 2010 Minnesota Department of Health (MDH) Scoping Decision Notice No. 1 (**Appendix A**), the following section discusses the required data elements for this Plan. In summary, the required data elements included all or portions of: geologic conditions, water resources, land use, public utility services, surface water quantity, groundwater quantity, and groundwater quality.

Precipitation: The average annual precipitation for the area around the Public Water Supplier during the five-year period from 2007-2011 was obtained from Minnesota Climatology Working Group, which is a joint effort between the University of Minnesota and the Minnesota Department of Natural Resources (DNR).

A recent United States Geological Survey (USGS) report (Delin 2009) and associated shapefile of calculated recharge rates for the state of MN was used as a starting point for recharge values. The average precipitation amount was used in conjunction with the interpretation of subsurface geological conditions and water chemistry data to verify recharge to the aquifer that is used by the Public Water Supplier.

Soils: Soils information was obtained from the U.S. Dept. of Agriculture Natural Resources Conservation Service Soil Survey Geographic (SSURGO) Database for Kannabec County, MN. The MDH also provided a soils shapefile that included infiltration characteristics. Soils information was used to refine the understanding of the surficial geology, validate recharge rates, and used in conjunction with other geologic and groundwater quality data to define the DWSMA vulnerability.

Geological Information: The local and regional geologic and hydrogeologic conditions influence the delineation of the WHPAs for the public water supply wells. By characterizing

these conditions, the geometry, location, and magnitude of groundwater recharge and discharge areas, and the groundwater flow direction of the source water aquifer could be determined or estimated.

Existing geological maps, reports, and studies that were used are listed in the References section of the plan. Through the use of public-domain well records and local and regional geologic studies and publications, the geology and hydrogeology of the area have been evaluated and reviewed to aid in the WHPA delineations and vulnerability assessments. These resources were provided by the City, the MDH, the Minnesota Geological Survey (MGS), and the USGS. Geologic Cross Sections were created and provided by the MDH and are presented as **Appendix B**.

These resources provided the basis for defining local geologic and hydrologic conditions, but this interpretation was refined using soils data, exposures of geological materials, and the records of wells, borings, exploration test holes, and excavations. The City has no additional geologic information from logs or borehole geophysical records of wells, borings, or exploration test holes, nor additional information from surface geophysical studies.

Specifically, a surficial geologic map (**Figure 3**) was prepared to define the lateral extent of the aquifer and its relationship to non-aquifer materials. A bedrock geologic map is presented as **Figure 4**. County Well Index boring logs were used to verify the extent of the surficial geology and the presence of bedrock at depth.

All of this geological information was used to define hydrogeologic boundaries that were incorporated into the delineation of the WHPA and used to assess DWSMA vulnerability. Also, the construction information about the public water supply wells was used in conjunction with groundwater quality data to assess well vulnerability.

Water Resources Information: Existing maps of major and minor watershed boundaries and wetlands were used in conjunction with water levels obtained from well records that are in CWI to identify areas where possible groundwater flow divides occur within the aquifer that is used by the Public Water Supplier.

The regional influence on the source water aquifer of major rivers in the area (e.g. the Snake River) and lakes (e.g. Mora Lake) has been accounted for in the groundwater flow modeling when delineating the WHPA.

The City of Mora and its municipal water wells are located within the Snake River major (Level 4) watershed. The Snake River watershed is very large, covering approximately 643,500 acres in Mille Lacs, Pine, Aitkin, Chisago, Isanti, and Kannabec Counties. The minor (Level 8) watershed in which the City's wells are located is the Middle Snake River watershed. The Snake River flows north-south, approximately ½ mile to the west of the City's wells.

Several small lakes, wetlands, and intermittent streams surround the City of Mora. Many of these water bodies are assumed to directly influence the WHPAs and DWSMAs of the municipal wells. This was based upon the mapped surficial geology data as well as stable isotope analytical data. Lake Mora is located directly to the north of the City wells, and although there is documented fine grained sediments found at the bottom of the lake, there is analytical data that shows a strong connection to the underlying sand and gravel aquifer. Many other small water bodies were located in areas overlying mapped glacial till units.

These features were assumed to be hydraulically independent of the sand and gravel aquifer as they are located in clay rich areas that likely have little hydraulic interaction with the aquifer below. Water Resources of the study area are presented in **Figure 5**.

The MDH provided the City with stable isotope, tritium, chloride, and chloride-bromide ratio data. These data indicate that there is a connection between the waters of Lake Mora and the City's water supply wells. A summary table of this data is provided as **Appendix C**.

Land Use Information: Political boundaries, U.S. Public Land Survey coordinates, and the center lines of highways, streets and roads were used to define the boundaries of the DWSMA.

Figures have been included in this Plan showing political boundaries and roadways, as well as public land surveys including township, range, and section boundaries. This information was primarily used to delineate the DWSMA and determine whether the limits of the DWSMA cross political boundaries. Specific land uses and zoning within and adjacent to the DWSMA will be reviewed, evaluated, assessed, and presented in Part II of the Plan.

Figures have been included in this Plan depicting the major transportation routes and corridors within the Mora area. However, sanitary and storm sewer coverage and presence of large-scale pipelines within the DWSMA will be examined in Part II of the Plan. Existing Landuse is presented in **Figure 6**.

Water Quantity Information: Since other wells in the Mora area influence the groundwater flow field of the source water aquifer, private and public wells were evaluated and assessed in detail during the delineations of the WHPAs for the City's public water supply wells. In addition, specific information related to the construction, maintenance, and use of the municipal wells has been compiled, utilized, and presented in the Plan (**Table 1**). This information was also used in delineating the WHPAs and completing the vulnerability assessments.

Groundwater pumping information from high capacity wells was obtained from the State Water Use Data System (SWUDS) that is maintained by the DNR. The annual pumping reported by the Public Water Supplier was used in determining the daily volume of water that is discussed in Section 2 of this Plan (**Table 2**). Furthermore, SWUDS data, combined with well construction records in CWI, was used to identify other high capacity wells that needed to be included in delineating the WHPA because they constitute a flow boundary (**Table 3**).

The Mora public water supply system currently uses and relies upon one source water aquifer, the Surficial Sand and Gravel Aquifer. All three active municipal wells (Wells 4, 5, and 6) are open to this aquifer. The sand and gravel aquifer appears adequate to meet the City's current and future water demand. The City has no immediate plans to replace or add municipal wells, or utilize any other source of water supply.

The City has provided the 2007-2011 water use and pumping volume records presented in this Plan to determine an appropriate discharge rate for the wells in delineating the WHPAs. In addition, the City has estimated is projected increase in groundwater use for 2015.

Currently, there are no known, significant, groundwater-use conflicts between the City and other parties.

Water Quality Information: The sand and gravel source water aquifer appears to be in direct hydrologic connection with surface waters or the land surface. Available groundwater quality information was used to characterize; the rate of recharge to the aquifer used by the Public Water Supplier, the degree of hydraulic connection between it and surface hydrologic features, and to assess DWSMA vulnerability. It is suggested that this information in conjunction with surface water quality data be utilized when updating the City's WHPP. Also, groundwater and surface water quality information will be able to be used to update well vulnerability.

The quality of the groundwater in the source water aquifer, and in the Mora area specifically, must be evaluated and assessed for this Plan. Groundwater contamination and undesirable groundwater quality will directly impact the public water supply system. Certain naturally-occurring constituents in the groundwater also provide information that can be used to determine the vulnerability of the source water aquifer. The City publishes an annual consumer confidence report that contains water quality data collected over the course of the year.

Due to a lack of fine-grained, clay-rich deposits directly overlying the sand and gravel aquifer in the area of Mora Well 6, as well as upgradient (north) of Wells 4 and 5, the water table sand and gravel aquifer is highly or very highly sensitive to pollution from land surface activities. As described above, there also appears to be a direct connection between Lake Mora and the sand and gravel aquifer. This indicates that contaminants released at the land surface, or to the surface waters of Lake Mora, could reach the aquifers within or hours to months.

Water samples from the public water supply system are routinely collected and analyzed by the MDH as required under the Minnesota Public Water Supply Program and the federal Safe Drinking Water Act. The samples are tested for microorganisms, inorganic compounds, organic chemicals, pesticides and herbicides, and radioactive contaminants. The MDH also provided the City with stable isotope, tritium, chloride and chloride-bromide ratio data. These data indicate that there is a connection between the waters of Lake Mora and the City's water supply wells. A summary table of this data is provided as **Appendix C**.

The overall quality of groundwater in Mora is good. No contaminants were detected at levels that violated the federal drinking water standards. Some were detected in trace amounts that were below legal limits. The City of Mora's 2010 Consumer Confidence Report is available on the City's website at:

http://www.ci.mora.mn.us/vertical/Sites/%7B10E9A731-228C-4FE8-9EA3-018C1162BBAE%7D/uploads/2010_ccr.pdf

2.2 Geological Setting

The Public Water Supplier is located in south central Kanabec County within the Middle Snake River watershed in a region of glacial, fluvial, and lacustrine sediment of the Superior provenance, deposited by the Superior lobe. The physiographic and geological conditions of the area impact the yield and vulnerability of the aquifer used by the Public Water Supplier.

The Middle Snake River watershed covers approximately 10,460 acres in Kanabec County of primarily agricultural land with scattered areas of forested and residential land uses (**Figure 6**).

Topography

The municipal wells are located within the city limits which is developed and generally flat sloping slightly to the north to Lake Mora and to the west to the Snake River. The greatest topography change is along the river valleys of the Snake River to the west and Spring Brook to the southeast. Both water bodies cross the quaternary sequences in the modeled area. There are also major and minor lakes that were modeled within the vicinity of the City wells.

Soils

Due to the glacial history in the area, soils in the Mora area (**Figure 7**) vary greatly and consist of Rosholt-Chetek complex, Milaca-Brennyville complex, Antigo-Chetek complex, Brennyville complex, Graycalm-Grayling complex, and Mahtomedi-Chetek complex soils on slopes from 0 to 30 percent slopes. These soils were formed in sediments from outwash plains, stream terraces, moraines, drumlins, and interdrumlins (SSURGO, 2011). A soils map is provided as **Figure 7**.

Surficial Geology

Surficial geology in the area of interest are of the Cromwell formation which consists of glacial, fluvial and lacustrine sediments of the Superior provenance. This material was deposited by the Superior lobe and its meltwater (Meyer 2008). The surficial geology consists of approximately 165 feet of undifferentiated drift, mainly till with some sand and gravel. The glacial drift overlies outwash of sand and gravel. More specifically, the sand and gravel outwash is characteristic of old northeast-southwest trending glacial eskers. These sinuous ridges of sand and gravel were formed by glacial meltwater discharged from the base of a glacier in ice walled tunnel valleys, creating a wide streambed which fills in with gravel and becomes buried in the current landscape. The eskers in Kanabec County were interpreted to have been laid down by Superior lobe meltwater (Meyer 2008). These features and the surficial geology can be found in **Figure 3**.

Bedrock Geology

The bedrock geology of Kanabec County consists of Meso-proterozoic age bedrock of the Hinckley and Fond du Lac Formations. These formations are part of the Keweenawan Supergroup and are encountered at approximately 805 feet amsl, or 215 feet bgs. The bedrock of the Hinckley Formation consists primarily of a medium to coarse grained, poorly sorted, quartz sandstone that dips southeastward at about 10-15 degrees. Underlying the Hinckley Formation are coarse grained arkosic sandstones and conglomerates of the Fond du Lac Formation. Interbedded shales occur in both the Hinckley and Fond du Lac Formations. No detailed bedrock maps exist for Kanabec County. **Figure 4** displays the coarse bedrock geology delineation taken from the available MGS Publication S-20, Bedrock Geology of MN.

Precipitation

The average annual precipitation for the area around the Public Water Supplier during the five-year period from 2007 to 2011 was obtained from Minnesota Climatology Working Group, which is a joint effort between the University of Minnesota and the DNR. The observations were recorded at a weather station that is located about 1 mile from Mora, MN (**Table 4**).

Table 4
Precipitation Data

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2007	0.96	2.12	3.16	2.81	1.63	2.4	2.31	4.51	5.94	5.46	0.06	1.53	32.89
2008	0.06	0.64	0.94	5.73	4.47	5.5	4.31	2.03	6.02	3	1.26	1.78	35.74
2009	0.57	0.91	2.46	1.46	1.09	2.89	4.65	6.17	0.94	6.05	0.44	1.71	29.34
2010	--	0.38	1.07	1.08	3.34	7.19	5.08	9.01	5.01	3.35	--	--	35.51
2011	--	--	--	1.64	7.14	3.23	5.82	5.39	0.59	--	0.22	--	24.03

Notes: All values are in inches. (--) denotes no data available.

Data obtained from MN Climatology Working Group for Mora station (State Climatology Office - DNR Waters, phone: 651-296-4214, web: http://climate.umn.edu).

2.3 Hydrogeologic Setting

Municipal Wells 4 and 5 are located in Section 11 and Municipal Well 6 is located in Section 14 of Township 39 North, Range 24 West. Well construction is summarized in **Table 1.** The aquifer utilized by the City's wells is generally composed of glacial sands and gravels and exhibits the following characteristics within the WHPA:

- Thickness ranges from 25 to 70 feet, and
- Has a base elevation of 797 feet above sea level.

The area containing Mora's municipal wells is bound by three bodies of water: Lake Mora to the north, the Snake River to the West, and Brook Spring to the East. Groundwater flows west-southwest toward the Snake River in the study area. A relatively small amount of groundwater migrates downward through glacial drift and into the bedrock.

The buried, semi-confined, unconsolidated aquifer within the Sand Plain Aquifer has high transmissivity. This high transmissivity is apparent in data collected and assessed in the Lake Mora Management Plan (BWS, 2002). The aquifer is more confined in the vicinity of Wells 4 and 5. Boring logs for Wells 4 and 5 show approximately 20 and 80 feet of cumulative clay thickness, respectively. The clay, however, does not exist at Well 6.

There is an apparent correlation between water elevations measured from the Snake River, Lake Mora, and local wells. Lake Mora's elevation mimics that of the regional unconfined shallow water table. During large precipitation or snowmelt runoff events, Lake Mora's elevation will decrease to match the groundwater elevation by seeping out of the sandy lake margins.

During a measured base-flow period (September 5-7, 1967), approximately 70 % of the discharge at the Snake River near Pine City gauging station (approximately 17.5 miles east of Mora Lake) was attributed to groundwater discharging from the surficial outwash aquifers and Hinckley-Fon du Lac aquifer directly to the main channel of the Snake River.

High yield wells are present within the unconfined aquifer. High yield wells in the area have localized drawdown effects, but do not significantly affect the regional groundwater table.

3.0 Delineation of the Wellhead Protection Area

3.1 Criteria Used to Delineate the Wellhead Protection Area

The criteria for delineating the WHPA, as required in Minnesota Rules 4720.5510, were addressed as follows.

Time of Travel

A 10-year time of travel was used to characterize groundwater movement in the aquifer that is used by the community water supply wells. Also, a one-year time of travel was used to define the emergency response area, as specified under Minnesota Rules 4720.5250. The 1- and 10-year capture zone boundaries are shown in **Figure 1.**

Daily Volume of Water Pumped

Information provided by the Public Water Supplier was used to determine the maximum discharge from each well. The results presented in **Table 2** reflect the total number of gallons pumped annually by each well and reported to the DNR under Groundwater Appropriations Permit No.1963-1039 for the years 2006 to 2010.

The maximum annual volume pumped by each well over the time period from 2006 to 2010 (projected amount over the next 5 years) was used to calculate the daily volume of discharge that was used in the groundwater flow model. The greatest annual pumping volume was divided by 365 days to calculate daily discharge. Gallons were converted to cubic meters to reflect groundwater model input requirements.

The historical (2006-2010) and projected (2015) pumping volumes for each of the public water supply wells are summarized in **Table 2**. The historical data was provided by the City, and the projected volumes were based on City estimates and historical water use trends. The highest volumes for each well are highlighted in the table. These volumes were converted to pumping rates and used in the groundwater flow modeling to delineate the 1-year and 10-year capture zones.

Groundwater Flow Field

Generally, groundwater flows toward the city wells from the northeast through the buried sand and gravel channel aquifer. Geologic boundaries between the aquifer and surrounding geologic materials affect the orientation of the flow field and the corresponding subsurface capture area for the city wells. This interpretation of the flow field was used to calibrate the flow field that was calculated using the MODFLOW groundwater flow model.

The information provided and presented in the Surficial Geology of the Mora 30'x60' Quadrangle (Meyer 2008) and Water Resources of the Snake River Watershed HA-488 (USGS 1974), were relied upon to define the local and regional groundwater flow field of the semi-confined sand and gravel aquifer. Based on Plate 1 of HA-488, the flow direction of the surficial aquifer is northeast to southwest, and has an estimated potentiometric surface elevation of 970 feet above mean sea level.

Flow Boundaries

The following flow boundaries were identified and incorporated into the delineation of the WHPA:

- Geological boundaries between the channelized sand and gravel aquifer and adjacent till material (till was represented as zones with lower hydraulic conductivites).
- Leaky confining unit above the semi-confined sand and gravel aquifer used by the City wells.
- Surface hydrologic features that provide recharge to the aquifer and/or impact aquifer water quality. The Snake River, Mora Lake, and Spring Lake were included in the model as well as Spring Brook and other smaller lakes and streams. All of the above mentioned hydrologic features were represented as river boundaries.
- The high-capacity wells identified in **Table 3**, in addition to those operated by the Public Water Supplier may impact WHPA the boundaries.
- Vertical infiltration from the surface (recharge).

Aquifer Transmissivity

An aquifer pumping test was conducted for the City on Well No. 6 in 1988. The test was performed in accordance with the Minnesota Wellhead Protection Rules (MN Rules Chapter 4720.5320 and 4720.5520). Existing published data was also found in the USGS Hydrologic Atlas "Water Resources of the Snake River Watershed, East-Central, MN" HA-488. Aquifer tests used in this document were completed using Mora village wells (1,2,3 and 4). An *Aquifer Test Plan* submitted to the Minnesota Department of Health (MDH) staff in February 2011. The aquifer pumping test reports for the Mora tests are provided in **Appendix D**.

The aquifer transmissivity and hydraulic conductivity (K) values derived from these tests were utilized in developing and refining the groundwater flow model used to delineate the WHPA for the sand and gravel source water aquifer. However, to address uncertainties inherently related to the pumping tests and the aquifer, a range of transmissivity and K values were used in the groundwater flow modeling. A conservative K value of 86.4 m/d (1x10-1 cm/s) was used for the glacial sand and gravel in the model. The values presented in the aquifer test plans were a starting point for the hydraulic conductivity values used for the sand and gravel aquifer body. As the model was calibrated, the K value used in the aquifer body was modified. **Table 5** summarizes the final groundwater flow model parameters and **Figures 10 and 11** show the hydraulic conductivity zones used in the model.

3.2 Method Used to Delineate the Wellhead Protection Area

A numerical groundwater model was developed to delineate the 10 year capture zones for the City's water supply wells. Based upon the sensitivity of the aquifer and the documentation of a hydraulic connection between Lake Mora and the aquifer, a delineation of the potential surface water contribution area was also required for the City's wellfields.

The final WHPA delineation is a composite of the numerical model delineation and the conjunctive delineation including surface water contribution areas. The WHPA delineation is shown in **Figure 1**.

Conceptual Groundwater Model

A two layer conceptual model was developed for the sand and gravel aquifer utilized by the City. The upper layer consists of unconfined sand and gravel zones as well as silt and clay till zones. These areas were identified in the surficial geology maps and verified by boring log data (**Figure 10**). The second layer consists of a sand and gravel body utilized by the City's municipal wells surrounded by a lower permeability unit similar to the silt and clay till zones in Layer 1 (**Figure 11**). Although the sand and gravel aquifer utilized in the areas of Wells 4 and 5 are locally confined, the two layers are hydraulically connected by the regional sand and gravel zones found in Layer 1. Aquifer thickness and bedrock surface topography were key factors in determining the groundwater flow fields. An aquiclude, or very low permeability bedrock layer, underlies both layers. The bedrock was not represented in this groundwater simulation model. The Snake River is a major groundwater discharge area and Lake Mora is a major groundwater source. These features, along with the other regional water bodies, were assigned river head boundaries.

Numerical Groundwater Model

MODFLOW is the name that has been given the USGS Modular Three-Dimensional Ground-Water Flow Model. Because of its ability to simulate a wide variety of systems, its extensive publicly available documentation, and its rigorous USGS peer review, MODFLOW has become the worldwide standard ground-water flow model. MODFLOW is used to simulate systems for water supply, containment remediation and mine dewatering. MODFLOW is most appropriate in those situations where a relatively precise understanding of the flow system is needed to make a decision. MODFLOW was developed using the finite-difference method. The finite-difference method permits a physical explanation of the concepts used in construction of the model

Groundwater flow within the aquifer is simulated in MODFLOW using a block-centered finite-difference approach. Layers can be simulated as confined, unconfined, or a combination of both. Flows from external stresses such as flow to wells, areal recharge, evapotranspiration, flow to drains, and flow through riverbeds can also be simulated.

Grid Development

Because MODFLOW is a block centered finite-difference model, a grid must be defined over the model domain. The grid spacing and size of cells varies across the model domain. In areas where impact from pumping and accuracy will not impact the capture zones, cells are as large as 243 x 383 meters. In areas where the accuracy of groundwater contours and the delineation of particle pathlines require greater accuracy (around pumping wells and

sources of recharge) the grid spacing is 2.6 x 3.1 meters. The thickness of the cells vary by the aquifer thickness.

Boundary Conditions
River boundaries were used to represent the water bodies in the model including Lake Mora. Due to the unique connection between Lake Mora and the groundwater system, as described above, low conductivity values were used to represent the deep, mucky bottoms of Lake Mora and higher conductivity values were used to represent the sandy near shore portions of Lake Mora. **Figure 8** shows the boundary conditions used to represent natural features in the model. Model files are provided as **Appendix E**.

Upper and Lower Boundary Conditions
The surface topography contours were interpolated from 2 foot contour Digital Elevation Model (DEM) data for Kanabec County. A base elevation of 846 feet msl was used for the bottom of layer 1 and a base elevation of 797 feet msl was used for the bottom of layer 2.

Porosity
A porosity of 0.30 was used for the surficial aquifer in both Layer 1 and 2.

Aquifer Recharge
Recharge values of 0.0004071 and 0.0005644 m/d were used in the model. Recharge zones are depicted in **Figure 9**. The recharge values assigned to this model fall within the ranges of percent precipitation as outlined by the Delin (USGS 2009).

3.3 Results of Model Calibration and Sensitivity Analysis

Model calibration is a procedure that compares the results of a model that are based on estimated input values to measured or "known" values. It is used to define model validity over a range of input values, or the confidence with which model results may be used. As a matter of practice, groundwater flow models are usually calibrated using water elevation or flux.

The Mora WHPP model was calibrated to hydraulic head by referencing modeled head results to the static water elevations in 237 wells that were selected from CWI. Each well was completed in the aquifer used by the Public Water Supplier wells and evaluated whether the reported static water level generally reflects the flow field (**Figures 12 and 13**). The calculated versus observed static water level elevations for each well were compared after each calibration run to determine how varying recharge and hydraulic conductivity produced the best match.

The best head calibration results were obtained by modifying hydraulic conductivity zones in shape and size. The best model calibration to measured heads in wells, however, produced unrealistically high flow out of the river boundary cells representing Mora Lake. This was improved by lowering the conductance values at the bottom of the lake and increasing the conductivity of the cells representing the shoreline of the lake better simulating the low permeability lake bottom sediments and high permeability near shore sediments documented in the Mora Lake study.

Model sensitivity is the amount of change in model results caused by the variation of a specific input parameter while keeping the other parameters constant. Using computer

models to simulate groundwater flow involves representing a complicated natural system in a more simplified manner. Local geologic conditions likely vary within the capture area of the wells, but existing information for the area around the Public Water Supplier is not sufficiently detailed to define this. As a result, the Mora WHPP model cannot represent the natural flow system exactly, but the results are valid when they are based upon a reasonable variation of input parameters. This is accomplished by performing an uncertainty analysis to evaluate uncertainties in the hydrogeologic data that may affect the size and shape of the capture zone for each well.

Groundwater flow direction and extent of the modeled capture zone may be sensitive to any of the model input parameters. The following discussion identifies the model input parameters that have the most significant impacts on the well capture zone.

Pumping Rate directly affects the volume of the aquifer that contributes water to the well. An increase in pumping rate leads to an equivalent increase in the volume of aquifer within the capture zone, proportional to the porosity of the aquifer materials.

Results - The pumping rate is defined by WHP rule requirements and is based on the results presented in **Tables 2 and 3**. Therefore, it is not a variable that will influence the delineation of the WHPA.

The direction of groundwater flow determines the orientation of the capture zone. Variations in the direction of groundwater flow will not affect the size of the capture zone but are important for defining the areas that are contributing water to the well.

Results - The potentiometric map that is produced by the Mora WHPP model closely matches that generated by contouring static water level data. Therefore, the direction of groundwater flow should not have a significant effect on the WHPA delineation given the current knowledge of hydraulic head distribution in the aquifer.

Aquifer transmissivity has a significant impact on the WHPA delineation because existing data indicate that local variability in aquifer composition may cause it to vary by as much as a factor of 10.

Results - To account for this possible variability, a sensitivity analysis was performed by varying the transmissivity over a range of plus and minus a factor of 10 of the calibrated value. Due to the relatively high hydraulic conductivity of the aquifer near the municipal wells, there was very minimal change in the size or direction of the capture zones as the K values were changed.

The thickness and porosity of the aquifer have little influence the size and shape of the capture zone because of the high hydraulic conductivity of the surficial aquifer in the vicinity of the municipal wells.

Results - Decreasing either thickness or porosity causes a nominal linear, proportional increase in the areal extent of the capture zones.

The river conductance values assigned to the river boundaries have a significant influence the size and shape of the capture zone because of the location of Lake Mora. As the conductance values are lowered for Lake Mora, the amount of surface water contributed by the lake is reduced and as the conductance values are raised, the amount of water contributed increases.

Results – Increasing the river conductance values decreases the size of the capture zone, however the volume of surface water contributed by Lake Mora becomes unrealistic. As the river conductance value decreases, the size of the capture zone increases, however the contribution of surface water from Lake Mora gets cut off.

3.4 Conjunctive Delineation

Based upon the sensitivity of the aquifer, the documentation of a hydraulic connection between the surface hydrologic features (Lake Mora) and the aquifer, and the evaluation criteria outlined in the MDH Guidance for Preparing A Conjunctive Delineation dated September 7, 2006, a conjunctive delineation was required for the City's wellfields. This delineation is provided in **Figure 1**. This additional area of potential surficial contribution is identified as the Surface Water Contribution Area. The surface water contribution area was delineated from the lakeshed boundary for Mora Lake and the City storm sewer catchment areas that discharge to Lake Mora.

There is likely contribution from Spring Lake to Mora Lake and potentially the well capture zones. The extent of this connection is not well understood at this point. MDH has recommended that rather than include the Spring Lake lakeshed in the surface water contribution area, additional monitoring be built into the City's Part II WHP Plan to better understand the connection and potential contribution from Spring Lake. The results of this additional monitoring will then be evaluated when the City's WHP Plan is amended.

3.5 Addressing Model Uncertainty

To address model uncertainty, typically, a composite capture zone is delineated in which the value for the parameters, which the model is sensitive to, are varied, within a reasonable range. As identified above, the model was most sensitive hydraulic conductivity and river conductance values. Due to the relatively high hydraulic conductivity of the aquifer near the municipal wells, there was very minimal change in the size or direction of the capture zones as the K values were changed. The model is also sensitive to the river conductance values assigned to the river boundaries, specifically those assigned to Lake Mora. The shape and size of the capture zones did not significantly change as the conductance values were reasonably changed. As described in Section 3.3, as river conductance values increase, the capture zone may decrease, however the volume of water contributed by the river boundary becomes unreasonable.

4.0 Delineation of the Drinking Water Supply Management Area

Figure 2 illustrates the Drinking Water Supply Management Area (DWSMA), which is the area surrounding the capture zones that can be identified by recognizable landmarks. The boundaries of the DWSMA were determined with the assistance of the public water supplier and use:

- Center-lines of highways, streets, roads, or railroad rights-of-ways;
- Public Land Survey coordinates;
- Property or fence lines; and
- Surface water bodies that interact with groundwater.

GIS shapefiles of the DWSMA are provided in **Appendix F**.

5.0 Vulnerability Assessments

The vulnerability assessments for the public water supply wells and the DWSMA are used to determine the scope of the inventory of potential contamination sources and to assign priorities for managing potential contamination sources within the DWSMA.

5.1 Assessment of Well Vulnerability

Minnesota Rule 4720.5210 requires a vulnerability assessment of the wells used by the public water supplier. The protocol for determining well vulnerability is described in the MDH document entitled Methodology for Phasing Wells into Minnesota's Wellhead Protection Program (1993), which was approved by the US Environmental Protection Agency (EPA) as part of its review of Minnesota's wellhead protection program description. The MDH uses the protocol to maintain a database defining the potential vulnerability of community and non-community public water supply wells. A score is calculated for each well using 1) construction criteria defined in the State Well Code, 2) geologic sensitivity, and 3) the results of water quality monitoring conducted by the MDH. A numeric score is assigned to each well based on the results of the three areas of evaluation. A cutoff score is used to define wells that are most likely to be vulnerable based on their construction, geologic setting, and sampling history.

Generally, the information provided on the MDH scoring sheets appears accurate and the City does not have additional or updated information to challenge the scoring. There is no indication from the well construction records to suggest that the Mora municipal wells were not properly constructed and grouted.

The DNR has developed a procedure for determining geologic sensitivity that is based on an L score. The L score increases 1 point for every 10 feet of clay overlying the aquifer. If the L score is 0 and the static water level is 20 feet or less, the geologic sensitivity is very high and vertical recharge to the aquifer likely occurs within hours to months. If the L score is 0 and the static water level is greater than 20 feet, the geologic sensitivity is high and vertical recharge is likely to occur within weeks to years. If the L score is 0, but there are 20 or more feet of silty or sandy shale or silty or sandy clay overlying the aquifer, the geologic sensitivity is moderate and vertical recharge is likely to occur within years to decades. An L score of 1 to 4 indicates that the aquifer exhibits a low geologic sensitivity vertical recharge likely occurs over decades to a century. An L score of 5 or greater indicates that the aquifer exhibits a very low geologic sensitivity and vertical recharge likely takes over a century to occur.

The wells used by the Public Water Supplier exhibit the following conditions:

Well 6 is completed in an unconfined sand and gravel aquifer, which implies that the City's Well 6 is vulnerable to contamination from land surface uses or activities. Wells 4 and 5, however, are completed in a semi-confined aquifer with clay present at depth. The water level in the aquifer occurs at approximately 35 feet below land surface. Based on the subsurface geologic conditions and depth to water at each well site, Wells 4 and 5 are given a DNR geologic sensitivity rating of medium and Well 6 is given a sensitivity rating of high.

According to the MDH SWP Vulnerability Rating sheets, the Mora Wells 4, 5 and 6 were all given an L score of 0. Even though well construction meets State Well Code construction standards, tritium and stable isotope data provided by the MDH (**Appendix B**) shows that there is a strong connection between surface water and groundwater and that the wells are

vulnerable to contamination. The MDH Well Vulnerability sheets are provided as **Appendix G**.

Results of the well vulnerability analysis - For wellhead and source water protection efforts, all of Mora's municipal wells have been classified as vulnerable.

5.2 Vulnerability Assessment for the Drinking Water Supply Management Area

The DWSMA for the City's municipal wells are assigned moderate and high vulnerability ratings. This classification was based on the DNR geologic sensitivity rating, the surficial geologic maps, and L scores calculated for wells located within the DWSMA.

Boring logs of wells located within the DWSMA were reviewed to verify the surficial geologic map units and initial vulnerability assignment. When sufficient lithologic information was available and L-scores could be calculated, they were. Most of the wells located within the DWSMA had L-scores of 0. These wells, however, had a depth to water of greater than 20 feet and there was a cumulative silt and/or clay thickness of greater than 20 feet, therefore the geologic sensitivity was classified as moderate. Wells in the area delineated and classified as high vulnerability had limited geologic information. Based upon the information available, the area was determined to have a high geologic sensitivity. **Figure 14** shows the DWSMA vulnerability delineation and calculated L-scores for wells within the DWSMA.

6.0 Recommendations

The following recommendations are made for plan implementation action items that the Public Water Supplier should consider. Each recommendation is referenced to the plan implementation category under which it can be incorporated.

Plan Implementation Category – Data Collection

Item 1 - Addressing the uncertainty in the extent of interconnectivity between the aquifer and Mora Lake.

The amount of connection between Mora Lake and the surficial aquifer is uncertain. During the simulation modeling a very low conductance value was added to the bottom of the Lake Mora. SWS recommends that additional isotope analysis be done by collecting stable isotope samples and comparing the isotope data from each of the water bodies to that of samples collected from each of the municipal wells. This will provide additional information that will help determine the interconnectivity of the water body and the source aquifer.

It is also recommended that chloride sampling be conducted, to better understand the potential impact to the City wells from surrounding surface water runoff. Chlorides have been identified in the City's wells as well as Lake Mora and are a contaminant of concern from surface runoff. This data will act as an additional indicator of the surface water groundwater connectivity.

Plan Implementation Category – Contingency Planning

Item 2 - Addressing the potential movement of contamination toward the community wells.

The MDH recommends that if contaminants are detected, the Public Water Supplier contact the MDH hydrologist so that the MDH can perform an evaluation of whether to continue pumping the impacted well(s). Turning off a well may alter the movement of contamination to other pumping wells and compound the problem. Therefore, it is very important to include this recommendation in the contingency plan.

7.0 Standard of Care

The interpretations presented in this report are based on local data collected during this study and previous studies, such as current and historical pumping tests and regional data collected from governmental agencies. Data collected and analyzed by others and used in this report may not be precise or accurate. This Plan does not account for any variations that may occur between points of exploration; geologic and hydrogeologic conditions likely differ across the study area. Also, it must be noted that seasonal and cyclical fluctuations in the hydrogeologic characteristics and properties of the aquifer will occur.

The scope of this report and the corresponding groundwater flow model and calculations is limited to the delineation of capture zones for the City of Mora municipal wells. Use of the groundwater flow model by other parties or for other purposes is not advised. Use or modification of the model for purposes other than the delineation of capture zones must be done with caution and a full understanding of the inherent assumptions and limitations of the data.

This Plan represents our understanding of the significant aspects of the local geologic and hydrogeologic conditions; the conclusions are based on our hydrogeologic and engineering judgement, understanding and perspective, and represent our professional opinions. These opinions were arrived at in accordance with the currently accepted standard of care for geologic and engineering practices at this time and location. No warranty is implied or intended.

8.0 References

Lindholm, G.F, et. al., 1974, Water Resources of the Snake River Watershed, East-Central Minnesota, Hydrologic Investigations Atlas (HA-488), Plates 1-3. United States Geological Survey Publication.

Meyer, Gary N., 2008, Surficial Geology of the 30'x60' Quadrangle, Central Minnesota., Miscellaneous Map Series Map (M-180), Surficial Geology, Mora Quadrangle. Minnesota Geological Survey

Delin, G.N. and J.D. Falteisek, 2007, Groundwater Recharge in Minnesota, Fact Sheet 2007-3002, US Dept. of the Interior, US Geological Survey.

McComas, Steve, 2002, Lake Mora Management Plan. Kanabec County, MN. Blue Water Science, Prepared for City of Mora.

USGS, 2006, NLCD 2006 Land Cover, Edition 1.0, Remote Sensing Image, United States Geological Survey, Sioux Falls, SD.

USDA, 2009, Soil Survey Geographic (SSURGO) Database for Kanabec County, MN, U.S. Department of Agriculture, Natural Resources Conservation Service.

MN Climatology Working Group for Mora station (State Climatology Office - DNR Waters, phone: 651-296-4214, web: http://climate.umn.edu)

List of Tables

Table 1 – Municipal Well Details

Table 2 – Municipal Well Production and Use

Table 3 – Local and Regional High Capacity Wells

Table 4 – Precipitation Data

Table 5 – Regional Aquifer Pumping Test Results – Sand and Gravel

Table 6 – Groundwater Flow Model Parameters

Table 1
Municipal Well Details

Well No.	Unique Well No.	Year Constructed	Northing*	Easting*	Aquifer Formation	Total Depth (ft)	Static Level** (ft)	Pumping Level** (ft)	Casing Depth (ft)	Casing Diameter (in)	Status	Vulnerability
4	217385	1964	5080459	477158	Glacial Sand and Gravel (QBAA)	195	56	75.8 (at 500 gpm)	170	12	Primary Active	Vulnerable
5	112239	1977	5080473	477337	Glacial Sand and Gravel (QBAA)	203	45	77.08 (at 2000 gpm)	145	16	Primary Active	Vulnerable
6	433279	1988	5080163	476988	Glacial Sand and Gravel (QBAA)	210	35	58.42 (at 1431 gpm)	150	16	Primary Active	Vulnerable

Notes: ft – feet, in – inches, gpm - gallons per minute,
gpm/ft - gallons per minute per foot of drawdown
** UTM Zone 15 metric coordinate system*
*** Data from well logs or aquifer pumping tests*

Vulnerability status based on MDH staff review of well construction, geologic materials, well use, and water quality

Table 2
Municipal Well Data

DNR Permit	Common Well Name	CWI Unique Well ID	Pumped Volumes (million gal/yr)					
			5 Year Projected*	2011	2010	2009	2008	2007
1963-1039	Well #4	217385	58.2	41.2	46	51.1	50.9	47.9
1963-1039	Well #5	112239	43.65	27.9	34	29.4	38.2	35.9
1963-1039	Well #6	433279	43.65	48.1	38.6	50	46.0	54.0
Total			145.5	117.2	118.6	130.5	135.1	137.8

* from Mora's Water Supply Plan

Table 3
Local and Regional High Capcaity Wells

Factility	DNR Permit No.	Unique Well No.	Northing	Easting	Aquifer	Use	Permitted Volume (MGY)	2009 Usage (MGY)	2008 Usage (MGY)	2007 Usage (MGY)	2006 Usage (MGY)	Discharge Used in Model (m^3/day)
BJORKLUND, CRAIG	2009-0069	747266	472468	399733	Quaternary	Sand and Gravel Washing	14.4	5.9	13	0	0	134.81
BAUERLY BROTHERS INC	1995-3241	561467	472853	399174	Quaternary	Sand and Gravel Washing	14.0	0	0	5.8	5.7	62.22

Notes: MGY-millions of gallons per year
Well coordinates in UTM Zone 15 NAD 83 Metric Units

Table 5
Groundwater Flow Model Parameters

Layer	Model Attribute	Aquifer Represented	Base Elevation (m AMSL)	Thickness (m)	Hydraulic Conductivity (m/d)	Porosity
1	Aquifer Body	Sand and Gravel	258.2	varies	54.24	0.30
	Glacial Sand and Gravel	Sand and Gravel	258.2	varies	86.4	0.30
	Diamicton	Low Permeability Non Aquifer	258.2	varies	8.64	0.30
	Diamicton	Low Permeability Non Aquifer	258.2	varies	0.864	0.30

Layer	Model Attribute	Aquifer Represented	Base Elevation (m AMSL)	Thickness (m)	Permeability (m/d)	Porosity
2	Aquifer Body	Sand and Gravel	243.0	15.2	54.24	0.30
	Glacial Sand and Gravel	Sand and Gravel	243.0	15.2	86.4	0.30

Recharge Values	4.071x10-4 m/d	5.644x10-4 m/d

Layer 1 aquifer thickness based upon surface topography. Approx. 50 m thick.
m = meters
m AMSL = meters above mean sea level
m/d = meters per day

List of Figures

Figure 1 – Mora Wellhead Protection Area

Figure 2 – Mora DWSMA

Figure 3 – Surficial Geology

Figure 4 – Bedrock Geology

Figure 5 – Land Cover and Water Resources

Figure 6 – SSURGO Soils

Figure 7 – Model Boundary Conditions

Figure 8 – Recharge Zones

Figure 9 – Layer 1 Hydraulic Conductivity

Figure 10 – Layer 2 Hydraulic Conductivity

Figure 11 – Modeled Head (2 Meter Contours)

Figure 12 – Modeled Head and Pathlines

Figure 13 – DWSMA Vulnerability

SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

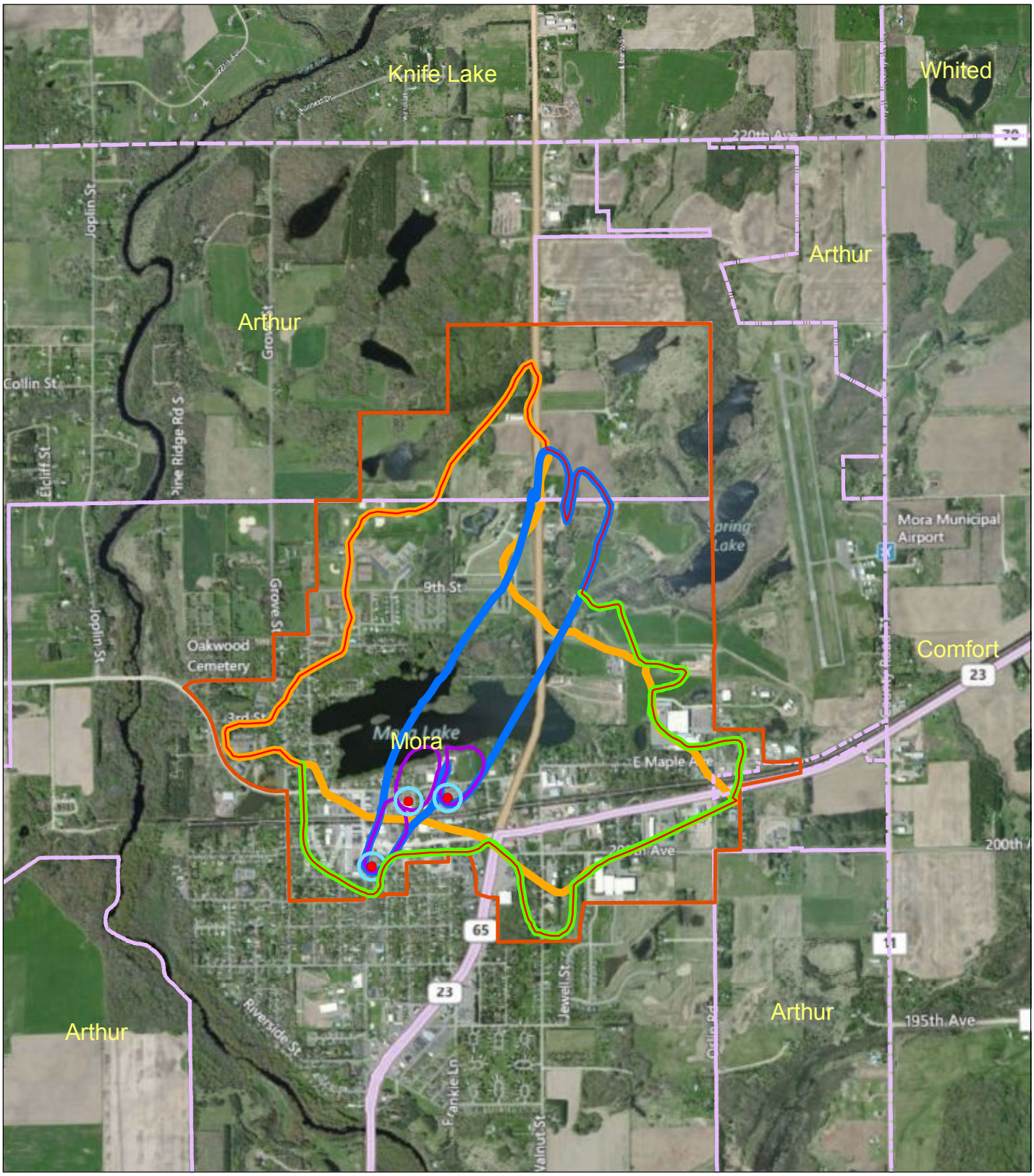
- Municipal Wells
- Inner Wellhead Management Zone (IWMZ)
- Emergency Response Area (ERA)
- WHPA
- 10-Year Capture Zone
- Storm Water Catchment Area
- Surface Water Contribution Area

0 125 250 500 750 Meters

Figure 1

Mora Wellhead Protection Area

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

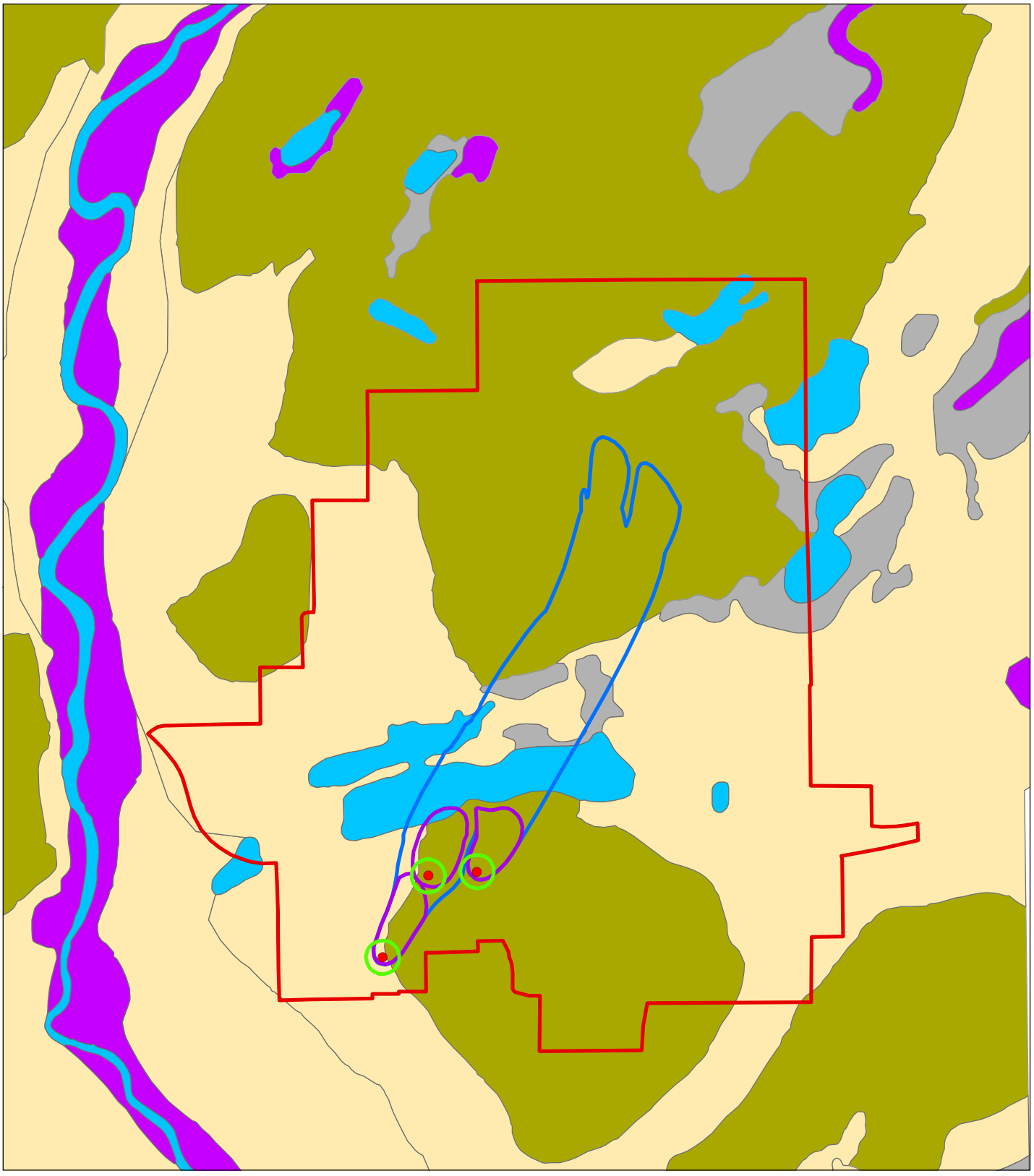
- Municipal Wells
- Drinking Water Supply Management Area (DWSMA)
- Inner Wellhead Management Zone (IWMZ)
- Emergency Response Area (ERA)
- WHPA
- 10 Year Capture Zone
- Stormwater Catchment Area
- Surface Water Contribution Area
- Municipal Boundary

0 125 250 500 750 1,000 Meters

Figure 2

DWSMA

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

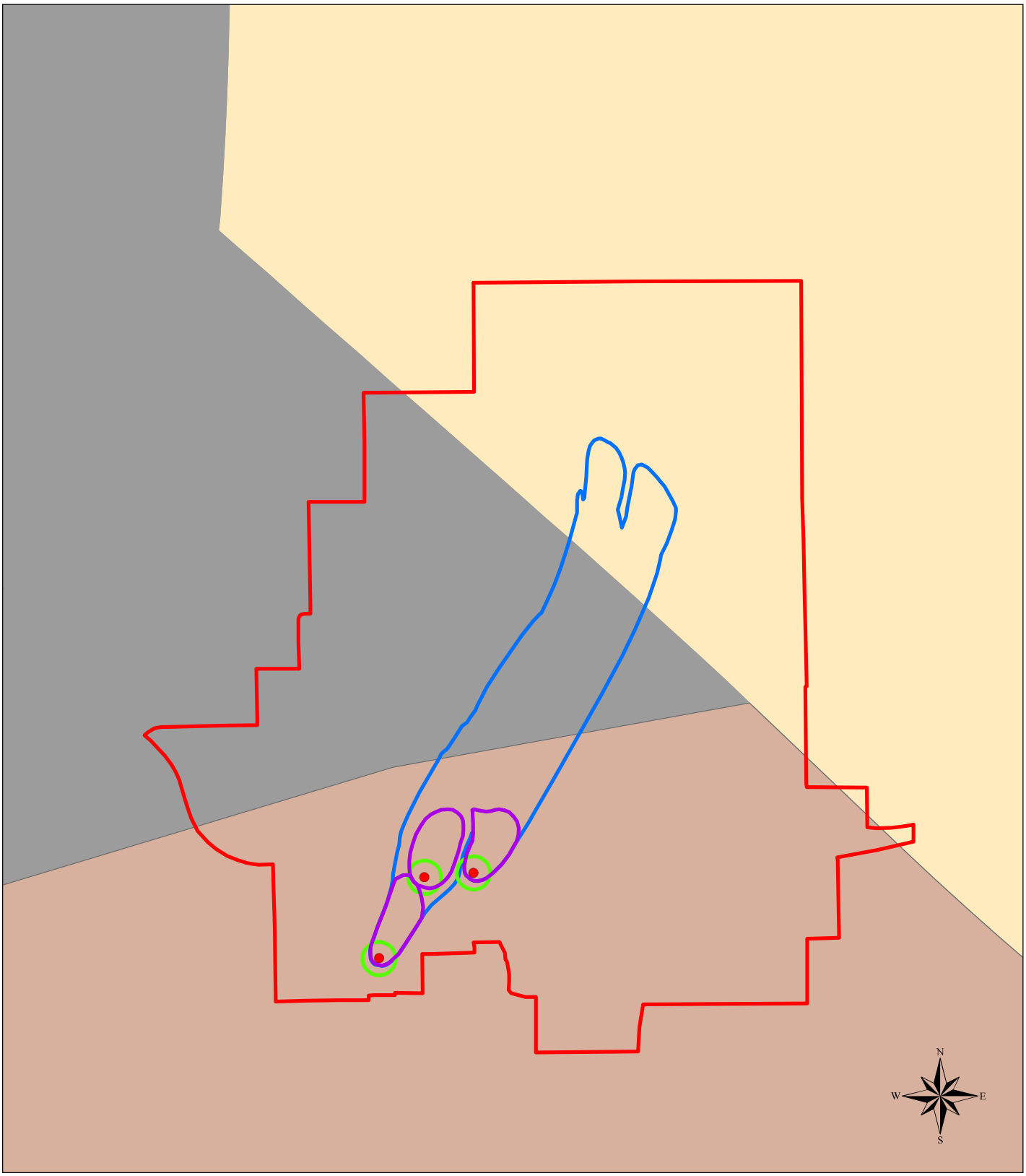
- Diamicton
- Organic
- Rock
- Sand
- Unspecified
- Water
- Municipal Wells
- ERA
- IWMZ
- WHPA
- DWSMA

0 137.5 275 550 825 Meters

N W E S

Figure 3
Surficial Geology
Mora Wellhead Protection Plan

Source: MGS M-180 Surficial Geology of Mora Quadrangle



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Municipal Wells
- DWSMA
- ERA
- IWMZ
- WHPA
- Fond du Lac Formation
- Upper Cambrian;Mt.Simon-Jordan
- Mafic Volc. & Felsic Intrusive

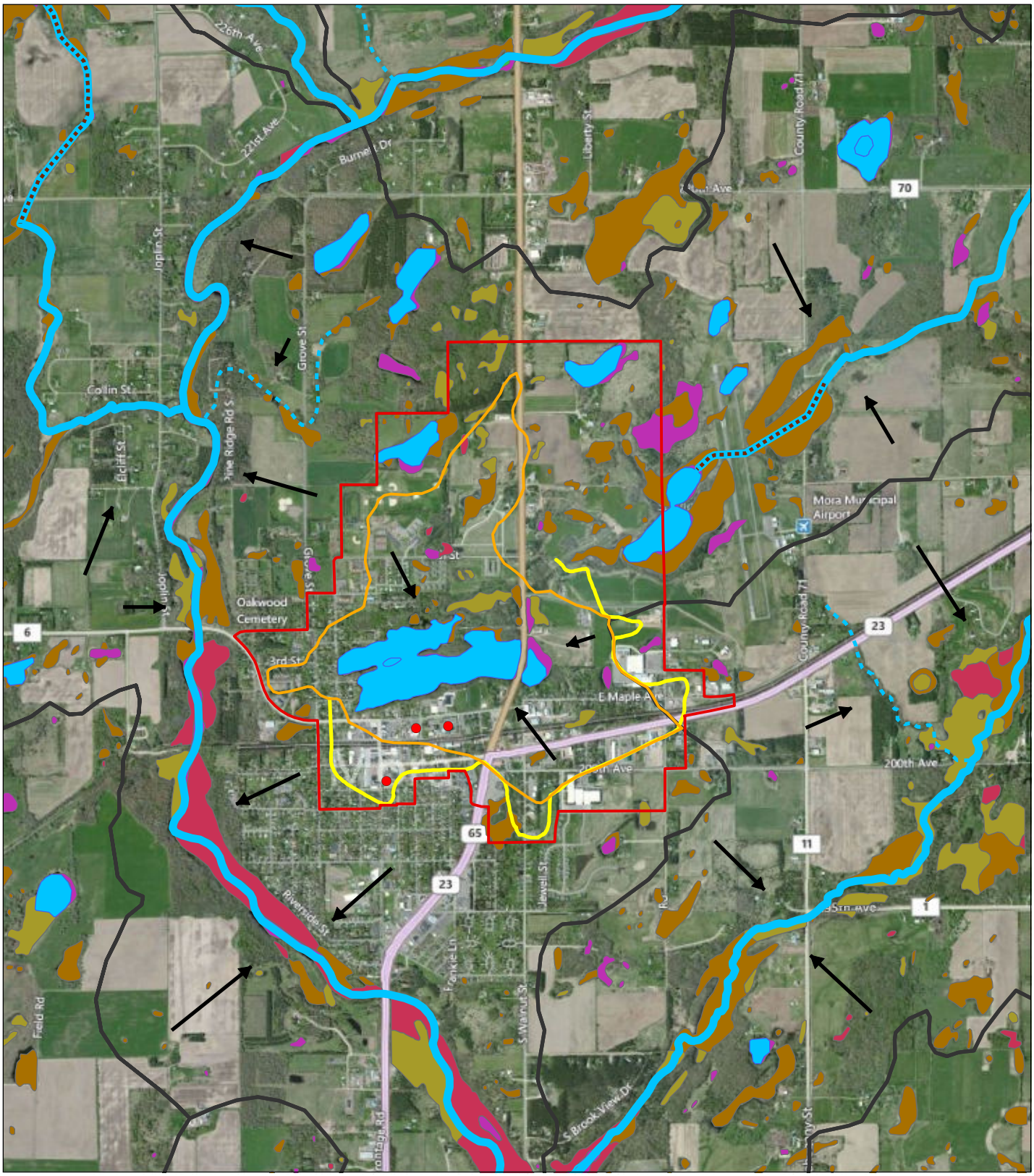
0 150 300 600 900 Meters

Figure 4

Bedrock Geology

Mora Wellhead Protection Plan

Source: MGS S-20 Bedrock Geology of MN



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Municipal Wells
- Drinking Water Supply Management Area (DWSMA)
- Lake Mora Lakeshed
- Stormwater Catchment Area
- Ditches
- Intermittent Streams
- Perennial Streams
- River
- Lakes
- Level 8 Minor Watershed

Wetlands
CLASS

- Aquatic Bed
- Emergent
- Forested
- Scrub -Shrub
- Unconsolidated Bottom
- Unconsolidated Shore

Surface Water Flow Direction

0 160 320 640 960 1,280
Meters

Figure 5

Water Resources

Mora Wellhead Protection Plan

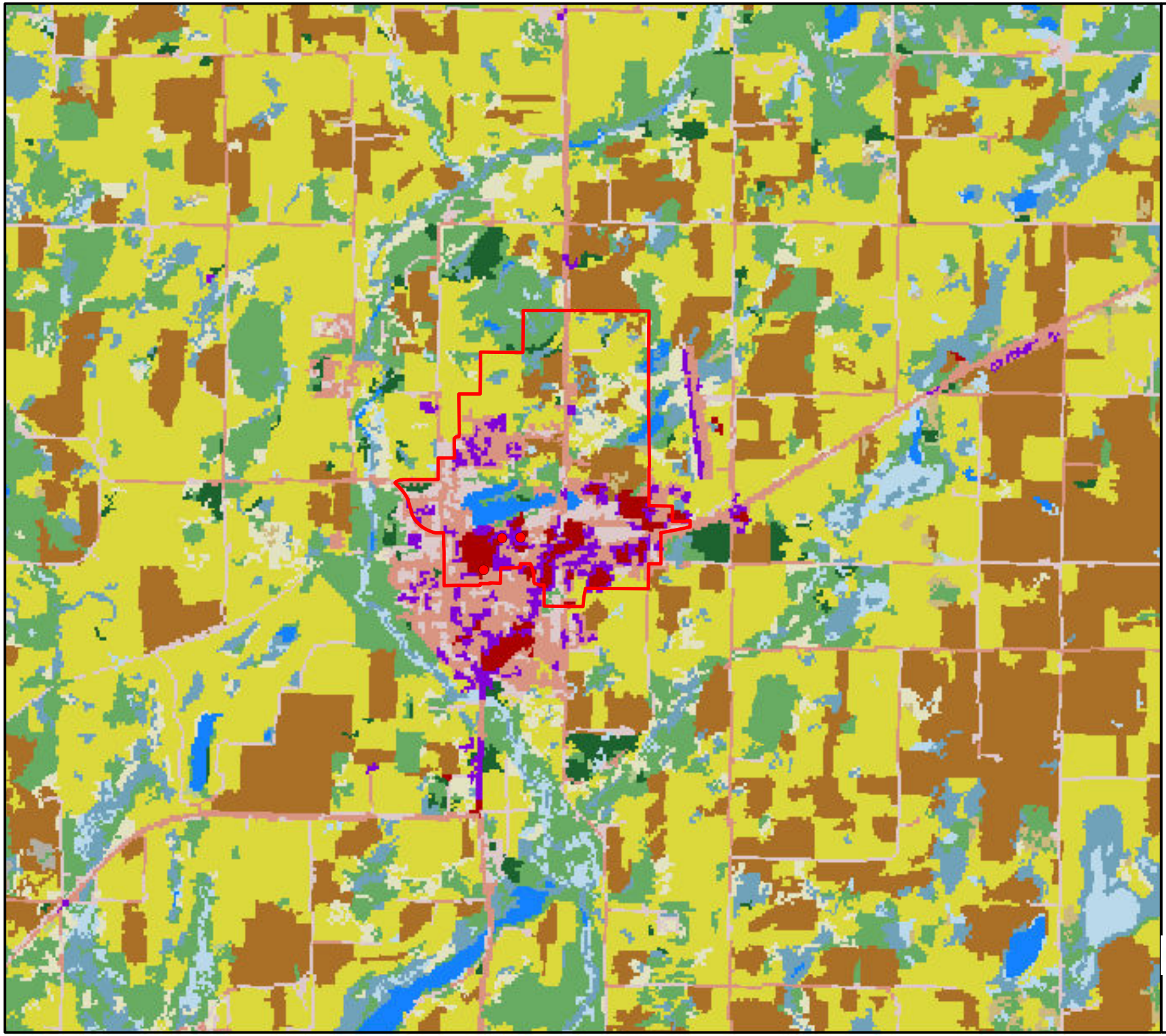


Figure 6

Land Cover

Legend

- Municipal Wells
- DWSMA

Land Cover

- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Perennial Snow/Ice
- Shrub/Scrub
- Unclassified
- Woody Wetlands

Source: NLCD 2006 Land Cover Database

0 200 400 800 1,200 Meters

SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

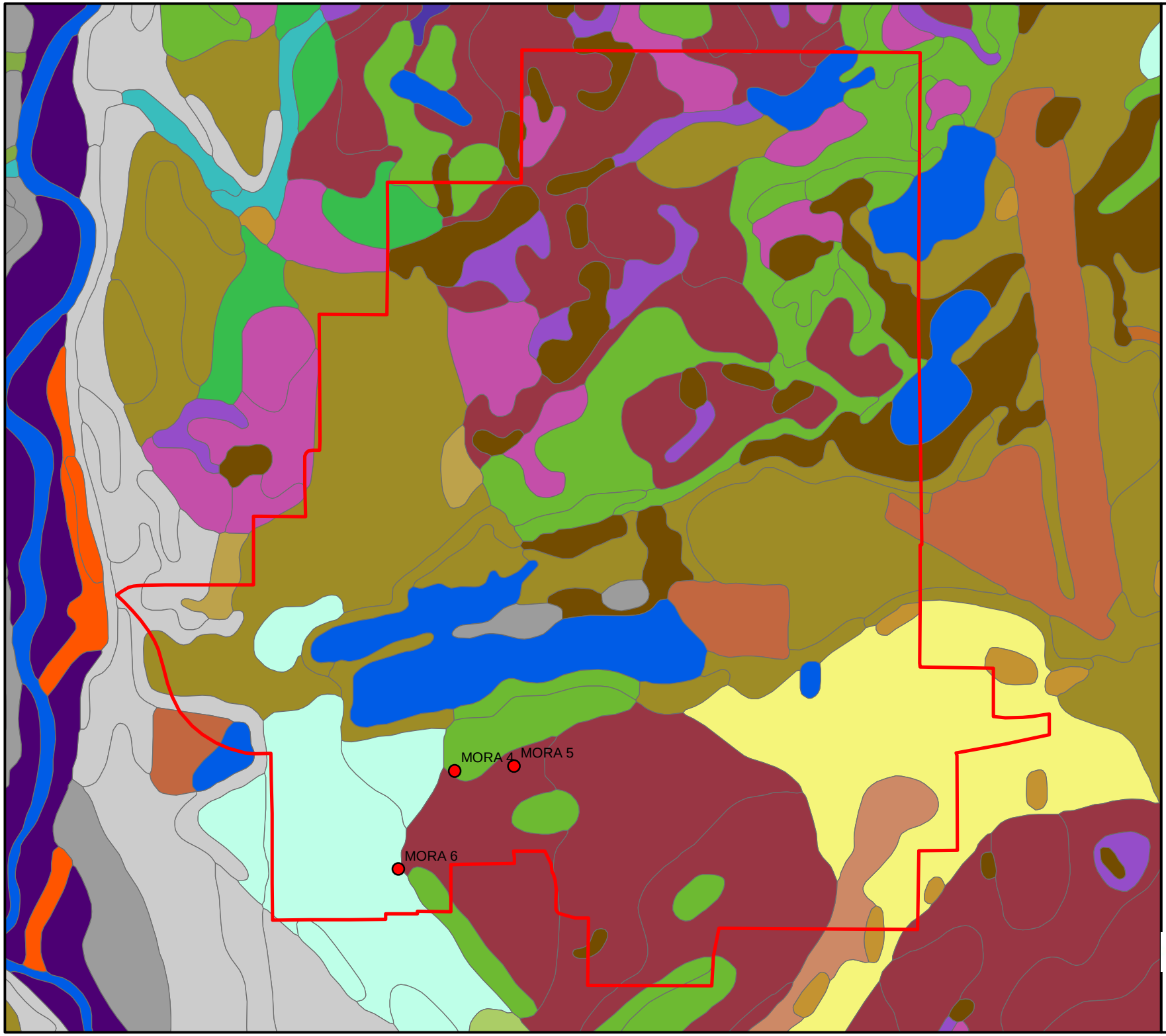


Figure 7

Soils

SSURGO

Legend

- Municipal Wells
- DWSMA

Soils

Complex Name

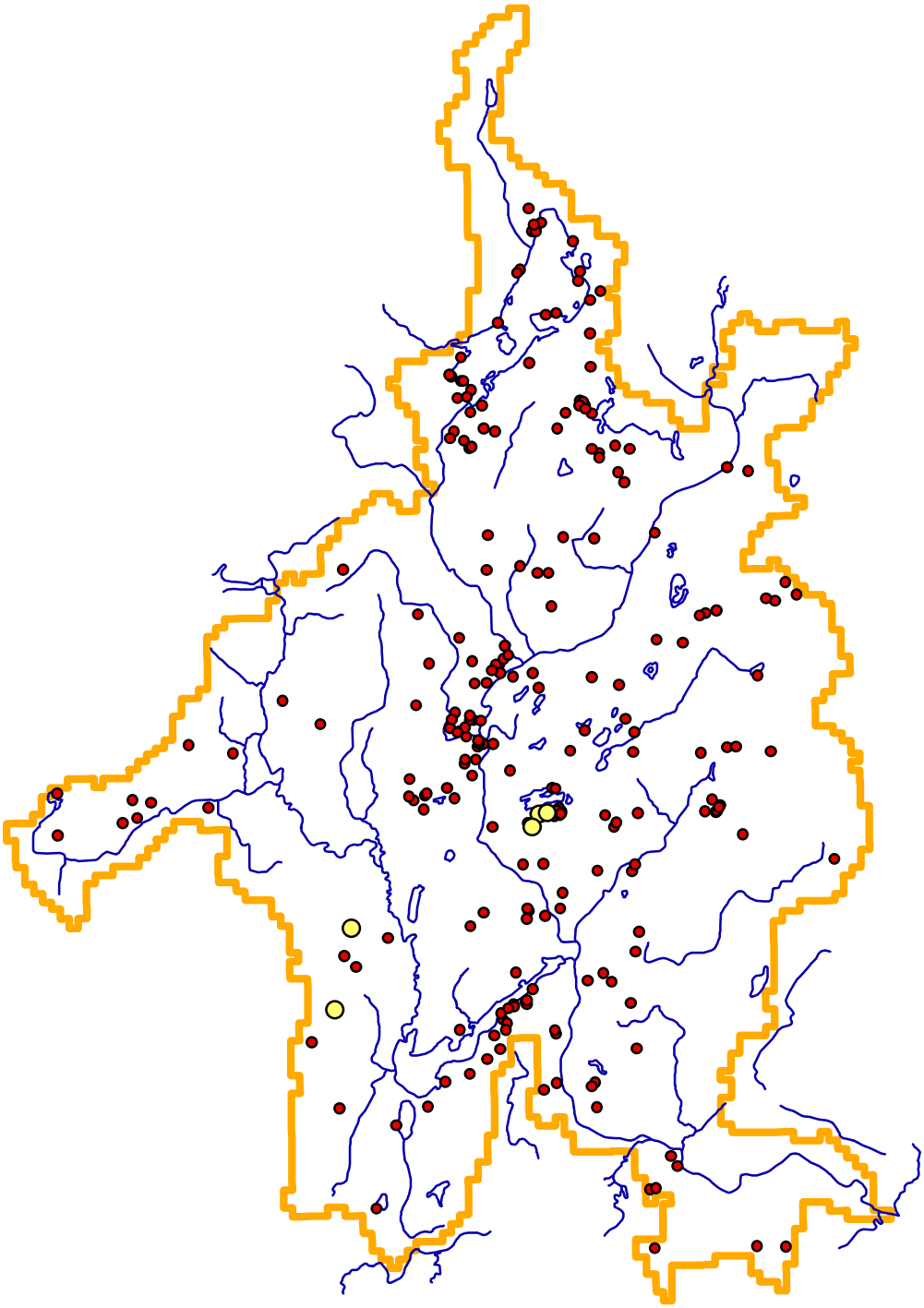
- Aftad
- Alban
- Annriver
- Antigo
- Billyboy
- Bowstring
- Brennyville
- Brickton
- Cathro
- Cebana
- Dalbo
- Fenander
- Fluvaquents
- Foglake
- Grasston
- Graycalm
- Greenwood
- Haybrook
- Hulligan
- Lenroot
- Lewis lake
- Longsiding
- Mahtomedi
- Meehan
- Milaca
- Minocqua
- Mora
- Oesterle
- Ossmer
- Pits
- Plover
- Pomroy
- Rosholt
- Scott Lake
- Seelyeville
- Udifluvents
- Udipsamments
- Udorthents
- Water
- Wurtsmith

Source: USDA NRCS SSURGO Database

0 62.5 125 250 375 Meters

SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Pumping Wells
- Targets
- River Boundaries
- Active Zone

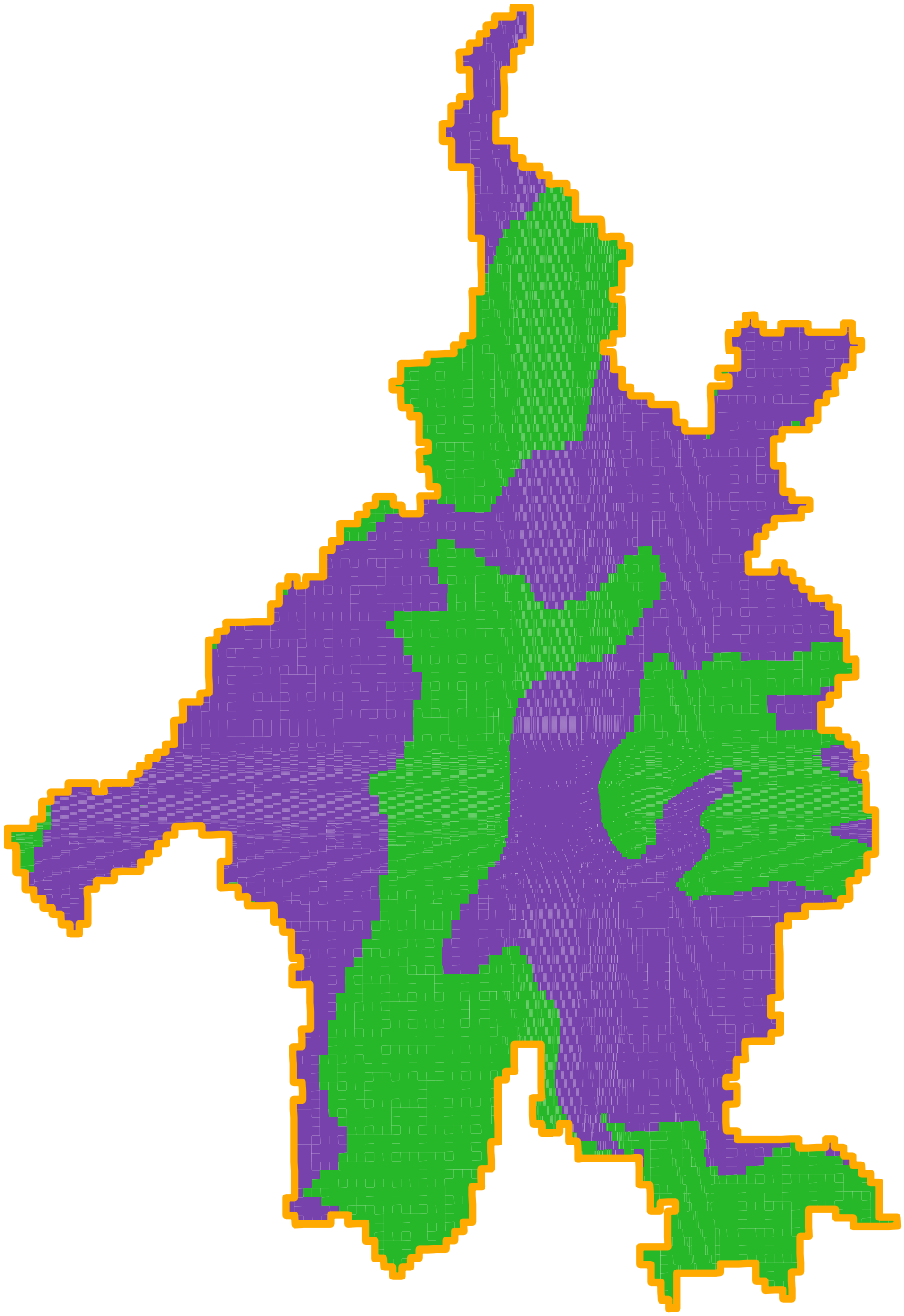
N
W E
S

0 1,100 2,200 4,400 6,600 Meters

Figure 8

Model Boundary Conditions

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

Recharge Zones Active Zone

m/d

0.0004071

0.0005644

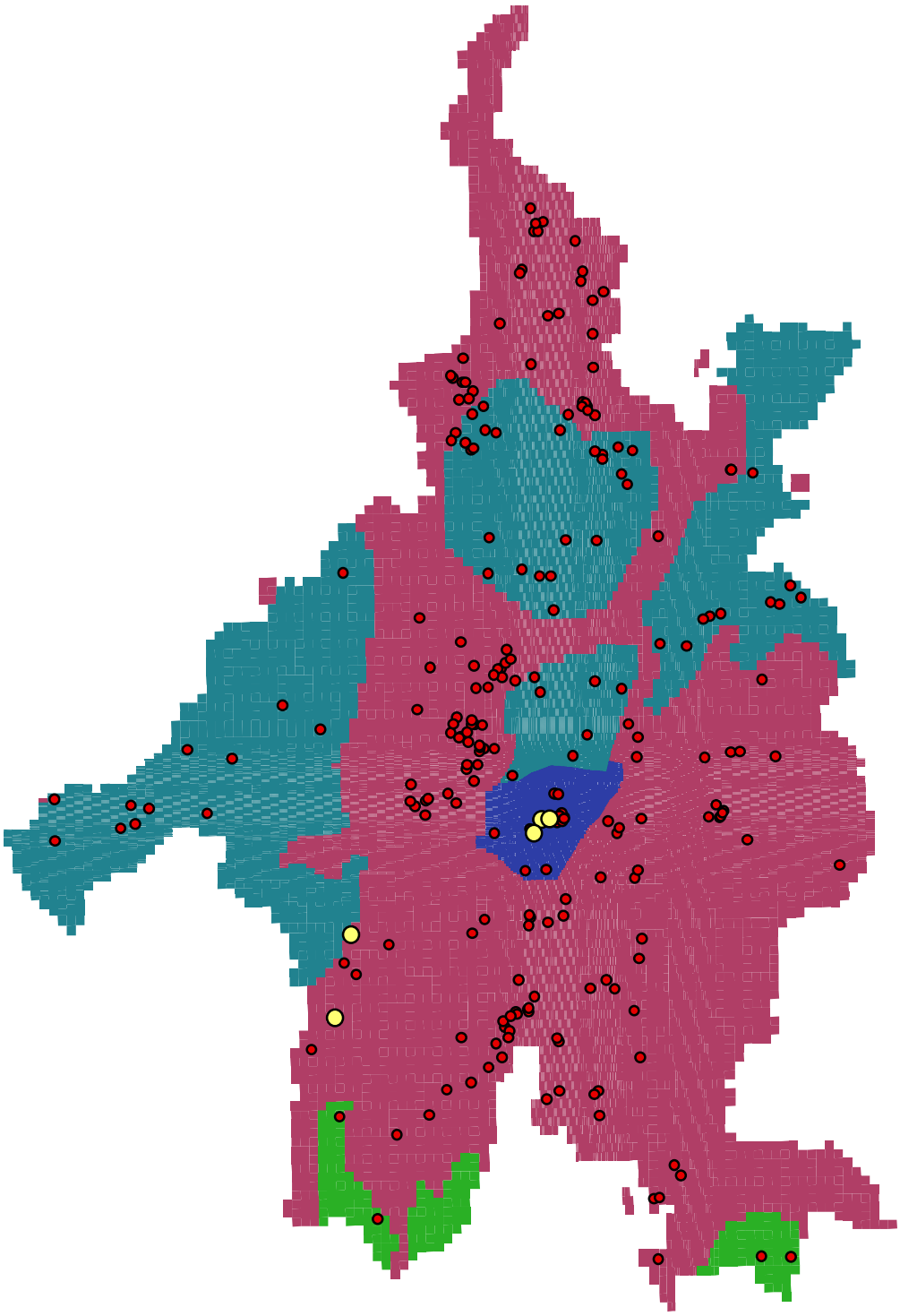
N W E S

0 1,200 2,400 4,800 7,200 Meters

Figure 9

Recharge Zones

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

Hydraulic Conductivity (Kx)
m/d
- 0.864
- 8.64
- 54.24
- 86.4

- Pumping Wells
- Targets

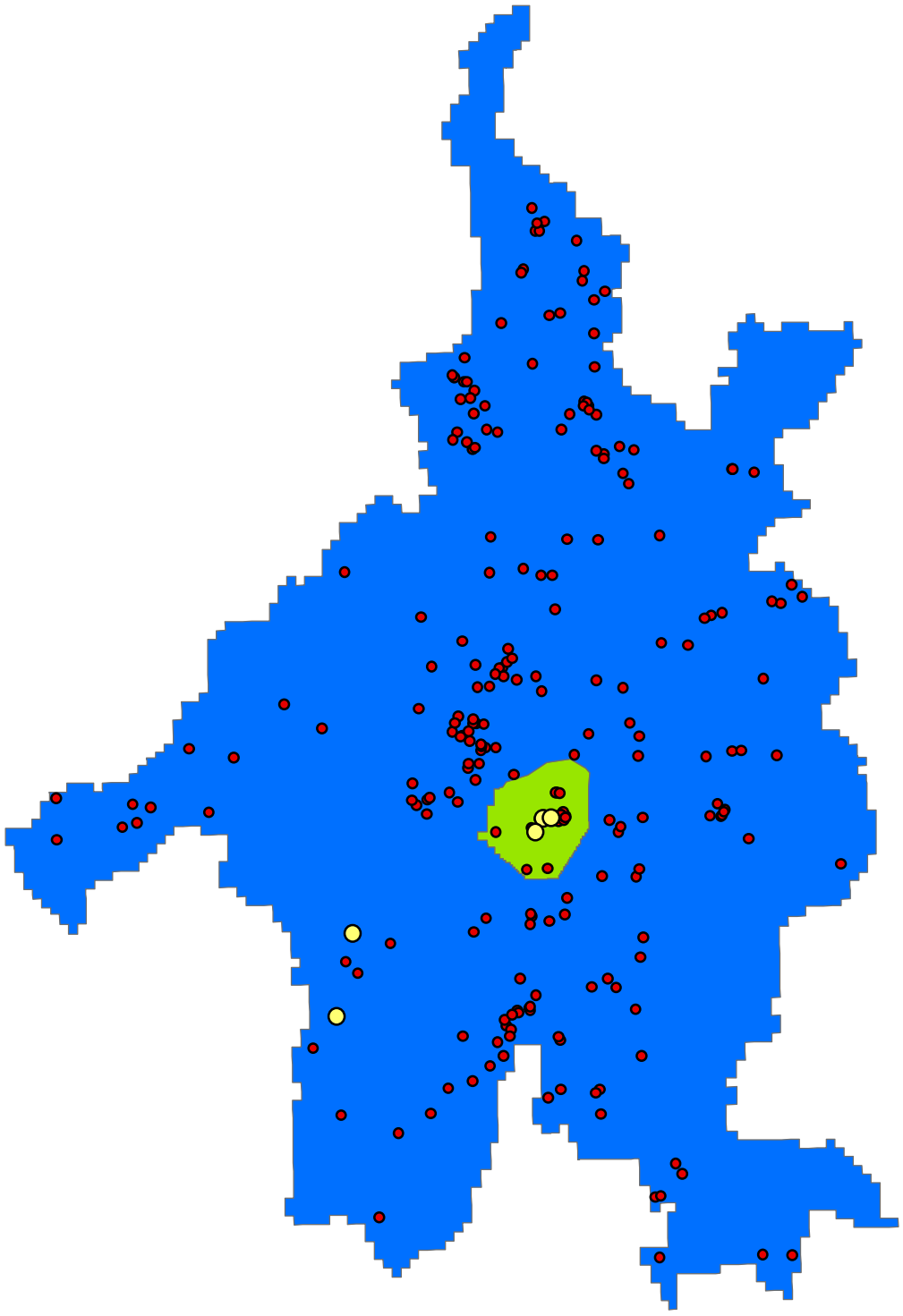
N
W E
S

0 1,200 2,400 4,800 7,200
Meters

Figure 10

Layer 1
Hydraulic Conductivity

Mora Wellhead
Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

Hydraulic Conductivity (Kx)
m/d
54.24
86.4

Targets
Pumping Wells

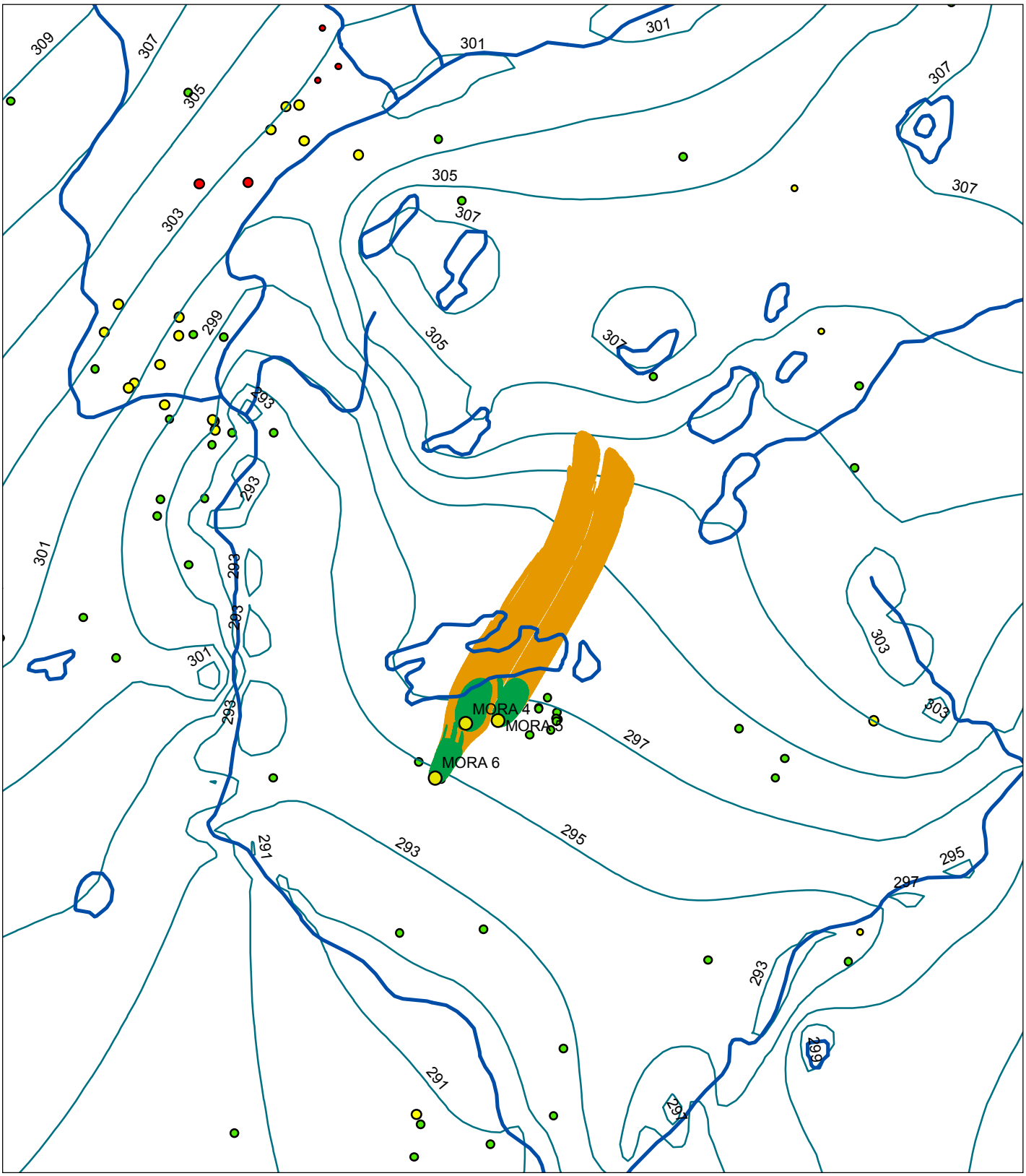
N
W E
S

0 1,250 2,500 5,000 7,500
Meters

Figure 11

Layer 2
Hydraulic Conductivity

Mora Wellhead
Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Municipal Wells
- 1 Year Pathlines
- 10 Year Pathlines
- Modeled Head (m)
- River Boundaries

Residual Head (m)

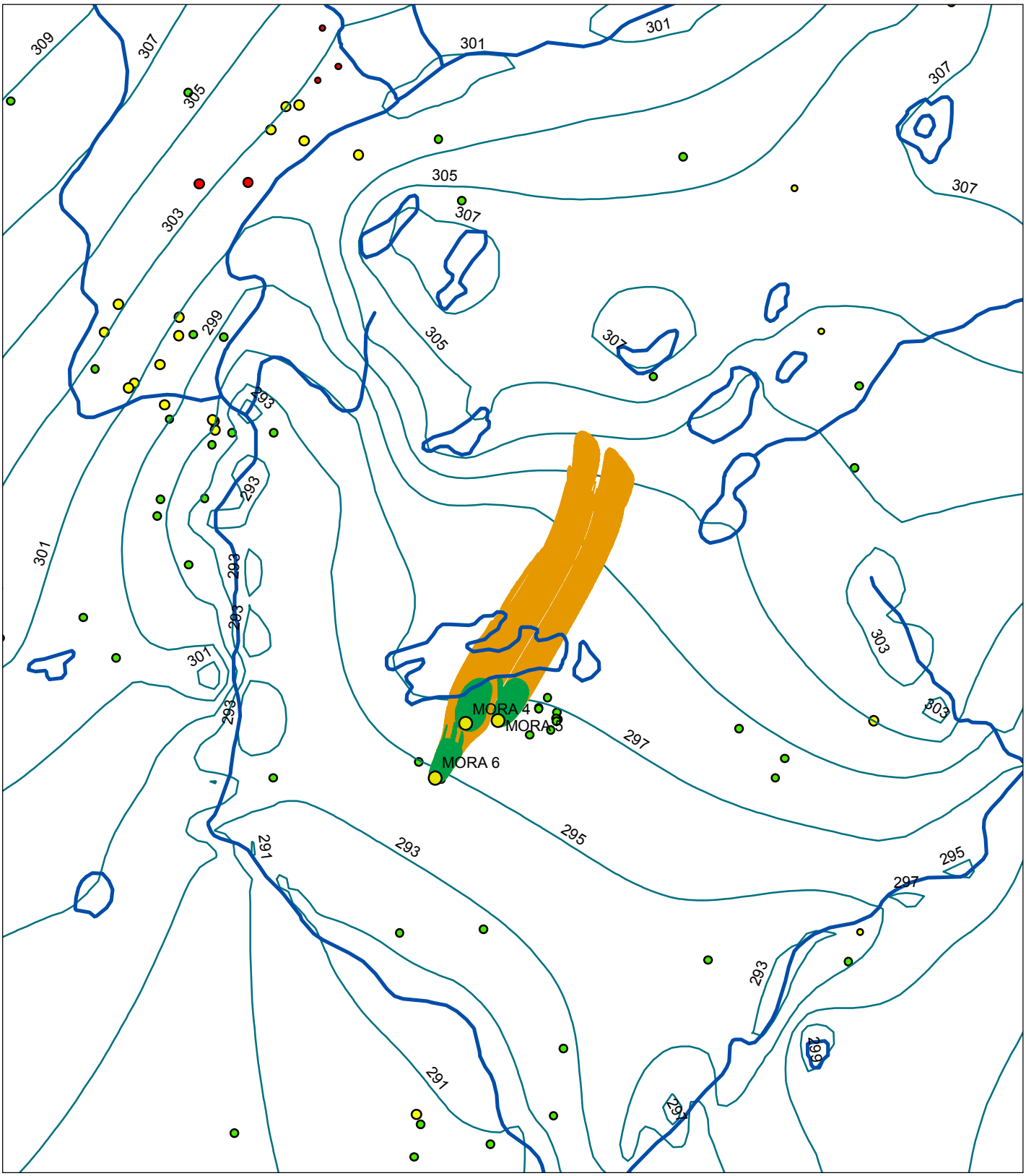
- -18.2 - -7.0
- -6.9 - -3.0
- -2.9 - 3.0
- 3.1 - 7.0
- 7.1 - 12.5

0 200 400 800 1,200 Meters

Figure 12

Modeled Head and Pathlines

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Municipal Wells
- 1 Year Pathlines
- 10 Year Pathlines
- Modeled Head (m)
- River Boundaries

Residual Head (m)

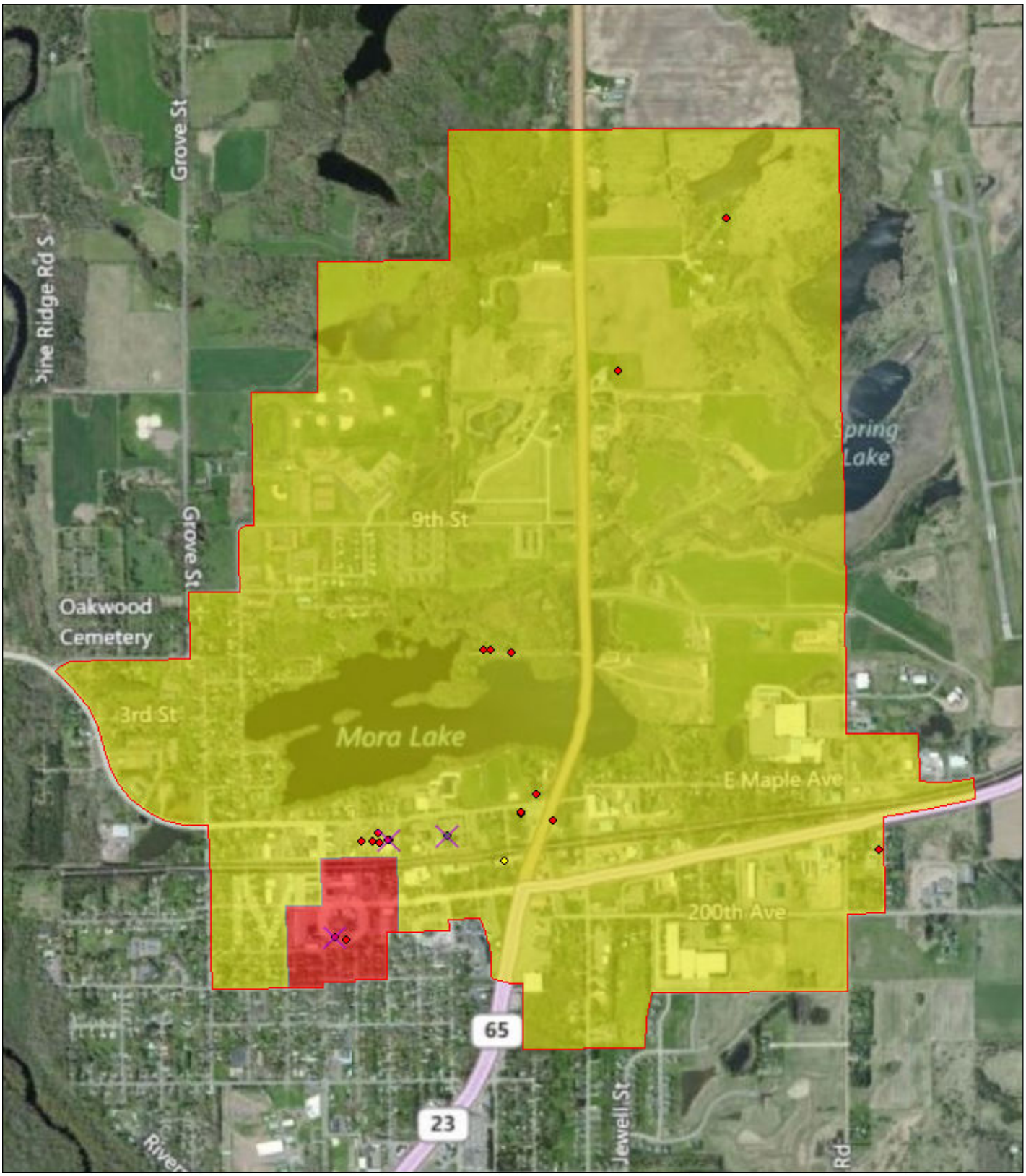
- -18.2 - -7.0
- -6.9 - -3.0
- -2.9 - 3.0
- 3.1 - 7.0
- 7.1 - 12.5

0 200 400 800 1,200 Meters

Figure 13

Modeled Head and Pathlines

Mora Wellhead Protection Plan



SOURCEWATER SOLUTIONS

213 4th St. E, Suite 418, St. Paul, MN 55101
Phone: (612) 354-2549
www.sourcewater-solutions.com

Legend

- Municipal Wells
- DWSMA

Vulnerability Classification

- High
- Moderate

L Score

0 1 2 8

0 125 250 500 750 Meters

Figure 14

DWSMA Vulnerability

Mora Wellhead Protection Plan

Appendix A

MDH Scoping 1 Decision Notice

January 4, 2010

Mr. Mike Kroon
Water Superintendent - City of Mora
101 Lake Street South
Mora, Minnesota 55051

Dear Mr. Kroon:

Subject: Scoping Decision Notice No. 1 for Mora Public Utilities Commission, PWSID 1330001

This letter provides notice of the results of the Scoping 1 meeting that we held with you, Mr. Joel Dhein (City of Mora), Mr. Erik Tomlinson (Short Elliot and Hendrickson Inc. [SEH]), and Mr. Aaron Meyer (Minnesota Rural Water Association) on December 10, 2009, regarding wellhead protection planning.

During the meeting, we discussed the preparation of Part I of a Wellhead Protection Plan that will document the 1) delineation of a wellhead protection area, 2) delineation of a drinking water supply management area, and 3) assessments of well and aquifer vulnerability related to these areas for Mora Well Nos. 4, 5 and 6 (Unique Nos. 217385, 112239 and 433279). The wellhead protection area is the surface and subsurface area supplying water to the city's wells. Understanding the extent of the wellhead protection area allows the Mora Public Utilities Commission (MPUC) and city to take steps to safeguard the drinking water supply from known and potential sources of contamination. The drinking water supply management area completely encloses the wellhead protection area and is delineated using recognizable landmarks.

According to the state wellhead protection rule, the city will have until October 1, 2012, to complete its entire Wellhead Protection Plan, Part I and Part II. As we discussed, the rule describes the criteria used for determining the time period for completion of the Wellhead Protection Plan (Minnesota Rules, part 4720.5130). It is our understanding that the MPUC has contracted with SEH to assist with the preparation of its Part I plan. We would appreciate an opportunity to meet with you and your consultant in the course of the development of Part I of the Wellhead Protection Plan. Such a meeting is now commonplace in the preparation of Part I wellhead protection plans and we use it to make sure that Minnesota Department of Health (MDH) staff, you, and your representatives are agreed as to the general conceptual approach to be used prior to conducting the formal delineation. As we usually strive to conduct this meeting after most of the background data has been assembled but before the delineation efforts begin, the meeting is called the pre-delineation meeting. In addition, your consultant may also wish to meet with you to obtain your input on the boundaries of the drinking water supply management area, which may consist of streets, roads, section lines, or other features (as permitted by Minnesota Rules).

At our meeting, we also discussed rule requirements and the types of information needed to prepare the Part I Plan. The Wellhead Protection Plan must be prepared in accordance with Minnesota Rules, parts 4720.5100 to 4720.5590. General wellhead protection requirements and criteria for delineating the wellhead protection area and data reporting are presented in Minnesota Rules, parts 4720.5500 to 4720.5510.

The enclosed Scoping Decision Notice No. 1 formally identifies the information that the city must provide to MDH to meet rule requirements for preparing Part I of the Wellhead Protection Plan. The wellhead rule refers to the existing information required for wellhead planning as data elements. Much of this

information is available in the public domain, as described in the Scoping Decision Notice No. 1 form. You only need to provide the information that is not in the public domain and, therefore, not available to MDH. The Scoping Decision Notice No. 1 form also 1) lists the Minnesota unique well number and well construction for each well that will be included in the Wellhead Protection Plan [Table 1], 2) lists the pumping volumes for each well [Table 2], and 3) includes a map of the well locations. A summary of the information that the city needs to provide is included at the end of the Scoping Decision Notice No.1 form.

Of particular importance to this project is any information regarding well re-construction and aquifer testing at your public wells. During our meeting, staff recalled production tests and capacity tests that were likely performed at the wells by various well contractors over the years. This type of information will be useful for characterizing aquifer parameters when delineating the wellhead protection areas. In addition, staff recalled a 2002 Lake Mora study that assessed hydraulic interactions between the lake and the groundwater aquifer serving your wells, as well as other studies that involved potential groundwater contamination issues. Information from these studies should also be assessed as part of this project.

Finally, it is our understanding that you will serve officially as the wellhead protection manager on behalf of the city. You are responsible for providing written notice to local units of government of the city's intent to develop the wellhead protection plan, as required by the wellhead protection rule (part 4720.5300, subpart 3). A copy of this notice should be forwarded to MDH and must include a list of the MPUC wells, their unique well numbers, and contact information for the Wellhead Protection Plan Manager. Mr. Aaron Meyer, Minnesota Rural Water Association, provided you with a template notification of intent letter and work plan during our meeting. If you would like additional examples or need assistance with this letter, please contact either Mr. Meyer at 320/808-7293 or me.

In closing, we look forward to working with you on completion of your Wellhead Protection Plan. If you have any questions regarding our comments, please contact me at 651/201-4691 or gail.haglund@state.mn.us.

Sincerely,

Gail Haglund, Hydrologist
Source Water Protection Unit
Environmental Health Division
P.O. Box 64975
St. Paul, Minnesota 55164-0975

GLH:kmc
Enclosures: Scoping Decision Notice No. 1, Summary of Data Requested, Map of Well Locations
Table 1 - Public Water Supply Well Information, Table 2 - Annual Volume of Water Pumped From City Wells, Table 3 - Permitted High-Capacity Wells
cc: Joel Dhein, Manager, City of Mora
Aaron Meyer, Minnesota Rural Water Association
Art Persons, MDH Planner Supervisor, Rochester District Office
bcc: Stephen C. Thompson, Water Monitoring Section, Minnesota Pollution Control Agency
Laurel Reeves, Division of Waters, Minnesota Department of Natural Resources
Brian Williams, Pesticide & Fertilizer Mgmt. Division, Minnesota Department of Agriculture
Eric Mohring, Hydrologist, Board of Water and Soil Resources

SCOPING DECISION NOTICE No. 1

The purpose for the first scoping meeting, as required by Minnesota Rule 4720.5310, is to discuss the information necessary for preparing the Part I report of a wellhead protection plan. The Part I report identifies the area that provides the source of drinking water for the public water supply (PWS) so that the PWS can develop land use or management practices to protect their groundwater resource from contamination. Specifically, the Part I report documents the delineation of the wellhead protection area (WHPA), the delineation of the drinking water supply management area (DWSMA), and assesses the vulnerability of the PWS wells and DWSMA.

The wellhead rule (Minnesota Rule 4720.5310) refers to the information required for wellhead planning as data elements. This form lists the data elements that are stated in Minnesota Rule 4750.5400. The Minnesota Department of Health (MDH) uses this form to designate which data elements are needed to prepare the Part I report, based on the hydrogeological setting, vulnerability of the wells, and aquifer information known at the time of the Scoping 1 Meeting.

Name of Public Water Supply		**Date**
City of Mora Public Utilities Commission **(PWSID = 1330001)**		January 4, 2010
Name of the Wellhead Protection Manager		
Mr. Mike Kroon, Water Superintendent		
Address	**City**	**Zip**
City Hall 101 Lake Street South	Mora	55051
Unique Well Numbers		**Phone**
217385 (Well No. 4), 112239 (Well No. 5) and 433279 (Well No. 6)		320-679-1511

Instructions for Completing the Scoping No. 1 Form

N	D	V	S	
X				**N =** If this box is checked with an "X," this data element is **NOT** necessary for the **Part I Report** of your Wellhead Protection Plan. This data element may be identified later at the Scoping 2 Meeting and used for the Part 2 Report. Please go to the next data element.

N	D	V	S	
	X			**D =** If this box is checked with an "X," the preparer of the Part I Report is **required** to use this information for the **DELINEATION** of the WHPA or the DWSMA. If there is no check in the "S" box, this information is available in the public domain or is on-file at MDH.

N	D	V	S	
		X		**V =** If this box is checked with an "X," the preparer of the Part I Report is **required** to use this information for the **VULNERABILITY** assessment of the PWS well(s) or the DWSMA. If there is no check in the "S" box, this information is available in the public domain or is on-file at MDH.

N	D	V	S	
			X	**S =** If this box is checked with an "X," the PWS **must SUBMIT** the information to the MDH.

DATA ELEMENTS ABOUT THE PHYSICAL ENVIRONMENT

A. PRECIPITATION

N	D	V	S	
	X			A.1: An existing map or list of local precipitation gauging stations.

Technical Assistance Comments: Precipitation values can be used to determine the local recharge in the groundwater model. The map can be used to determine the closest gauging station. The locations of the gauging stations are available in the public domain.

N	D	V	S	
	X		X	A.2: An existing table showing the average monthly and annual precipitation, in inches, for the preceding five years.

Technical Assistance Comments: This information may be used for determining local recharge for the groundwater model. This information may be available in the public domain if there is a local gauging station, or may be obtained from the local wastewater treatment plant. Submit only if the information is not available in the public domain

B. GEOLOGY

N	D	V	S	
	X	X	X	B.1: An existing geologic map and a description of the geology, including aquifers, confining layers, recharge areas, discharge areas, sensitive areas as defined in Minnesota Statutes, section 103H.005, subdivision 13, and groundwater flow characteristics.

Technical Assistance Comments: Information of this type is required to characterize the geologic and hydrogeologic setting of the MPUC wells. This information is used to define aquifer geometry, location and magnitude of the recharge and discharge areas, and groundwater flow information. Aquifer tests or alternatives listed in MN Rules 4720.5510, subpart 6, can be used to help characterize flow in the aquifer. Reference all information used to develop the conceptual model of the geologic setting and submit to the MDH only the information that is not available in the public domain.

N	D	V	S	
	X	X	X	B.2: Existing records of the geologic materials penetrated by wells, borings, exploration test holes, or excavations, including those submitted to the department.

Technical Assistance Comments: Information of this type may be useful to refine the understanding of the geologic and hydrogeologic setting on a local basis. Submit only if the MPUC has information of test drilling or site investigations that are not available in the public domain.

N	D	V	S	
	X	X	X	B.3: Existing borehole geophysical records from wells, borings, and exploration test holes.

Technical Assistance Comments: Information from geophysical records may provide additional information about aquifer thickness, well construction, and water level information at a local level. Submit only if the information is not available in the public domain.

N	D	V	S	
	X	X	X	B.4: Existing surface geophysical studies.

Technical Assistance Comments: Information from geophysical studies may be useful to refine the understanding of the geology on a local basis. Submit only if the information is not available in the public domain.

C. SOILS

N	D	V	S	
	X	X		C.1: Existing maps of the soils and a description of soil infiltration characteristics.

Technical Assistance Comments: This information is in the public domain and can be used to delineate the WHPA and assess the vulnerability of the DWSMA because it indicates the underlying geology.

N	D	V	S	
X				C.2: A description or an existing map of known eroding lands that are causing sedimentation problems.

Technical Assistance Comments:

D. WATER RESOURCES

N	D	V	S	
	X		X	D.1: An existing map of the boundaries and flow directions of major watershed units and minor watershed units.

Technical Assistance Comments: This information is in the public domain and may be used to delineate the surface water contribution area of the WHPA, if applicable. Submit a map showing the local watershed of Lake Mora.

N	D	V	S	
	X	X		D.2: An existing map and a list of public waters as defined in Minnesota Statutes, section 103G.005, subdivision 15, and public drainage ditches.

Technical Assistance Comments: This information is in the public domain and may be used to delineate the surface water contribution area of the WHPA, if applicable, and determine the vulnerability of the DWSMA.

N	D	V	S	
X				D.3: The shoreland classifications of the public waters listed under sub-item (2), pursuant to part 6120.3000 and Minnesota Statutes, sections 103F.201 to 103F.221.

Technical Assistance Comments:

N	D	V	S	
	X			D.4: An existing map of wetlands regulated under Chapter 8420 and Minnesota Statutes, section 103G.221 to 103G.2373.

Technical Assistance Comments:
This information is in the public domain and may be used to delineate the surface water contribution area of the WHPA, if applicable, and determine the vulnerability of the DWSMA.

N	D	V	S	
X				D.5: An existing map showing those areas delineated as floodplain by existing local ordinances.

Technical Assistance Comments:

DATA ELEMENTS ABOUT THE LAND USE

E. LAND USE

N	D	V	S	
	X		X	E.1: An existing map of parcel boundaries.

Technical Assistance Comments: This information may be helpful in delineating the DWSMA, if available. During our scoping meeting, it was indicated that an electronic parcel map and file is available, but that the city was in the process of updating the information. Please submit the electronic parcel files when the updating is complete.

N	D	V	S	
	X		X	E.2: An existing map of political boundaries.

Technical Assistance Comments: Please provide this information if the boundaries have been updated/changed from what is available in the public domain. This information may be helpful in delineating the DWSMA. An electronic format for the map is preferable.

N	D	V	S	
	X			E.3: An existing map of public land surveys, including township, range, and section.

Technical Assistance Comments: This information is available in the public domain and may be helpful in delineating the DWSMA.

N	D	V	S	
X				E.4: A map and an inventory of the current and historical agricultural, residential, commercial, industrial, recreational, and institutional land uses and potential contaminant sources.

Technical Assistance Comments:

N	D	V	S	E.5: An existing, comprehensive land-use map.
X				

Technical Assistance Comments:

N	D	V	S	E.6: Existing zoning map.
X				

Technical Assistance Comments:

F. PUBLIC UTILITY SERVICES

N	D	V	S	F.1: An existing map of transportation routes or corridors.
	X			

Technical Assistance Comments: This information is available in the public domain and may be helpful in delineating the DWSMA.

N	D	V	S	F.2: An existing map of storm sewers, sanitary sewers, and the public water supply systems.
	X		X	

Technical Assistance Comments: Do not submit a map of the storm sewers and sanitary sewers. Describe the difference in how much water is pumped and how much is sold. The difference is the leakage that may be used as recharge in the groundwater model.

N	D	V	S	F.3: An existing map of gas and oil pipelines used by gas and oil suppliers.
X				

Technical Assistance Comments:

N	D	V	S	F.4: An existing map or list of public drainage systems.
	X	X		

Technical Assistance Comments: This information is available in the public domain and may be helpful in delineating the DWSMA.

N	D	V	S	F.5: An existing record of construction, maintenance, and use of the public water supply well(s) and other wells within the DWSMA.
	X	X	X	

Technical Assistance Comments: Please provide: 1) the pumping rates for the current and previous years, and the projected annual pumping rates for the next five years for each well in the PWS; and 2) well records for the MPUC wells if the information is different than that on-file with the MDH. Information about the MPUC wells may affect the vulnerability assessment due to rehabilitation/reconstruction of a well or changes in pumping rates.

DATA ELEMENTS ABOUT WATER QUANTITY

G. SURFACE WATER QUANTITY

N	D	V	S	
	X	X		G.1: An existing description of high, mean, and low flows on streams.

Technical Assistance Comments: This information is available in the public domain and may be used to determine hydraulic connections between surface water bodies and the aquifer(s) of concern.

N	D	V	S	
	X			G.2: An existing list of lakes where the state has established ordinary high water marks.

Technical Assistance Comments: This information is available in the public domain. The information may be used to determine the WHPA.

N	D	V	S	
	X	X	X	G.3: An existing list of permitted withdrawals from lakes and streams, including source, use, and amounts withdrawn.

Technical Assistance Comments: Only required if different from the DNR database. Surface water bodies may be in direct hydraulic connection with the aquifer(s) of concern and withdrawals may affect water levels in both the surface water and adjacent groundwater systems.

N	D	V	S	
	X			G.4: An existing list of lakes and streams for which state protected levels or flows have been established.

Technical Assistance Comments: This information is available in the public domain and may be used to determine hydraulic connections between surface water bodies and the aquifer(s) of concern.

N	D	V	S	
	X	X	X	G.5: An existing description of known water-use conflicts, including those caused by groundwater pumping.

Technical Assistance Comments: Please notify MDH of surface water/well interference problems of which the PWS is aware. Conflicts between use of groundwater resources and surface water bodies would indicate a hydrologic boundary that would need to be considered in delineating the WHPA.

H. GROUNDWATER QUANTITY

N	D	V	S	
	X	X	X	H.1: An existing list of wells covered by state appropriation permits, including amounts of water appropriated, type of use, and aquifer source.

Technical Assistance Comments: Please submit this information for wells that are not permitted by the DNR because this information may be useful in identifying the hydrologic boundary conditions that could affect the size and shape of the WHPA boundaries.

N	D	V	S	
	X	X	X	H.2: An existing description of known well interference problems and water-use conflicts.

Technical Assistance Comments: Please notify the MDH of well interference problems of which the PWS is aware. Interference problems with other wells, if present, likely indicate a hydrologic boundary that would need to be considered in making the WHPA delineation.

N	D	V	S	
	X	X	X	H.3: An existing list of state environmental boreholes, including unique well number, aquifer measured, years of record, and average monthly levels.

Technical Assistance Comments: Only submit monthly water level measurements (with unique well numbers and dates) that are not in the public domain.

DATA ELEMENTS ABOUT WATER QUALITY

I. SURFACE WATER QUALITY

N	D	V	S	
X				I.1: An existing map or list of the state water quality management classification for each stream and lake.

Technical Assistance Comments:

N	D	V	S	
		X	X	I.2: An existing summary of lake and stream water quality monitoring data, including: 1. Bacteriological contamination indicators 2. Inorganic chemicals 3. Organic chemicals 4. Sedimentation 5. Dissolved oxygen 6. Excessive growth or deficiency of aquatic plants.

Technical Assistance Comments: This information can be used to evaluate surface water/groundwater interactions and aquifer water quality. Submit if the MPUC has information that is not available in the public domain.

J. GROUNDWATER QUALITY

N	D	V	S	
	X	X	X	J.1: An existing summary of water quality data, including: 1) bacteriological contamination indicators; 2) inorganic chemicals; and 3) organic chemicals.

Technical Assistance Comments: Submit if the MPUC has information that is not available in the public domain, because the information may help explain groundwater flow paths.

N	D	V	S	
	X	X	X	J.2: An existing list of water chemistry and isotopic data from wells, springs, or other groundwater sampling points.

Technical Assistance Comments: Submit if the MPUC has information that is not available in the public domain, because the information may help explain groundwater flow paths.

N	D	V	S	
	X	X	X	J.3: An existing report of groundwater tracer studies.

Technical Assistance Comments: Submit if the MPUC has information that is not available in the public domain, because the information may help explain groundwater flow paths.

N	D	V	S	
		X	X	J.4: An existing site study and well water analysis of known areas of groundwater contamination.

Technical Assistance Comments: Submit if the MPUC has information on contaminant sources not available in the public domain, because these reports may contain additional geologic or hydrogeologic information.

N	D	V	S	
X				J.5: An existing property audit identifying contamination.

Technical Assistance Comments:

N	D	V	S	
	X	X		J.6: An existing report to the Minnesota Department of Agriculture and the Minnesota Pollution Control Agency of contaminant spills and releases.

Technical Assistance Comments: Notify the MDH of reports on spills or contaminant releases that are on-file with the MPUC but are not in the public domain. These reports do not need to be submitted, but MDH staff would like to review reports.

Summary of Data Request
Specific Data to be provided to the MDH by the Mora Public Utilities Commission

As discussed during the first scoping meeting on December 10, 2009, the Mora Public Utilities Commission (MPUC) will supply the following information for Part I of their wellhead protection plan to the Minnesota Department of Health (MDH). The number of the data element that refers to the information needed to prepare the Part I report is listed in parenthesis at the end of each request.

1) Municipal well information: Use Tables 1 and 2, the well records for the MPUC wells, and a map showing the locations of the public wells, to review the accuracy of 1) all MPUC well construction, 2) well locations, and 3) pumping information. (F.5)

   Table 1 lists well use and construction for each of the MPUC wells. Have you reconstructed any wells? If so, are there records for the reconstructed wells?

   The enclosed map shows the locations of the MPUC water supply wells. Please let us know if you feel the wells are not correctly located. These locations must be used to delineate your wellhead protection areas.

   Table 2 shows the available pumping information and indicates what information MPUC needs to provide for the delineation of the capture zone. Please provide 1) the pumping data for the last two years that was sent to the Minnesota Department of Natural Resources, 2) whether this rate was measured or estimated, and 3) the projected annual pumping amounts for the next five years.

2) Please provide a copy of any aquifer test or specific capacity information for the MPUC wells that was obtained during well construction, maintenance, or repair. During our meeting, staff recalled production tests and capacity tests that were likely performed at the wells by various well contractors over the years. This is the type of information that is useful for estimating aquifer parameters and delineating the wellhead protection area for your wells. Please send the results from this pumping test if you have a copy in your files. (B.1)

3) Mora staff indicated that the city was in the process of updating its electronic parcel map and data file. Please provide an electronic copy of the parcel map after it has been completed. This information could be used for defining the Drinking Water Supply Management Area (DWSMA). If you wish to use parcel lines, please provide the parcel identification number for each parcel boundary along with the map. Have the city boundaries changed? If the city boundaries have changed, please provide the new boundaries. The boundaries of the DWSMA may be larger if political boundaries are used instead of the parcel boundaries. (E.1 and E.2)

4) If there are private well records, soil boring reports, geophysical studies, or water level measurements in your files that MDH staff did not identify at the scoping meeting and that would be available for MDH staff to review and copy, please notify the MDH. (B.2, B.3, B.4, and H.3)

5) Please identify reports that you have on-file relating to leaks/contamination sites that may be a concern to your drinking water supply that the MDH may review and copy. (J.4)

6) If your files contain water chemistry data, such as bacteria, virus, inorganic, organic, or isotopic results from wells or other groundwater sampling points, that is not currently available to the MDH that the MDH may review and copy, please notify the MDH. (J.1 and J.2)

7) Please identify reports that you have in your files relating to groundwater tracer studies that have been conducted. (J.3)

8) Please provide information about other high-capacity wells in your area that may not be permitted and are not listed on the attached Table 3. (H.1)

9) Mora staff indicated that a study assessing the issue of surface-groundwater connection between Lake Mora and the MPUC wells was completed in 2002; a copy of this report was provided to the Department on December 22, 2009. This information could be very useful for the delineation of the wellhead protection area. Also, please describe any conflicts over water use that MPUC has been involved with, such as 1) private wells that went dry (or well interference) or 2) springs or wetlands that were affected. Was the Department of Natural Resources involved in resolving the conflict? (G.5 and H.2)

10) Please describe the annual amount of water that is lost due to leaks in the distribution system. Can you identify specific parts of the distribution system where this loss occurs? (F.2)

11) Please provide average monthly precipitation values from the wastewater treatment facility during the preceding five years. (A.2)

12) Please identify any other reports about surface water withdrawals or surface water monitoring data from lakes, streams, or wetlands that are not in the public domain that MDH staff could review and copy. (G.3 and I.2)

Table 1
Municipal Water Supply Well Information
Mora, Minnesota

Local Well Name	Unique Number	Use/ Status[1]	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Well Vulnerability	Aquifer
4	217385	**P**	12	170	195	1964	Vulnerable	Glacial Deposits
5	112239	**P**	16	145	203	1977	Vulnerable	Glacial Deposits
6	433279	**P**	16	150	210	1988	Vulnerable	Glacial Deposits

Note: 1. Primary (P) or Emergency Backup (E) Well

Table 2
Annual Volume of Water Pumped from MPUC Wells
(Gallons)

Well Name/ Number	2005	2006[+]	2007[+]	2008[++]	2009[++]	Projected 2014[++]
W4 (217385)	57,809,000	45.1 MG	47.9 MG			
W5 (112239)	33,066,000	35.4 MG	35.9 MG			
W6 (433279)	36,091,000	47.3 MG	54.0 MG			

Source: The DNR State Water Use Database System (SWUDS), Permit Number 631039, the city, and MPUC.

[+] Approximate volumes in million gallons; accurate volumes to be obtained, if possible.

[++] Information not available in public domain; please provide the 2008 and projected volumes.

Table 3
Permitted High-Capacity Wells and Surface Water Intakes
DNR State Water Use Database System (SWUDS)

Well Name/ Unique Number	DNR Permit Number	Aquifer/ Resource	Use	2003	2004	2005	2006[+]	2007[+]	2008*
Unknown	053072-1	QWTA	Pollution Containment			106,064	0.1 MG	0.0	

Source: The DNR State Water Use Database System (SWUDS).

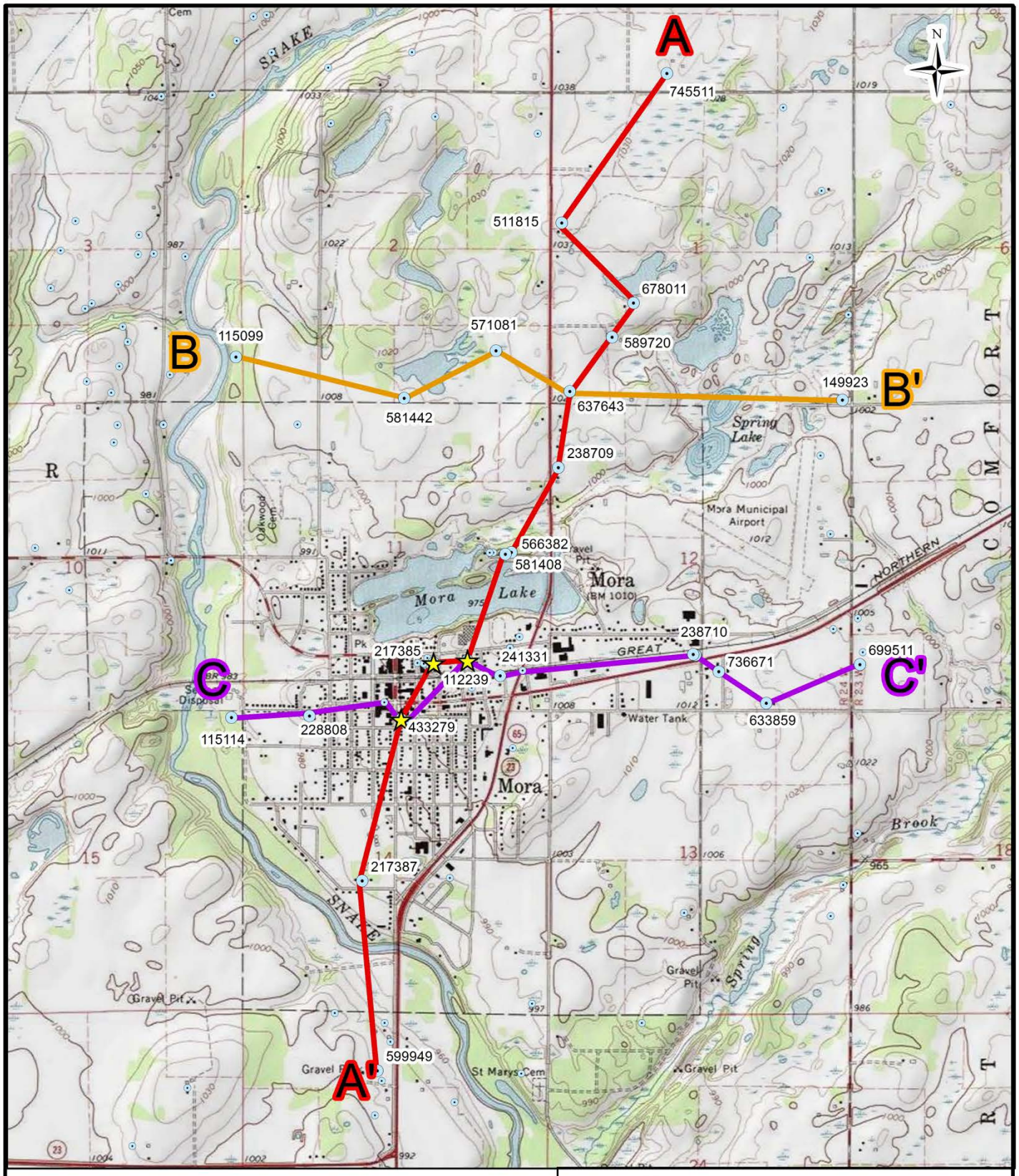
[+] Approximate volumes in million gallons; accurate volumes to be obtained, if possible.

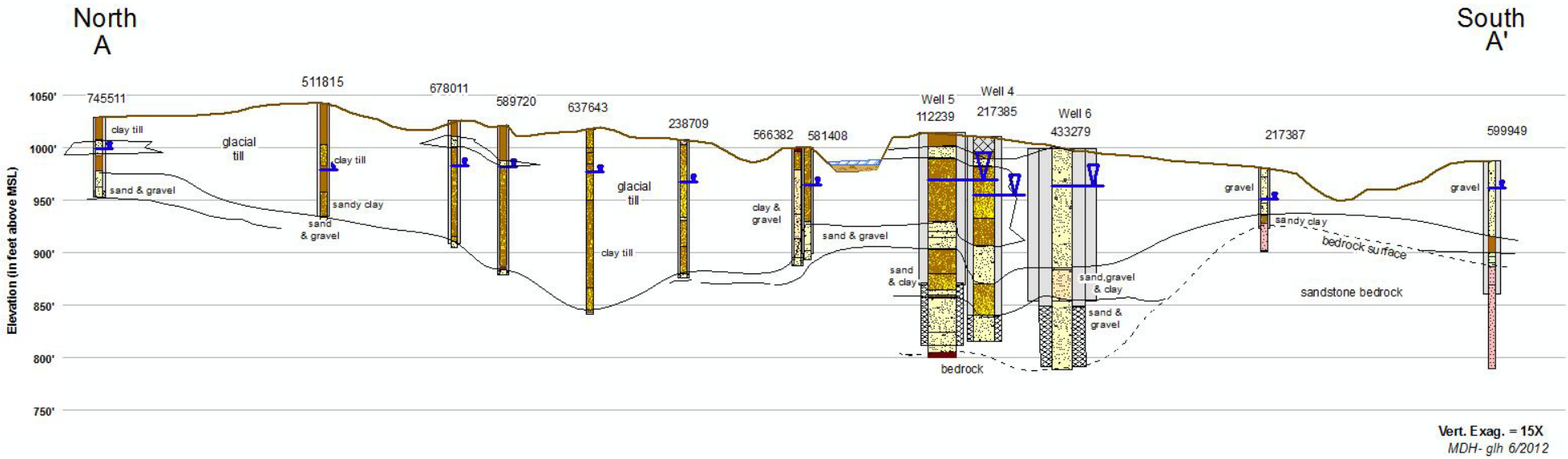
* Information to be obtained.

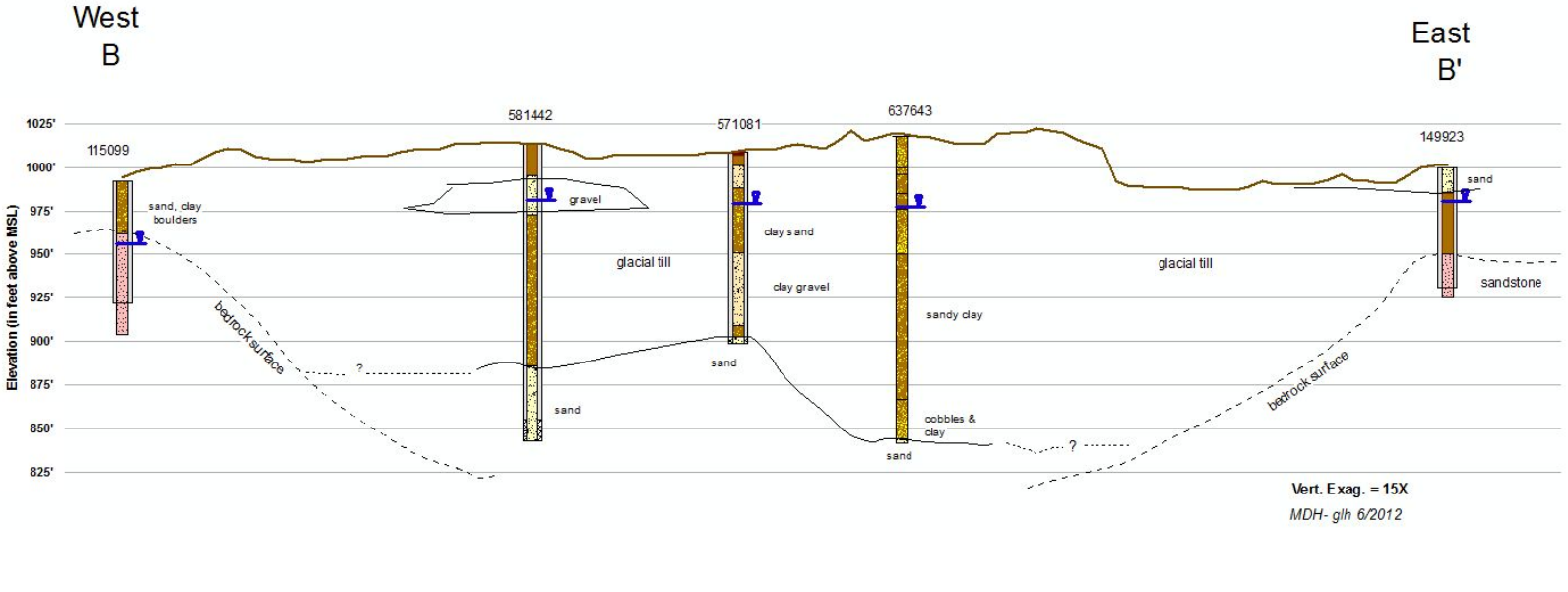

Mora Public Utilities Commission
Well Locations
December, 2009
Lake Mora
State Hwy 65
Well 4
(217385)
Well 5
(112239)
Forest Ave E
Well 6
(433279)
500 0 500 Feet
Explanation
MPUC Wells
Located Wells

Appendix B

Geologic Cross Sections


A
A'
B
B'
C
C'
745511
511815
678011
571081
589720
115099
581442
637643
149923
238709
566382
581408
238710
217385
241331
736671
699511
112239
115114
228808
433279
633859
217387
599949
Mora
Mora Lake
Spring Lake
Mora Municipal Airport
Water Tank
Gravel Pit
St Marys Cem
SNAKE
NORTHERN
GREAT
N
0 0.25 0.5 1 Miles
Explanation
Mora Wells
Cross-Section Wells
Located Wells
Geologic Transects
Section A-A'
Section B-B'
Section C-C'
MINNESOTA MDH DEPARTMENT of HEALTH
Trends of Geologic Transects
Mora, Minnesota





Ground Surface
Water Level

Geologic Materials

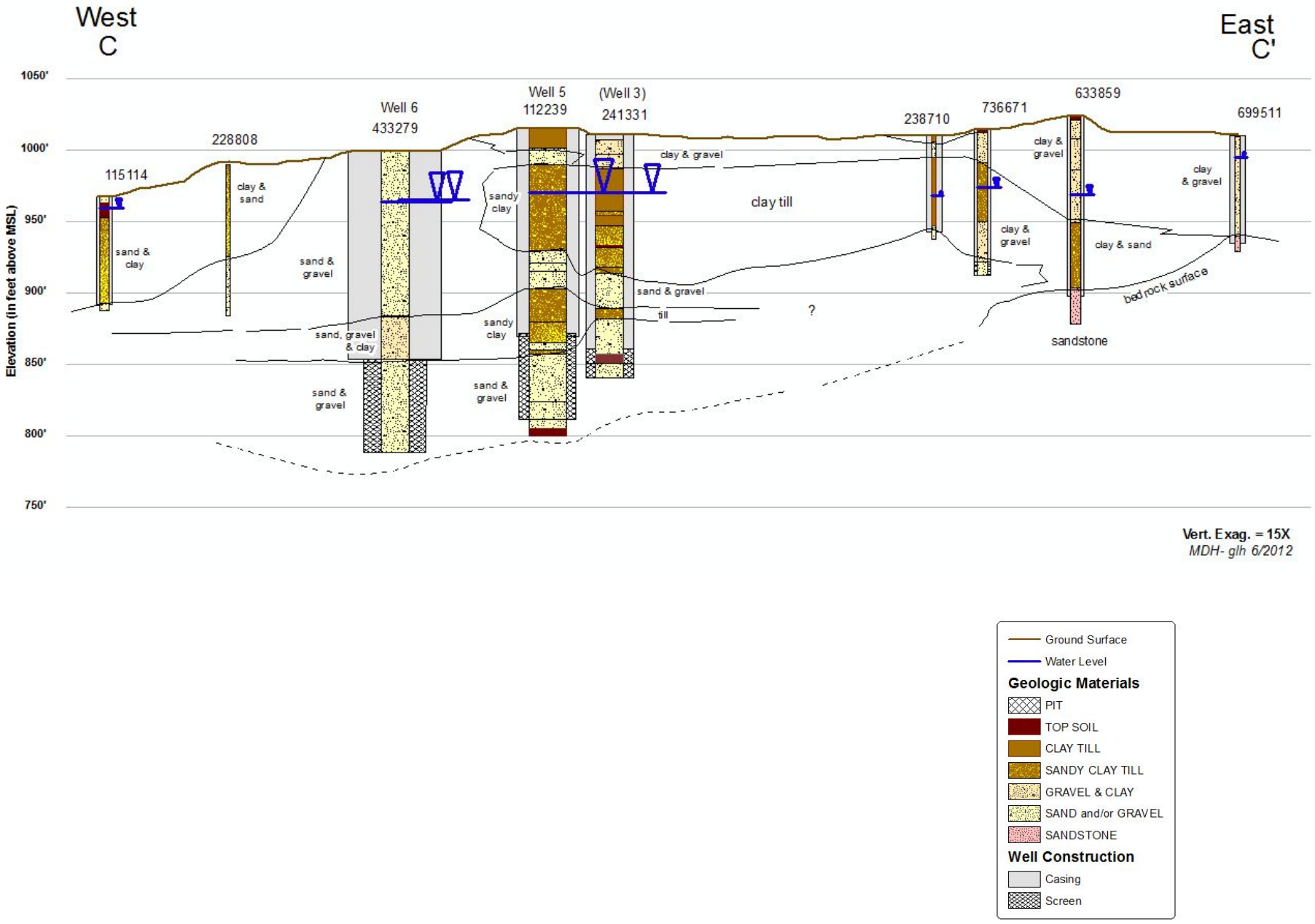
- PIT
- TOP SOIL
- CLAY TILL
- SANDY CLAY TILL
- GRAVEL & CLAY
- SAND and/or GRAVEL
- SANDSTONE

Well Construction

- Casing
- Screen

MINNESOTA MDH DEPARTMENT OF HEALTH

Geologic Cross-Sections A-A' and B-B'
Mora, Minnesota



MINNESOTA MDH DEPARTMENT OF HEALTH

Geologic Cross-Sections C-C'

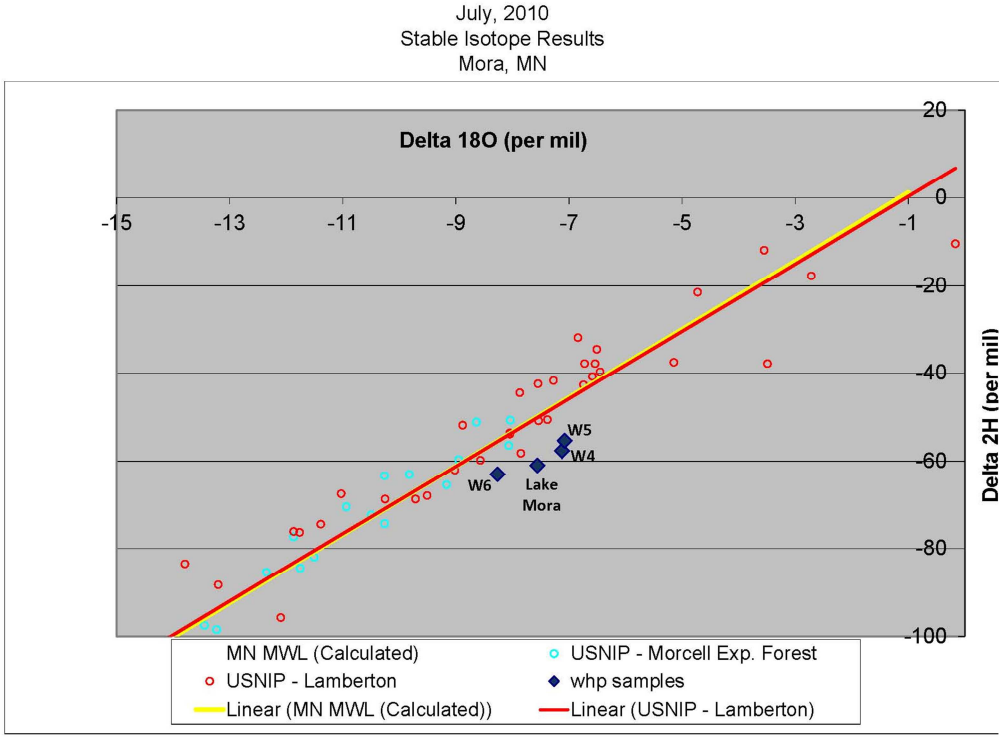
Mora, Minnesota

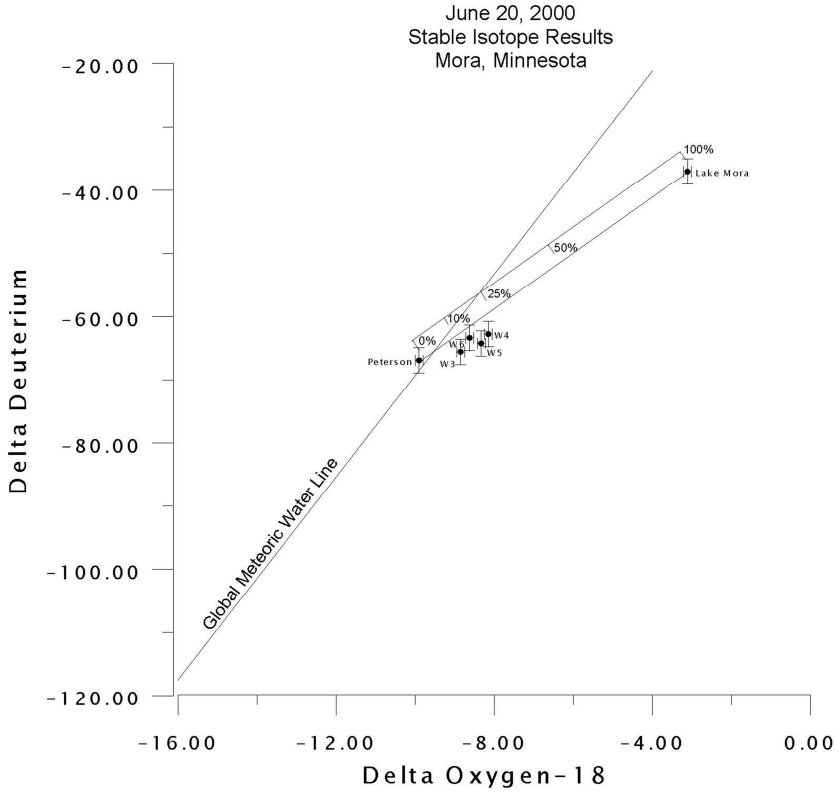
Appendix C

MDH Water Quality Data

City of Mora
Summary of Cl/Br, TOC and Isotope Data

Name	Chloride (mg/l) (07/2010)	Cl/Br ratio (07/2010)	TOC (mg/l) (10/2010)	Stable Isotopes (per mil) July 2011 Delta 18O	Delta 2H	Stable Isotopes (per mil) June 2000 Delta 18O	Delta 2H	Tritium (TU) July 2011	Tritium (TU) June 2000
Well 4 (217385)	18.6	1232	3.9	-7.13	-57.68	-8.15	-62.76	7.0	11.4
Well 5 (112239)	21.6	1480	4.8	-7.08	-55.34	-8.33	-64.23	6.9	8.9
Well 6 (433279)	23.9	1165	4.0	-8.27	-62.98	-8.62	-63.35	7.0	25.6
Lake Mora	14.5	(--Br not detected)		-7.56	-60.95	-3.11	-36.99		





Notes- In the two months preceding July 7 2010, rainfall measured 11.5-12.3 inches in Mora. The lake isotopes are more similar to precip values.
In the two months preceding June 20 2000, rainfall measured ~4.7 inches; the lake has a stronger evaporative signature.

Appendix D

Aquifer Test Plan and Pump Test Data

MINNESOTA MDH DEPARTMENT OF HEALTH
Division of Environmental Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Aquifer Test Plan

Public Water Supply ID: 1330001 **PWS Name:** City of Mora, MN

Contact

Aquifer Test Contact: Erik Tomlinson
Contractor Name & Address: 3535 Vadnais Center Drive
City, State, Zip: Saint Paul, Minnesota 55110
Phone: 651.490.2022 **Fax:** 651.490.2150

Proposed Aquifer Test Method

- [x] 1. An existing pumping test that meets the requirements of wellhead protection rule part 4720.5520 and that was previously conducted on a public well in your water supply system.
- [ ] 2. An existing pumping test that meets the requirements of wellhead protection rule part 4720.5520 and that was previously conducted on another well in a hydrogeologic setting determined by the department to be equivalent.
- [ ] 3. A pumping test conducted on a new or existing public well in your water supply system and that meets the requirements for larger sized water systems (wellhead protection rule part 4720.5520).
- [ ] 4. A pumping test conducted on a new or existing public well in your water supply system and that meets the requirements for smaller sized water systems (wellhead protection rule part 4720.5530).
- [ ] 5. An existing pumping test that does not meet the requirements of wellhead protection rule part 4720.5520 and that was previously conducted on: 1) a public water supply well or 2) another well in a hydrogeologic setting determined by the department to be equivalent.
- [ ] 6. An existing specific capacity test or specific capacity test for the public water supply well.
- [x] 7. An existing published transmissivity value.

C **Include all pumping test data and the estimated transmissivity value when the aquifer test method proposed is one of those specified in Nos. 1, 2, 5, 6, or 7 listed above.**

HE-01555-01 (2/02)
IC #140-0606

Test Description

Pumped Well Unique No: 433279

Test Duration (Hours): 24

Location - Township, Range, Section, Quarters: 39-24-14-ABBCA

Pump Type: Ford

Discharge Rate: variable

Number of Observation Wells: 0

Flow Rate Measuring Device Type: flow meter

☐ **Confined** ■ **Unconfined**

C **You must include a map showing the location of the pumping well and observation well(s).**

Rationale for Proposed Test Method

Briefly describe the rationale for method selected:

Data published in USGS Hydrogeologic Atlas "Water Resources of the Snake River Watershed, East-Central, Minnesota" HA-488.

Aquifer test used completed using Mora village wells (1,2,3,4) determined transmissivity to be 1.1X10^4 ft2/day (~1000 m2/day) and storage coefficient of approximately 3x10-3.

A pumping test was completed on Mora Well # 6 in 1988. Resulting transmissivity for this well is approximately 3.26 X10^4 ft2/day (~3000 m2/day) and a storage coefficient of approximately 2.61e-10.

List all unique numbers of wells that this Aquifer Test Plan applies to:

217385 (well 4)					
1112239 (well 5)					
433279 (well 6)					

Reviewed by:	Approved: ☐ Yes ☐ No	Approval Date:

Appendix E

Model Files (CD)

Appendix F

GIS Files (CD)

Appendix G

MDH Well Vulnerability Sheets

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1330001 TIER: 1
SYSTEM NAME: Mora WHP RANK:
WELL NAME: Well #4 UNIQUE WELL #: 00217385

COUNTY: Kanabec TOWNSHIP NUMBER: 39 RANGE: 24 W SECTION: 11 QUARTERS: DCBD

CRITERIA		DESCRIPTION		POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian		
DNR Geologic Sensitivity Rating	:	Medium		25
L Score	:	0		
Geologic Data From	:	Well Record		
Year Constructed	:	1964		
Construction Method	:			5
Casing Depth	:	170		10
Well Depth	:	195		
Casing grouted into borehole?		Unknown		5
Cement grout between casings?		Not applicable		0
All casings extend to land surface?		Yes		0
Gravel - packed casings?		Unknown		0
Wood or masonry casing?		No		0
Holes or cracks in casing?		Unknown		0
Isolation distance violations?				0
Pumping Rate	:	690		10
Pathogen Detected?				0
Surface Water Characteristics?				0
Maximum nitrate detected	:	Unknown		0
Maximum tritium detected	:	7 07/15/2010		VULNERABLE
Non-THMS VOCs detected?				0
Pesticides detected?		Atrazine	07/10/1991	VULNERABLE
Carbon 14 age	:	Unknown		0
Wellhead Protection Score	:			55
Wellhead Protection Vulnerability Rating	:			VULNERABLE
Vulnerability Overridden	:			

COMMENTS
Previous tritium result of 11.4 TU on 6/20/2000. Previous O-18 of -8.15 and 2H of -62.76 (no date).

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1330001 TIER: 1
SYSTEM NAME: Mora WHP RANK:
WELL NAME: Well #5 UNIQUE WELL #: 00112239

COUNTY: Kanabec TOWNSHIP NUMBER: 39 RANGE: 24 W SECTION: 11 QUARTERS: DCAD

CRITERIA		DESCRIPTION		POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian		
DNR Geologic Sensitivity Rating	:	Medium		25
L Score	:	0		
Geologic Data From	:	Well Record		
Year Constructed	:	1977		
Construction Method	:	Cable Tool/Bored		0
Casing Depth	:	145		10
Well Depth	:	203		
Casing grouted into borehole?		Yes		0
Cement grout between casings?		Yes		0
All casings extend to land surface?		Yes		0
Gravel - packed casings?		No		0
Wood or masonry casing?		No		0
Holes or cracks in casing?		Unknown		0
Isolation distance violations?				0
Pumping Rate	:	750		10
Pathogen Detected?				0
Surface Water Characteristics?				0
Maximum nitrate detected	:	Unknown		0
Maximum tritium detected	:	6.9 07/15/2010		VULNERABLE
Non-THMS VOCs detected?				0
Pesticides detected?		Atrazine	07/10/1991	VULNERABLE
Carbon 14 age	:	Unknown		0
Wellhead Protection Score	:			45
Wellhead Protection Vulnerability Rating	:			VULNERABLE
Vulnerability Overridden	:			

COMMENTS
Previous tritium result of 8.9 TU on 6/20/2000. Previous O-18 of -8.33 and 2H of -64.23 (no date).

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1330001 TIER: 1
SYSTEM NAME: Mora WHP RANK:
WELL NAME: Well #6 UNIQUE WELL #: 00433279

COUNTY: Kanabec TOWNSHIP NUMBER: 39 RANGE: 24 W SECTION: 14 QUARTERS:

CRITERIA		DESCRIPTION	POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian	
DNR Geologic Sensitivity Rating	:	High	0
L Score	:	0	
Geologic Data From	:	Well Record	
Year Constructed	:	1988	
Construction Method	:	Cable Tool/Bored	0
Casing Depth	:	150	10
Well Depth	:	210	
Casing grouted into borehole?		Yes	0
Cement grout between casings?		Yes	0
All casings extend to land surface?		Yes	0
Gravel - packed casings?		No	0
Wood or masonry casing?		No	0
Holes or cracks in casing?		Unknown	0
Isolation distance violations?			0
Pumping Rate	:	770	10
Pathogen Detected?			0
Surface Water Characteristics?			0
Maximum nitrate detected	:	Unknown	0
Maximum tritium detected	:	7 07/15/2010	VULNERABLE
Non-THMS VOCs detected?			0
Pesticides detected?			0
Carbon 14 age	:	Unknown	0
Wellhead Protection Score	:		20
Wellhead Protection Vulnerability Rating	:		VULNERABLE
Vulnerability Overridden	:		

COMMENTS
Previous tritium result of 25.6 TU on 6/20/2000. Previous O-18 of -8.62 and 2H of -63.35 (no date).

Appendix G

Inner Wellhead Management Zone Inventories

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1330001
NAME	Mora
ADDRESS	Mora Water Superintendent, City Hall, 101 Lake Street South, Mora, MN 55051

COMMUNITY

FACILITY (WELL) INFORMATION

NAME	Well #4
FACILITY ID	S04
UNIQUE WELL NO.	217385
COUNTY	Kanabec

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1330001 S04	UNIQUE WELL NO.	217385

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		

PWS ID / FACILITY ID	1330001 S04	UNIQUE WELL NO.	217385

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	160	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	180	N
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		N		
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		Y	16	
MON	Monitoring well	record dist.	record dist.		Y	105	
MON	Monitoring well	record dist.	record dist.		Y	136	
WEL	Operating well	record dist.	record dist.		Y	171	
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		Y	150	N
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		Y	20	Y
*HS1	Hazardous substance buried piping	50	50		N		
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		

PWS ID / FACILITY ID	1330001 S04	UNIQUE WELL NO.	217385

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		Y	115	N
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		Y	120	N
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
	none found within 200' of this well.						

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

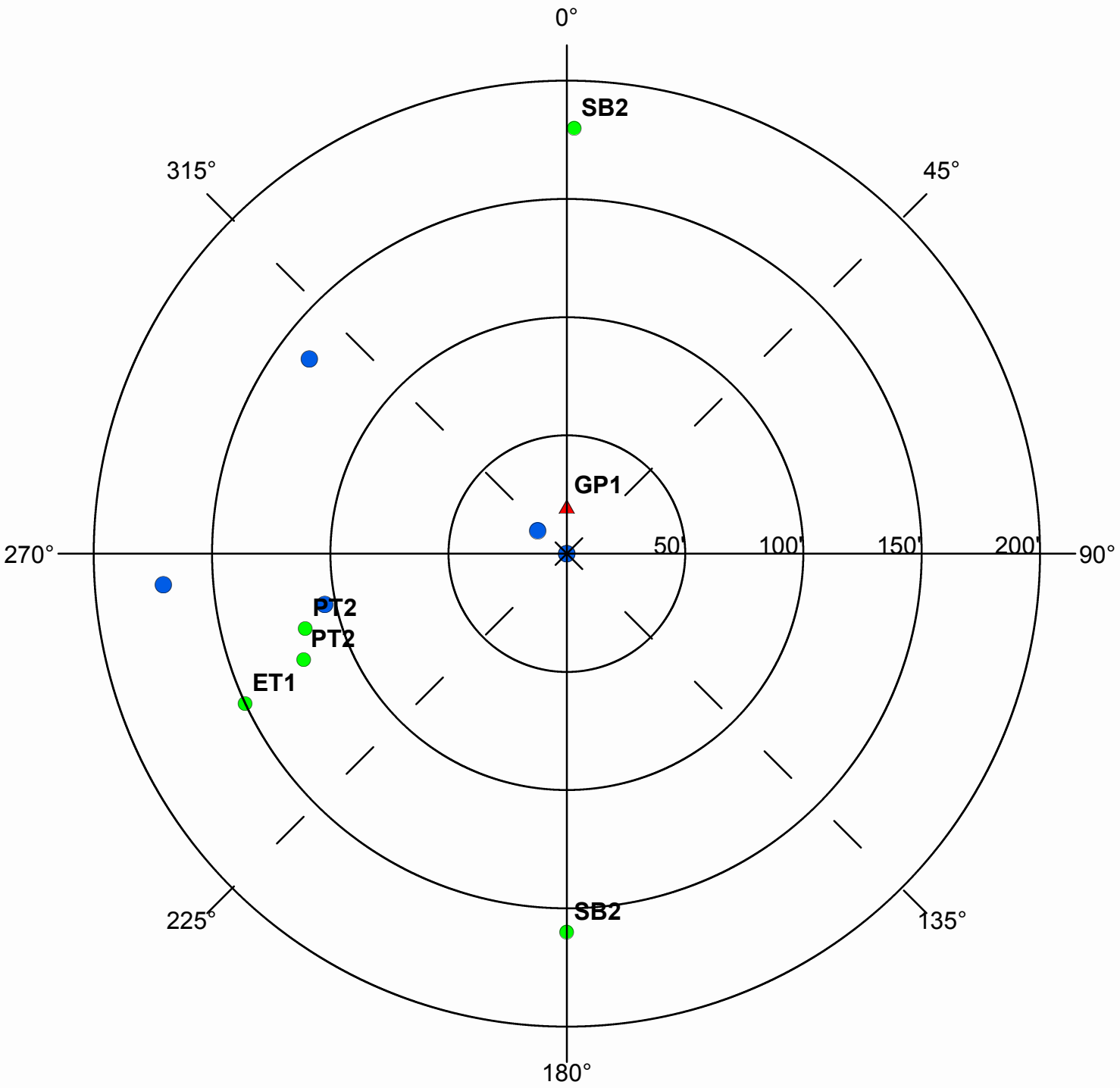
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / FACILITY ID	1330001 S04	UNIQUE WELL NO.	217385

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.



Were the isolation distances maintained for the new sources of contamination?	(Y)	N	N/A
Is the system monitoring existing nonconforming sources of contamination?	Y	(N)	N/A

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Wettlaufer, Mark (SWP)	DATE	8 - 28 - 2013

PWS ID / FACILITY ID	1330001 S04	UNIQUE WELL NO.	217385

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED
See recommended WHP Measures 1 and 2 below.		

COMMENTS

1) West cement containment wall around 2 (30,000 gal.) diesel fuel tanks to be re-installed Fall, 2013 per City of Mora Water Supply Mgr. and Electric Utility Mgr.

2) Water Supply Mgr. to work with City Electric Utility staff to continue to monitor, report and clean up any spills in and around electric plant near City Well # 4.

3) The monitoring wells noted on the report have been sealed per the inspection and information found in CWI, but have not been removed from this report.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1330001
NAME	Mora
ADDRESS	Mora Water Superintendent, City Hall, 101 Lake Street South, Mora, MN 55051

COMMUNITY

FACILITY (WELL) INFORMATION

NAME	Well #5
FACILITY ID	S05
UNIQUE WELL NO.	112239
COUNTY	Kanabec

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1330001 S05	UNIQUE WELL NO.	112239

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		

PWS ID / FACILITY ID	1330001 S05	UNIQUE WELL NO.	112239

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	170	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	180	N
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		N		
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		N		
WEL	Operating well	record dist.	record dist.		N		
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		N		
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		Y	20	Y
*HS1	Hazardous substance buried piping	50	50		N		
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		

PWS ID / FACILITY ID	1330001 S05	UNIQUE WELL NO.	112239

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		N		
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
	none found within 200' of this well.						

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

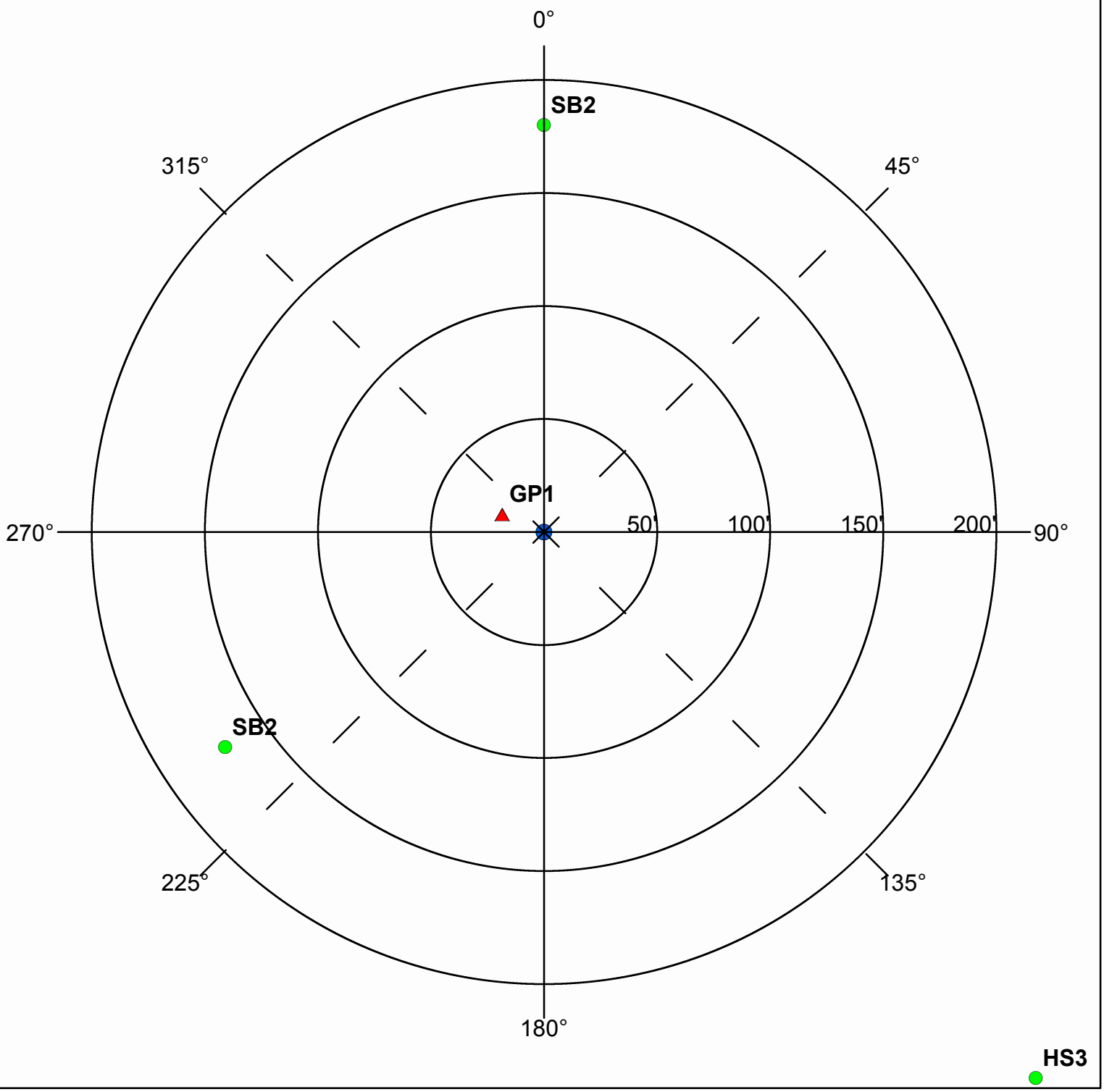
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / FACILITY ID	1330001 S05	UNIQUE WELL NO.	112239

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.



Were the isolation distances maintained for the new sources of contamination?	(Y)	N	N/A
Is the system monitoring existing nonconforming sources of contamination?	Y	(N)	N/A

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Wettlaufer, Mark (SWP)	DATE	8 - 28 - 2013

PWS ID / FACILITY ID	1330001 S05	UNIQUE WELL NO.	112239

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

Monitoring Wells and former petroleum release site located 3 blocks east near Jerry's Bait.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1330001
NAME	Mora
ADDRESS	Mora Water Superintendent, City Hall, 101 Lake Street South, Mora, MN 55051

COMMUNITY

FACILITY (WELL) INFORMATION

NAME	Well #6
FACILITY ID	S06
UNIQUE WELL NO.	433279
COUNTY	Kanabec

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1330001 S06	UNIQUE WELL NO.	433279

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		

PWS ID / FACILITY ID	1330001 S06	UNIQUE WELL NO.	433279

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		N		
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		Y	90	N
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		N		
WEL	Operating well	record dist.	record dist.		Y	115	
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		N		
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		Y	30	Y
*HS1	Hazardous substance buried piping	50	50		N		
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		

PWS ID / FACILITY ID	1330001 S06	UNIQUE WELL NO.	433279

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		N		
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
SBA	Sewer buried, approved, air tested	50	20		Y	135	N
SWD	Storm water drain pipe, 12 inches or greater	50	20		Y	150	N

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

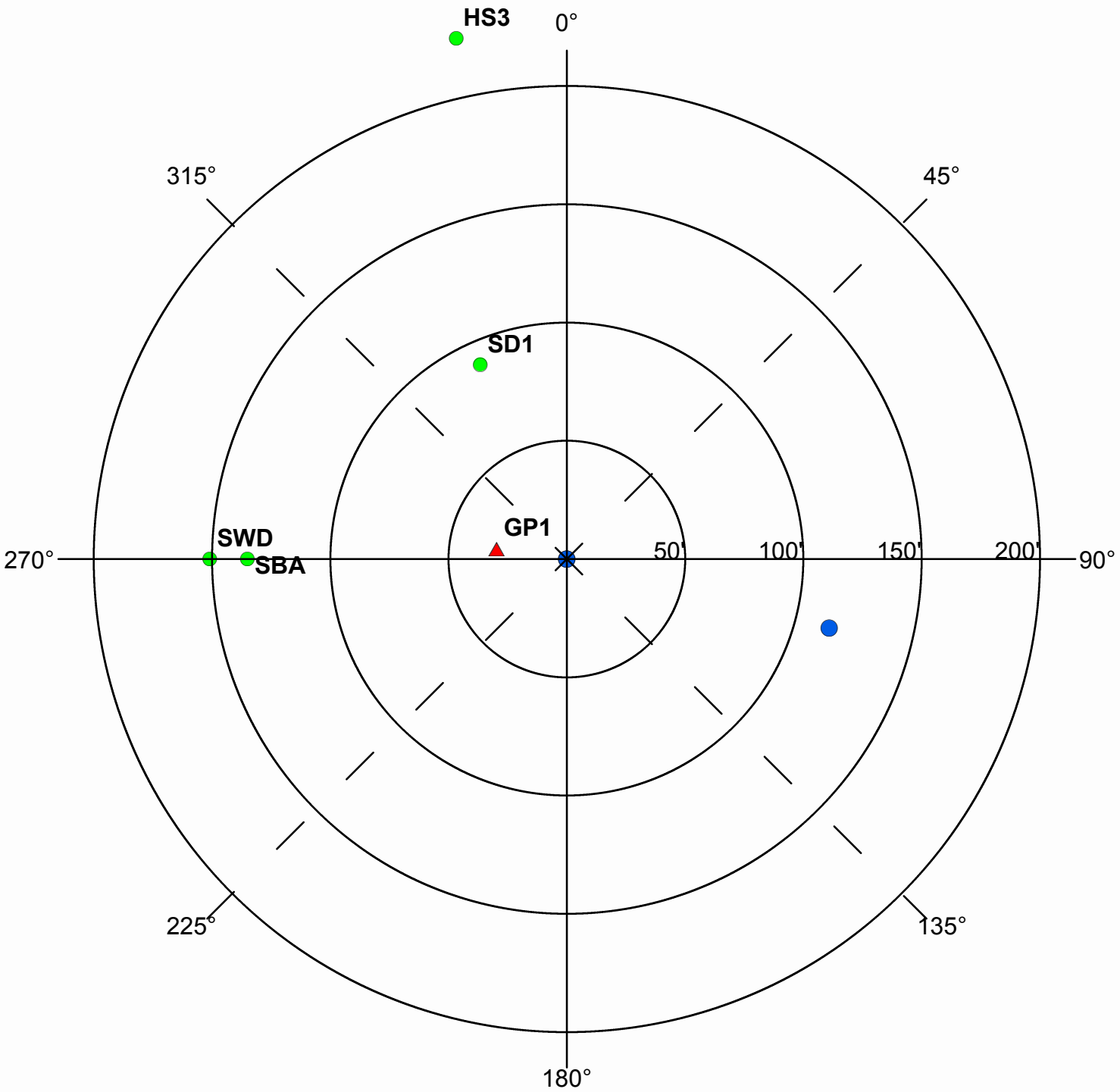
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / FACILITY ID	1330001 S06	UNIQUE WELL NO.	433279

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.



Were the isolation distances maintained for the new sources of contamination?	(Y)	N	N/A
Is the system monitoring existing nonconforming sources of contamination?	Y	(N)	N/A

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Wettlaufer, Mark (SWP)	DATE	8 - 28 - 2013

PWS ID / FACILITY ID	1330001 S06	UNIQUE WELL NO.	433279

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

Former Creamery / Co-op site located west of existing gas station per PWS Mgr.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Appendix G

Inner Wellhead Management Zone Inventories