WELLHEAD PROTECTION PLAN
FOR THE

Marshall and Polk
Rural Water System

This plan is in effect from:

August 2013

Forward

This document presents the wellhead protection (WHP) plan for Marshall and Polk Rural Water System that will help provide for an adequate and safe drinking water supply for community residents. It contains the following components:

- Assessment of the data elements used to prepare the plan;
- Delineation of the wellhead protection area;
- Delineation of the drinking water supply management area;
- Assessments of well and drinking water supply management area vulnerability;
- Impact of land and water use changes on the public water supply well(s) used by the water supplier;
- Issues, problems, and opportunities affecting the well(s), well water, and the drinking water supply management area;
- Wellhead protection goals for this plan;
- Objectives and plan of action for achieving the wellhead protection goals;
- Evaluation program for assessing the effectiveness of this plan; and
- Contingency strategy to address an interruption of the water supply.

Water Supply Wells Included in This Plan

Unique Number	Well Name or Number	Use/Status[1]
240757	**Well 1**	**P**
240758	**Well 2**	**P**
513019	**Well 5**	**P**
473633	**Well 6**	**P**

[1]P = Primary Water Supply Well, E = Emergency Backup Well, S = Seasonal Well

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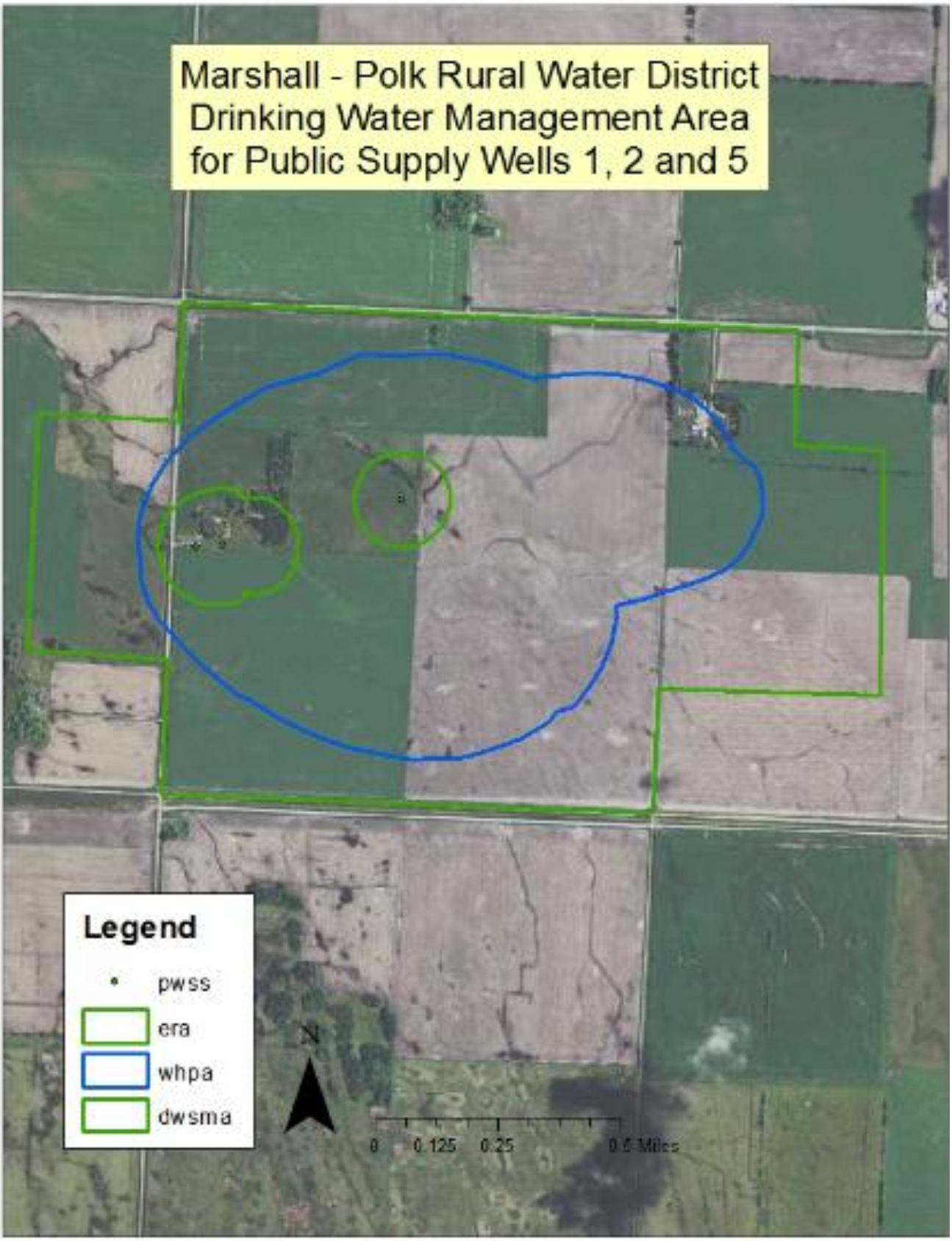
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Drinking Water Management Area
for Public Supply Wells 1, 2 and 5
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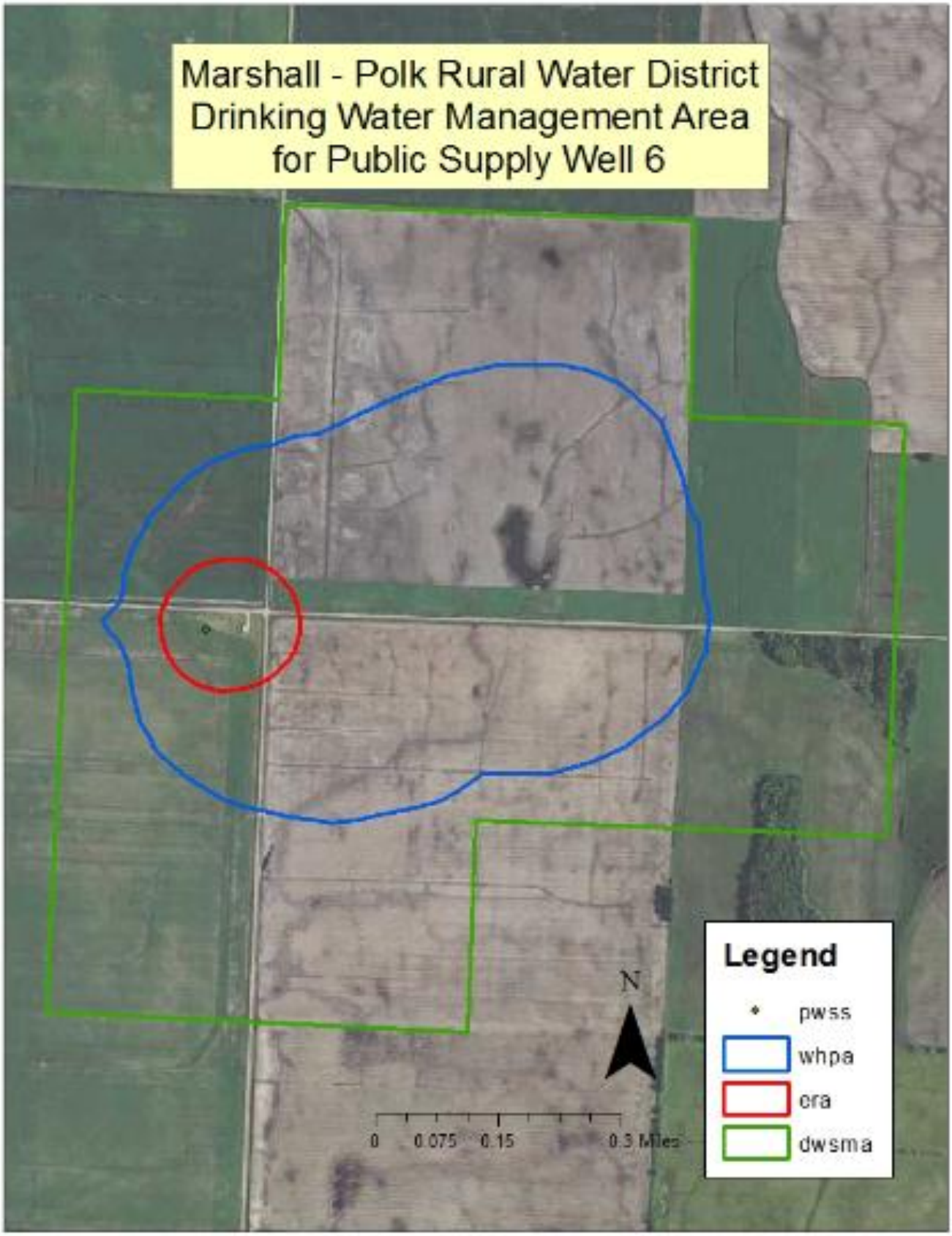
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Drinking Water Management Area
for Public Supply Well 6
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Chapter 1 - Introduction

1.1 Background

The wellhead protection (WHP) plan for Marshall and Polk Rural Water was prepared in cooperation with the Minnesota Department of Health (MDH). It contains specific actions that Marshall Polk Rural Water will take to fulfill WHP requirements that are specified under Minnesota Rules, part 4720.5100 to 4720.5590. Also, the support that Minnesota state agencies, federal agencies, Kittson, Marshall and Polk Counties, and others will provide is presented to identify their roles in protecting the Marshall Polk Rural Water drinking water supply. The plan is effective for 10 years after the approval date specified by MDH and the Marshall Polk Rural Water is responsible for implementing its WHP plan of action, as described in Table 9 of this report. Furthermore, Marshall and Polk Rural Water will evaluate the status of plan implementation at least every two-and-one-half years to identify whether its WHP plan is being implemented on schedule.

1.2 Plan Appendices

Much of the technical information that was used to prepare this plan is contained in the appendices but is summarized in the main body of this plan. In particular:

- Appendix I contains the amendments to the first part of the plan, consisting of the delineation of the wellhead protection area (WHPA), the drinking water supply management area (DWSMA), and the vulnerability assessments for the public water supply well(s) and the DWSMA. This part of the plan is summarized in Chapter 3.
- Appendix II contains the inventory of potential contamination sources. This inventory is discussed in Chapter 4 in terms of assigning risk to the Marshall and Polk Rural Water's water supply and is also discussed in Chapter 6, relating to issues, problems or opportunities.
- Appendix III contains the contingency strategy to provide for an alternate water supply if there is a disruption caused by contamination or mechanical failure. This information is discussed in Chapter 11.

Chapter 2 - Identification and Assessment of the Data Elements Used to Prepare the Plan

The data elements that are included in this plan were used to 1) delineate the WHPA and the DWSMA and to assess DWSMA and well vulnerability and 2) document the need for the WHP measures that will be implemented to help protect the Marshall Polk Rural Water's water supply from potential sources of contamination. The Marshall Polk Rural Water met with representatives from MDH on two occasions to discuss data elements that are specified in Minnesota Rules, part 4720.5400, for preparing a WHP plan.

The first scoping meeting, held on November 22, 2010, addressed the data elements that were needed to support the delineation of the WHPA, the DWSMA, and the well(s) and DWSMA vulnerability assessments. The second scoping meeting, held on June 19, 2012 discussed the data elements required to 1) identify potential risks to the public water supply and 2) develop effective management strategies to protect the public water supply in relation to well and DWSMA vulnerability. The results of each meeting were communicated to the Marshall Polk Rural Water by MDH through a formal scoping

decision notice. Not all of the data elements listed in the WHP rule had to be addressed in the WHP plan because of the nonvulnerable nature of the Marshall and Polk Rural Water's source of drinking water.

The following table presents the data element assessment results relative to the overall impact that each data element has on the four items listed.

Table 1 - Assessment Results for the Data Elements

Definitions-
High (H) – the data element has a direct impact
Moderate (M) – the data element has an indirect or marginal Impact
Low (L) - the data element has little if any impact
Shaded Area – the data element was not required by MDH for preparing the WHP plan.

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
Precipitation					MN Climatology Office
Geology					
Maps and geologic descriptions	M	H	M	H	MGS, DNR, USGS, Consultant Reports
Subsurface data	H	H	H	H	MGS, MDH, MPCA, DNR, MDA
Borehole geophysics	L	L	L	H	MGS, Consultant Reports
Surface geophysics	M	M	L	M	DNR, MPCA, Consultant Reports
Maps and soil descriptions					NRCS
Eroding lands					NRCS
Soils					
Maps and soil descriptions					
Eroding lands					
Water Resources					
Watershed units					DNR, USGS
List of public waters					DNR
Shoreland classifications					DNR
Wetlands map					LMIC
Floodplain map					FEMA
Land Use					
Parcel boundaries map	L	H	L	H	County
Political boundaries map	L	H	L	L	County Metro Council
PLS map	L	H	L	L	MPRW, MGEO
Land use map and inventory	M	H	M	M	Sanborn Fire Maps, Historical Society, MPRW Records, County
Comprehensive land use map	L	L	L	L	MPRW, County
Zoning map	L	L	L	L	MPRW, County
Public Utility Services					
Transportation routes and corridors					
Storm/sanitary sewers and					MPRW

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
PWS system map					
Oil and gas pipelines map					LMIC
Public drainage systems map or list					County, LMIC
Records of well construction, maintenance, and use	H	H	H	M	MPRW, CWI, MDH files
Surface Water Quantity					
Stream flow data					DNR, USGS, Metro Council
Ordinary high water mark data					DNR
Permitted withdrawals					DNR
Protected levels/flows					DNR
Water use conflicts					DNR
Groundwater Quantity					
Permitted withdrawals	H	H	H	H	DNR
Groundwater use conflicts	M	M	H	H	DNR
Water levels	H	H	H	M	DNR, MPCA, MDA, MDH, MPRW
Surface Water Quality					
Stream and lake water quality management classification					DNR
Monitoring data summary					MPCA, SWCD, WSD/WMO
Groundwater Quality					
Monitoring data	H	H	H	H	MPCA, MDH
Isotopic data	M	M	M	M	MDH
Tracer studies	M	M	M	M	Not Available *(default description)*
Contamination site data					MPCA, MDA
Property audit data from contamination sites					MPRW, MPCA
MPCA and MDA spills/release reports					MPRW, MPCA

These data items identified in the Scoping 2 document that were required to be submitted as part of this plan (if existing). Following is a list of data items that were researched and found not to be in existence, or in a format that is able to be included in the report.

- Existing Zoning Maps were not found. Marshall County Land Use Plan map is included (Figure 10)
- Maps of the Marshall & Polk System and Parcel maps are available at the Marshall Polk Rural Water Office.
- CCR Report for Marshall & Polk Rural Water System is located in Appendix VI

Chapter 3 - Delineation of the Wellhead Protection Area, Drinking Water Supply Management Area and Vulnerability Assessments

A detailed description of the process used for 1) delineating the WHPA and the DWSMA, and 2) preparing the vulnerability assessments of the Marshall and Polk Rural Water System water supply well(s) and DWSMA is presented in Appendix I. The Marshall and Polk Rural Water Supplier requested that MDH do this work and it was performed by Rich G. Soule who is licensed as a geoscientist by the State of Minnesota. (Appendix I)

3.1 WHPA and DWSMA Delineation

Figure 1 shows the boundaries of the WHPA and the DWSMA. The WHPA was delineated using computer simulations of groundwater movement to generate the underground capture zones for Marshall and Polk Rural Water Well 1 (Unique No.240757), Well 2 (Unique No. 240758), Well 5 (Unique No. 513019), Well 6 (Unique No. 473633). The WHPA for these water supply wells is shown in Figure 1& 2.

The DWSMA boundaries were designated using the following criteria:

- Center-lines of highways, streets, roads, or railroad rights-of-ways;
- Public Land Survey coordinates;
- Property or fence lines;
- Political boundaries.

3.2 Well Vulnerability Assessment

The construction and water quality obtained from each primary and emergency backup well(s) used by the Marshall and Polk Water Supplier is included in the assessment of well vulnerability. The vulnerability of Marshall and Polk Rural Water wells is considered low because they are constructed so that each well is adequately sealed into the borehole and does not pump water that contains human-caused contaminants. (Appendix I)

3.3 DWSMA Vulnerability Assessment

The low vulnerability assigned to the DWSMA (Figure 1& 2) was determined using geologic, soils, and groundwater chemistry information and indicates that at least 10 feet of clay-rich geological material covers the source water aquifer. The very low vulnerability assigned to the DWSMA was determined using geologic, soils, and groundwater chemistry information and indicates that the source water aquifer is covered by at least 50 continuous feet of clay-rich geological material. (Appendix I)

Chapter 4 - Establishing Priorities and Assigning Risk to Potential Contamination Sources

The types of potential contamination sources that may exist within the DWSMA were derived from the information collected to satisfy the data element requirements (Chapter 2). The impact assigned to each data element as part of the assessment process (Table 1) was used to assess the types of potential contamination sources that may present a risk to the Marshall and Polk Rural Water's drinking water supply. The low vulnerability assessment for the DWSMA indicates that, generally, only wells, other types of boreholes, excavations that may reach the aquifer and certain types of Environmental Protection Agency Class V Wells are likely to impact the Marshall and Polk Rural Water wells.

4.1 Contaminants of Concern

None of the human-caused contaminants regulated under the federal Safe Drinking Water Act have been detected at levels indicating that any well itself serves to draw contaminants into the aquifer as a result of pumping. Historically the well water quality used by the Marshall and Polk Rural Water System has been excellent and exceeds federal safe drinking water standards. The lack of tritium in the well water indicates that the aquifer is being recharged with "aged "water. The presence of aged water indicates that the aquifer receives recharge over a long time period and is not likely to be directly impacted by land uses.

4.2 Inventory Results and Risk Assessment

A description of the locations of potential contamination sources is presented in Appendix II. A summary of the results for the IWMZ is listed in Table 2 and Table 3 presents these results for the remainder of the DWSMA. The priority assigned to each type of potential contamination source addresses 1) the number inventoried, 2) its proximity to a Marshall and Polk Rural Water well, 3) the capability of local geologic conditions to absorb a contaminant, 4) the effectiveness of existing regulatory controls, 5) the time required for the Marshall & Polk Rural Water system to obtain cooperation from governmental agencies that regulate it, and 6) the administrative, legal, technical, and financial resources needed. A **high (H)** risk potential implies that the potential source type has the greatest likelihood to negatively impact the Marshall and Polk Rural Water's water supply and should receive highest priority for management. A **low (L)** risk potential implies that a lower priority for implementing management measures is assigned.

Table 2 - Potential Contamination Sources and Assigned Risk for the IWMZ

Source Type	Total	Level of Risk
No known private wells located in IWMZ		
Marshall and Polk Rural Water Wells	4	L

Table 3 - Potential Contamination Sources and Assigned Risk for the Rest of the DWSMA

Potential Source Type	Total Number	Number Within Emergency Response Area and Level of Risk		Number Within Remainder of the DWSMA and Level of Risk	
Private Well	1			1	*H*

Chapter 5 - Impact of Land and Water Use Changes on the Public Water Supply Well(s)

The Marshall and Polk Rural Water estimates that the following changes to the physical environment, land use, surface water, and groundwater-may occur over the 10-year period that the WHP plan is in effect (Table 4). This is needed to determine whether new potential sources of contamination may be introduced in the future and to identify future actions for addressing these anticipated sources. Land and water use changes may introduce new contamination sources or result in changes to groundwater use and quality. The anticipated changes may occur within the jurisdictional authority of the Marshall and Polk Rural Water, although some may not. Table 4 describes the anticipated changes to the physical environment, land use, and surface water or groundwater in relationship to the 1) influence that existing governmental land and water programs and regulations may have on the anticipated change, and 2) administrative, technical, and financial considerations of the Marshall & Polk Rural Water system and property owners within the DWSMA.

Table 4 - Expected Land and Water Use Changes

Expected Change (Physical Environment, Land Use, Surface Water, Groundwater)	Impact of the Expected Change On the Source Water Aquifer	Influence of Existing Government Programs and Regulations on the Expected Change	Administrative, Technical, and Financial Considerations Due to the Expected Change
Physical Environment: No changes to the aquifer are anticipated within the next 10 years	Does not apply	Current pumping rates and storage are more than adequate so no significant programs or regulations are necessary	No expected change in water volume of water pumped is expected in the near future.
Land Use: Not applicable	Not applicable	Not applicable	Not applicable.
Surface Water: Not applicable	Not applicable	Not applicable	Not applicable
Groundwater: If a new high capacity well is constructed in or near the DWSMA it may impact the boundaries of the delineated areas.	This may alter the current DWSMA boundaries and may increase the rate at which surface water recharges the aquifer depending on where this well is constructed	The DNR permits new high capacity wells within the area. MPRWS will work closely with DNR/MDH on notification of new wells	No high capacity wells of any type are expected to be drilled in the drinking water supply management area. Marshall and Polk Rural Water System will request to be notified if any new high capacity wells are permitted with in the one mile of the DWSMA.

Chapter 6 - Issues, Problems, and Opportunities

6.1 Identification of Issues, Problems and Opportunities

The Marshall and Polk Rural Water System has identified water and land use issues and problems and opportunities related to 1) the aquifer used by the Marshall and Polk Rural Water supply wells, 2) the quality of the well water, or 3) land or water use within the DWSMA. The Marshall and Polk Rural Water assessed 1) input from public meetings and written comments it received, 2) the data elements identified by MDH during the scoping meetings, and 3) the status and adequacy of the Marshall and Polk Rural Water's official controls and plans on land and water uses, in addition to those of local, state, and federal government programs. The results of this effort are presented in the following table, which defines the nature and magnitude of contaminant source management issues in the Marshall and Polk Rural Water's DWSMA. Identifying issues, problems and opportunities, including resource needs, enables the Marshall and Polk Rural Water to 1) take advantage of opportunities that may be available to make effective use of existing resources, 2) set meaningful priorities for source management and 3) solicit support for implementing specific source management strategies.

6.2 Comments Received

There have been several occasions for local governments, state agencies, and the general public to identify issues and comment on the Marshall and Polk Rural Water's WHP plan. At the beginning of the planning process, local units of government were notified that the Marshall and Polk Rural Water was going to develop its WHP plan and were given the opportunity to identify issues and comment. A public information meeting was held to review the results of the delineation of the wellhead protection area, DWSMA, and the vulnerability assessments. The meetings of the Marshall and Polk Rural Water's wellhead protection team were open to the public. Also, a public hearing was held before the completed WHP plan was sent to MDH for state agency review and approval. To date, no comments were provided at the public meetings.

Table 5 - Issues, Problems, and Opportunities

Issue Identified	Impacted Feature	Problem Associated with the Identified Issue	Opportunity Associated with the Identified Issue	Adequacy of Existing Controls to Address the Issue
There may be unused and unsealed wells on residential properties.	Aquifer DWSMA Well Water Quality	The Marshall and Polk Rural Water needs to assess which wells present a threat to the aquifer based upon their depth, construction, and state of repair.	The Marshall and Polk Rural Water can partner with Marshall and Polk Counties to help property owners pay for the costs of properly sealing unused wells.	The Marshall and Polk Rural Water does not have authority to require that unused wells be properly sealed. The MDH has authority to require well sealing.
Marshall and Polk Rural Water does not have land control in the DWSMA.	Aquifer DWSMA Well Water Quality	Marshall and Polk Rural Water has to rely on the County to administer land uses and help manage potential contaminant sources in the	Marshall and Polk Rural water could enter into a joint planning effort with the county and townships to guide land uses decisions within the DWSMA	Counties currently regulate land uses within the DWSMA. Marshall and Polk Rural Water needs to decide if these existing land use controls are sufficient to protect

		DWSMA.		the water supply
Marshall and Polk Rural Water will continue to encourage landowners within the DWSMA to enroll all or portions of their property in the Conservation Reserve Program	Aquifer DWSMA Well Water Quality	While both DWSMA's are considered nonvulnerable from land use contamination MPRWS will explore all measures to protect drinking water supply of their customers.	This would reduce the intensity of agricultural land use in the DWSMA and provide additional protection of the ground water supply at both the Warren and Schuster fields.	USDA staff can provide valuable technical and financial assistance to help manage agricultural fields within the DWSMA.
New high capacity wells drilled within the DWSMA or one mile of the DWSMA might alter the WHPA boundary and provide a pathway for pollutants to enter into the aquifer	Aquifer DWSMA Well Water Quality	Marshall and Polk Rural Water has no authority over the construction and pumping rates for newly constructed high capacity wells.	Marshall and Polk Rural Water will need to work closely with MDH and the DNR-Waters in the identification of new high capacity wells which might be drilled within the DWSMA or 1 mile of the DWSMA boundaries and their potential impact on WHPA boundaries. Marshall and Polk will submit letters to DNR & MDH requesting formal notification of all high capacity wells permitted in the DWSMA	Current state rules are considered adequate insofar as allowing private wells to be constructed according to construction codes and setbacks. But, state rules do not consider drinking water wells as a land use and therefore, well ownership and usage cannot be controlled by local units of government.
It is always difficult to foresee or plan for the future and unknown threats to the drinking water supply may need to be addressed in the future.	Aquifer DWSMA Well Water Quality	Marshall and Polk Rural Water may need to ask for assistance or manage threats to their drinking water supply in the future which are unknown at this time.	Marshall and Polk Rural Water can ask for assistance from federal, state and local units of government in addressing any potential threats to their drinking water supply. Financial and technical assistance may be available through some of these agencies for addressing future problems.	N/A
Marshall and Polk Rural Water has limited resources and funds to implement the wellhead protection plan	Aquifer DWSMA Well Water Quality	With limited resources implementing the WHP plan will be a challenge for Marshall and Polk Rural Water.	Form partnerships with the township, counties and state agencies that have regulatory authority or programs in the DWSMA so they can help with implementations. The Marshall and Polk Rural Water will add a line item for WHP implementation in the budget	Will apply for grand fund when they become available. Will apply for SWP implementation grant funds.

Chapter 7 - Existing Authority and Support Provided by Local, State, and Federal Governments

In addition to its own controls, the Marshall and Polk Rural Water Supplier will rely upon partnerships formed with local units of government, state agencies, and federal agencies with regulatory controls or resource management programs in place to help implement its WHP plan. The level of support that a local, state, and federal agency can provide depends on its legal authority, as well as the resources available to local governments.

7.1 Existing Controls and Programs of the Public Water Supplier

Table 6 shows the legal controls and/or programs that the Marshall and Polk Rural Water has identified to support the management of potential contamination sources within the DWSMA.

Table 6 - Controls and Programs of the Public Water Supplier

Type of Control	Program Description
Fee and Hook Up Ordinance	Establishes utility fees and hook up requirements for Marshall and Polk Rural Water System.

7.2 Local Government Controls and Programs

The following departments or programs within Marshall and Polk Counties may be able to assist the MPRWS with issues relating to potential contamination sources that 1) have been inventoried or 2) may result from changes in land and water use within the DWSMA:

Table 7 - Local Agency Controls and Programs

Government Unit	Name of Control/Program	Program Description
Polk County	Land Use Control Ordinance Zoning and Conditional Use	Provides countywide regulations and direction regarding land use decisions.
Marshall County	Water Planning	Establishes countywide goals and priorities towards protecting water resources
	Septic Sewage system permit	Provides technical assistance and enforcement of the individual sewage treatment system state programs.
Marshall County	Comprehensive Plan	Determines community goals and aspirations in terms of community development. Establishes public policy in terms of transportation, utilities, land use, recreation and housing.

7.3 State Agency and Federal Agency Support

MDH will serve as the contact for enlisting the support of other state agencies on a case-by-case basis regarding technical or regulatory support that may be applied to the management of potential contamination sources. Participation by other state agencies and the federal government is based on legal authority granted to them and resource availability. Furthermore, MDH 1) administers state regulations that affect specific potential sources of contamination and 2) can provide technical assistance to property owners to comply with these regulations.

The following table identifies the specific regulatory programs or technical assistance that state and federal agencies may provide to the Marshall & Polk Rural Water system to support implementation of the WHP plan. It is likely that other opportunities for assistance may be available over the 10-year period that the plan is in effect due to changes in legal authority or increases in funding granted to state and federal agencies. Therefore, the table references opportunities available when the Marshall and Polk Rural Water's WHP plan was first approved by MDH.

Table 8 - State and Federal Agency Controls and Programs

Government Unit	Type of Program	Program Description
MDH	State Well Code (Minnesota Rules, Chapter 4725)	MDH has authority over the construction of new wells and the sealing of wells. MDH staff in the Well Management Program offer technical assistance for enforcing well construction codes, maintaining setback distances for certain contamination sources, and well sealing.
MDH	WHP	MDH has staff that will help the Marshall and Polk Rural Water identify technical or financial support that other governmental agencies can provide to assist with managing potential contamination sources.
DNR	Water appropriation permitting (Minnesota Rules, Chapter 6115)	DNR can require that anyone requesting an increase in existing permitted appropriations, or to pump groundwater, must address concerns regarding the impacts to drinking water if these concerns are included in a WHP plan.
MPCA	Storm water Program Storage Tank Program	MPCA administers the programs dealing with storage tank regulations and storm water management.
U.S. Dept. of Agriculture (USDA)	Farm Bill Programs	The local USDA Service Center can provide technical and financial support for individuals and farmers through the Farm Bill.

MN Dept. of Natural Resources	Water Appropriation Permitting (MR Chapter 6115	DNR can require that anyone requesting an increase in existing permitted appropriations or to pump groundwater must address concerns of the impacts to drinking water if these concerns are included in a WHP Plan.
EPA	Class V Wells Program	EPA administers this program which inventories and regulates Class V Wells.
MDA	Nutrient and Chemical Programs	MDA administers the programs which regulate the storage and application of nutrients and chemicals (pesticides and herbicides) and provide in field technical advice to farmers located within the DWSMA's.

7.4 Support Provided by Nonprofit Organizations

The Minnesota Rural Water Association will assist Marshall and Polk Rural Water with implementing its WHP plan by providing 1) reference education and outreach materials for land owners, 2) technical support for implementing individual WHP action items listed in the plan, and 3) assisting Marshall and Polk Rural Water with assessing the results of plan implementation.

Chapter 8 - Goals

Goals define the overall purpose for the WHP plan, as well as the end points for implementing objectives and their corresponding actions. The WHP team identified the following goal after considering the impacts that 1) changing land and water uses have presented to drinking water quality over time and 2) future changes that need to be addressed to protect the community's drinking water:

- To promote public health by maintaining a safe, potable drinking water supply for all residents served, both now and into the future.

Chapter 9 - Objectives and Plan of Action

Objectives provide the focus for ensuring that the goals of the WHP plan are met and that priority is given to specific actions that support multiple outcomes of plan implementation.

Both the objectives and the wellhead protection measures (actions) that support them are based on assessing 1) the data elements (Chapter 2), 2) the potential contaminant source inventory (Chapter 4), 3) the impacts that changes in land and water use present (Chapter 5) and 4) issues, problems, and opportunities referenced to administrative, financial, and technical considerations (Chapter 6).

9.1 Objectives

The following objectives have been identified to support the goals of the WHP plan for the Marshall & Polk Rural Water system:

1. Create awareness and general knowledge about the importance of WHP in the Marshall and Polk Rural Water system area.
2. Properly inventory and manage potential contaminant sources to protect the drinking water supply for the Marshall and Polk Rural Water System.
3. Gather additional information within the DWSMA in order to better understand the size and vulnerability of the DWSMA.
4. Effectively track and report the implementation efforts and wellhead protection plan progress to all governing authorities.
5. Manage the Inner Wellhead Management Zone to prevent contamination of the aquifer near the Marshall and Polk supply wells.
6. Effectively prepare the Marshall and Polk Rural Water System for disruptions to the water distribution system.

9.2 WHP Measures and Action Plan

Based upon the factors, the WHP team has identified WHP measures that will be implemented by the Marshall and Polk Rural Water System over the 10-year period that its WHP plan is in effect. The objective that each measure supports is noted as well as 1) the lead party and any cooperators, 2) the anticipated cost for implementing the measure and 3) the year or years in which it will be implemented.

The following categories are used to further clarify the focus that each WHP measure provides, in addition to helping organize the measures listed in the action plan:

- Data Collection
- IWMZ Management
- Land Use Management
- Potential Contamination Source Management
- Public Education and Outreach
- Reporting and Evaluation
- Water Use and Contingency Strategy

9.3 Establishing Priorities

WHP measures reflect the administrative, financial, and technical requirements needed to address the risk to water quality or quantity presented by each type of potential contamination source. Not all of these measures can be implemented at the same time, so the WHP team assigned a priority to each. A number of factors must be considered when WHP action items are selected and prioritized (part 4720.5250, subpart 3):

- Contamination of the public water supply wells by substances that exceed federal drinking water standards.
- Quantifiable levels of contamination resulting from human activity.
- The location of potential contaminant sources relative to the wells.

- The number of each potential contaminant source identified and the nature of the potential contaminant associated with each source.
- The capability of the geologic material to absorb a contaminant.
- The effectiveness of existing controls.
- The time needed to acquire cooperation from other agencies and cooperators.
- The resources needed, i.e., staff, money, time, legal, and technical resources.

The Marshall and Polk Rural Water Supplier assigned a priority ranking for WHP measures below for any measure which directly managed or abated a threat by a potential contaminant source within the DWSMA. The following table lists each measure that will be implemented over the 10-year period that the Marshall and Polk Rural Water's WHP plan is in effect, including the priority assigned to each measure.

Table 9 - WHP Plan of Action

Public Education and Outreach – Implementation Action Items															
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (#1): Develop and release periodic items to the local news media regarding WHP efforts of the Marshall and Polk RWS. Topics; WHP, highlighting abandoned well sealing programs, educational efforts, etc.	1	High	MPRWS, MRWA, MDH, Marshall Co. Polk Co.	$200	•							•		
WHP Measure (#2): Marshall and Polk RWS will develop and print a 3- fold informational brochure explaining the WHP Plan and its purpose, to be distributed thru local outlets to citizens served by the water system and the general public. Brochure will be available at Marshall and Polk RWS office at all times.	1 & 2	High	MPRWS, MRWA, MDH	$300	•	•								
WHP Measure (#3): MPRWS will participate in local water planning efforts and identify areas where joint collaboration could be achieved that would help protect and promote groundwater protection in Marshall and Polk Counties. This could include having a Marshall and Polk RWS Staff member or Board of Directors member on the County Water Plan Task Force.	1	High	MPRWS, Marshall Co. Polk Co.	Staff and board time	•	•	•	•	•	•	•	•	•	•

WHP Measure (#4): Marshall Polk Rural Water will work on developing a website to use as a local distribution for WHP materials and notification of WHP areas. Marshall Polk Rural Water will apply for grant funds if and when available for development. If no funds are available MPRW will continue to work towards completion as funds are available.	1	High	MPRWS, MDH, MRWA	Staff Time $2,000	•			•			•			•

Inner Wellhead Management Zone – Implementation Action Items													
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**								
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (5): Assist MDH staff in completing the Inner Wellhead Management Zone Inventory for the public water supply wells.	2 & 5	Low	MDH, MPRWS	Staff Time				•					•	
WHP Measure(6): Follow all setback requirements for new potential contaminant sources within the IWMZ.	2 & 5	High	MPRWS	Staff Time	Annually									
WHP Measure (7): Implement the WHP Measures and Findings in the IWMZ Inventory and Sanitary Survey Reports.	2 & 5	High	MDH, MPRWS	Staff Time	Annually									
WHP Measure (8): Contact your MDH Planner if changes to the locations or construction of potential contaminant sources are proposed in the IMWZ.	2 & 5	High	MDH, MPRWS	Staff Time	•	•	•	•	•	•	•	•	•	•

Table 9 - WHP Plan of Action - Continued

Potential Contaminant Source Management – Implementation Action Items													
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (9): The wellhead protection team/manager will continually attempt to locate potential contaminant sources in the DWSMA. This will be accomplished through direct contact with landowners and through visual observation as the WHP team travels through the DWSMA	2 & 3	High	MPRWS	Staff Time	•	•	•	•	•	•	•	•	•	•
WHP Measure (10): The Marshall and Polk RWS will work with the County and apply for a grant via MDH to help seal unused wells located in the DWSMA. If they receive the grant they will use the money to seal the wells. If they do not receive a grant then the MPRWS will work cooperatively with the local units of government to provide as much cost share as possible to help seal the wells.	2	Moderate	MDH, Marshall Co., Polk Co.	Staff Time $1,000		•					•			
WHP Measure (11): Collaborate with the MDH Source Water Protection unit in the identification of new high-capacity wells that are proposed for construction within the DWSMA or within one mile of the DWSMA. The WHP Manager will alert the MDH Source Water Protection Unit upon learning about the pending construction or use of a high capacity well in this area. Potential impacts will be evaluated by MDH.	2 & 3	High	MPRWS, MDH, MN DNR	Staff Time	•	•	•	•	•	•	•	•	•	•

WHP Measure (12): Marshall and Polk Rural Water will work towards creating better security for their system through the purchase of backup generators and security cameras at the Well sites and office. MPRWS will apply for grant funds if and when available. If no funds are available MPRWS will continue to work towards added security for their water supply system.	2,5 & 6	High	MPRWS, MDH	Staff Time $10,000	•	•	•	•	•	•	•	•	•	•
WHP Measure (13): Marshall and Polk Rural water will share information regarding the location of any potential Class V well(s) with MDH if any well(s) are located within the DWSMA in the future. At the current time no Class V wells were identified by the WHP team.	2 & 3	Low	MDH, EPA	Staff Time	As needed									
WHP Measure(14): It is always difficult to foresee or plan for the future. If a critical issue or potential contaminant threat becomes an issue I the future for Marshall and Polk Rural Water, they will promptly take actions to prevent this contaminant source from polluting their drinking water supply	2	Low	MDH, EPA, MRWA,MPCA, MN DNR	Staff Time	•	•	•	•	•	•	•	•	•	•
WHP Measure (15): The City will track any high-capacity wells if identified in the area and ask MDH lab to do analysis of impact to wells water quality and quantity	2	High	MPRWS, MDH	Staff Time	As needed									
WHP Measure(16): Marshall and Polk Rural Water will ask MDH for assistance in sampling well(s) for tritium in year 8 applying for grant funds if and when available.	3	Moderate	MPRWS, MDH	Staff Time $1,000								•		

Land Use Controls and Management – Implementation Action Items														
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (17): Mail letter to both Marshall County and Polk County and ask that Marshall and Polk Rural Water be able to provide formal comments on any pending land use changes within the DWSMA and two mile of the DWSMA limits. Request to be notified of any pending changes in land uses so that MPRWS has the opportunity to comment on any pending land uses.	1 & 2	Moderate	Marshall County Polk County	Staff Time	•				•				•	

Reporting and Evaluation – Implementation Action Items														
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (18): Conduct a self-evaluation every 2.5 years on the wellhead protection progress and submit the report to the MDH Planner. Present 8 year evaluation at the Scoping One meeting for the plan amendment	4	Moderate	MDH	Staff Time $200			•			•		•		
WHP Measure (19): Complete an annual report and annually brief the Council on management priorities for the upcoming year and status of implementation.	4	High	MPRWS	Staff Time $200	•	•	•	•	•	•	•	•	•	•

Data Collection – Implementation Action Items													
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (20): Marshall and Polk Rural Water may apply for a grant to monitor impacts on aquifer if they determine the need for observation well(s). If no grant funds are available MPRWS will work towards placing observation wells if needed or required by the DNR	3	Moderate	Marshall Co. Polk Co.	Staff Time	•				•				•	

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Contingency Strategy – Implementation Action Items													
Description	**Objective**	**Priority**	**Responsible Party & Cooperators**	**Cost**	**Implementation Time Frame**									
					2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
WHP Measure (21): Marshall and Polk Rural Water will annually review and update their Contingency Strategy/Water Plan to keep emergency data current.	6	High	Marshall Co. Polk Co.	Staff Time	Annually									

9.4 Commitments From Cooperators

The agencies listed in Table 10 have indicated they will support the Public Water Supplier with implementing the WHP measure(s) in which they are identified.

Table 10 - Cooperating Agencies List

Agency	Measure
Marshall and Polk Rural Water	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19
MRWA	1,2,4,14
MDH	1,2,4,5,7,8,10,11,12,13,14,16
Marshall County	1,3,10,15,20,21
Polk County	1,3,10,15,20,21
MN DNR	11 ,14
EPA	13
MPCA	14

Chapter 10 - Evaluation Program

Evaluation is used to support plan implementation and is required under Minnesota Rules, part 4720.5270, prior to amending the Marshall and Polk Rural Water's WHP plan. Plan evaluation is specified under Objective 2 and provides the mechanism for determining whether WHP action items are achieving the intended result or whether they need to be modified to address changing administrative, technical, or financial resource conditions within the DWSMA. The Marshall and Polk Rural Water has identified the following procedures that it will use to evaluate the success with implementing its WHP plan:

1. An annual briefing to the Marshall and Polk Rural Water council will provide the basis for documenting whether each action step for that year was implemented.
2. The WHP team will meet, at a minimum, every two-and-one-half years to assess the status of plan implementation and to identify issues that impact the implementation of action steps throughout the DWSMA;
3. The Marshall and Polk Rural Water will assess the results of each action item that has been taken annually to determine whether the action item has accomplished its purpose or whether modification is needed. Assessment results will be presented in the annual report to the Marshall and Polk Rural Water council.
4. The Marshall and Polk Rural Water will prepare a written report that documents how it has assessed plan implementation and the action items that were carried out. The report will be presented to MDH at the first scoping meeting held with the Marshall and Polk Rural Water to begin amending the WHP plan.

Chapter 11 - Contingency Strategy

The WHP plan includes a contingency strategy that addresses disruption of the water supply caused by either contamination or mechanical failure. Marshall and Polk Rural Water System has a contingency water supply plan in effect that was approved by the Minnesota Department of Natural Resources and fulfills the contingency planning requirements for wellhead protection. A copy of this plan can be found in Appendix III.

Chapter 12 - Glossary of Terms

Data Element. A specific type of information required by the Minnesota Department of Health to prepare a wellhead protection plan.

Drinking Water Supply Management Area (DWSMA). The surface and subsurface areas surrounding a public water supply well, including the wellhead protection area, that must be managed by the entity identified in the wellhead protection plan. (Minnesota Rules, part 4720.5100, subpart 13). This area is delineated using identifiable landmarks that reflect the scientifically calculated wellhead protection area boundaries as closely as possible.

Emergency Response Area (ERA). The part of the wellhead protection area that is defined by a one-year time of travel within the aquifer that is used by the public water supply well (Minnesota Rules part 4720.5250, subpart 3). It is used to set priorities for managing potential contamination sources within the DWSMA.

Emergency Standby Well. A well that is pumped by a public water supply system only during emergencies, such as when an adequate water supply cannot be achieved because one or more primary or seasonal water supply wells cannot be used.

Inner Wellhead Management Zone (IWMZ). The land that is within 200 feet of a public water supply well (Minnesota Rules, part 4720.5100, subpart 19). The public water supplier must manage the IWMZ to help protect it from sources of pathogen or chemical contamination that may cause an acute health effect.

Nonpoint Source Contamination. Refers to contamination of the drinking water aquifer that is caused by polluted runoff or pollution sources that cannot be attributed to a specifically defined origin, e.g., runoff from agricultural fields, feedlots, or urban areas.

Point Source Contamination. Refers to contamination of the drinking water aquifer that is attributed to pollution arising from a specifically defined origin, such as discharge from a leaking fuel tank, a solid waste disposal site, or an improperly constructed or sealed well.

Primary Water Supply Well. A well that is regularly pumped by a public water supply system to provide drinking water.

Seasonal Water Supply Well. A well that is only used to provide drinking water during certain times of the year, either when pumping demand cannot be met by the primary water supply well(s) or for a facility, such as a resort, that is closed to the public on a seasonal basis.

Vulnerability. Refers to the likelihood that one or more contaminants of human origin may enter either 1) a water supply well that is used by the public water supplier or 2) an aquifer that is a source of public drinking water.

WHP Area (WHPA). 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 (Minnesota Statutes, part 103I.005, subdivision 24).

WHP Plan Goal. An overall outcome of implementing the WHP plan, e.g., providing for a safe and adequate drinking water supply.

WHP Measure. A method adopted and implemented by a public water supplier to prevent contamination of a public water supply, and approved by the Minnesota Department of Health under Minnesota Rules, parts 4720.5110 to 4720.5590.

WHP Plan Objective. A capability needed to achieve one or more WHP goals, e.g., implementing WHP measures to address high priority potential contamination sources within 5 years.

Chapter 13 - List of Acronyms

CWI - County Well Index

DNR - Minnesota Department of Natural Resources

EPA - United States Environmental Protection Agency

MDA - Minnesota Department of Agriculture

MDH - Minnesota Department of Health

MGS - Minnesota Geological Survey

MN DOT - Minnesota Department of Transportation

MPCA - Minnesota Pollution Control Agency

MPRWS - Marshall and Polk Rural Water System

SWCD - Soil and Water Conservation District

USDA - United States Department of Agriculture

Chapter 14 – References

MN Rural Water Association (MRWA) website:
http://www.mrwa.com

MN Department of Health (MDH) Drinking Water Protection website:
http://www.health.state.mn.us/divs/eh/water

MN Department of Health (MDH) Source Water Protection website
http://www.health.state.mn.us/divs/eh/water/swp/index.htm

MN Pollution Control Agency (MPCA) website:
http://www.pca.state.mn.us/

MN Department of Agriculture (MDA) Protecting Our Lands & Waters website:
http://www.mda.state.mn.us/protecting.aspx

US Environmental Protection Agency (EPA source Water protection website:
http://water.epa.gove/infrastructue/drinkingwater/sourcewater /protection/index.cfm

Chapter 15 – FIGURES

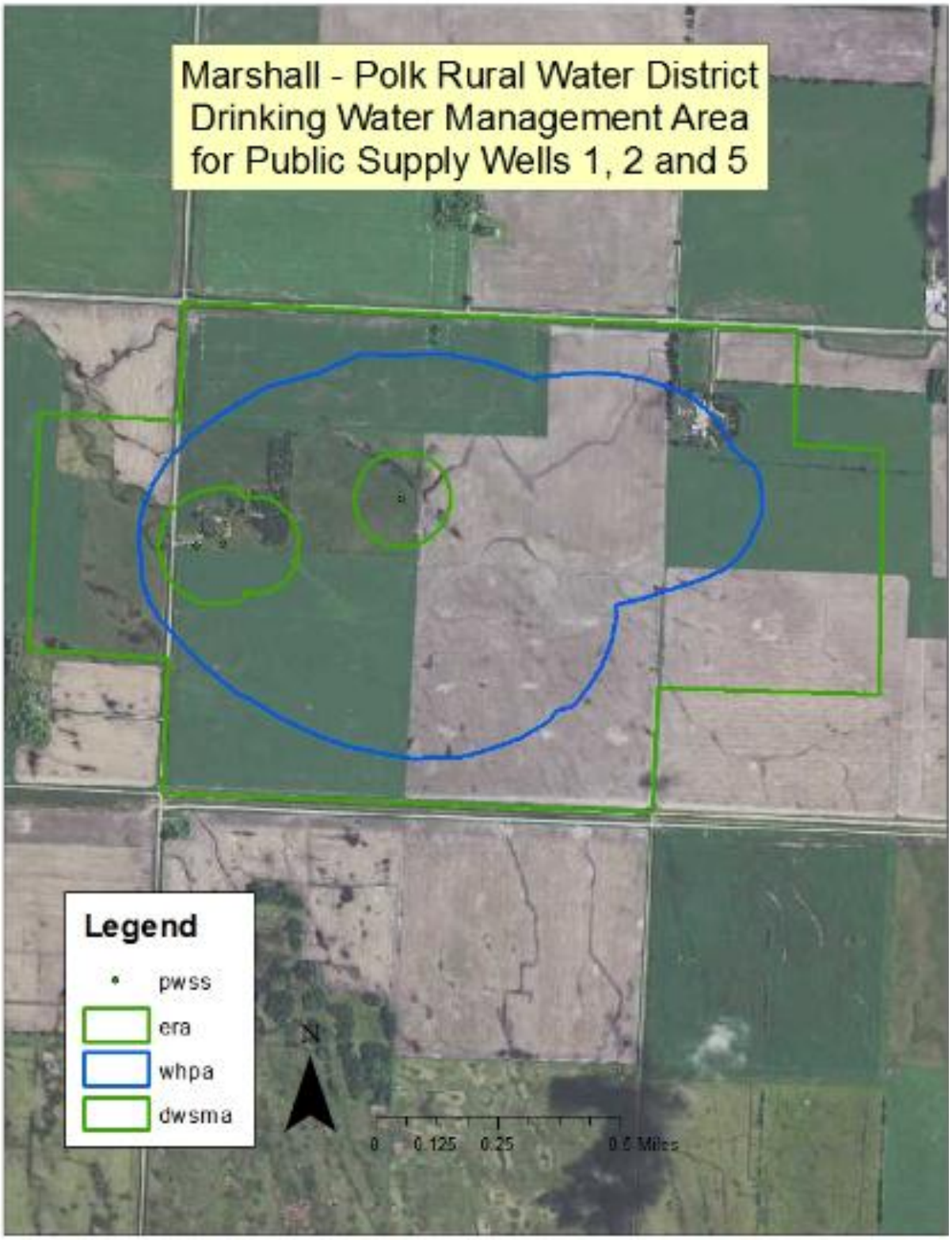

Figure 1: Drinking Water Management Area (DWSMA) Wells 1, 2 & 5

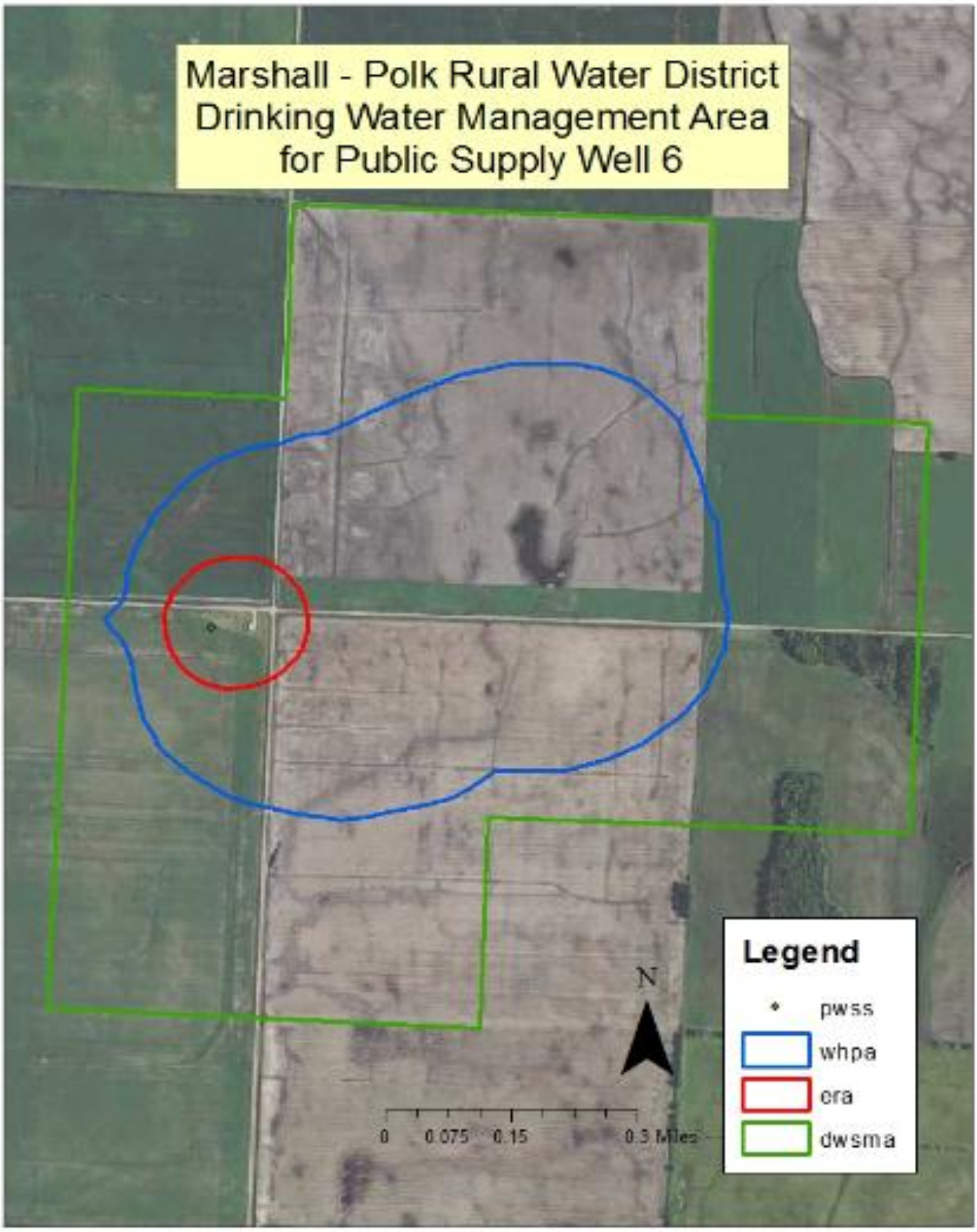

Figure 2: Drinking Water Management Area (DWSMA) Well 6

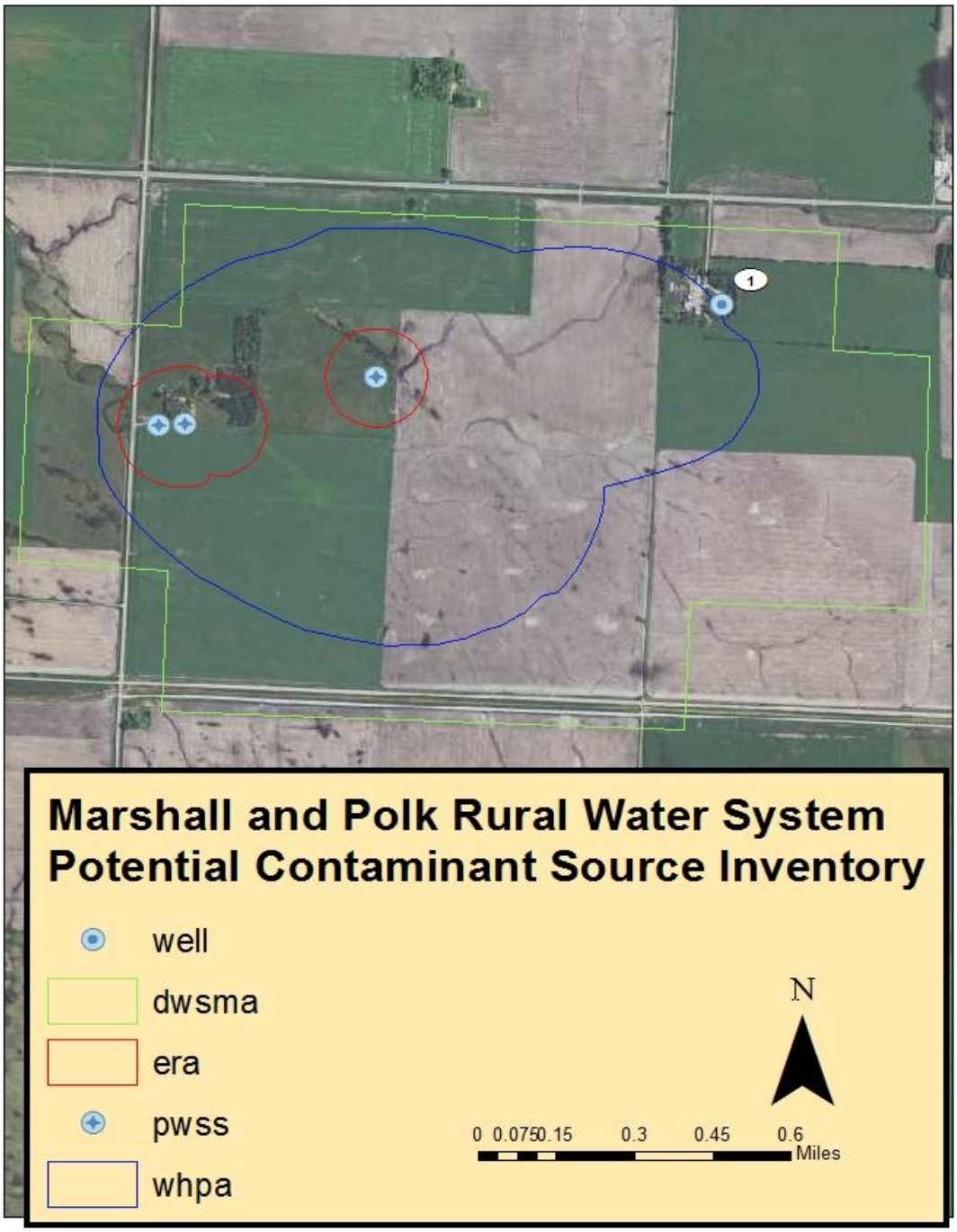

Figure 3

Figure 3: Potential Contaminant Source Inventory Wells 1, 2, & 5

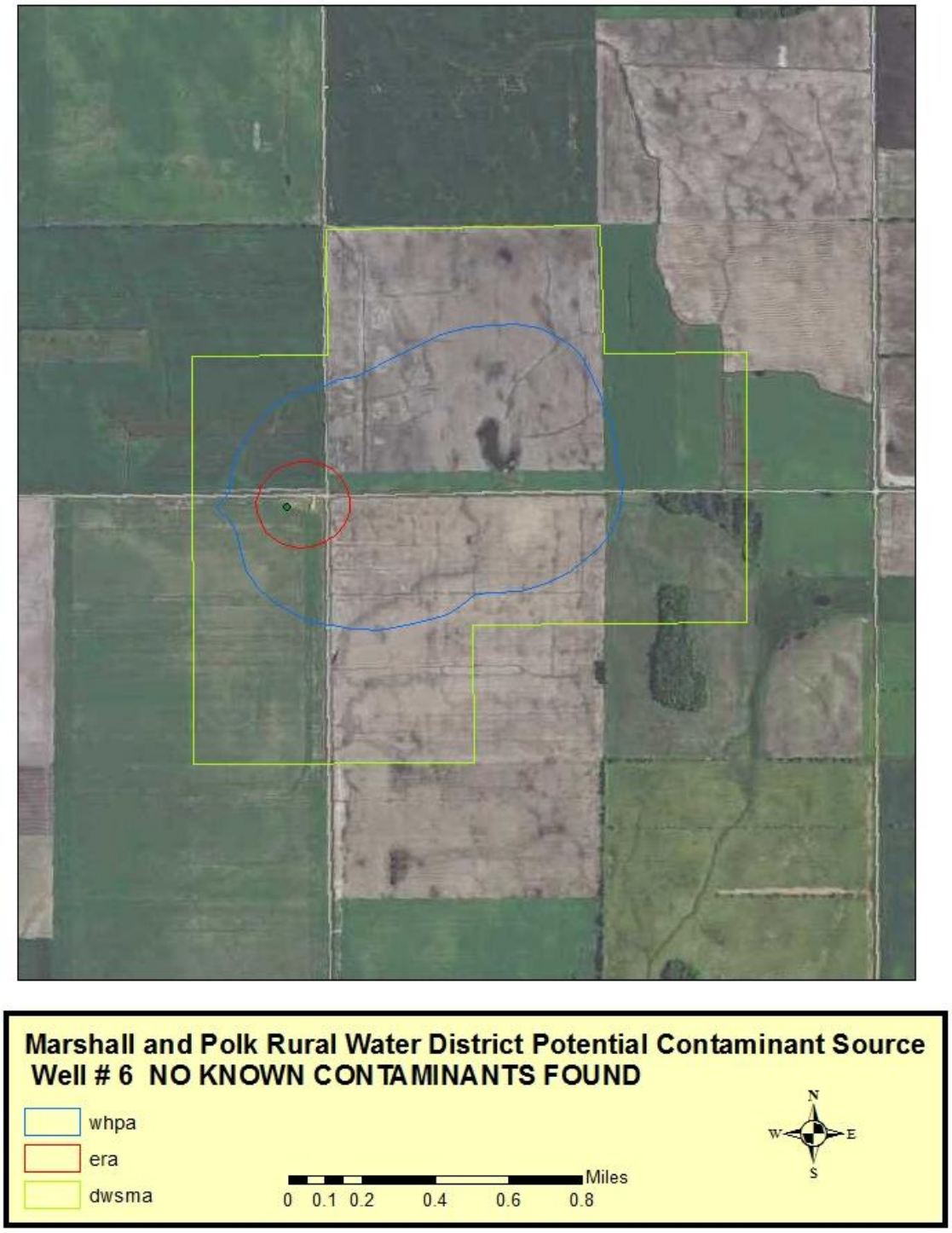

Figure 4

Figure 4: Potential Contaminant Source Inventory Well 6

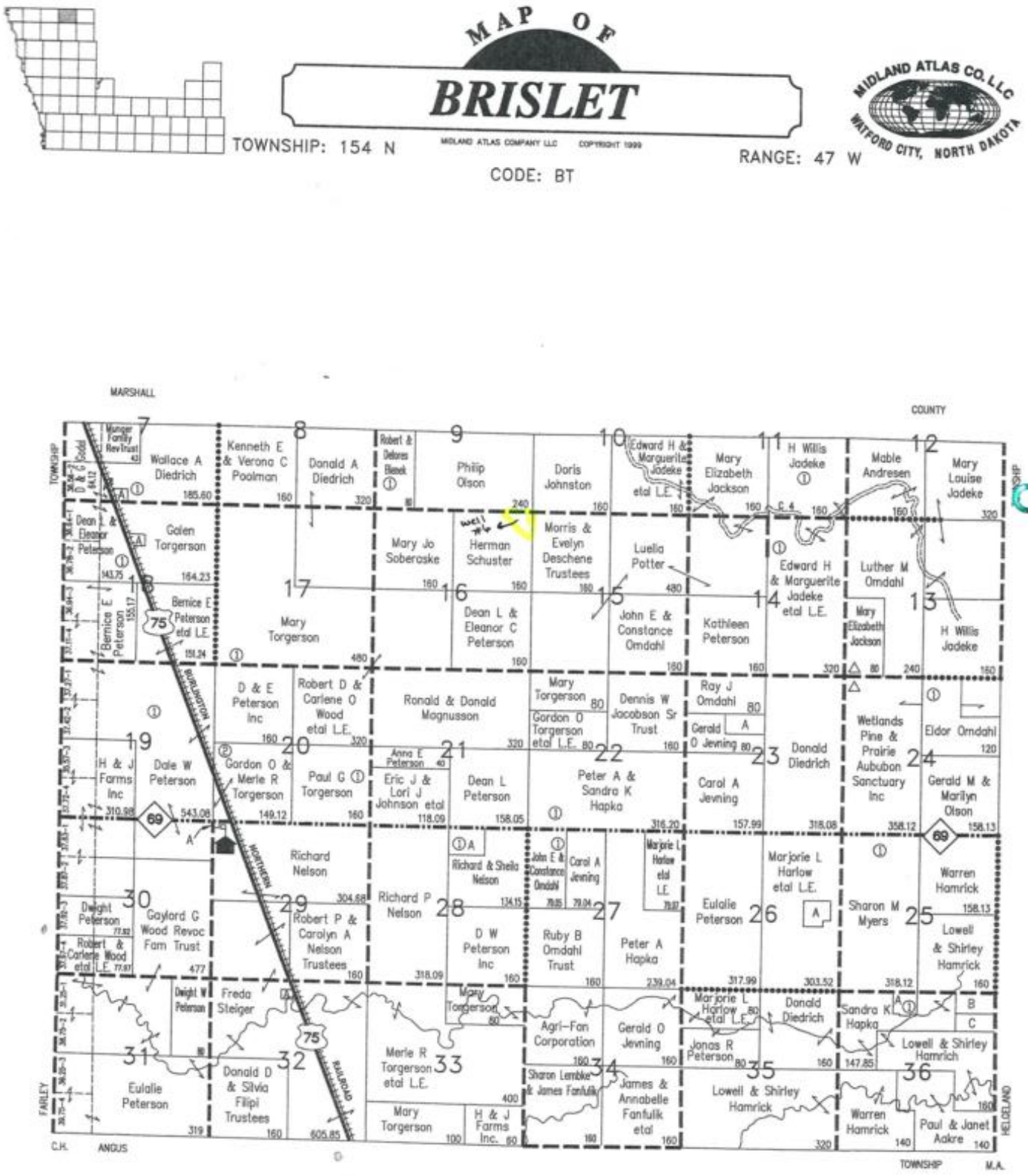

Figure 5: Polk County Boundaries and Towhnships

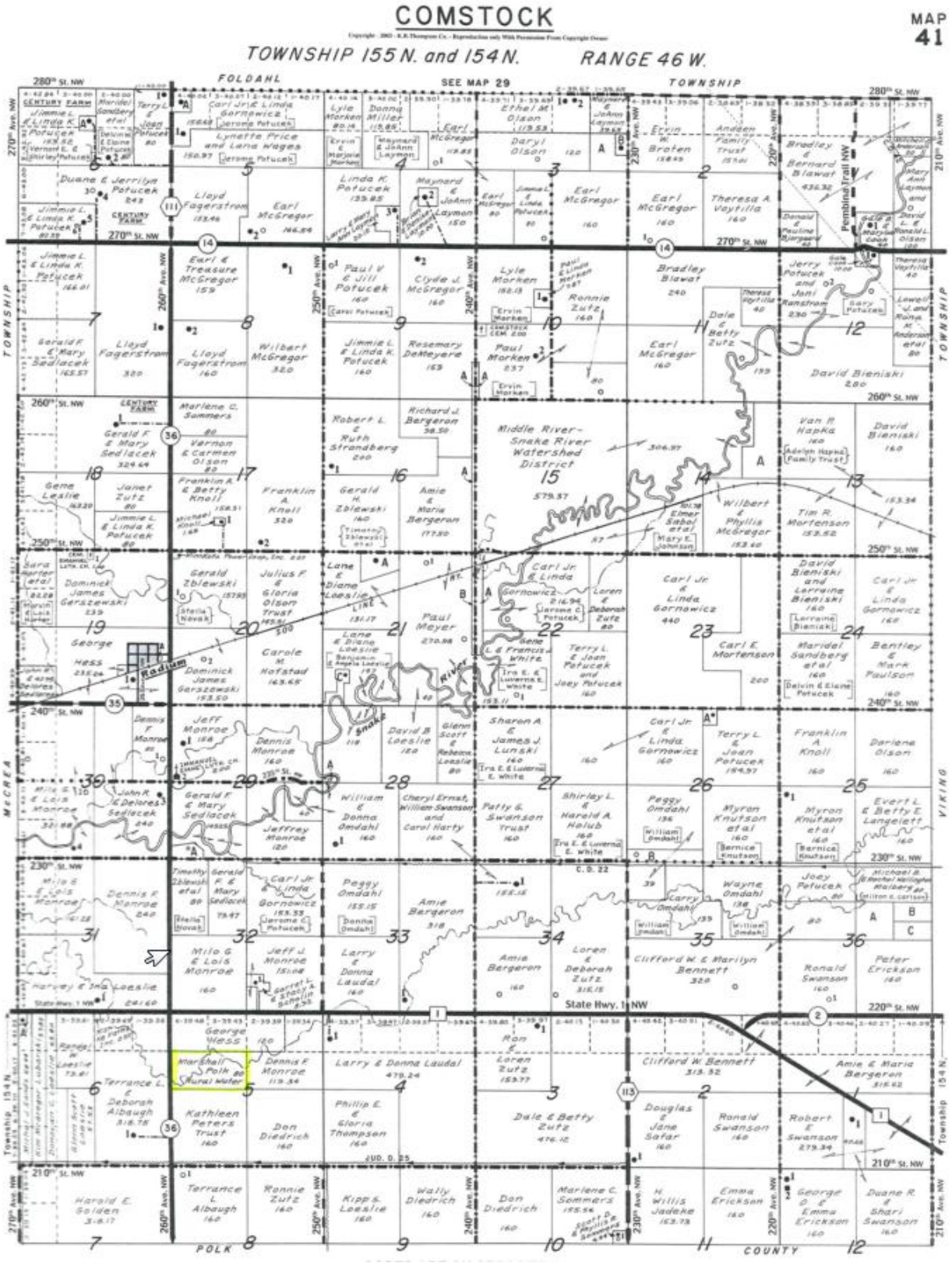

Figure 6: Marshall County Boundaries and Townships

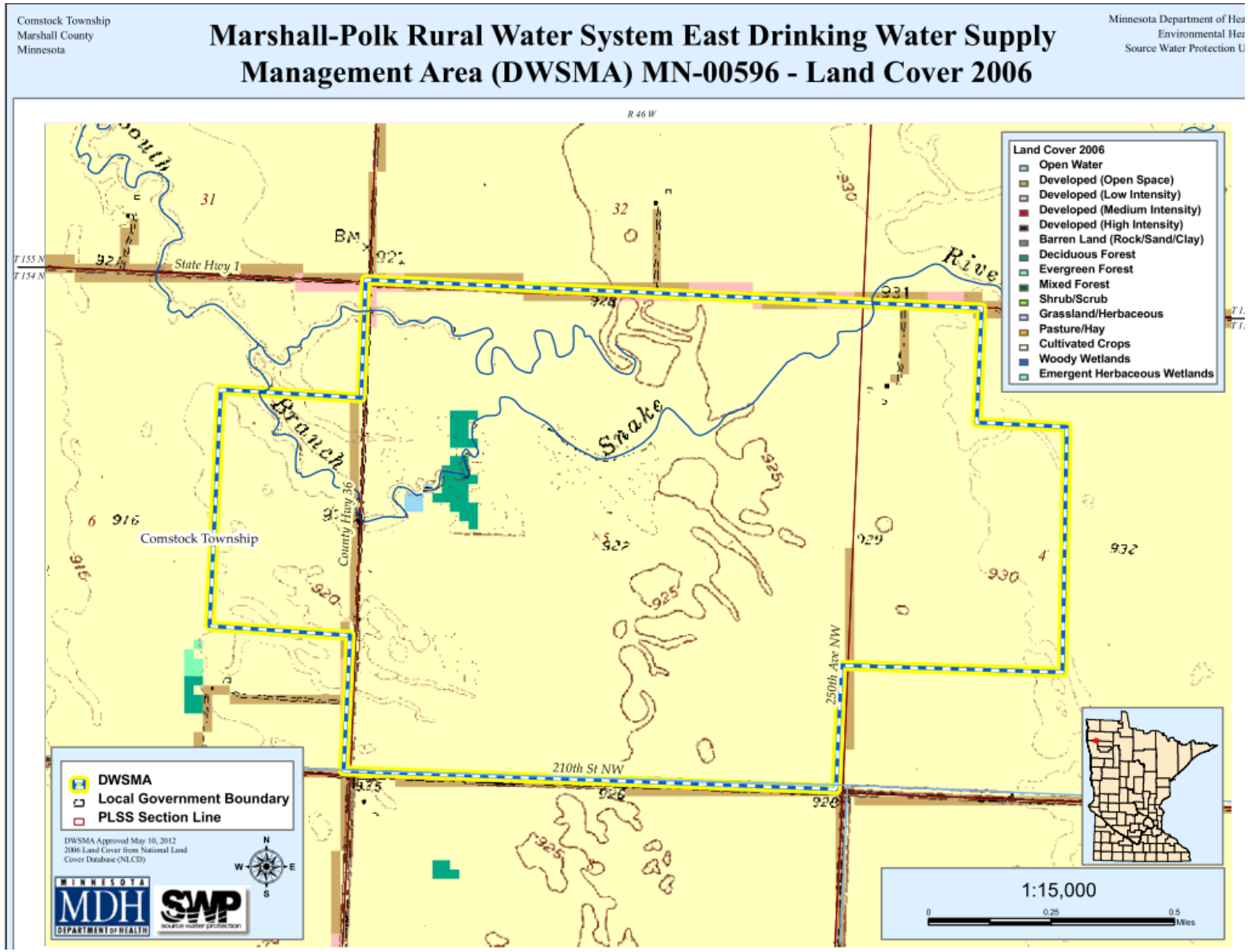

Figure 7: Land Use Map Marshall County

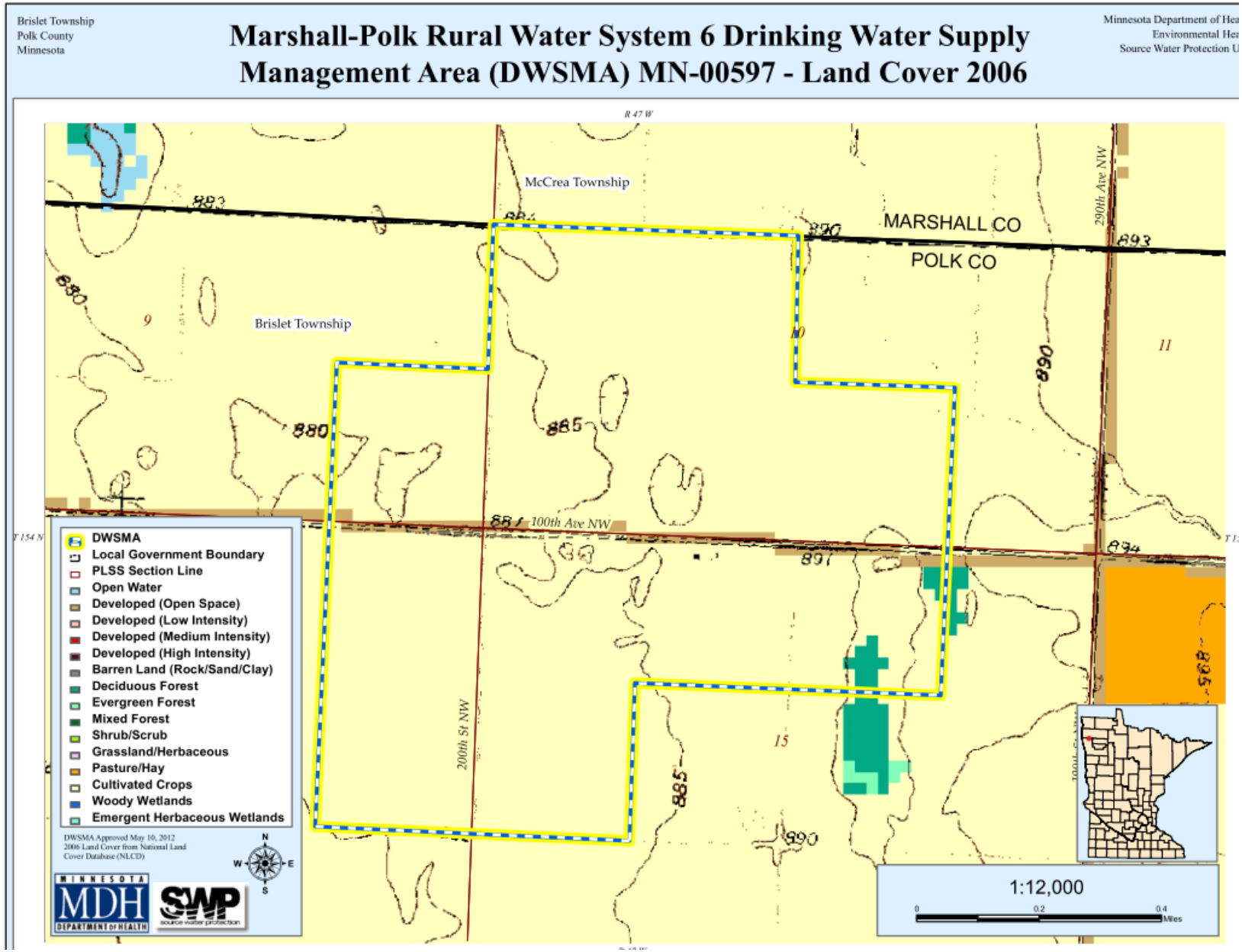

Figure 8: Land Use Map Polk County

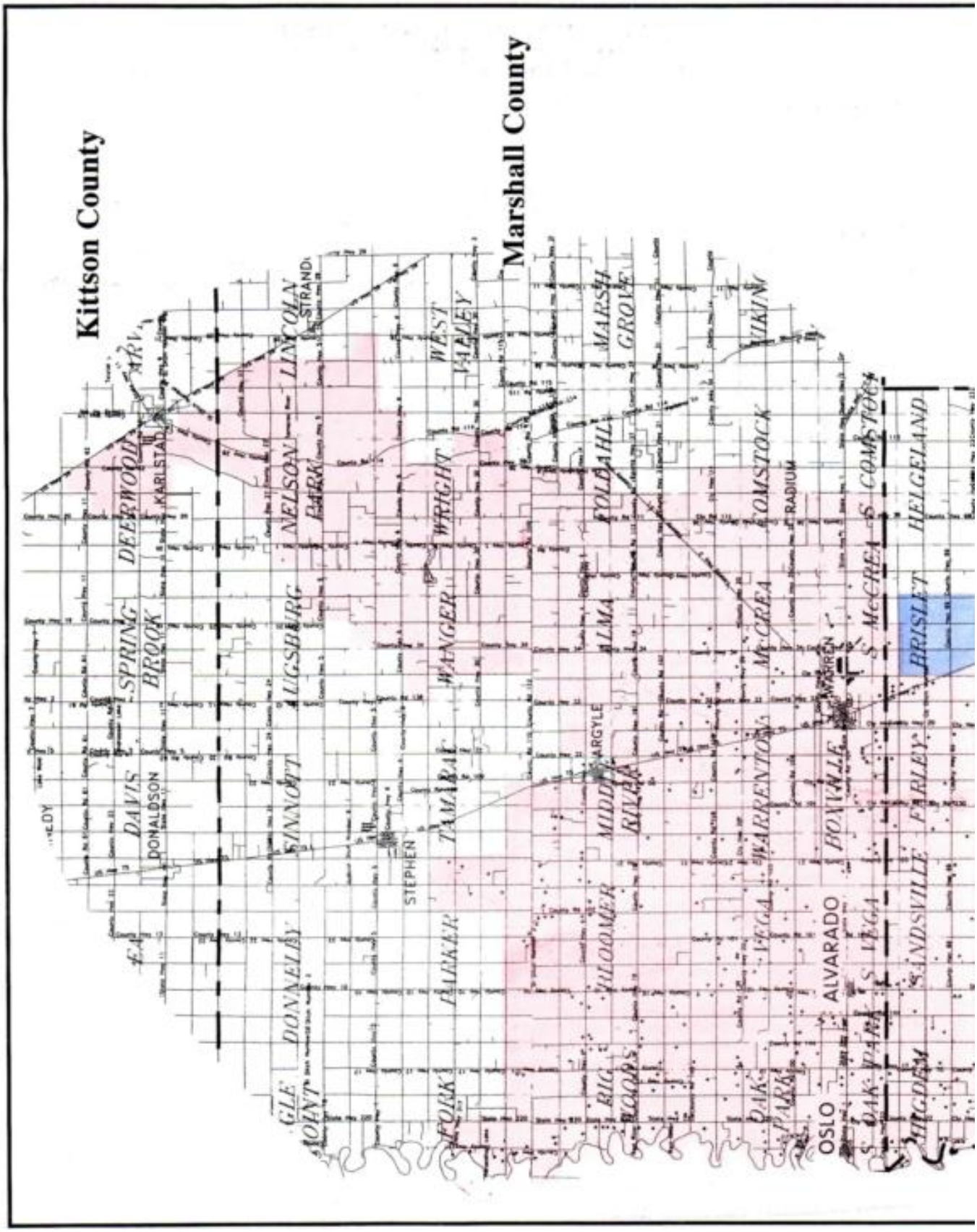

Figure 9 – Marshall & Polk Rural Water System- Marshall County

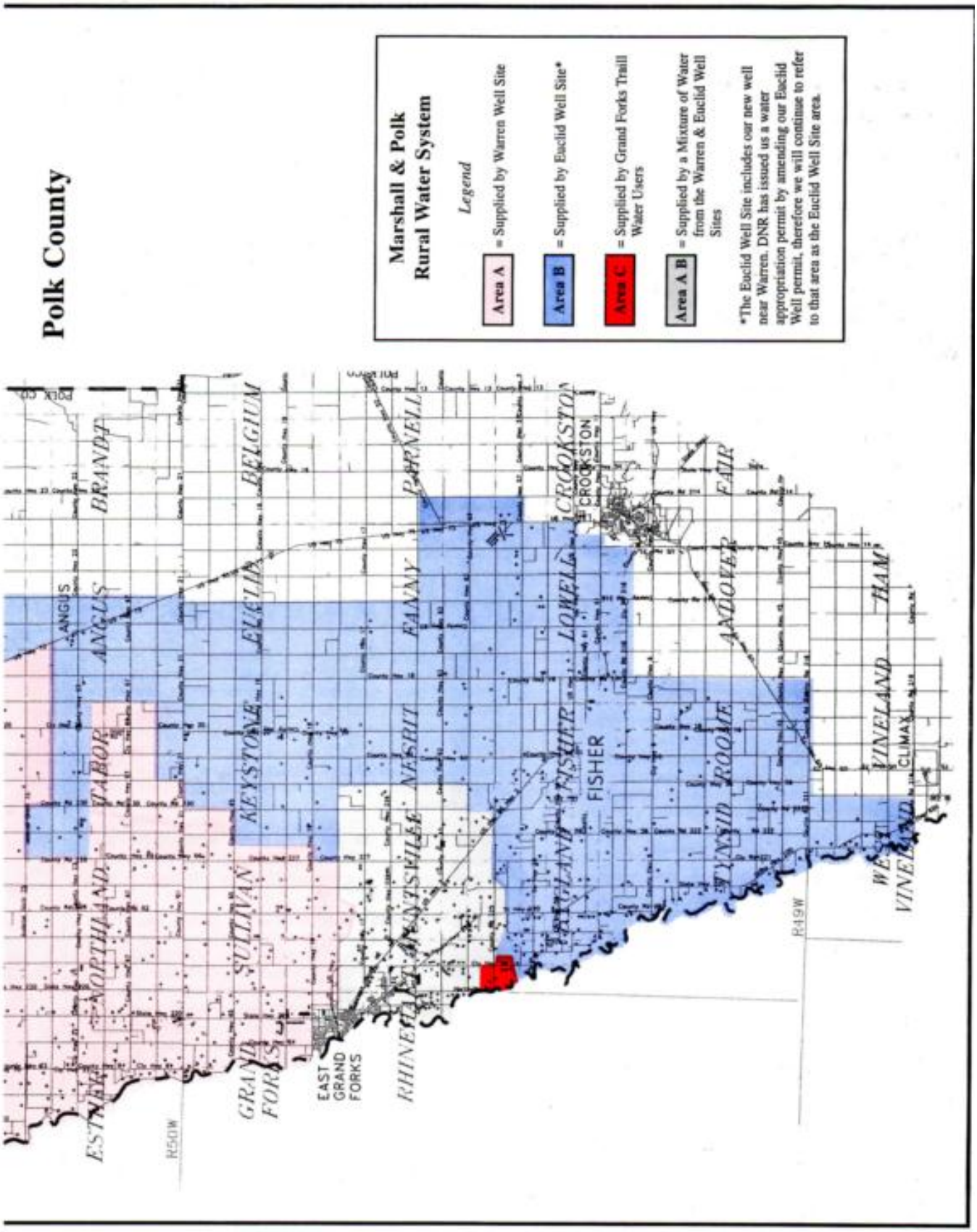

Figure 10 – Marshall & Polk Rural Water System- Polk County

Figure 1: Land Use in Marshall County

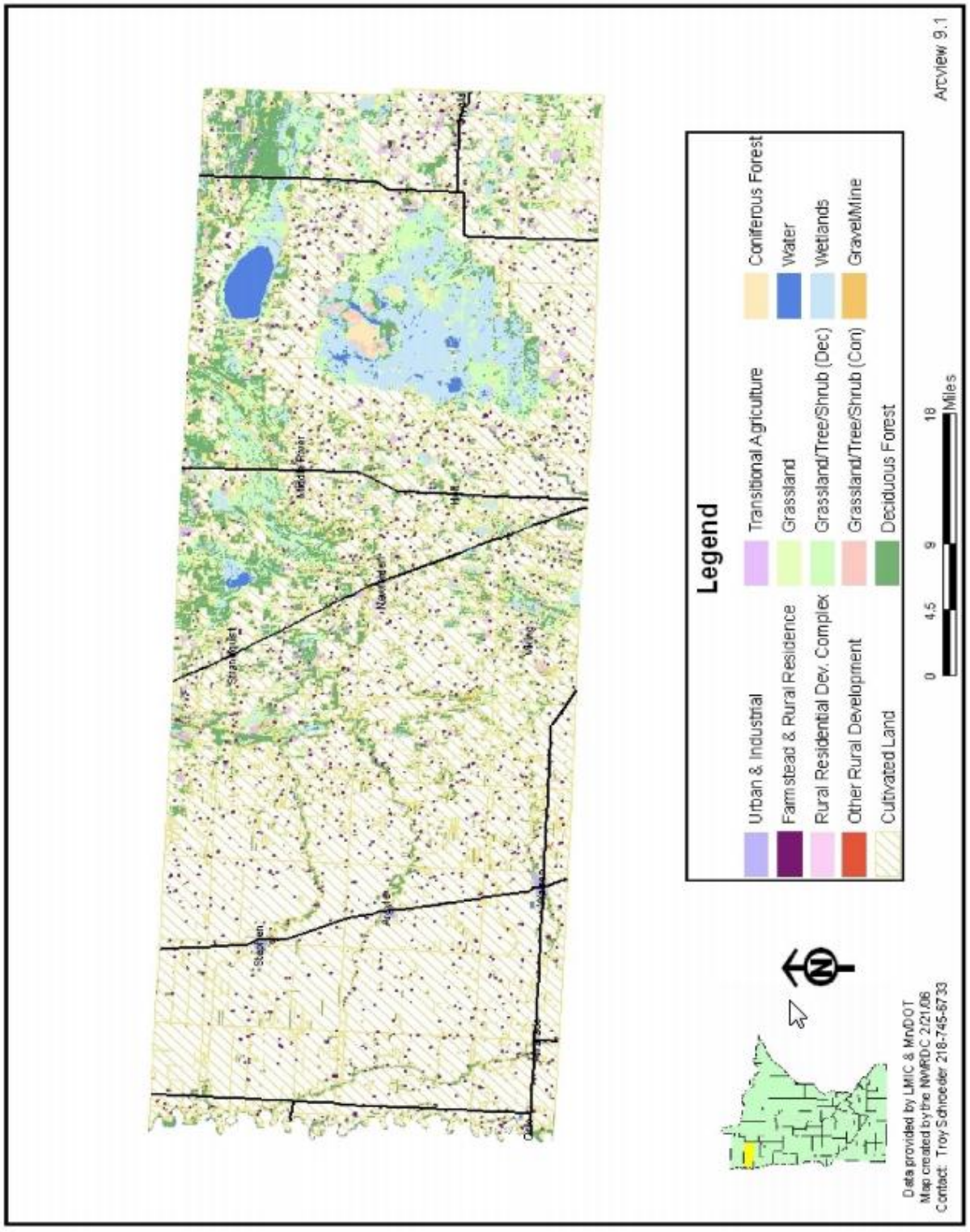

Figure 11 – Marshall County – Land Use

APPENDIX I

PLAN 1 and
AMENDMENTS to Wellhead Protection Plan

Wellhead Protection Plan Amendment

Part I

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

For

Marshall-Polk Rural Water System

January 2012

Tracy J. Lund
R.G. Soule

Minnesota Department of Health

Review copy pending MDH approval.

Table of Contents

List of Tables

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Glossary of Terms

Data Element. A specific type of information required by the Minnesota Department of Health to prepare a wellhead protection plan.

Drinking Water Supply Management Area (DWSMA). The area delineated using identifiable land marks that reflects the scientifically calculated wellhead protection area boundaries as closely as possible (Minnesota Rules, part 4720.5100, subpart 13).

Drinking Water Supply Management Area Vulnerability. An assessment of the likelihood that the aquifer within the DWSMA is subject to impact from land and water uses within the wellhead protection area. It is based upon criteria that are specified under Minnesota Rules, part 4720.5210, subpart 3.

Emergency Response Area (ERA). The part of the wellhead protection area that is defined by a one-year time of travel within the aquifer that is used by the public water supply well (Minnesota Rules, part 4720.5250, subpart 3). It is used to set priorities for managing potential contamination sources within the DWSMA.

Inner Wellhead Management Zone (IWMZ). The land that is within 200 feet of a public water supply well (Minnesota Rules, part 4720.5100, subpart 19). The public water supplier must manage the IWMZ to help protect it from sources of pathogen or chemical contamination that may cause an acute health effect.

Wellhead Protection (WHP). A method of preventing well contamination by effectively managing potential contamination sources in all or a portion of the well's recharge area.

Wellhead Protection Area (WHPA). 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 (Minnesota Statutes, section 103I.005, subdivision 24).

Well Vulnerability. An assessment of the likelihood that a well is at risk to human-caused contamination, either due to its construction or indicated by criteria that are specified under Minnesota Rules, part 4720.5550, subpart 2.

Acronyms

CWI - County Well Index

DNR - Minnesota Department of Natural Resources

EPA - United States Environmental Protection Agency

FSA - Farm Security Administration

MDA - Minnesota Department of Agriculture

MDH - Minnesota Department of Health

MGS - Minnesota Geological Survey

MnDOT - Minnesota Department of Transportation

MnGEO - Minnesota Geospatial Information Office

MPCA - Minnesota Pollution Control Agency

NRCS - Natural Resource Conservation Service

SWCD - Soil and Water Conservation District

UMN - University of Minnesota

USDA - United States Department of Agriculture

USGS - United States Geological Survey

1. Introduction

This document describes the amended Part I of the wellhead protection (WHP) plan for the Marshall-Polk Rural Water System. The previous wellhead protection plan was approved in October of 2001, and the deadline for the completion of the amended plan is July 3, 2012. The Minnesota Department of Health (MDH) developed Part I of the wellhead protection (WHP) plan at the request of the Marshall-Polk Rural Water System (PWSID 1450005). The work was performed in accordance with the Minnesota Wellhead Protection Rule, parts 4720.5100 to 4720.5590. The differences in the two delineations are discussed in Section 4.5.

This report presents delineations of the wellhead protection areas (WHPAs) and drinking water supply management areas (DWSMAs), and the vulnerability assessments for the public water supply wells and DWSMAs. Figure 1 shows the boundaries for the WHPAs and the DWSMAs. The WHPAs are defined by a 10-year time of travel. Figure 1 also shows the emergency response areas (ERAs), which are defined by a 1-year time of travel. An inner wellhead management zone (IWMZ), which is the area within a 200-foot radius around the well, serves as the wellhead protection area for emergency wells and is not displayed in this report. Definitions of rule-specific terms that are used are provided in the "Glossary of Terms."

This report also documents the technical information that was required to prepare this portion of the WHP plan in accordance with the Minnesota Wellhead Protection Rule. Additional technical information is available from MDH.

The wells included in the WHP plan are listed in Table 1.

Table 1 - Water Supply Well Information

Local Well ID	Unique Number	Use/ Status[1]	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Aquifer[2]	Well Vulnerability
Well 1	240757	A, P	8	156	171	1976	QBAA	Non-vulnerable
Well 2	240758	A, P	8	182	197	1976	QBAA	Non-vulnerable
Well 3	163384	E	8	104	124	1981	QBAA	Non-vulnerable
Well 4	166210	E	8	103	123	1981	QBAA	Non-vulnerable
Well 5	513019	A, P	8	393	419	1992	QBAA	Non-vulnerable
Well 6	473633	A, P	16	335	375	1990	QBAA	Non-vulnerable

Note: 1. Active (A), Primary (P), Emergency (E).
2. Quaternary Buried Artesian Aquifer, i.e. glacial sand and gravel materials

2. Assessment of the Data Elements

MDH staff met with representatives of the Marshall-Polk Rural Water System on November 22, 2010, for a scoping meeting that identified the data elements required to prepare Part I of the WHP plan amendment. Table 2 presents the assessment of these data elements relative to the present and future implications of planning items that are specified in Minnesota Rules, part 4720.5210.

Table 2 - Assessment of Data Elements

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
Precipitation					
Geology					
Maps and geologic descriptions	M	H	H	H	MGS, DNR, USGS
Subsurface data	M	H	H	H	MGS, MDH, DNR
Borehole geophysics	M	H	H	H	MGS
Surface geophysics	L	L	L	L	
Maps and soil descriptions					
Eroding lands					
Water Resources					
Watershed units					
List of public waters					
Shoreland classifications					
Wetlands map					
Floodplain map					
Land Use					
Parcel boundaries map	L	H	L	L	Not available
Political boundaries map	L	H	L	L	MnGEO
PLS map	L	H	L	L	MnGEO
Land use map and inventory	M	H	M	M	
Comprehensive land use map	L	L	L	L	
Zoning map	L	L	L	L	
Public Utility Services					
Transportation routes and corridors					
Storm/sanitary sewers and PWS system map					
Oil and gas pipelines map					
Public drainage systems map or list					
Records of well construction, maintenance, and use	H	H	H	H	Marshall-Polk RWS, CWI, MDH files
Surface Water Quantity					
Stream flow data					
Ordinary high water mark data					
Permitted withdrawals					
Protected levels/flows					
Water use conflicts					
Groundwater Quantity					
Permitted withdrawals	H	H	H	H	DNR
Groundwater use conflicts	H	H	H	H	DNR

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
Water levels	H	H	H	H	DNR, MDH, Marshall-Polk RWS
Surface Water Quality					
Stream and lake water quality management classification					
Monitoring data summary					
Groundwater Quality					
Monitoring data	H	H	H	H	MPCA, MDH, USGS
Isotopic data	H	H	H	H	MPCA, MDH, USGS
Tracer studies	H	H	H	H	Not available
Contamination site data	M	M	M	M	Not available
Property audit data from contamination sites					
MPCA and MDA spills/release reports					

Definitions Used for Assessing Data Elements:

High (H) - the data element has a direct impact
Moderate (M) - the data element has an indirect or marginal impact
Low (L) - the data element has little if any impact
Shaded - the data element was not required by MDH for preparing the WHP plan

Acronyms used in this report are listed on page ii, after the "Glossary of Terms."

3. General Descriptions

3.1 Description of the Water Supply System

The Marshall-Polk Rural Water System obtains its drinking water supply from four primary wells; Table 1 summarizes information regarding them.

3.2 Description of the Hydrogeologic Setting

The description of the hydrologic setting for the aquifers used to supply drinking water is presented in Table 3.

Table 3 - Description of the Hydrogeologic Setting

Attribute	Descriptor	Data Source
Aquifer Material	Unconsolidated sand and gravel materials	CWI
Porosity Type and Value	Primary: 25%	Fetter, 2001
Aquifer Thickness	Thicknesses vary considerably in both sand aquifer units: Shallower aquifer, Wells 1 (240757) and 2 (240758): estimated between 10 and 65 feet thick. Deep aquifer, Wells 5 (513019) and 6 (473633): estimated between 22 and 138 feet thick.	CWI; geologic cross sections (Figures 4, 5 and 6) and area well logs
Stratigraphic Top Elevation	Shallower aquifer: sand and gravel units dip to the west so elevations vary between 672 and 866 feet, MSL as modeled, with an elevation of around 780 feet at Wells 1 (240757) and 2 (240758). Deep aquifer: as modeled, the top of the unit is between 509 and 639 feet, MSL.	CWI; geologic cross sections (Figures 4, 5 and 6) and area well logs
Stratigraphic Bottom Elevation	Shallow aquifer: varies between 609 and 853 feet, MSL, due to the westward dip of the unit. Deep aquifer: as modeled, varies between 494 and 614 feet MSL, but few wells fully penetrate the unit.	CWI; geologic cross sections (Figures 4, 5 and 6) and area well logs
Hydraulic Confinement	Confined	CWI; geologic cross sections (Figures 3, 4, 5 and 6) and area well logs
Transmissivity	Range of Values for Shallow aquifer: 100 – 7,305 ft^2/day Range of Values for Deep aquifer: 10 – 1,900 ft^2/day	A range of transmissivity values was used to reflect changes in aquifer composition and thickness as well as uncertainties related to the quality of existing aquifer test data. See Table 4 for the reference value.
Hydraulic Conductivity	Range of Values for Shallow aquifer: 22 - 310 ft/day Range of Values for Deep aquifer: 2 - 579 ft/day	The range of values was derived using specific capacity data obtained from well records and/or from additional aquifer test results listed in the "Selected References" section of this report.
Groundwater Flow Field	See Figure 2 - Ambient Groundwater Flow Field	Defined by using static water level elevations from well records in the CWI database and documents listed in the "Selected References" section of this report.

Figures 3, 4, 5 and 6 show the distribution of the aquifer and its stratigraphic relationships with adjacent geologic materials. They were prepared using well record data that is contained in the CWI

database. The geological maps and studies that were used to further define local hydrogeologic conditions are provided in the "Selected References" section of this report.

4. Delineation of the Wellhead Protection Area

4.1 Delineation Criteria

The boundaries of the WHPAs for the Marshall-Polk Rural Water System are shown in Figure 1. Table 4 describes how the delineation criteria that are specified under Minnesota Rules, part 4720.5510, were addressed.

Table 4 - Description of WHPA Delineation Criteria

Criterion	Descriptor	How the Criterion was Addressed
Flow Boundary	None	There are no known flow boundaries close enough to the Marshall-Polk Rural Water System wells that may have an impact on their capture areas.
Flow Boundary	Other High-Capacity Wells Table 6	The pumping amounts were determined using the same approach used for the public water supply wells. The pumping amounts of these other wells were included in the methods used for the delineation.
Daily Volume of Water Pumped	See Table 5	Pumping information was obtained from the DNR, Appropriations Permits PA-1976-1100 and PA-1981-1079, and was converted to a daily volume pumped by each well.
Groundwater Flow Field	See Figure 2	The model calibration process addressed the relationship between the calculated versus observed groundwater flow field.
Aquifer Transmissivity (T)	Shallow aquifer Reference Value: 1,912 ft^2/day Deep aquifer near Well 5 (513019) Reference Value: 1,805 ft^2/day Deep aquifer near Well 6 (473633) Reference Value: 23,222 ft^2/day	The aquifer test plan was approved on August 22, 2011 and T was determined from area specific capacity test results (shallow aquifer wells 1 (240757) and 2 (240758) and the deep aquifer near well 6 (473633)) and pump test data (deep aquifer near well 5 (513019). Uncertainty regarding aquifer transmissivity was addressed as described in Section 4.4.
Time of Travel	10 years	The public water supplier selected a 10 year time of travel.

Information provided by the Marshall-Polk Rural Water System was used to identify the maximum volume of water pumped annually by each well over the previous five-year period, as shown in Table 5. Also, the estimated pumping for the next five years is shown. Previous pumping values have been reported to the DNR, as required by the Marshall-Polk Rural Water System's Groundwater Appropriation Permit (Nos. 1976-1100 and 1981-1079). The maximum daily volume of discharge used as an input parameter in the model was calculated by dividing the greatest annual pumping volume by 365 days.

Table 5
Annual Volume of Water Discharged from Water Supply Wells

Well Name	Unique No.	2006	2007	2008	2009	2010	Modeled Future Pumping	Daily Volume (gallons)
Well 1	240757	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 2	240758	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 5	513019	**39.9**	35.0	30.8	34.5	36.5	39.9	109,240
Well 6	473633	38.3	37.5	42.5	**45.2**	42.5	45.2	123,751
System Total		116.6	112.5	114.3	115.5	117	126.1	345,243

(Expressed as millions of gallons except where indicated. Bolding indicates greatest annual pumping volume.)

In addition to the wells used by the Marshall-Polk Rural Water System, Table 6 shows other high-capacity wells that were included in the delineation to account for their pumping impacts on the capture areas for the system's wells. Pumping data was obtained from the DNR State Water Use Database System.

Table 6 - Other Permitted High-Capacity Wells

Unique Number	Well Name	DNR Permit Number	Aquifer	Use	Annual Volume of Water Pumped (millions of gallons)	Daily Volume (gallons)
162389	City of Warren Well 6	1981-1099	QBAA	Municipal Waterworks	48.8	133,607
511095	Dwight W. Peterson	1990-1151	QBAA	Major Crop Irrigation	17.9	49,008

4.2 Method Used to Delineate the Wellhead Protection Area

The WHPAs for the Marshall-Polk Rural Water Supply wells were determined using a combination of two methods. The first involved calculating the groundwater capture zone deterministically using representative aquifer parameters that were input into MLAEM, a groundwater modeling code (Strack, 1989). The second approach used the analytical groundwater flow method Oneka (Barnes and Soule, 2002). The results of these separate analyses are presented in Figure 7. Each resulting WHPA

boundary is a composite of the capture zones calculated using these two approaches (Figure 1). The input files for both models are available at MDH upon request.

The MLAEM Code was selected because it is a semi-quantitative method capable of simulating the influence of vertical infiltration and the pumping influence of multiple high-capacity wells, if necessary. It produces a conservative estimate because aquifer recharge is not used as an input parameter. It is appropriate to use MLAEM for these particular delineations because no flow boundaries were directly observed in drillers' logs in the area around the primary city wells, at least in the areas defined by a 1-year and 10-year time of travel. It does have somewhat limited capabilities to address aquifer settings that exhibit variable geologic conditions or variations in the direction of the groundwater flow field.

A second code, using the analytical groundwater flow method named Oneka (Barnes and Soule, 2003), was used to assess the probability of impacts that local variations in hydrogeologic conditions may have on a well capture zone. This model treats the aquifer properties and the available water level measurements as variable input parameters. The locations of wells, water levels, and the aquifer geometry were evaluated using information from the CWI database. For the solution, Oneka finds the flow field that best fits the network of water level elevations by varying the values of the aquifer thickness and transmissivity. Oneka then evaluates the probability of the capture of a given point based on the number of times it is included in the capture areas generated by the total number of solutions. The output from the model is a capture zone probability map for the specified time of travel (10 years).

4.3 Results of Model Calibration and Sensitivity Analysis

Model calibration is a procedure that compares the results of a model to measured or known values. This procedure can be used to define model validity over a range of input values, or it can help determine the level of confidence with which model results may be used. As a matter of practice, groundwater flow models are usually calibrated using water elevation observations. However, owing to the relatively limited amount of water elevation data for the two separate Quaternary sand and gravel aquifer units used by the Marshall-Polk Rural Water System, a flowpath model based on available hydraulic head observations was calculated and a model uncertainty analysis was conducted in place of a traditional model calibration. Flowpath lines were calculated in the MLAEM Model using equations that reflected 1) a constant pumping rate, 2) direction of groundwater flow, 3) hydraulic gradient, 4) aquifer thickness, 5) aquifer permeability, and 6) aquifer porosity. As such, it was a simple calculation of the portion of the aquifer that contributes water, based on the width of the flow field that is affected by pumping.

The Oneka Model was used to support the MLAEM results by using an iterative process to provide the best fit for the ranges of values assigned to its input parameters. This helped to define the subset of values for which the delineation results are most likely to reflect local hydrogeologic conditions and, therefore, provide the best calibration results.

Model sensitivity is the amount of change in model results caused by the variation of a particular input parameter. Because of the simplicity of the MLAEM model, the direction and extent of the modeled capture zone may be very sensitive to any of the input parameters:

- The 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. However, the pumping rate

is based on the results presented in Table 5 and, therefore, is not a variable factor that will influence the delineation of the WHPAs.

- The direction of groundwater flow determines the orientation of the capture area. 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 the source of water to each well. The ambient groundwater flow fields that are defined in Figure 2 provide the basis for determining the extent to which each model run reflects the conceptual understanding of the orientation of the capture area for a well.
- An hydraulic gradient of zero produces a circular capture zone, centered on the well. As the hydraulic gradient increases, the capture zone changes into an elliptical shape, with the well centered on the down-gradient focal point. The hydraulic gradient was determined by using water level elevations that were taken from wells that have verified locations (Figure 2). Generally, the accuracy of the hydraulic gradient determination is directly proportional to the amount of available data that describes the distribution of hydraulic head in the aquifer.
- The aquifer thickness, permeability, and porosity influence the size and shape of the capture zone. A decrease in either thickness or porosity causes a linear, proportional increase in the areal extent of the capture zone; whereas permeability defines the relative proportions of the capture zone width to length. A decrease in permeability decreases the length of the capture zone and increases the distance to the stagnation point, making the capture zone more circular in shape and centered around the well.

4.4 Addressing Model Uncertainty

Using computer models to simulate groundwater flow necessarily involves representing a complicated natural system in a simplified manner. Local geologic conditions may vary within the capture area of the Marshall-Polk Rural Water System wells, but the amount of existing information that is needed to accurately define this degree of variability is often not available for portions of a WHPA. In addition, the current capabilities of groundwater flow models may not be sufficient to represent the natural flow system exactly. However, the results are valid within a range defined by the reasonable variation of input parameters for this delineation setting.

The MLAEM Code, used as it was in these delineations, has limited capabilities to address these kinds of uncertainties, other than by using multiple runs in which the following the six input parameters are varied: 1) constant pumping rate, 2) hydraulic gradient, 3) direction of ambient flow, 4) aquifer thickness, 5) aquifer permeability, and 6) porosity. The uncertainty associated with the MLAEM Code results from 1) the model deficiencies mentioned above, 2) the sensitivity of the code itself, and 3) the fact that the model cannot be calibrated. The steps employed for this delineation to address model uncertainty were:

1) Pumping Rate - For each well, a maximum historical (five-year) pumping rate or an engineering estimate of future pumping, whichever is greater (Minnesota Rules, part 4720.5510, subpart 4).
2) Ambient Flow Field - A composite of capture zones created from angles of flow that are 10 degrees greater and 10 degrees lesser than the representative angle of ambient flow (Minnesota Rules, part 4720.5510, subpart 5, B(2).
3) Aquifer Thickness - The open-hole interval for each well was used rather than a representative thickness of the aquifer.
4) Probability Analysis - The Oneka Model was used to estimate capture zone probability.

Capture areas were developed for a range of groundwater flow directions, aquifer permeabilities, and times of travel of one and ten years (Figure 7). As the model code uses constant input values for each run, several runs were required to include all variations in input parameters. Table 7 documents the variables used to address MLAEM Code model uncertainty.

Table 7 - Model Parameters Used in MLAEM Code Model Runs

Well Name	File Name	Discharge (m^3/day)	Transmisisivity (m^2/day)	Gradient	Flow Angle (N of E)	Porosity (%)	Aquifer Thickness (meters)	Remarks
1 (240757)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
1 (240757)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
1 (240757)	MP-1and2_ plus10.txt	212.5	450	0.0028	187	25	4.57	Base flow direction plus 10 degrees
2 (240758)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
2 (240758)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
2 (240758)	MP-1and2_ plus10.txt	212.5	450	0.0028	187	25	4.57	Base flow direction plus 10 degrees
5 (513019)	MP-5_base.txt	413.5	168	0.0032	193	25	7.92	Base flow direction
5 (513019)	MP-5_ minus10.txt	413.5	168	0.0032	183	25	7.92	Base flow direction minus 10 degrees
5 (513019)	MP-5_ plus10.txt	413.5	168	0.0032	203	25	7.92	Base flow direction plus 10 degrees
6 (473633)	MP-6_base.txt	468.4	2157	0.0032	193	25	12.2	Base flow direction
6 (473633)	MP-6_ minus10.txt	468.4	2157	0.0032	183	25	12.2	Base flow direction minus 10 degrees
6 (473633)	MP-6_ plus10.txt	468.4	2157	0.0032	203	25	12.2	Base flow direction plus 10 degrees

Oneka Model - Uncertainty related to water levels reported on well records is based on the accuracy of the ground elevation assigned to the well using topographic maps and the transient variability of the water levels in the aquifer over time. Water levels that are probably inaccurate were identified using data from 1) the CWI database, and 2) DNR observation well measurements. Only water levels that fit the two flow fields (Figure 2) were used for the Oneka analysis. Additionally, assessment of the Oneka input parameters with regard to rainfall statistics for the area was used to further narrow the statistical distribution of hydraulic conductivities used within the model.

The Oneka Model helps to address uncertainties related to aquifer parameters as variations of the flow field. A 10-year capture zone probability map (Figure 7) was generated for the Marshall-Polk Rural Water System wells; the values used for the Oneka Model are shown in Table 8. The Oneka results fit well with the capture zones calculated from the MLAEM model. The probability maps for the Marshall-Polk Rural Water System wells show that uncertainty within a capture zone increases as the distance from a particular water supply well increases (Figure 7).

Table 8 - Range of Values Used for the Oneka Model

Well Number	File Name	Hydraulic Conductivity (meters/day)	Thickness (meters)	Porosity (%)
1 (240757)	MP1.one	2 - 60	4.57	25
2 (240758)	MP2.one	2 - 60	4.57	25
5 (513019)	MP5.one	15 – 34	7.92	25
6 (473633)	MP6.one	2 - 24	12.2	25

4.5 Amendment Changes

Significant changes in the available information merited a review of the existing groundwater flow model used to delineate the WHPAs. A comparison of the two models is given in Table 9 and the DWSMAs are shown in Figure 1b. As indicated, one of the capture zones modeled in 2001 is for a well that is no longer in use by the Marshall-Polk Rural Water System near Euclid, approximately 17 miles to the south of the wells currently used. Because that well is no longer in use, that DWSMA delineated in 2001 is no longer valid and is not shown in Figure 1b.

Table 9 – Summary of Changes in the Delineation Criteria and Models

Delineation	2001	2011
PWS Pumping Wells	5 Wells 240757, 240758 , 513019, 163384, 166210	4 wells (240757, 240758, 513019, 473633)
Travel Time	10 years	10 years
DWSMA Vulnerability	Low	Low
Surface Water Contribution	None	None
Model	WHPA, MLAEM	MLAEM
Saturation	Confined	Confined
Thicknesses	19.8 m at 240757 240758 7.9 m well 51039 only	4.57 m (240757 and 240758); 7.92 m (513019); 12.2 m (473633)
Permeability	8.9 m/day at 240757 240758	98.4 m/day (240757 and 240758); 21.2 m/day (513019);

	5.4 m/day well 51039	177 m/day (473633)
Porosity	25%	25%
Recharge (m/day)	Not assessed	Not assessed
Head Boundaries	Red River, head contour, aquifer inhomogeneities	Head Contours
PWS Pumping Rates	311 m3/d at 240757 240758 674 m3/d at 513019	212.5 m^3/day (240757 and 240758); 413.5 m^3/day (513019); 468.4 m^3/day (473633)
Other Pumping	None	NoneNone

5. Delineation of the Drinking Water Supply Management Area

The boundaries of the Drinking Water Supply Management Areas (DWSMA) were defined by the public water supplier using the following features (Figure 1):

- Center-lines of highways, streets, roads, or railroad rights-of-ways;
- Public Land Survey coordinates;
- Property or fence lines; or
- Political boundaries.

6. Vulnerability Assessments

The Part 1 wellhead protection plan includes the vulnerability assessments for the Marshall-Polk Rural Water System wells and DWSMAs. These vulnerability assessments are used to help define potential contamination sources within each DWSMA and select appropriate measures for reducing the risk that they present to the public water supply overall.

6.1 Assessment of Well Vulnerability

The vulnerability assessment for each well used by the Marshall-Polk Rural Water System is listed in Table 1 and is based upon the following conditions:

1) Well construction meets current State Well Code specifications (Minnesota Rules, part 4725) for Well 5 (513019). Construction specifications for Wells 1 (240757), 2 (240758) and 6 (473633) are either missing or do not meet current Well Code requirements for grouting;
2) The geologic conditions at all four well sites include a cover of clay-rich geologic materials over the aquifers used that is sufficient to retard or prevent the vertical movement of contaminants; and
3) Water samples collected November 22, 2010 from all four wells showed tritium concentrations that were below the method detection limit.

6.2 Assessment of Drinking Water Supply Management Area Vulnerability

The vulnerability of Marshall-Polk Rural Water System's two DWSMAs is based upon the following information:

1) Isotopic and water chemistry data from wells located within the DWSMAs indicate that the aquifer contains water that has no detectable levels of tritium or human-caused contamination; and
2) Review of the geologic logs contained in the CWI database and geological maps and reports indicate that the aquifer exhibits a low to very low geologic sensitivity throughout both DWSMAs and is isolated from the direct vertical recharge of surface water.

Therefore the DWSMAs have low vulnerability ratings, in accordance with the Minnesota Wellhead Protection Rule (parts 4720.5100 to 4720.5590) and MDH guidance documents.

7. Selected References

Barnes, R.J., and Soule, R.G. (2002), *Oneka: A simple analytical element model for stochastic capture zone delineation*, 8 p., St. Paul, Minn., draft paper.

Blandford, T.N., and Huyakorn, P.S. (1991), *WHPA 2.0: A modular semi-analytical model for the delineation of wellhead protection areas*, EPA 68-08-0003, U.S. Environmental Protection Agency, Office of Ground-Water Protection, Washington, D.C., 246 p.

Blum, J.L. (1997), *Analysis of Marshall-Polk Rural Water System Pumping Test Data*, Minnesota Department of Health, St. Paul, MN, 35 p.

Fetter, C.W. (2001), *Applied Hydrogeology*, 4th ed., Prentice-Hall, Upper Saddle River, N.J., 598 p.

Geologic Sensitivity Project Workgroup (1991), *Criteria and guidelines for assessing geologic sensitivity of ground water resources in Minnesota*, Minnesota Department of Natural Resources, Division of Waters, St. Paul, Minn., 122 p.

Strack, O.D.L. (1989), *Groundwater mechanics*, Prentice Hall, Englewood Cliffs, N.J., 732 p.

Amendments to the Wellhead Protection Plan for

Marshall-Polk Rural Water Supply System
Public Water Supply Identification Number 1450005

Relating to

Delineation of the Wellhead Protection Area

Delineation of the Drinking Water Supply Management Area

Well Vulnerability Assessment

Drinking Water Supply Management Area Vulnerability

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February 2012

1.0 Introduction

This document describes the amendments to Part I of the wellhead protection (WHP) plan for the Marshall-Polk Rural Water System (PWSID 1450005). The purpose for amending the plan is to address changes that have occurred since the plan was last approved in order to update the WHP measures that are needed to protect public drinking water.

The current WHP plan was approved in October of 2001, and the deadline for the completion of the amended plan is July 3, 2012. The Minnesota Department of Health (MDH) has conducted the amendment to Part I of the WHP plan at the request of the Marshall-Polk Rural Water System. The work was performed in accordance with the Minnesota Wellhead Protection Rule, parts 4720.5100 to 4720.5590.

2. 0 Plan Amendments

The proposed amendments that are contained in this document refer to pages in the Part 1 WHP plan as described herein:

Walsh, J.F., (2001), *Wellhead protection plan for the Marshall-Polk Rural Water System--Part 1,* Minnesota Department of Health, St. Paul, Minn., 56 p.

2.1 Changes to the wells that are included in the amended WHP plan.

The description of the rural water supply system on page 5 is amended using the following table. Wells that are no longer included are identified using ~~strikeout~~. **Bolding** reflects the changes to the wells from the current plan or refers to wells that are added as part of the plan amendment:

Table 1A - Water Supply Well Information

Local Well ID	Unique Number	Use	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Aquifer[2]	Well Vulnerability
Well 1	240757	P	8	156	171	1976	QBAA	Low
Well 2	240758	P	8	182	197	1976	QBAA	Low
~~**Well 3**~~	~~**163384**~~		~~**8**~~	~~**104**~~	~~**124**~~	~~**1981**~~		
~~**Well 4**~~	~~**166210**~~		~~**8**~~	~~**103**~~	~~**123**~~	~~**1981**~~		
Well 5	513019	P	8	393	419	1992	QBAA	Low
Well 6	**473633**	**P**	**16**	**335**	**375**	**1990**	**QBAA**	**Low**

Note: 1. Primary (P), Emergency (E).
2. Quaternary Buried Artesian Aquifer, i.e. glacial sand and gravel materials

3.1 Changes to the Wellhead Protection Areas

The wellhead protection areas (WHPAs) that are presented on Figure 1 (page 3) and Figure 2 (page 4) are replaced with Figure 1A and Figure 2A respectively. The discussion for these changes is contained in this section of the amended plan. In addition, the amended emergency response areas (ERAs) that are based upon a one year time of travel for each well are xincluded in Figures 1A and 2A.

3.2 Changes to the Annual Volume of Water Discharged from the Water Supply Wells

The description of the daily volume of water pumped from each well on pages 8 and 9 is amended using the following table:

Table 2A - Annual Volume of Water Discharged from Water Supply Wells

Well Name	Unique No.	2006	2007	2008	2009	2010	Modeled Future Pumping	Daily Volume (gallons)
Well 1	240757	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 2	240758	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 5	513019	**39.9**	35.0	30.8	34.5	36.5	39.9	109,240
Well 6	473633	38.3	37.5	42.5	**45.2**	42.5	45.2	123,751
System Total		116.6	112.5	114.3	115.5	117	126.1	345,243

(Expressed as millions of gallons except where indicated. **Bolding** indicates greatest annual pumping volume.)

3.3 Aquifer Test Plan

The current aquifer test plan was amended on August 22, 2011 to include well 6 (473633) and to reflect that wells 3 (163384) and 4 (166210) are no longer used.

3.4 Aquifer Transmissivity

The discussion of aquifer transmissivity on page 9 is amended to include the estimated value of 23,222 ft^2/day at well 6 (473633).

3.5 Method Used to Delineate the Wellhead Protection Area

Some aspects of the method used to delineate the wellhead protection areas differ from those used in the previous delineation. The main difference was the use of a method that explicitly

incorporates the estimated uncertainty in the transmissivity of the aquifer and the groundwater flow direction. The discussion of the method used to delineate the wellhead protection area on page 9 – 16 is replaced with the following:

The WHPAs for the Marshall-Polk Rural Water Supply wells were determined using a combination of two methods. The first involved calculating the groundwater capture zone deterministically using representative aquifer parameters that were input into MLAEM, a groundwater modeling code (Strack, 1989). The second approach used the analytical groundwater flow method Oneka (Barnes and Soule, 2002). The results of these separate analyses are presented in Figure 1. Each resulting WHPA boundary is a composite of the capture zones calculated using these two approaches (Figure 1). The input files for both models are available at MDH upon request.

The MLAEM Code was selected because it is a semi-quantitative method capable of simulating the influence of vertical infiltration and the pumping influence of multiple high-capacity wells, if necessary. It produces a conservative estimate because aquifer recharge is not used as an input parameter. It is appropriate to use MLAEM for these particular delineations because no flow boundaries were directly observed in drillers' logs in the area around the primary city wells, at least in the areas defined by a 1-year and 10-year time of travel. It does have somewhat limited capabilities to address aquifer settings that exhibit variable geologic conditions or variations in the direction of the groundwater flow field.

The Oneka code (Barnes and Soule, 2003), was used to assess the probability of impacts that local variations in hydrogeologic conditions may have on a well capture zone. This model treats the aquifer properties and the available water level measurements as variable input parameters. The locations of wells, water levels, and the aquifer geometry were evaluated using information from the CWI database. For the solution, Oneka finds the flow field that best fits the network of water level elevations by varying the values of the aquifer thickness and transmissivity. Oneka then evaluates the probability of the capture of a given point based on the number of times it is included in the capture areas generated by the total number of solutions. The output from the model is a capture zone probability map for the specified time of travel (10 years).

Results of Model Calibration and Sensitivity Analysis

Model calibration is a procedure that compares the results of a model to measured or known values. This procedure can be used to define model validity over a range of input values, or it can help determine the level of confidence with which model results may be used. As a matter of practice, groundwater flow models are usually calibrated using water elevation observations. However, owing to the relatively limited amount of water elevation data for the two separate Quaternary sand and gravel aquifer units used by the Marshall-Polk Rural Water System, a flowpath model based on available hydraulic head observations was calculated and a model uncertainty analysis was conducted in place of a traditional model calibration. Flowpath lines were calculated in the MLAEM Model using equations that reflected 1) a constant pumping rate, 2) direction of groundwater flow, 3) hydraulic gradient, 4) aquifer thickness, 5) aquifer permeability, and 6) aquifer porosity. As such, it was a simple calculation of the portion of the aquifer that contributes water, based on the width of the flow field that is affected by pumping.

The Oneka Model was used to support the MLAEM results by using an iterative process to provide the best fit for the ranges of values assigned to its input parameters. This helped to define the subset of values for which the delineation results are most likely to reflect local hydrogeologic conditions and, therefore, provide the best calibration results.

Model sensitivity is the amount of change in model results caused by the variation of a particular input parameter. Because of the simplicity of the MLAEM model, the direction and extent of the modeled capture zone may be very sensitive to any of the input parameters:

- The 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. However, the pumping rate is based on the results presented in Table 5 and, therefore, is not a variable factor that will influence the delineation of the WHPAs.
- The direction of groundwater flow determines the orientation of the capture area. 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 the source of water to each well. The ambient groundwater flow fields that are defined in Figure 2 provide the basis for determining the extent to which each model run reflects the conceptual understanding of the orientation of the capture area for a well.
- An hydraulic gradient of zero produces a circular capture zone, centered on the well. As the hydraulic gradient increases, the capture zone changes into an elliptical shape, with the well centered on the down-gradient focal point. The hydraulic gradient was determined by using water level elevations that were taken from wells that have verified locations (Figure 2). Generally, the accuracy of the hydraulic gradient determination is directly proportional to the amount of available data that describes the distribution of hydraulic head in the aquifer.
- The aquifer thickness, permeability, and porosity influence the size and shape of the capture zone. A decrease in either thickness or porosity causes a linear, proportional increase in the areal extent of the capture zone; whereas permeability defines the relative proportions of the capture zone width to length. A decrease in permeability decreases the length of the capture zone and increases the distance to the stagnation point, making the capture zone more circular in shape and centered around the well.

Addressing Model Uncertainty

Using computer models to simulate groundwater flow necessarily involves representing a complicated natural system in a simplified manner. Local geologic conditions may vary within the capture area of the Marshall-Polk Rural Water System wells, but the amount of existing information that is needed to accurately define this degree of variability is often not available for portions of a WHPA. In addition, the current capabilities of groundwater flow models may not be sufficient to represent the natural flow system exactly. However, the results are valid within a range defined by the reasonable variation of input parameters for this delineation setting.

The MLAEM Code, used as it was in these delineations, has limited capabilities to address these kinds of uncertainties, other than by using multiple runs in which the following the six input parameters are varied: 1) constant pumping rate, 2) hydraulic gradient, 3) direction of ambient flow, 4) aquifer thickness, 5) aquifer permeability, and 6) porosity. The uncertainty associated with the MLAEM Code results from 1) the model deficiencies mentioned above, 2) the sensitivity of the code itself, and 3) the fact that the model cannot be calibrated. The steps employed for this delineation to address model uncertainty were:

1) Pumping Rate - For each well, a maximum historical (five-year) pumping rate or an engineering estimate of future pumping, whichever is greater (Minnesota Rules, part 4720.5510, subpart 4).
2) Ambient Flow Field - A composite of capture zones created from angles of flow that are 10 degrees greater and 10 degrees lesser than the representative angle of ambient flow (Minnesota Rules, part 4720.5510, subpart 5, B(2).
3) Aquifer Thickness - The open-hole interval for each well was used rather than a representative thickness of the aquifer.
4) Probability Analysis - The Oneka Model was used to estimate capture zone probability.

Capture areas were developed for a range of groundwater flow directions, differences in aquifer permeability, and times of travel of one and ten years (Figures 1A and 2A). As the model code uses constant input values for each run, several runs were required to include all variations in input parameters. Table 3A documents the variables used to address MLAEM Code model uncertainty.

Table 3A - Model Parameters Used in MLAEM Code Model Runs

Well Name	File Name	Discharge (m^3/day)	Transmissivity (m^2/day)	Gradient	Flow Angle (N of E)	Porosity (%)	Aquifer Thickness (meters)	Remarks
1 (240757)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
1 (240757)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
1 (240757)	MP-1and2_ plus10.txt	212.5	450	0.0028	187	25	4.57	Base flow direction plus 10 degrees
2 (240758)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
2 (240758)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
2 (240758)	MP-1and2_ plus10.txt	212.5	450	0.0028	187	25	4.57	Base flow direction plus 10 degrees
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5 (513019)	MP-5_ minus10.txt	413.5	168	0.0032	183	25	7.92	Base flow direction minus 10 degrees
5 (513019)	MP-5_ plus10.txt	413.5	168	0.0032	203	25	7.92	Base flow direction plus 10 degrees
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6 (473633)	MP-6_ plus10.txt	468.4	2,157	0.0032	203	25	12.2	Base flow direction plus 10 degrees

Oneka Model - Uncertainty related to water levels reported on well records is based on the accuracy of the ground elevation assigned to the well using topographic maps and the transient variability of the water levels in the aquifer over time. Water levels that are probably inaccurate were identified using data from 1) the CWI database, and 2) DNR observation well measurements. Only water levels that fit the two flow fields were used for the Oneka analysis. Additionally, assessment of the Oneka input parameters with regard to rainfall statistics for the area was used to further narrow the statistical distribution of hydraulic conductivities used within the model.

The Oneka Model helps to address uncertainties related to aquifer parameters as variations of the flow field. A 10-year capture zone probability map for wells 1 (240757), 2 (240758), and 5 9513019) is shown in Figure 3A and another for well 6 (473633 is shown in Figure 4A. The values used for these Oneka Model runs are shown in Table 4A. The Oneka results fit well with the capture zones calculated from the MLAEM model. The probability maps for the Marshall-Polk Rural Water System wells show that uncertainty within a capture zone increases as the distance from a particular water supply well increases.

Table 4A - Range of Values Used for the Oneka Model

Well Number	File Name	Hydraulic Conductivity (meters/day)	Thickness (meters)	Porosity (%)
1 (240757)	MP1.one	2 - 60	4.57	25
2 (240758)	MP2.one	2 - 60	4.57	25
5 (513019)	MP5.one	15 – 34	7.92	25
6 (473633)	MP6.one	2 - 24	12.2	25

4.0 Delineation of the Drinking Water Supply Management Area

The delineation of the drinking water supply management area (DWSMA) on page 16 is amended to reflect the changes to the WHPAs for wells 1 (240757), 2 (240758), and 5 (513019) in the Warren well field and the addition of well 6 (473633) at a separate location. The boundaries of the two DWSMAs (Figures 1A and 2A) were determined using the following criteria:

- Center-lines of highways, streets, roads, or railroad rights-of-ways;
- Public Land Survey coordinates;
- Property or fence lines; and
- Political boundaries

5.0 Assessment of Well Vulnerability

The assessment of well vulnerability on pages 49 - 56 is replaced with the following:

The vulnerability assessment for each well used by the Marshall-Polk Rural Water System is listed in Table 1 and is based upon the following conditions:

1) Well construction meets current State Well Code specifications (Minnesota Rules, part 4725) for Well 5 (513019). Construction specifications for Wells 1 (240757), 2 (240758) and 6 (473633) are either missing or do not meet current Well Code requirements for grouting;
2) The geologic conditions at all four well sites include a cover of clay-rich geologic materials over the aquifers used that is sufficient to retard or prevent the vertical movement of contaminants; and
3) Water samples collected November 22, 2010 from all four wells showed tritium concentrations that were below the method detection limit.

6.0 Drinking Water Supply Management Area Vulnerability Assessment

The assessment of DWSMA vulnerability on page 50 is amended to include a low vulnerability that is assigned to the DWSMA shown in Figure 2A for well 6 (473633).

7.0 References

The following references are added to those listed on page 16:

Barnes, R.J., and Soule, R.G. (2002), *Oneka: A simple analytical element model for stochastic capture zone delineation*, 8 p., St. Paul, Minn., draft paper.

Blandford, T.N., and Huyakorn, P.S. (1991), *WHPA 2.0: A modular semi-analytical model for the delineation of wellhead protection areas,* EPA 68-08-0003, U.S. Environmental Protection Agency, Office of Ground-Water Protection, Washington, D.C., 246 p.

Blum, J.L. (1997), *Analysis of Marshall-Polk Rural Water System Pumping Test Data*, Minnesota Department of Health, St. Paul, MN, 35 p.

Fetter, C.W. (2001), *Applied Hydrogeology*, 4th ed., Prentice-Hall, Upper Saddle River, N.J., 598 p.

Geologic Sensitivity Project Workgroup (1991), *Criteria and guidelines for assessing geologic sensitivity of ground water resources in Minnesota,* Minnesota Department of Natural Resources, Division of Waters, St. Paul, Minn., 122 p.

Strack, O.D.L. (1989), *Groundwater mechanics*, Prentice Hall, Englewood Cliffs, N.J., 732 p.

FIGURES

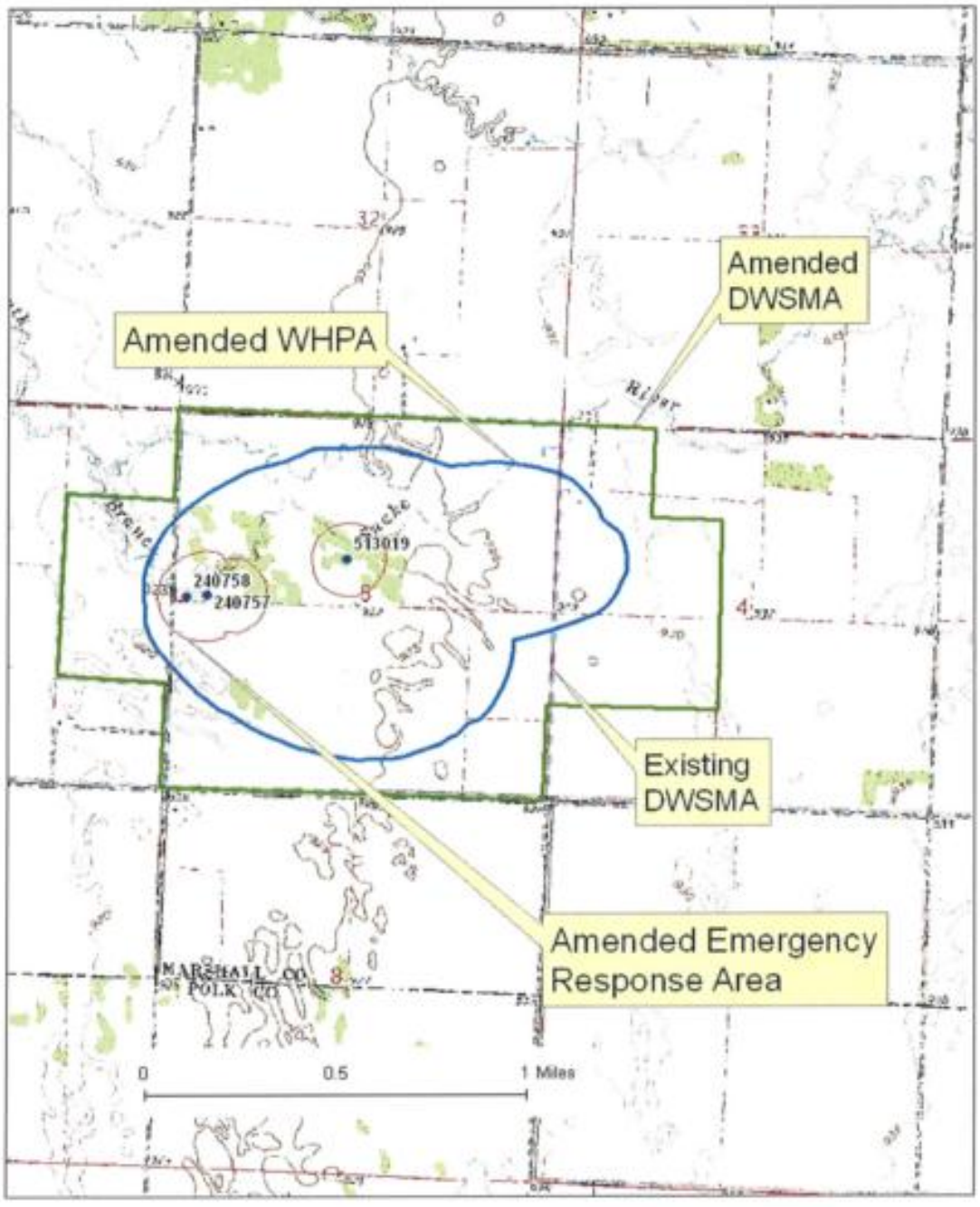

Figure 1A Amended WHPA and DWSMA for Wells 1(240757), 2 (240758), and 6 (473633)

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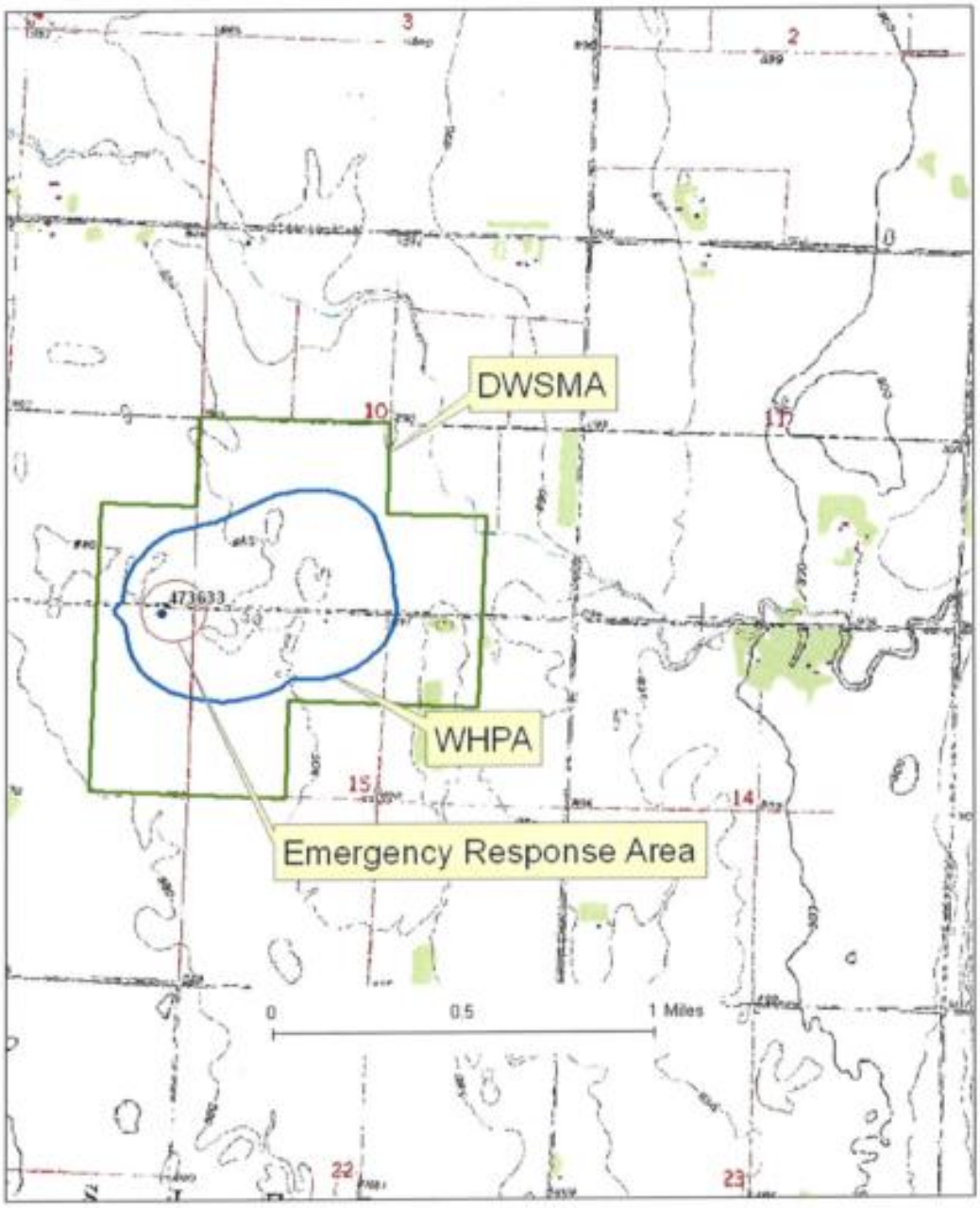

Figure 2A Wellhead Protection Area and Drinking Water Supply Management Area for Well 6 (473633)

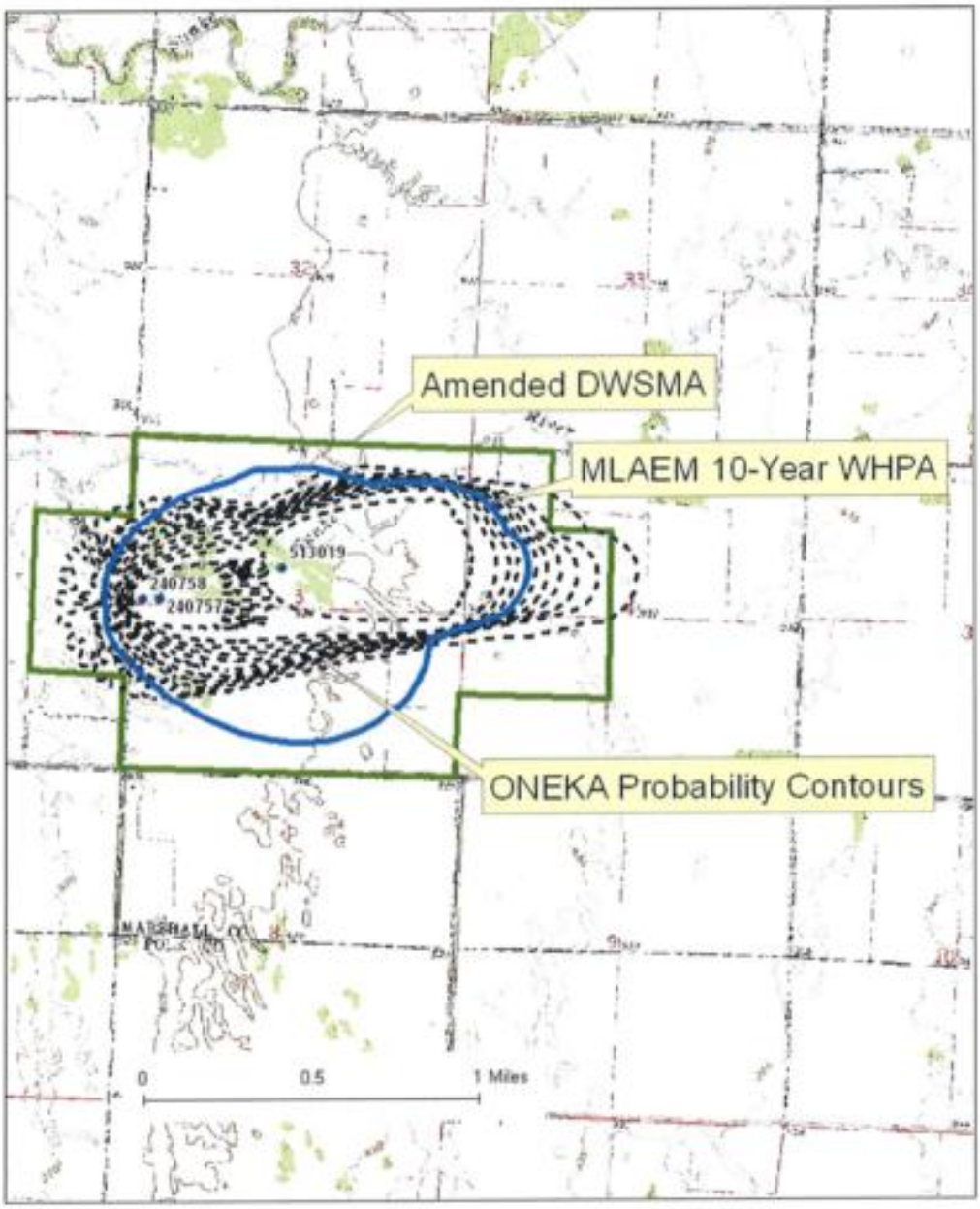

Figure 3A Comparison of ONEKA Analysis and MLAEM WHPA Boundaries for Well 1(240757), Well 2 (240758), and Well 5 (513019)

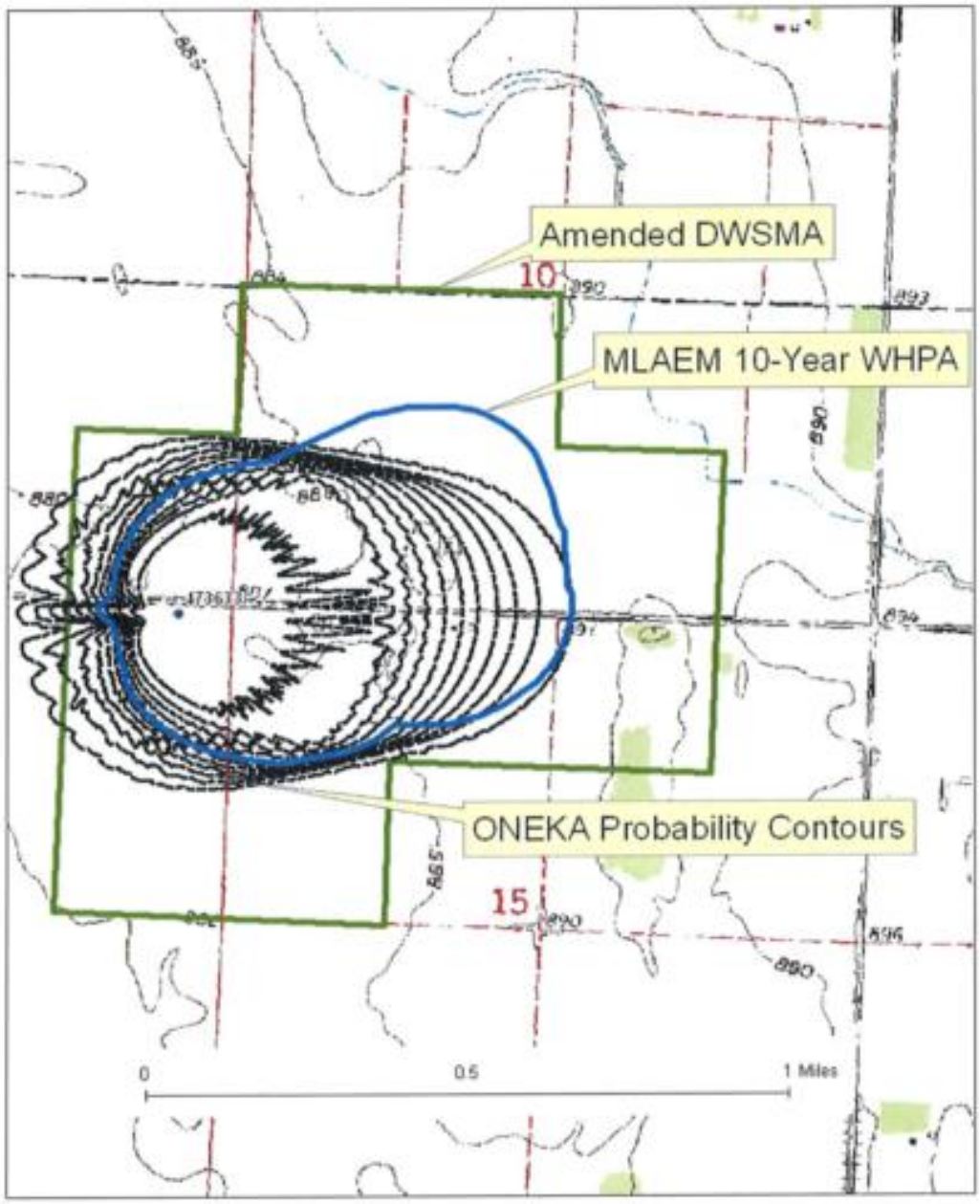

Figure 4A Comparison of ONEKA Analysis and MLAEM WHPA Boundaries for Well 6 (473633)

Amendments to the Wellhead Protection Plan for

Marshall-Polk Rural Water Supply System

Public Water Supply Identification Number 1450005

Relating to

Delineation of the Wellhead Protection Area

Delineation of the Drinking Water Supply Management Area

Well Vulnerability Assessment

Drinking Water Supply Management Area Vulnerability

Tracy J. Lund
R.G. Soule, P.G.

Minnesota Department of Health

March 2012

1.0 Introduction

This document describes the amendments to Part I of the wellhead protection (WHP) plan for the Marshall-Polk Rural Water System (PWSID 1450005). The purpose for amending the plan is to address changes that have occurred since the plan was last approved, in order to update the WHP measures needed to protect public drinking water.

The current WHP plan was approved in October of 2001, and the deadline for the completion of the amended plan is July 3, 2012. The Minnesota Department of Health (MDH) conducted the amendment to Part I of the WHP plan at the request of the Marshall-Polk Rural Water System. The work was performed in accordance with the Minnesota Wellhead Protection Rule, parts 4720.5100 to 4720.5590.

2.0 Plan Amendments

The proposed amendments that are contained in this document refer to pages in the Part 1 WHP plan as described herein:

> Walsh, J.F., (2001), *Wellhead protection plan for Marshall-Polk Rural Water System--Part 1,* Minnesota Department of Health, St. Paul, Minn., 56 p.

2.1 Changes to the Wells Included in the Amended WHP Plan

The description of the rural water supply system on page 5 is amended using the following table. Wells that are no longer included are identified using ~~strikeout~~. **Bolding** reflects the changes to the wells from the current plan or refers to wells that are added as part of the plan amendment.

Table 1A - Water Supply Well Information

Local Well ID	Unique Number	Use[1]	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Aquifer[2]	Well Vulnerability
Well 1	240757	P	8	156	171	1976	QBAA	Low
Well 2	240758	P	8	182	197	1976	QBAA	Low
~~**Well 3**~~	~~**163384**~~		~~**8**~~	~~**104**~~	~~**124**~~	~~**1981**~~		
~~**Well 4**~~	~~**166210**~~		~~**8**~~	~~**103**~~	~~**123**~~	~~**1981**~~		
Well 5	513019	P	8	393	419	1992	QBAA	Low
Well 6	**473633**	**P**	**16**	**335**	**375**	**1990**	**QBAA**	**Low**

Note: 1. Primary (P) Well
2. Quaternary Buried Artesian Aquifer, i.e., glacial sand and gravel materials

3.0 Changes to the Wellhead Protection Areas

The wellhead protection areas (WHPAs) that are presented on Figure 1 (page 3) and Figure 2 (page 4) are replaced with Figure 1A and Figure 2A, respectively. The discussion for these changes is contained in this section of the amended plan. In addition, the amended emergency response areas (ERAs) that are based upon a one year time of travel for each well are included in Figures 1A and 2A.

3.1 Changes to the Annual Volume of Water Discharged from the Water Supply Wells

The description of the daily volume of water pumped from each well on pages 8 and 9 is amended using the following table.

Table 2A - Annual Volume of Water Discharged from Water Supply Wells

Well Name	Unique No.	2006	2007	2008	2009	2010	Modeled Future Pumping	Daily Volume (gallons)
Well 1	240757	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 2	240758	19.2	20.0	**20.5**	17.9	19.0	20.5	56,126
Well 5	513019	**39.9**	35.0	30.8	34.5	36.5	39.9	109,240
Well 6	473633	38.3	37.5	42.5	**45.2**	42.5	45.2	123,751
System Total		116.6	112.5	114.3	115.5	117	126.1	345,243

(Expressed as millions of gallons except where indicated. **Bolding** indicates greatest annual pumping volume.)

3.2 Aquifer Test Plan

The current aquifer test plan was amended on August 22, 2011, to include Well 6 (473633) and to reflect that Wells 3 (163384) and 4 (166210) are no longer used.

3.3 Aquifer Transmissivity

The discussion of aquifer transmissivity on page 9 is amended to include the estimated value of 23,222 ft^2/day at Well 6 (473633).

3.4 Method Used to Delineate the Wellhead Protection Area

Some aspects of the method used to delineate the wellhead protection areas (WHPAs) differ from those used in the previous delineation. The main difference was the use of a method that explicitly incorporates the estimated uncertainty in the transmissivity of the aquifer and the groundwater flow direction. The discussion of the method used to delineate the wellhead protection area on pages 9-16 is replaced with the following.

The WHPAs for the Marshall-Polk Rural Water System wells were determined using a combination of two methods. The first involved calculating the groundwater capture zone deterministically using representative aquifer parameters that were input into MLAEM, a groundwater modeling code (Strack, 1989). The second approach used the analytical groundwater flow method Oneka (Barnes and Soule, 2002). The results of these separate analyses are presented in Figure 1A. Each resulting WHPA boundary is a composite of the capture zones calculated using these two approaches (Figure 1A). The input files for both models are available at MDH upon request.

The MLAEM Code was selected because it is a semi-quantitative method capable of simulating the influence of vertical infiltration and the pumping influence of multiple high-capacity wells, if necessary. It produces a conservative estimate because aquifer recharge is not used as an input parameter. It is appropriate to use MLAEM for these particular delineations because no flow boundaries were directly observed in drillers' logs in the area around the primary city wells, at least in the areas defined by a 1-year and 10-year time of travel. It does have somewhat limited capabilities to address aquifer settings that exhibit variable geologic conditions or variations in the direction of the groundwater flow field.

The Oneka Code (Barnes and Soule, 2003) was used to assess the probability that local variations in hydrogeologic conditions may have an impact on a well capture zone. This model treats the aquifer properties and the available water level measurements as variable input parameters. The locations of wells, water levels, and the aquifer geometry were evaluated using information from the CWI database. For the solution, Oneka finds the flow field that best fits the network of water level elevations by varying the values of the aquifer thickness and transmissivity. Oneka then evaluates the probability of the capture of a given point based on the number of times it is included in the capture areas generated by the total number of solutions. The output from the model is a capture zone probability map for the specified time of travel (10 years).

Results of Model Calibration and Sensitivity Analysis

Model calibration is a procedure that compares the results of a model to measured or known values. This procedure can be used to define model validity over a range of input values, or it can help determine the level of confidence with which model results may be used. As a matter of practice, groundwater flow models are usually calibrated using water elevation observations. However, owing to the relatively limited amount of water elevation data for the two separate Quaternary sand and gravel aquifer units used by the Marshall-Polk Rural Water System, a flowpath model based on available hydraulic head observations was calculated and a model uncertainty analysis was conducted in place of a traditional model calibration. Flowpath lines were calculated in the MLAEM Model using equations that reflected 1) a constant pumping rate, 2) direction of groundwater flow, 3) hydraulic gradient, 4) aquifer thickness, 5) aquifer permeability, and 6) aquifer porosity. As such, it was a simple calculation of the portion of the aquifer that contributes water, based on the width of the flow field that is affected by pumping.

The Oneka Model was used to support the MLAEM results by using an iterative process to provide the best fit for the ranges of values assigned to its input parameters. This helped to define the subset of values for which the delineation results are most likely to reflect local hydrogeologic conditions and, therefore, provide the best calibration results.

Model sensitivity is the amount of change in model results caused by the variation of a particular input parameter. Because of the simplicity of the MLAEM Model, the direction and extent of the modeled capture zone may be very sensitive to any of the input parameters:

- The 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. However, the pumping rate is based on the results presented in Table 5 and, therefore, is not a variable factor that will influence the delineation of the WHPAs.
- The direction of groundwater flow determines the orientation of the capture area. 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 the source of water to each well. The ambient groundwater flow fields that are defined in Figure 2 (previous report) provide the basis for determining the extent to which each model run reflects the conceptual understanding of the orientation of the capture area for a well.
- An hydraulic gradient of zero produces a circular capture zone, centered on the well. As the hydraulic gradient increases, the capture zone changes into an elliptical shape, with the well centered on the down-gradient focal point. The hydraulic gradient was determined by using water level elevations that were taken from wells that have verified locations (Figure 2, previous report). Generally, the accuracy of the hydraulic gradient determination is directly proportional to the amount of available data that describes the distribution of hydraulic head in the aquifer.
- The aquifer thickness, permeability, and porosity influence the size and shape of the capture zone. A decrease in either thickness or porosity causes a linear, proportional increase in the areal extent of the capture zone; whereas permeability defines the relative proportions of the capture zone width to length. A decrease in permeability decreases the length of the capture zone and increases the distance to the stagnation point, making the capture zone more circular in shape and centered around the well.

Addressing Model Uncertainty

Using computer models to simulate groundwater flow necessarily involves representing a complicated natural system in a simplified manner. Local geologic conditions may vary within the capture area of the Marshall-Polk Rural Water System wells, but the amount of existing information that is needed to accurately define this degree of variability is often not available for portions of a WHPA. In addition, the current capabilities of groundwater flow models may not be sufficient to represent the natural flow system exactly. However, the results are valid within a range defined by the reasonable variation of input parameters for this delineation setting.

The MLAEM Code, used as it was in these delineations, has limited capabilities to address these kinds of uncertainties, other than by using multiple runs in which the following the six input parameters are varied: 1) constant pumping rate, 2) hydraulic gradient, 3) direction of ambient flow, 4) aquifer thickness, 5) aquifer permeability, and 6) porosity. The uncertainty associated with the MLAEM Code results from 1) the model deficiencies mentioned above, 2) the sensitivity of the code itself, and 3) the fact that the model cannot be calibrated. The steps employed for this delineation to address model uncertainty were:

1) Pumping Rate - For each well, a maximum historical (five-year) pumping rate or an engineering estimate of future pumping, whichever is greater (Minnesota Rules, part 4720.5510, subpart 4).

2) Ambient Flow Field - A composite of capture zones created from angles of flow that are 10 degrees greater and 10 degrees lesser than the representative angle of ambient flow (Minnesota Rules, part 4720.5510, subpart 5, B(2).

3) Aquifer Thickness - The open-hole interval for each well was used rather than a representative thickness of the aquifer.

4) Probability Analysis - The Oneka Model was used to estimate capture zone probability.

Capture areas were developed for a range of groundwater flow directions, differences in aquifer permeability, and times of travel of one and ten years (Figures 1A and 2A). As the model code uses constant input values for each run, several runs were required to include all variations in input parameters. Table 3A documents the variables used to address MLAEM Code model uncertainty.

Table 3A - Model Parameters Used in MLAEM Code Model Runs

Well Name	File Name	Discharge (m^3/day)	Transmissivity (m^2/day)	Gradient	Flow Angle (N of E)	Porosity (%)	Aquifer Thickness (meters)	Remarks
1 (240757)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
1 (240757)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
1 (240757)	MP-1and2_ plus10.txt	212.5	450	0.0028	187	25	4.57	Base flow direction plus 10 degrees
2 (240758)	MP-1and2_ base.txt	212.5	450	0.0028	177	25	4.57	Base flow direction
2 (240758)	MP-1and2_ minus10.txt	212.5	450	0.0028	167	25	4.57	Base flow direction minus 10 degrees
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5 (513019)	MP-5_ minus10.txt	413.5	168	0.0032	183	25	7.92	Base flow direction minus 10 degrees
5 (513019)	MP-5_ plus10.txt	413.5	168	0.0032	203	25	7.92	Base flow direction plus 10 degrees
6 (473633)	MP-6_base.txt	468.4	2,157	0.0032	193	25	12.2	Base flow direction
6 (473633)	MP-6_ minus10.txt	468.4	2,157	0.0032	183	25	12.2	Base flow direction minus 10 degrees
6 (473633)	MP-6_ plus10.txt	468.4	2,157	0.0032	203	25	12.2	Base flow direction plus 10 degrees

Oneka Model - Uncertainty related to water levels reported on well records is based on the accuracy of the ground elevation assigned to the well using topographic maps and the transient variability of the water levels in the aquifer over time. Water levels that are probably inaccurate were identified using data from 1) the CWI database, and 2) DNR observation well measurements. Only water levels that fit

the two flow fields were used for the Oneka analysis. Additionally, assessment of the Oneka input parameters with regard to rainfall statistics for the area was used to further narrow the statistical distribution of hydraulic conductivities used within the model.

The Oneka Model helps to address uncertainties related to aquifer parameters as variations of the flow field. A 10-year capture zone probability map for Wells 1 (240757), 2 (240758), and 5 (513019) is shown in Figure 3A and another for Well 6 (473633) is shown in Figure 4A. The values used for these Oneka model runs are shown in Table 4A. The Oneka results fit well with the capture zones calculated from the MLAEM Model. The probability maps for the Marshall-Polk Rural Water System wells show that uncertainty within a capture zone increases as the distance from a particular water supply well increases.

Table 4A - Range of Values Used for the Oneka Model

Well Number	File Name	Hydraulic Conductivity (meters/day)	Thickness (meters)	Porosity (%)
1 (240757)	MP1.one	2 - 60	4.57	25
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4.0 Delineation of the Drinking Water Supply Management Area

The delineation of the drinking water supply management area (DWSMA) on page 16 of the previous report is amended to reflect the changes to the WHPAs for Wells 1 (240757), 2 (240758), and 5 (513019) in the Warren well field, and the addition of Well 6 (473633) at a separate location. The boundaries of the two DWSMAs (Figures 1A and 2A) were determined using the following criteria:

- Center-lines of highways, streets, roads, or railroad rights-of-ways;
- Public Land Survey coordinates;
- Property or fence lines; and
- Political boundaries.

5.0 Assessment of Well Vulnerability

The assessment of well vulnerability on pages 49-56 is replaced with the following.

The vulnerability assessment for each well used by the Marshall-Polk Rural Water System is listed in Table 1A and is based upon the following conditions:

1) Well construction meets current State Well Code specifications (Minnesota Rules, part 4725) for Well 5 (513019). Construction specifications for Wells 1 (240757), 2 (240758) and 6 (473633) are either missing or do not meet current Well Code requirements for grouting.

2) The geologic conditions at all four well sites include a cover of clay-rich geologic materials over the aquifers used that is sufficient to retard or prevent the vertical movement of contaminants.

3) Water samples collected November 22, 2010, from all four wells showed tritium concentrations that were below the method detection limit.

6.0 Drinking Water Supply Management Area Vulnerability Assessment

The assessment of DWSMA vulnerability on page 50 is amended to include a low vulnerability that is assigned to the DWSMA shown in Figure 2A for Well 6 (473633).

7.0 References

The following references are added to those listed on page 16:

Barnes, R.J., and Soule, R.G. (2002), *Oneka: A simple analytical element model for stochastic capture zone delineation*, 8 p., St. Paul, Minn., draft paper.

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Fetter, C.W. (2001), *Applied hydrogeology*, 4th ed., Prentice-Hall, Upper Saddle River, N.J., 598 p.

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Strack, O.E., and Strack, F.D. (1997), *A tutorial to mlaem and slaem,* Strack Consulting, Inc., 71 p.

Figures

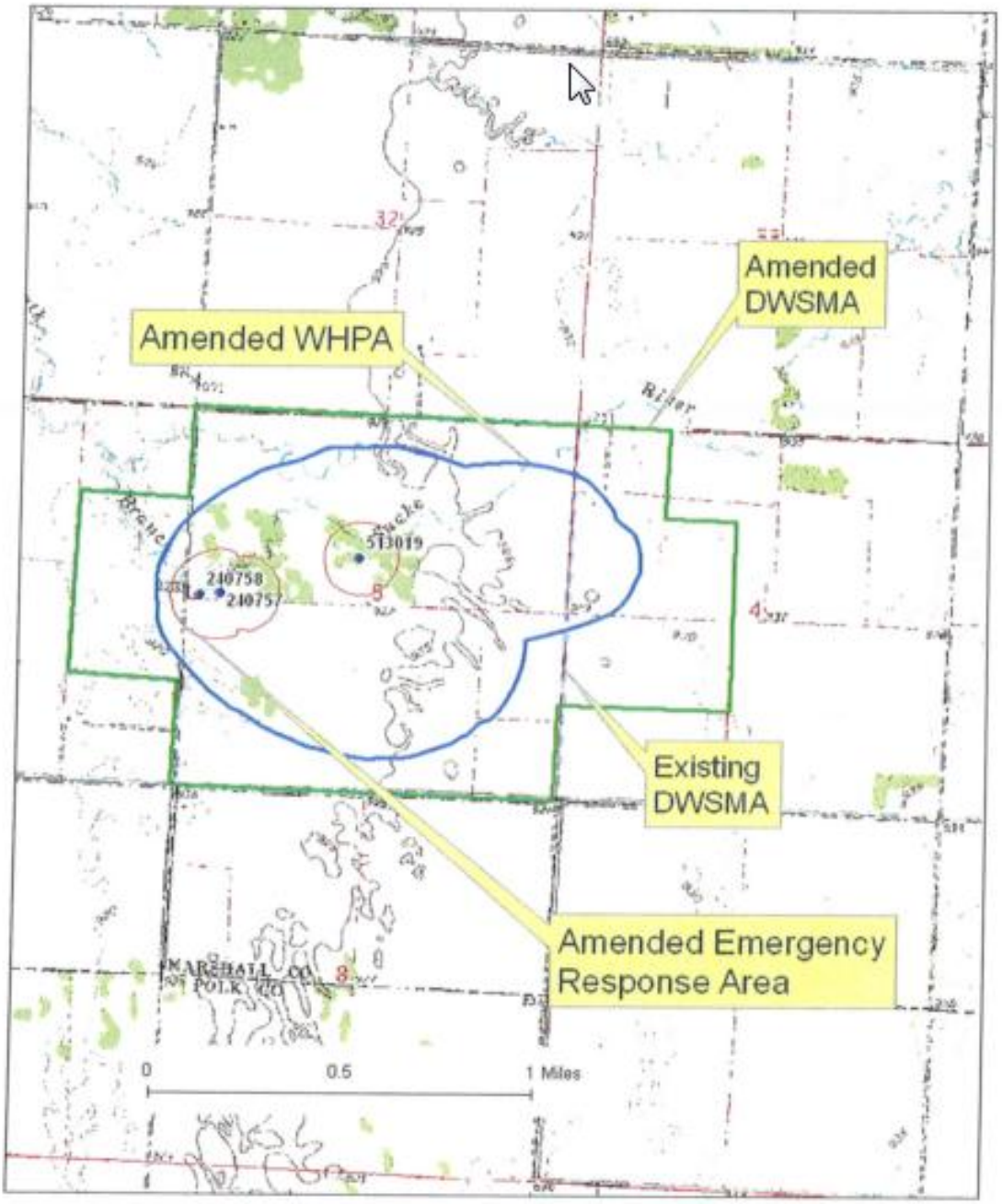


Figure 1A - Amended WHPA and DWSMA for Wells 1 (240757), 2 (240758), and 5 (513019)

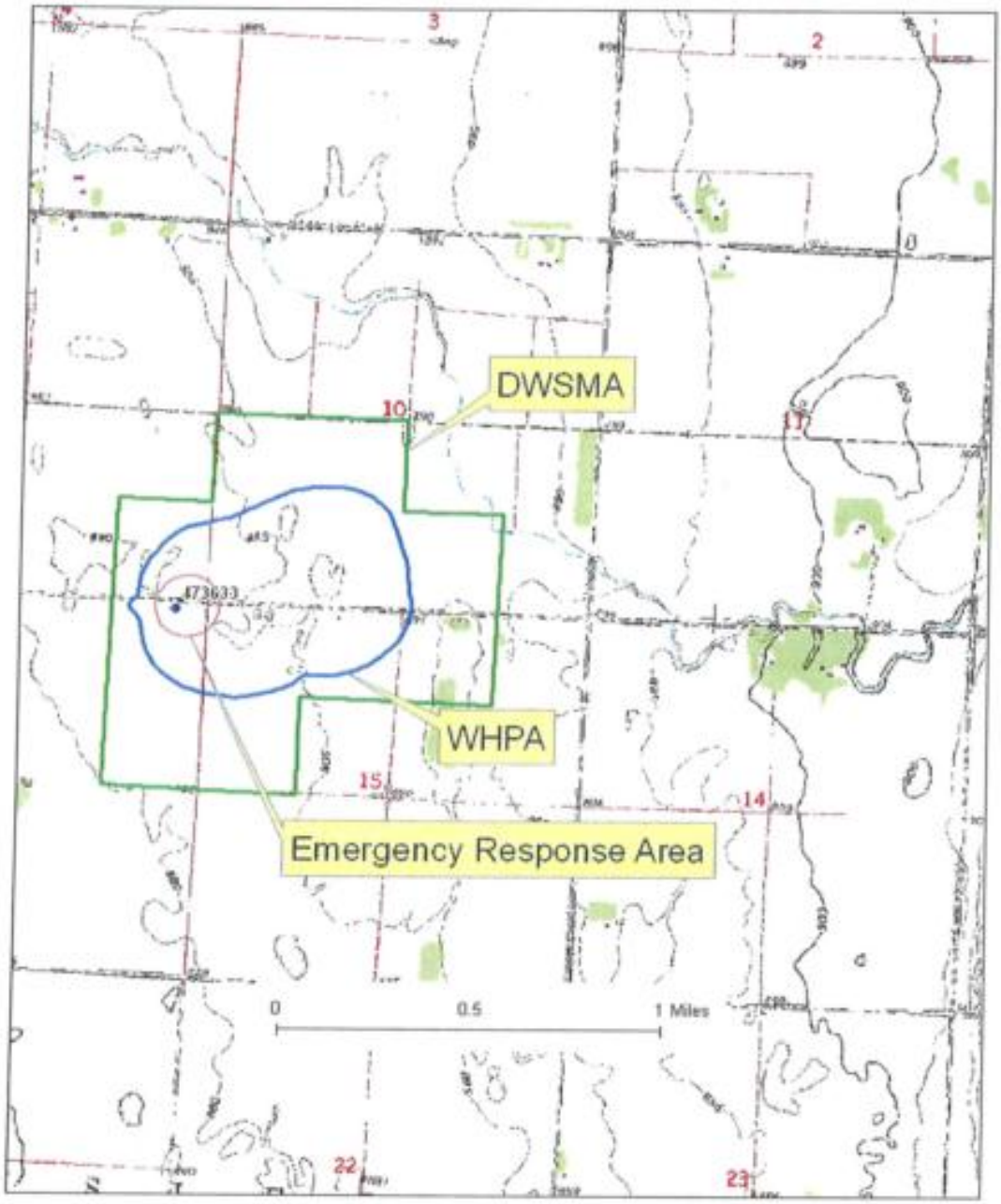


Figure 2A - Wellhead Protection Area and Drinking Water Supply Management Area for Well 6 (473633)

11

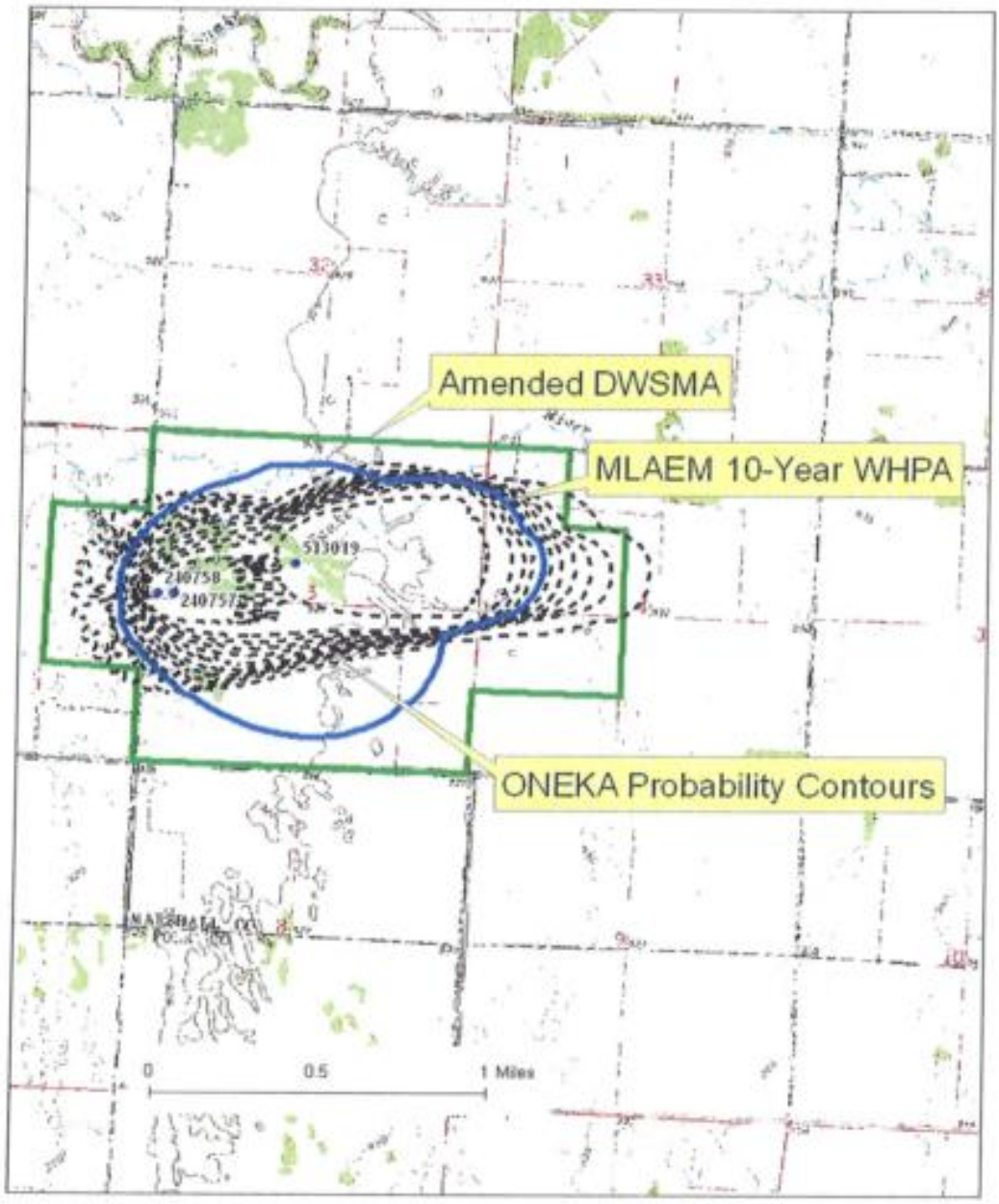


Figure 3A - Comparison of ONEKA Analysis and MLAEM WHPA Boundaries for Well 1(240757), Well 2 (240758), and Well 5 (513019)

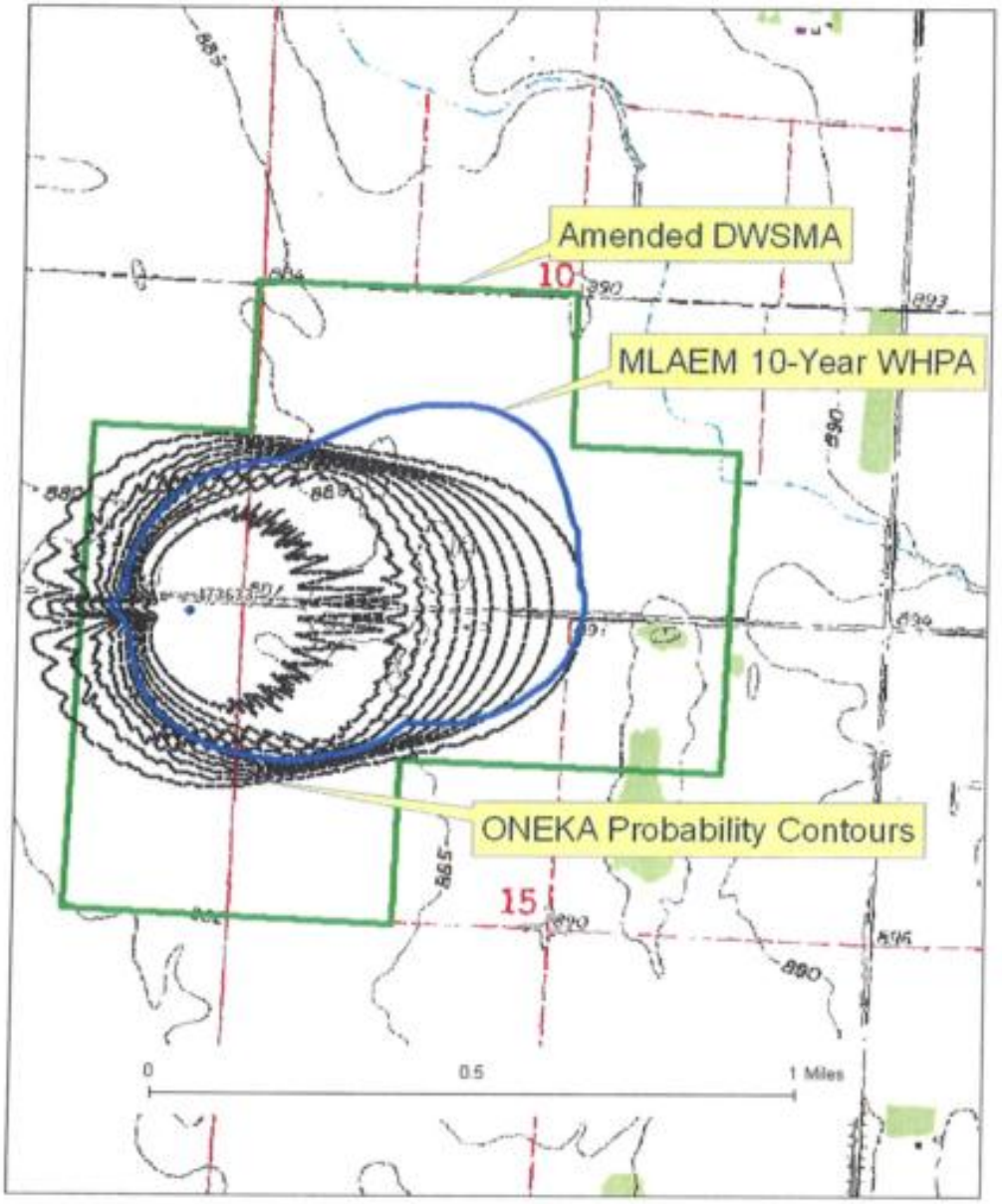


Figure 4A - Comparison of ONEKA Analysis and MLAEM WHPA Boundaries for Well 6 (473633)

13

Figures

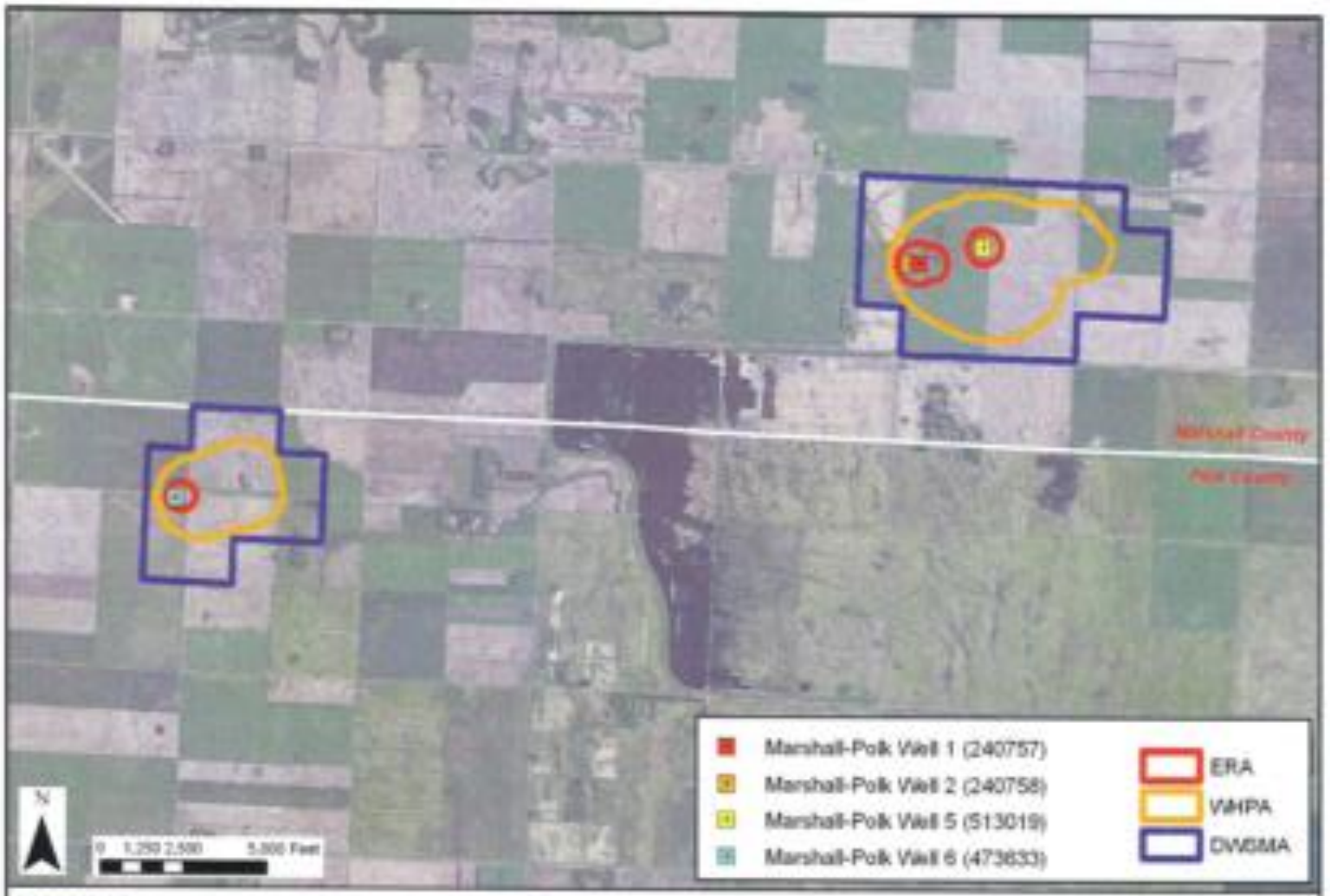


Figure 1.
Map of the Wellhead Protection Area and Drinking Water Supply Management Area
Marshall-Polk Rural Water System

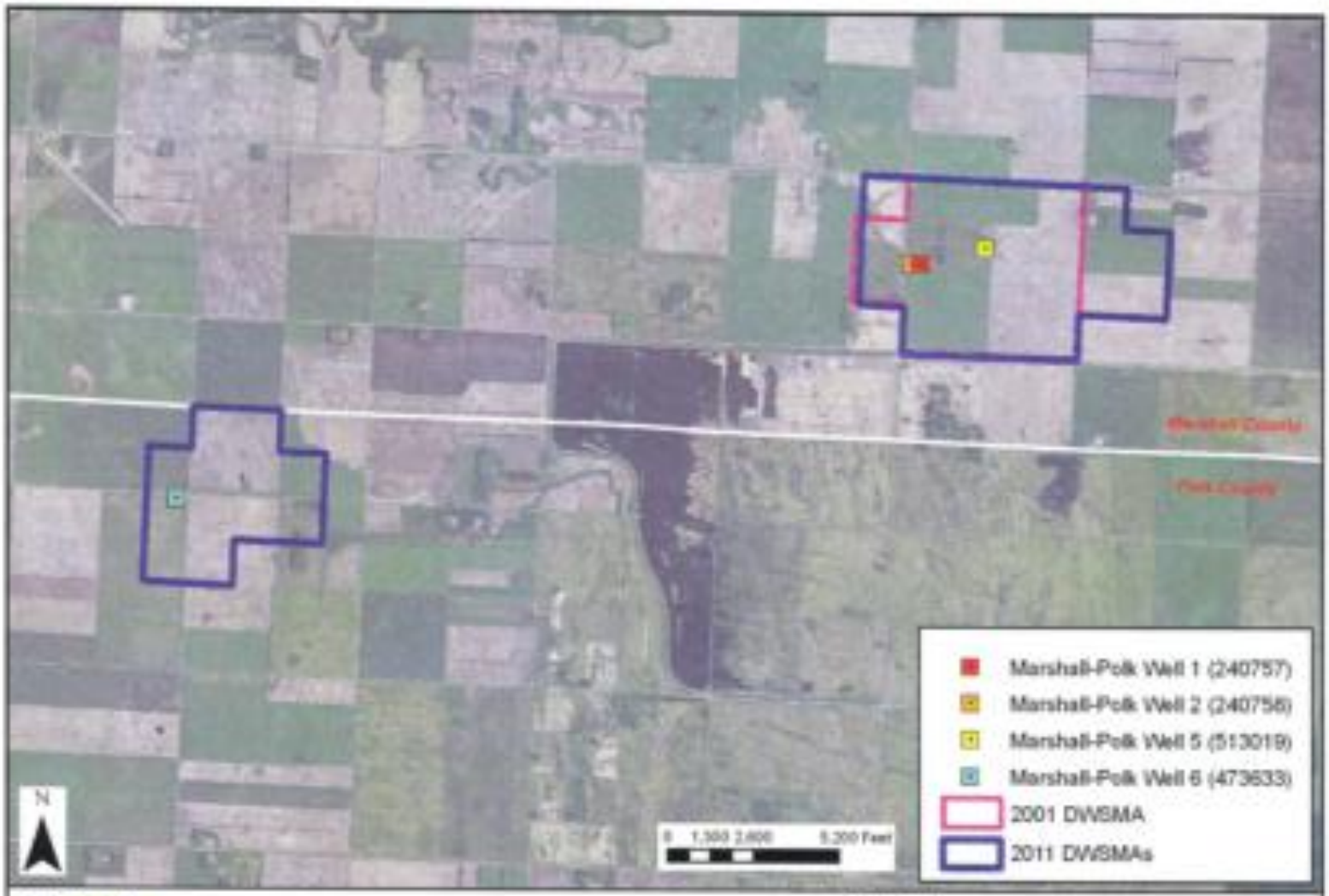


Figure 1a.
Comparison of Prior and Amended DWSMAs
Marshall-Polk Rural Water System

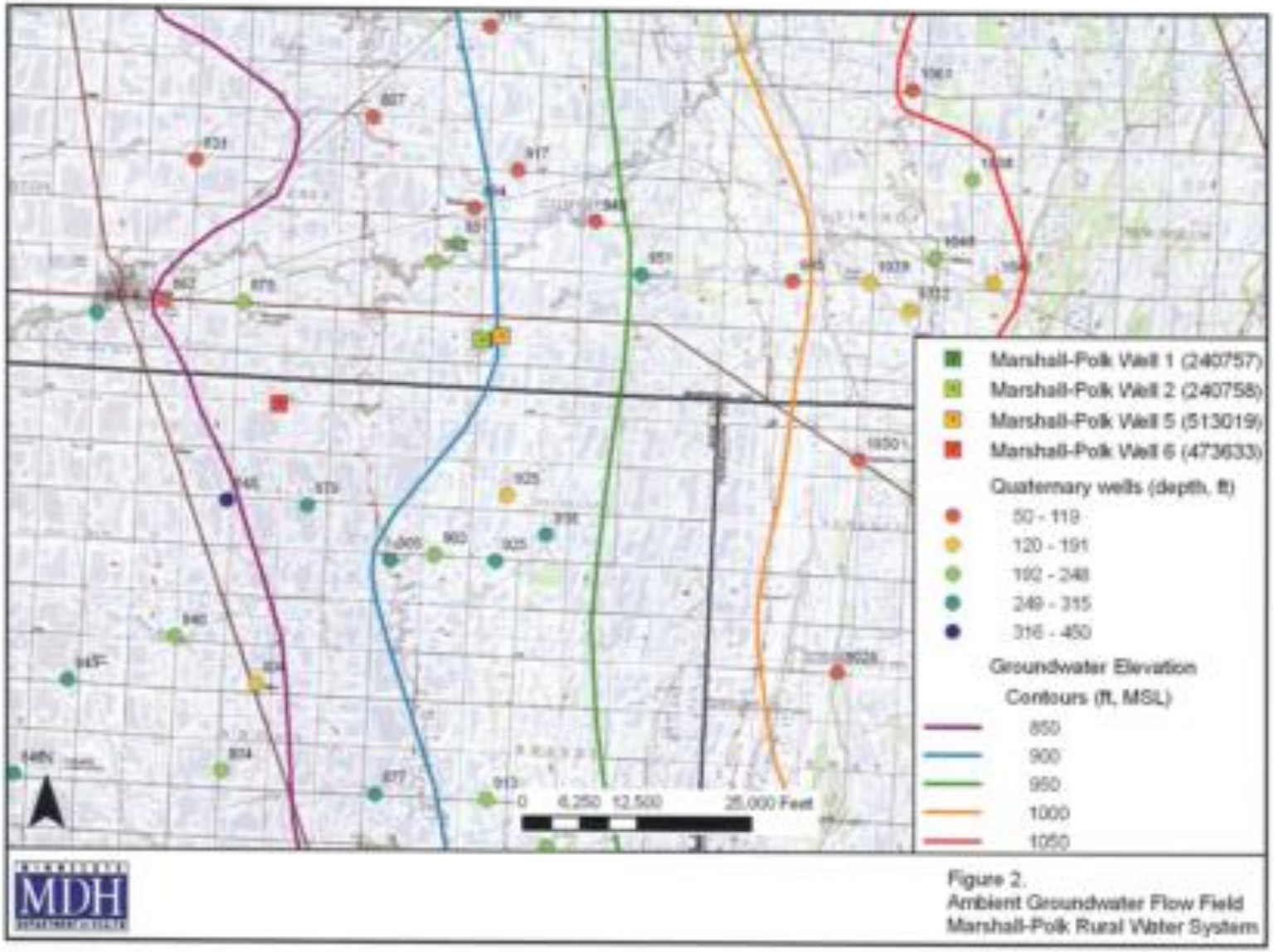


Figure 2.
Ambient Groundwater Flow Field
Marshall-Polk Rural Water System

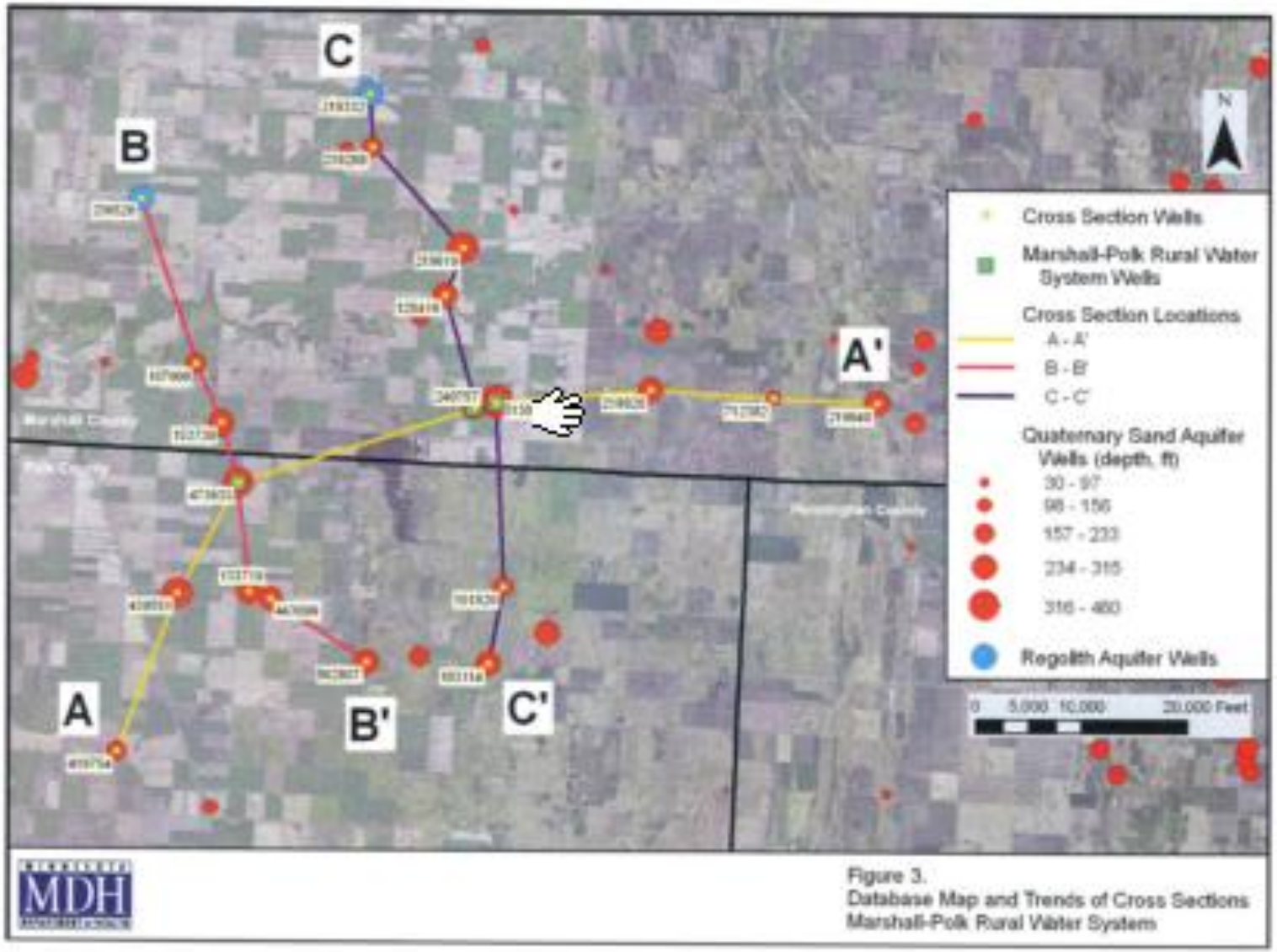


Figure 3.
Database Map and Trends of Cross Sections
Marshall-Polk Rural Water System

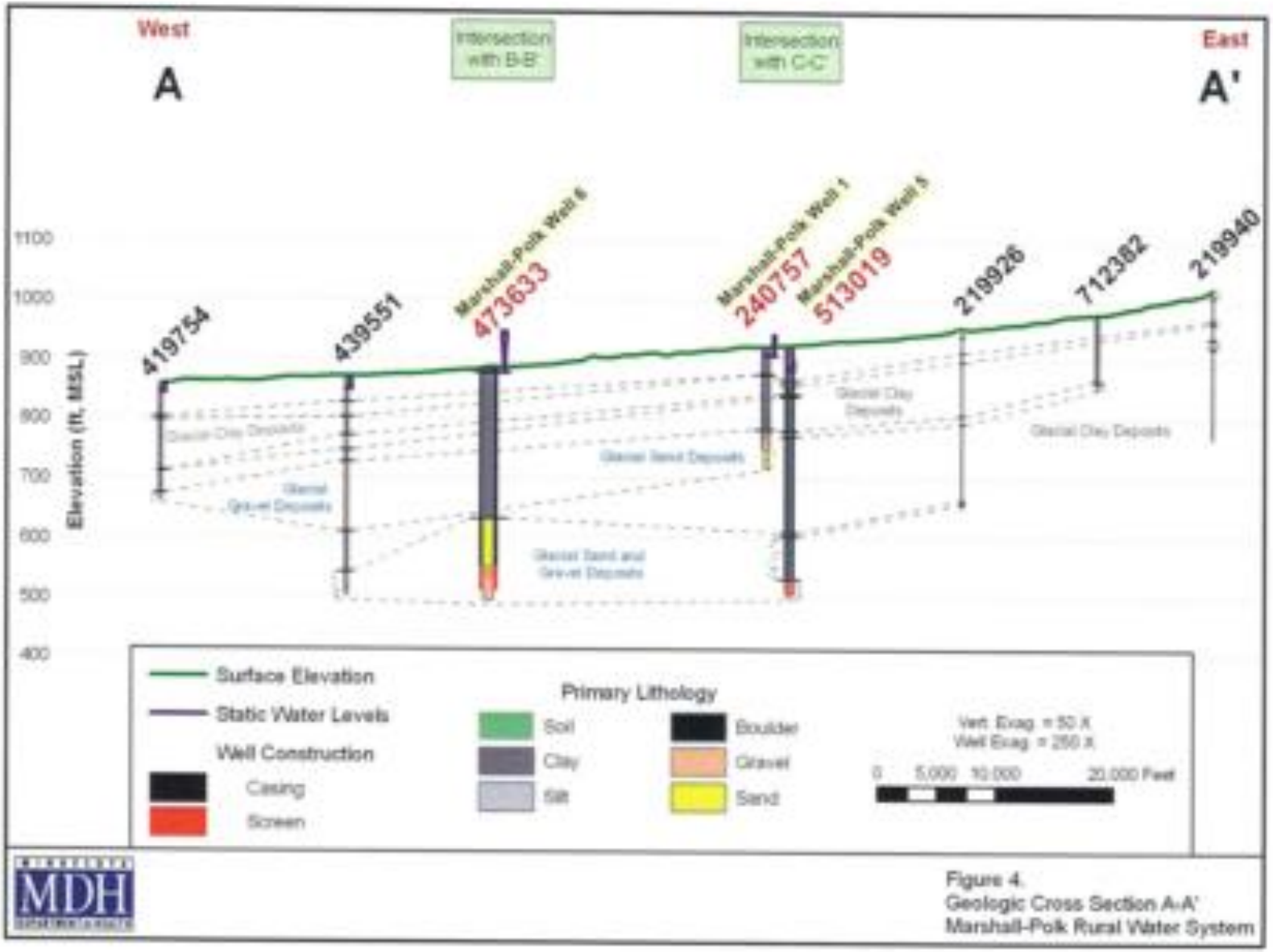


Figure 4.
Geologic Cross Section A-A'
Marshall-Polk Rural Water System

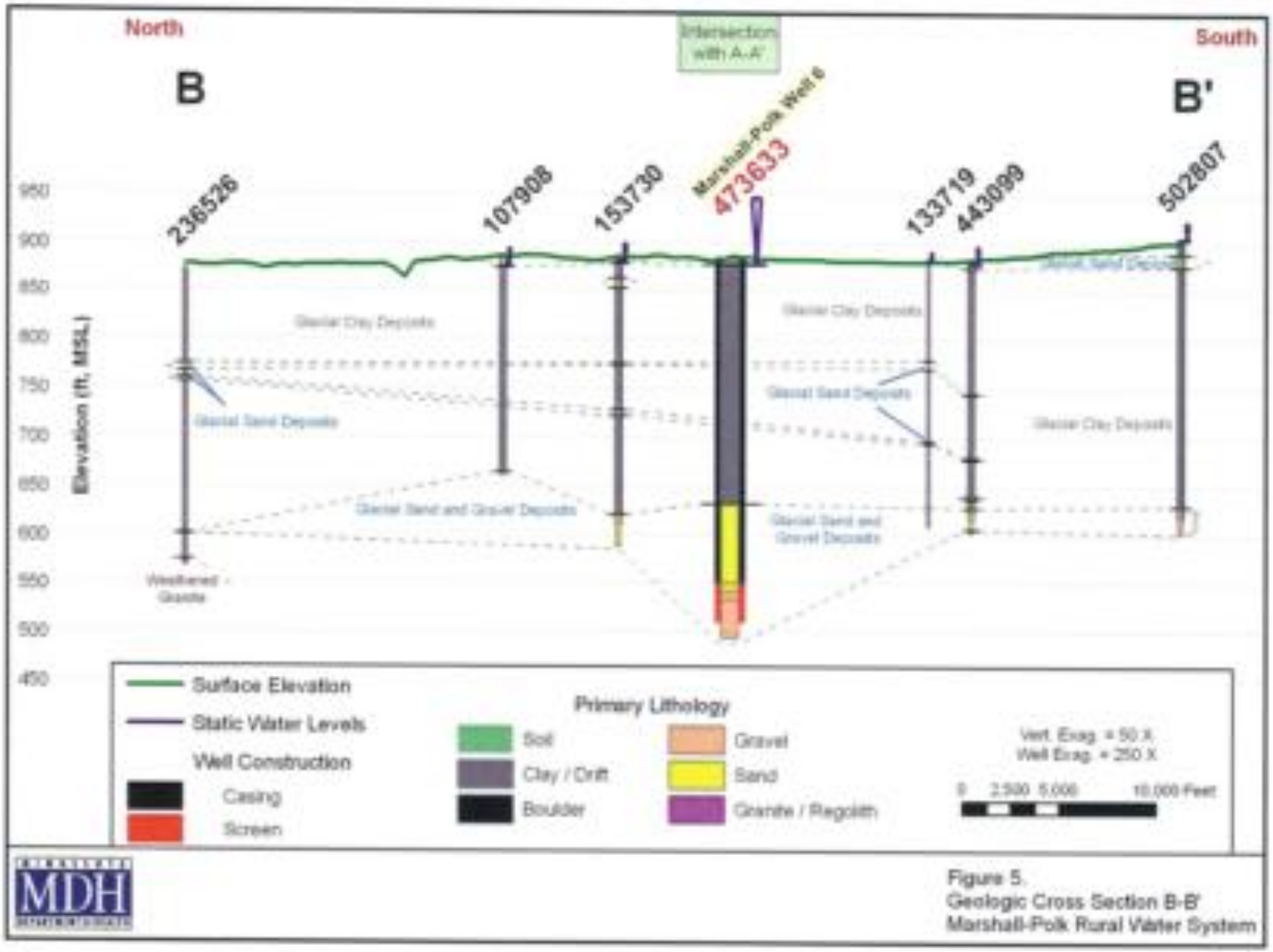


Figure 5.
Geologic Cross Section B-B'
Marshall-Polk Rural Water System

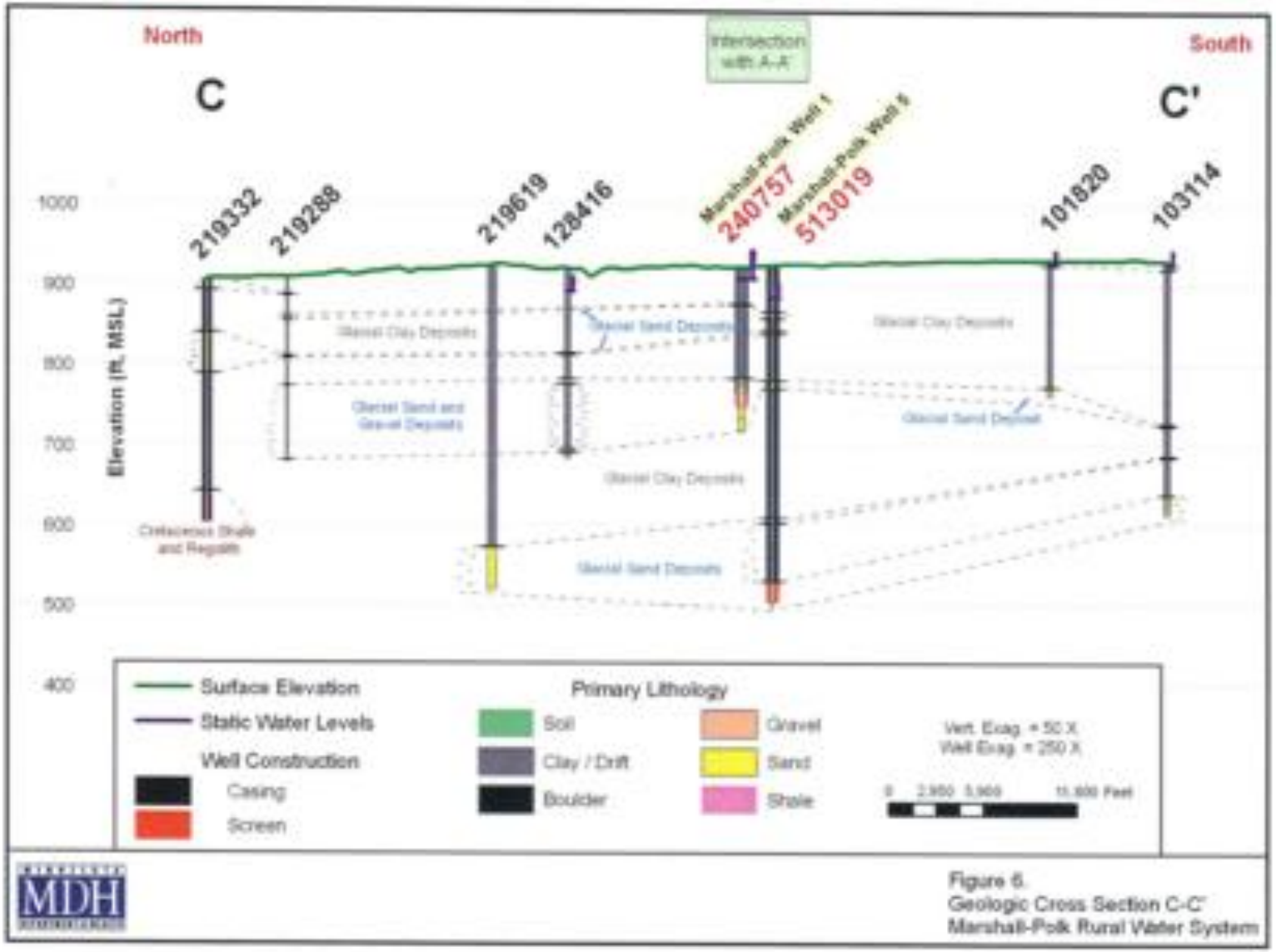


Figure 6.
Geologic Cross Section C-C'
Marshall-Polk Rural Water System

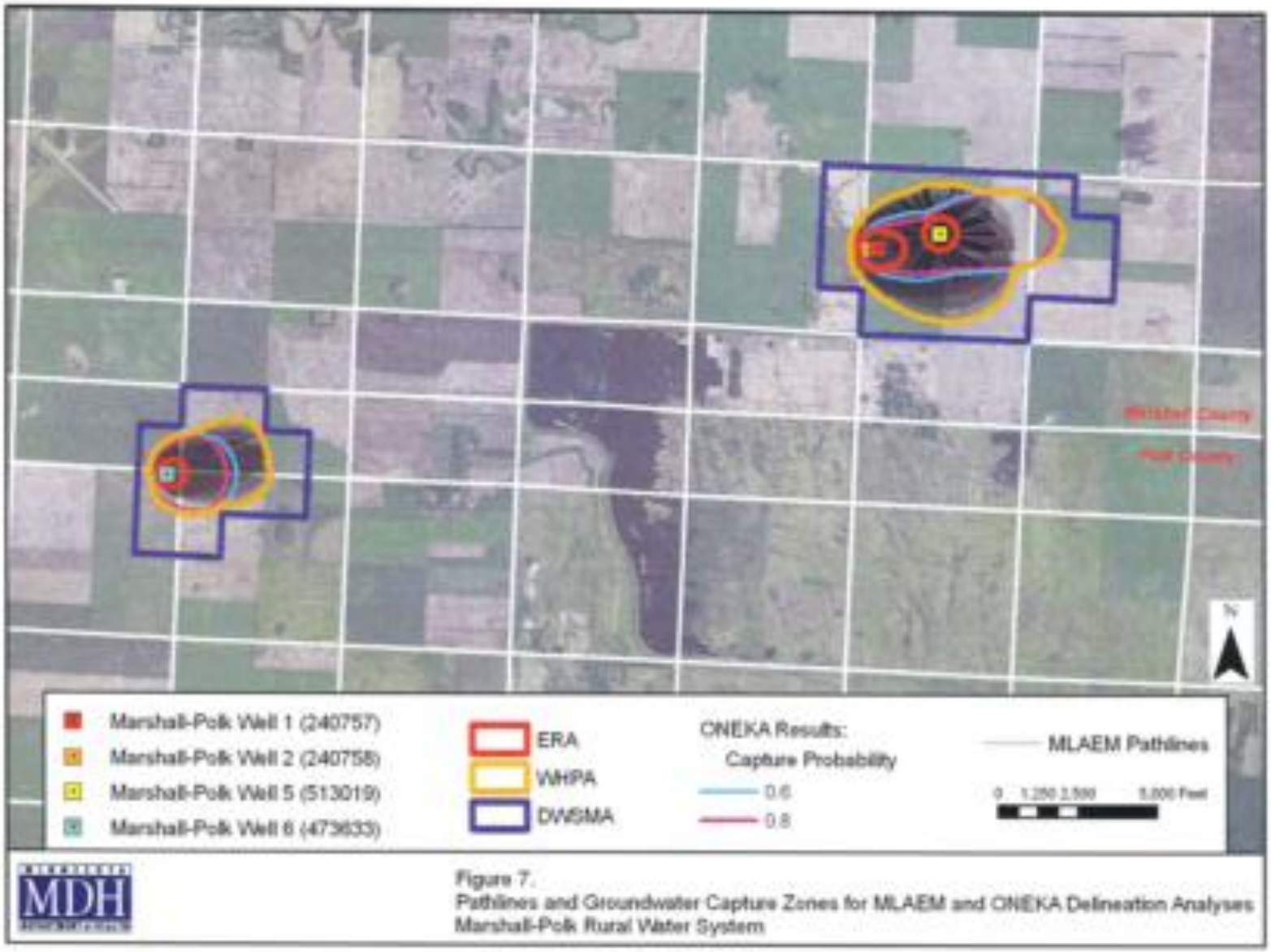


Figure 7.
Pathlines and Groundwater Capture Zones for MLAEM and ONEKA Delineation Analyses
Marshall-Polk Rural Water System

APPENDIX II
POTENTIAL CONTAMINANTS SOURCE INVENTORY

Marshall Polk Rural Water – Potential Contaminants Source Inventory						
MDH Facility #	**Name**	**Address**	**Parcel #**	**Potential Contaminant Source Type**	**Status**	**Comments**
1	Larry & Donna Laudal	24943 State HWY 1 NW Warren, MN	09-204-001	Well	Active	Domestic Well

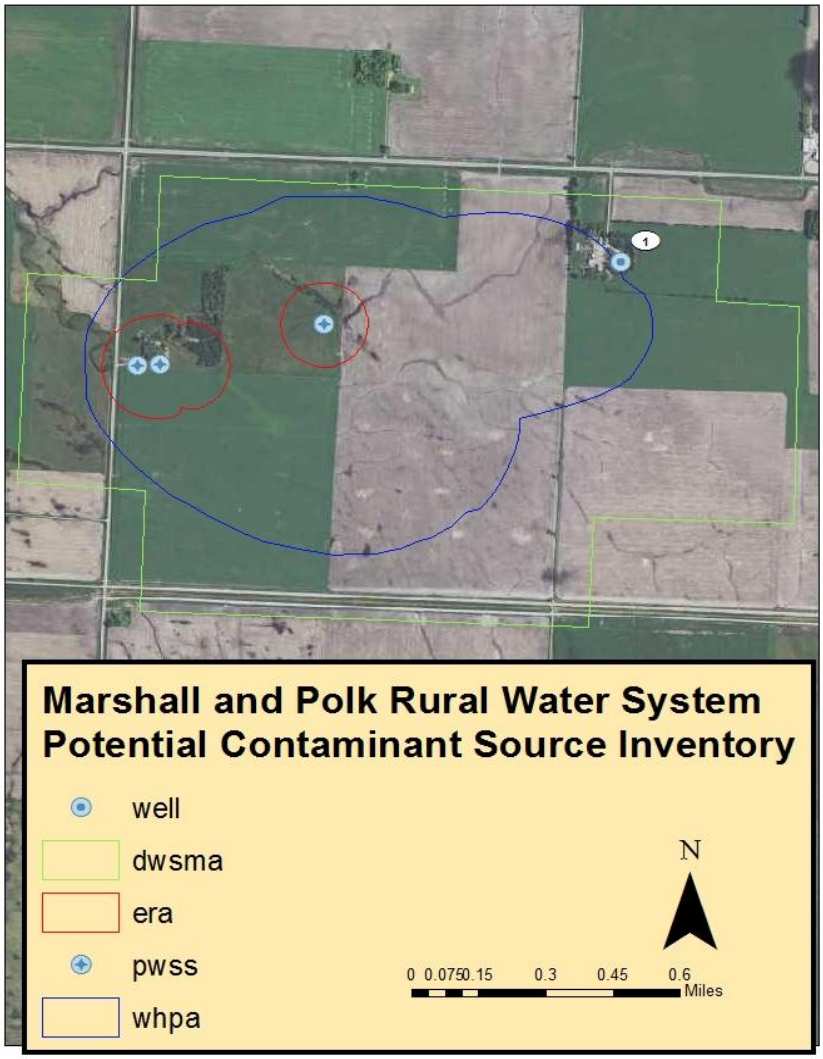


Figure 3

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

MDH

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1450005 **COMMUNITY**
NAME	Marshall-Polk Rural Water System
ADDRESS	Marshall-Polk Water Superintendent, 401 North Main, Warren, MN 56762

FACILITY (WELL) INFORMATION

NAME	Well #1
FACILITY ID	S01
UNIQUE WELL NO.	240757
COUNTY	Marshall

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ **YES** (Please attach a copy)
☐ **NO** ☐ **UNDETERMINED**

PWS ID / FACILITY ID	1450005 S01	UNIQUE WELL NO.	240757

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well*	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[3] (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)[4]	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)[3]	75	75	150	N		

PWS ID / FACILITY ID	1450005 S01	UNIQUE WELL NO.	240757

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		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		N		
*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	1450005 S01	UNIQUE WELL NO.	240757

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	Y	68	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							
WAT	Stream, river, pond, lake, wetland	50	50		Y	115	N
PLE	Property line or easement	50	N/A		Y	55	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.

Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

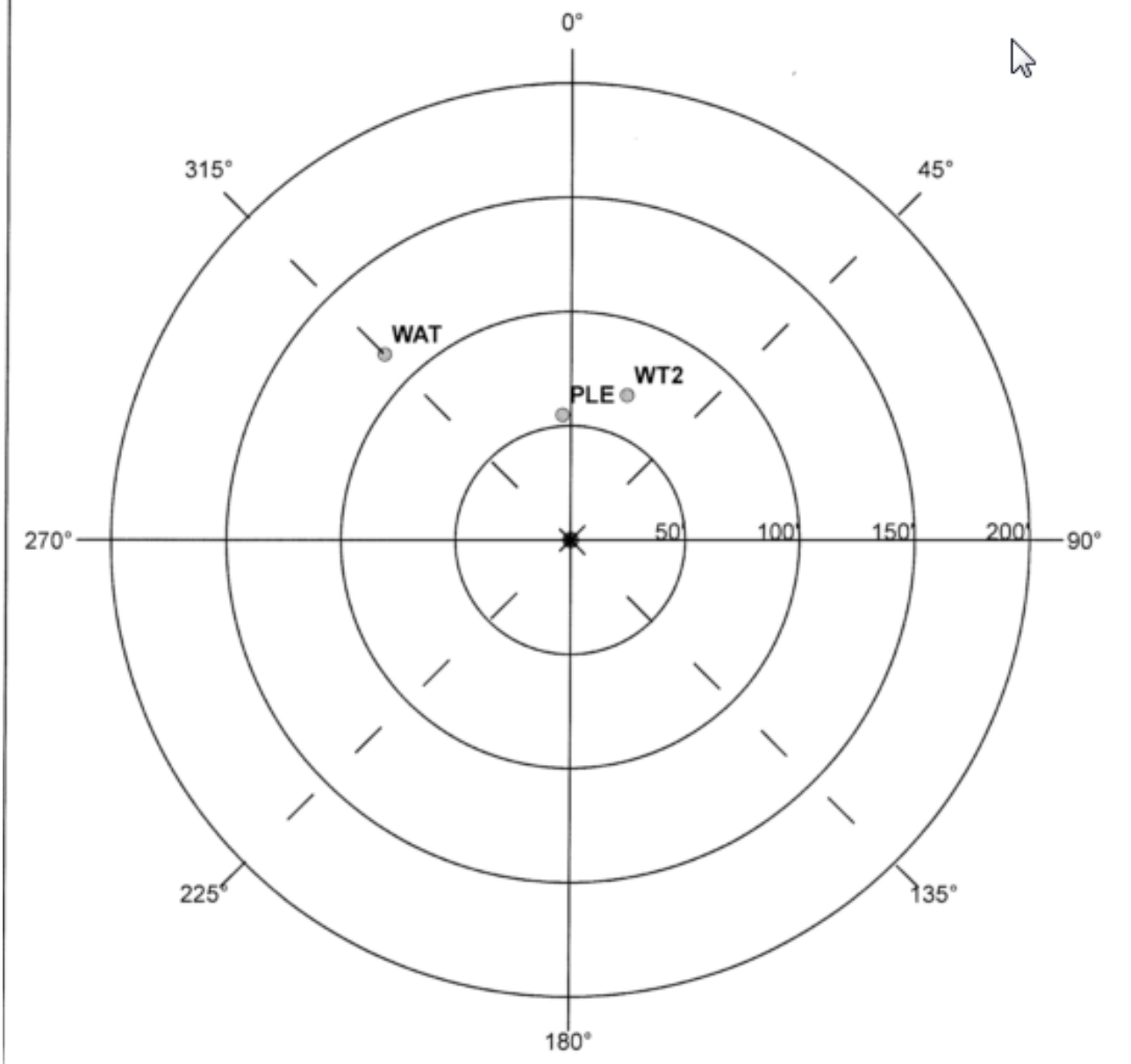
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; 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	1450005 S01	UNIQUE WELL NO.	240757

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	Strodtman, Mike	**DATE**	7 - 28 - 2011

PWS ID / FACILITY ID	1450005 S01	UNIQUE WELL NO.	240757

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

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

MDH

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID 1450005 **COMMUNITY**
NAME Marshall-Polk Rural Water System
ADDRESS Marshall-Polk Water Superintendent, 401 North Main, Warren, MN 56762

FACILITY (WELL) INFORMATION

NAME Well #2

FACILITY ID S02
UNIQUE WELL NO. 240758
COUNTY Marshall

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?
☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1450005 S02	UNIQUE WELL NO.	240758

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)[4]	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)[3]	75	75	150	N		

PWS ID / FACILITY ID	1450005 S02	UNIQUE WELL NO.	240758

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		N		
SWI	Storm water drainage well[3] (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	85	
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		Y	85	N
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		Y	30	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	25	N
*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)[3]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		

PWS ID / FACILITY ID	1450005 S02	UNIQUE WELL NO.	240758

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		Y	85	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							
BLD	Building (does not contain any actual or potential contaminant sources.)	3	3		Y	20	N
PLE	Property line or easement	50	N/A		Y	50	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.

Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

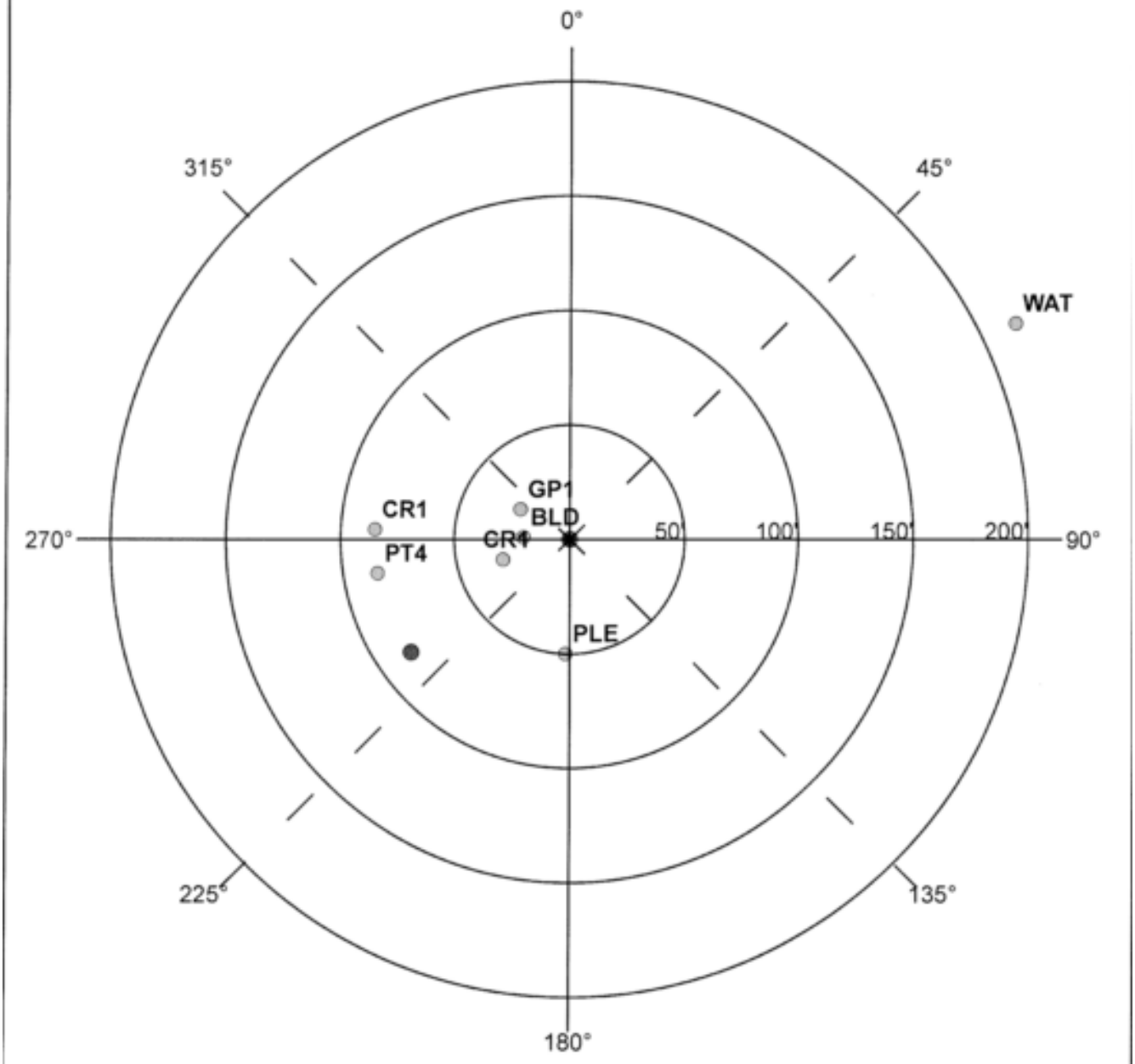
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; 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	1450005 S02	UNIQUE WELL NO.	240758

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	Strodtman, Mike	DATE	7 - 28 - 2011

PWS ID / FACILITY ID	1450005 S02	UNIQUE WELL NO.	240758

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED
Floor drains, such as in pumphouses, that discharge to a gravel pocket or seepage pit should have a "No Dumping" sign posted.		

COMMENTS

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

MDH 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	1450005 **COMMUNITY**
NAME	Marshall-Polk Rural Water System
ADDRESS	Marshall-Polk Water Superintendent, 401 North Main, Warren, MN 56762

FACILITY (WELL) INFORMATION

NAME	Well #5
FACILITY ID	S05
UNIQUE WELL NO.	513019
COUNTY	Marshall

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1450005 S05	UNIQUE WELL NO.	513019

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[2])	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	1450005 S05	UNIQUE WELL NO.	513019

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		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		N		
*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	1450005 S05	UNIQUE WELL NO.	513019

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							
	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.

Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

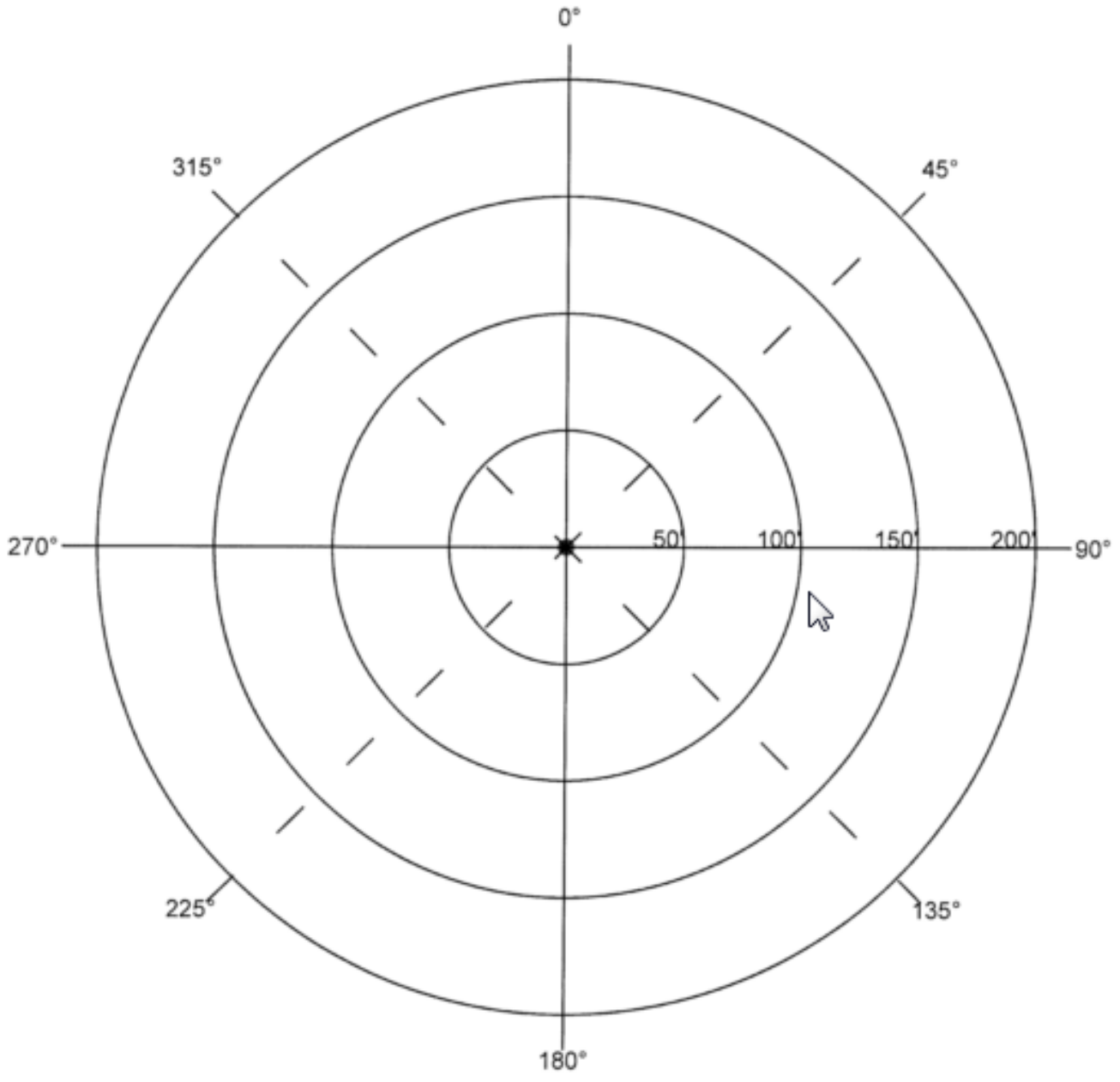
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; 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	1450005 S05	UNIQUE WELL NO.	513019

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	Strodtman, Mike	DATE	7 - 28 - 2011

PWS ID / FACILITY ID	1450005 S05	UNIQUE WELL NO.	513019

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

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

MDH 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	1450005 **COMMUNITY**
NAME	Marshall-Polk Rural Water System
ADDRESS	Marshall-Polk Water Superintendent, 401 North Main, Warren, MN 56762

FACILITY (WELL) INFORMATION

NAME	Well #6
FACILITY ID	S07
UNIQUE WELL NO.	473633
COUNTY	Marshall

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ YES (Please attach a copy)
☐ NO ☐ UNDETERMINED

PWS ID / FACILITY ID	1450005 S07	UNIQUE WELL NO.	473633

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	1450005 S07	UNIQUE WELL NO.	473633

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		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		N		
*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	1450005 S07	UNIQUE WELL NO.	473633

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							
	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.

Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

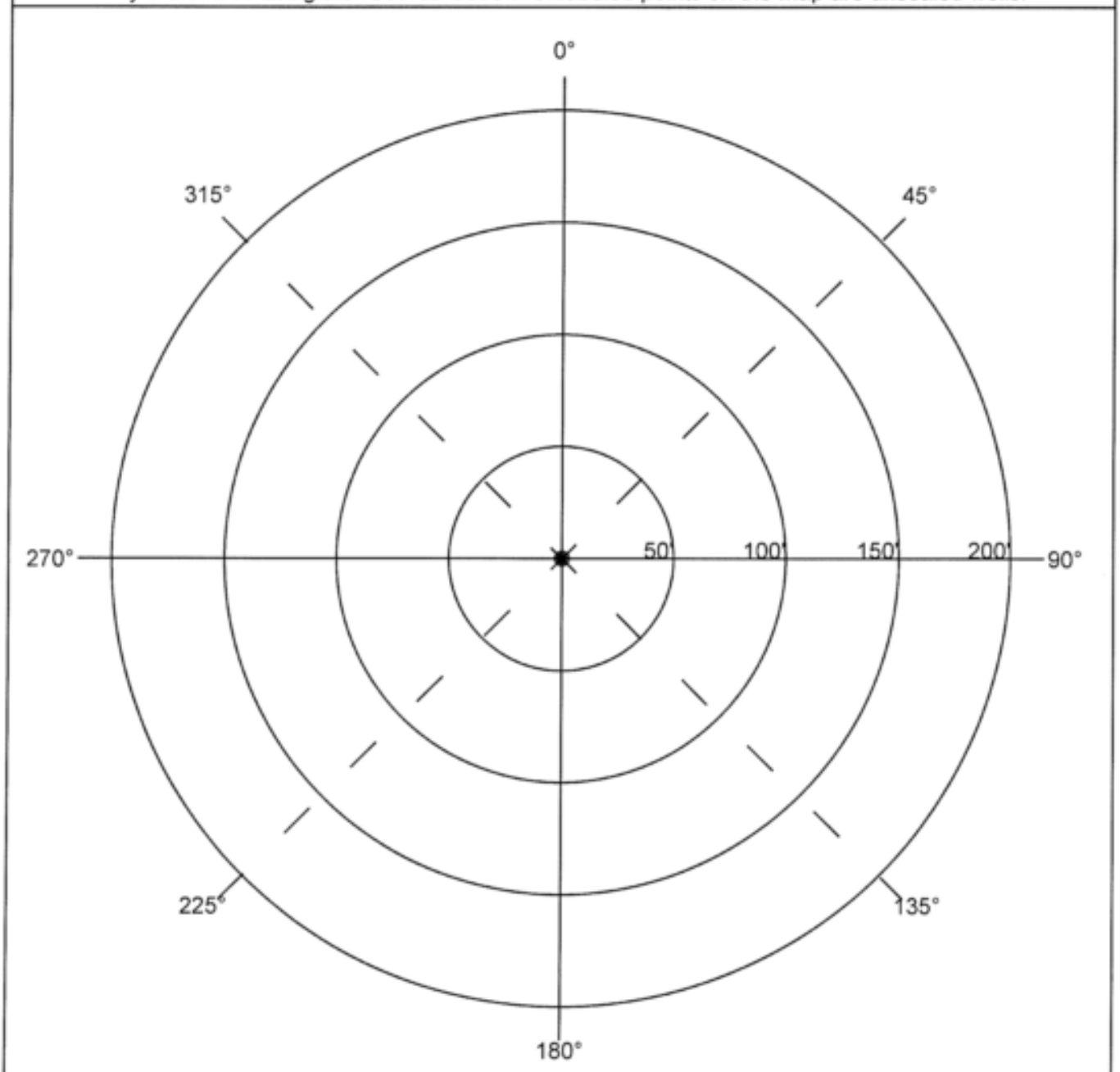
[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; 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	1450005 S07	UNIQUE WELL NO.	473633

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	Minerich, George	DATE	11 - 22 - 2010

PWS ID / FACILITY ID	1450005 S07	UNIQUE WELL NO.	473633

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

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 III

WATER SUPPLY/CONTINGENCY PLAN

Marshall & Polk Rural Water

Water Supply Plan
November 5, 2008

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)	761100 and 811079
Name of Water Supplier	Marshall & Polk Rural Water System
Address	401 N. Main Street, Warren, MN 56762
Contact Person	Larry L. Murphy
Title	Manager
Phone Number	218-745-5471
E-Mail Address	mprws@mncable.net

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.
Agriculture use is included in C/I/I total.

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
1998	3,000	3,000	1,173	67.464	3.991	14.475	85.930	107.418	20	0.235	0.258	61.6	78.5
1999	3,000	3,000	1,206	63.909	3.964	18.662	86.495	114.936	25	0.237	0.321	58.4	79.0
2000	3,200	3,200	1,284	72.641	3.788	18.702	95.131	118.723	20	0.261	0.373	62.2	81.4
2001	3,295	3,295	1,382	70.987	3.488	17.156	91.631	115.943	21	0.251	0.440	59.0	76.2
2002	3,295	3,295	1,404	71.564	3.716	17.556	92.836	110.988	16	0.254	0.400	59.5	77.2
2003	3,295	3,295	1,408	74.771	4.680	19.096	96.547	114.847	16	0.265	0.405	62.2	80.3
2004	3,400	3,400	1,420	69.217	3.953	18.886	92.055	116.305	21	0.252	0.436	55.8	74.2
2005	3,291	3,291	1,480	71.816	4.660	30.555	107.030	122.074	12	0.293	0.415	59.8	89.1
2006	3,311	3,311	1,501	77.095	4.109	29.961	111.165	129.909	14	0.305	0.532	63.8	92.0
2007	3,317	3,317	1,509	71.820	3.986	30.788	106.593	124.146	14	0.292	0.414	59.3	88.0

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.
Water demand is affected by weather - more water is used during dry conditions. Water consumption per user has decreased over past years. Assumption is aging population and more water efficient apparatuses.

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

Customer	Gallons per year	% of total annual use
City of Fisher	11,355,000	10.7
City of Oslo	10,478,000	9.8
City of Alvarado	8,955,000	8.4
Doug Torgerson	765,500	0.7
Farmers Union Oil Co.	360,000	0.3
Dan's Flying Service	349,200	0.3
Johnson Airspray	314,400	0.3
Rivard Farms Inc.	292,800	0.3
John Thorson	238,800	0.2
Thomas Osowski	222,000	0.2

B. TREATMENT AND STORAGE CAPACITY.

TABLE 3(A) Water Treatment

Water Treatment Plant Capacity	1,720,000	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.		
4 Sites: Warren Well Site: Iron removal gravity filters, pre chlorination, post chlorination & fluoridation Euclid Well Site: Emergency Only - No treatment Schuster Well Site: Chlorination & Fluoridation Grand Forks Trail Water District: Purchase treated water		

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

Total Storage Capacity	**Average Day Demand** (average of last 5 years)	
610,000 Gallons	333,000 Gallons per day	
Type of Structure	Number of Structures	Gallons
Elevated Storage	0	0
Ground Storage	0	0
Other: Below Ground Storage	11	610,000

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	2,250	Gallons per minute
Firm Capacity (largest pump out of service)	750	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 (E thru J). 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 (none).

Well # or name	Unique Well Number	Year Installed	Well & Casing Depth (ft)	Well Diameter (in)	Capacity (GPM)	Geologic Unit	Status
1	240757	1976	171	8	150	Sand & Gravel	Online
2	240758	1976	197	8	150	Sand & Gravel	Online
3	163384	1981	124	8	100	Sand & Gravel	Emergency
4	166210	1981	123	8	100	Sand & Gravel	Emergency
5	513019	1992	419	8	450	Sand & Gravel	Online
6	473633	1990	375	16	1500	Sand & Gravel	Online

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)
None		

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
Grand Forks Traill Water District	50/.05	Grand Forks Traill Water District

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
City of Warren	150 Est./0.2	Supply both ways as needed
Well # 3 & 4 on Page 4	100/0.15	

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)
2008	3,333	0.29	0.45	110
2009	3,349	0.29	0.45	111
2010	3,365	0.29	0.45	111
2011	3,381	0.29	0.45	112
2012	3,397	0.29	0.45	112
2013	3,413	0.29	0.45	113
2014	3,429	0.30	0.45	113
2015	3,445	0.30	0.45	114
2016	3,461	0.30	0.45	114
2017	3,475	0.30	0.45	115

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).
Estimated growth equals 0.5% per year. Usage stays constant due to water conservation measures.

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. **If water levels are not currently measured each year, a monitoring plan that includes a schedule for water level readings must be submitted as Attachment (none).**

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.)
OB Well #1	Observation	Monthly	Draw down gauge
OB Well #2	Observation	Monthly	Draw down gauge
OB Well #3	Observation	Monthly	Draw Down gauge
OB Well #4	Observation	Monthly	Draw down gauge
240757	Production	Daily	SCADA
240758	Production	Daily	SCADA
163384	Emergency	Monthly	Draw down gauge
166210	Emergency	Monthly	Draw down gauge
513019	Production	Daily	SCADA
473633	Production	Daily	SCADA

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 A. Static Water Level Graph: Provide monitoring data (graph or table) for as many years as possible.

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.
No known natural resource impacts.

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.
Well level records & WHP Plan indicate an adequate supply for future projection.

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:	July 3, 2002
Date for Next WHP Update:	Not required at this time per MDH letter on 8/11/06
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 (CIP Attachment -none).

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.

Proposed 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.
No new water sources being considered at this time.

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.
System has a continuing preventative maintenance program. All water treatment & pumping facilities have been recently upgraded. Scada pump control program will be completed within the next 2 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	Larry Murphy	218-745-5471
Alternate Emergency Response Lead	Jason Hillman	218-745-5471
Emergency Response Plan Certification Date	December 1995	

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 X 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 X 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 (none). 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
City of Warren	unknown	Can supply water in both directions
Grand Forks Traill Water Dis.	50/.050	Limited to pipe flow capacity
Euclid Well Site	200/.061	DNR Permit - Arsenic Levels

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
None		

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	0.2	0.001
Institutional	0	None	None
Commercial	2	0.003	0.00015
Industrial	3	0.0009	0.000045
Irrigation	-	None	None
Wholesale	Cities 1	0.085	0.004
Non-essential	6	Unknown	0.00005
	TOTALS 3	0.29	0.005

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 does 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	Water Main Break
	Treatment Capacity	Loss of Production
X	Storage Capacity	Security Breach
	Groundwater Levels	Contamination
	Surface Water Flows or Levels	Other (list in Table 9)
	Pump, Booster Station or Well Out of Service	

X Governor's Executive Order – Critical Water Deficiency (required by statute)

Table 9 Demand Reduction Procedures

Condition	Trigger(s)	Actions
Stage 1 (Mild)	60 % Full	Increase discharge pressures. Turn on time fill features. Decrease inlet pressures to reservoirs that are at trigger level.
Stage 2 (Moderate)	50 % Full	By pass pressure reducing valves. Open loops to alternative water lines.
Stage 3 (Severe)	40 % Full	Restrict usage
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.
Public Service Announcements

E. 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 requires 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	18,777,670 gallons	
Average percent unaccounted water for the last 5 years	15.4	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%.		
Continue to monitor water loss. Repair waterline breaks.		

Residential Gallons Per Capita Demand (GPCD)		
Average residential GPCD use for the last 5 years (use data from Table 1)	60	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.		

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.
Has stayed about the same based on estimated population. Actual demand per connection has decreased over past 10 years.

Peak Demands (calculate average ratio for last five years using data from Table 1)	
Average maximum day to average day ratio	1.566
If peak demands exceed a ratio of 2.6, describe the goals for lowering peak demands.	
Average peak demand is only a ratio of 1.5	

B. Water Conservation Programs. Describe all short-term conservation measures that are available for use in an emergency and long-term measure 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	1,442	1,442	30	N/A / As needed
Institutional	0	0	0	N/A /
Commercial	59	59	30	N/A / As needed
Industrial	6	6	30	N/A / As needed
Public Facilities	0	0	0	N/A /
Other	3	3	10	9 / As needed
TOTALS	1,510	1,510		

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.
No plans

TABLE 10 (B) Water Source Meters

	Number of Meters	Meter testing schedule (years)	Average age/meter replacement schedule (years)
Water Source (wells/intakes)	6	10 - 15 years depending on gallons measured	2 / As needed
Treatment Plant	-	-	- / -

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:

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.
In 2008 the last leak detection survey was completed. Review water loss daily via SCADA trending graphs. Allowable loss for new pipe standards based on 2,251 inch miles of pipe equals 18,765,000 gallons per year. The 2007 unaccounted for water was 17,552,000 gallons, which was less than new pipe standards. Obtaining a water loss of less than 10% is not practical for a rural water system. See attachment "D".

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 or 0 cubic feet

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: 5/01/2007

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 (none) or list current water rates including base/service fees and volume charges below.
2008 Rate = $5.00 / 1,000 gallons

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.
Per contract with cities

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 (none) 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.

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

List education efforts for the last three years in Attachment (none) 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).
Work with County Plan Co-Coordinator with Water Festival

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).
None

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.

METROPOLITAN COUNCIL

PART IV. ITEMS FOR METROPOLITAN AREA PUBLIC SUPPLIERS

Minnesota Statute 473.859 requires water supply plans to be completed for all local units of government in the seven-county Metropolitan Area as part of the local comprehensive planning process. Much of the required information is contained in Parts I-III of these guidelines. However, the following additional information is necessary to make the water supply plans consistent with the Metropolitan Land Use Planning Act upon which local comprehensive plans are based. Communities should use the information collected in the development of their plans to evaluate whether or not their water supplies are being developed consistent with the Council's Water Resources Management Policy Plan.

Policies. Provide a statement(s) on the principles that will dictate operation of the water supply utility: for example, "It is the policy of the city to provide good quality water at an affordable rate, while assuring this use does not have a long-term negative resource impact."

Impact on the Local Comprehensive Plan. Identify the impact that the adoption of this water supply plan has on the rest of the local comprehensive plan, including implications for future growth of the community, economic impact on the community and changes to the comprehensive plan that might result.

Demand Projections

Year	Total Community Population	Population Served	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Projected Demand (MGY)
2010					
2020					
2030					
Ultimate					

Population projections should be consistent with those in the Metropolitan Council's *2030 Regional Development Framework* or the Communities 2008 Comprehensive Plan update. If population served differs from total population, explain in detail why the difference (i.e., service to other communities, not complete service within community etc.).

PLAN SUBMITTAL AND REVIEW OF THE PLAN

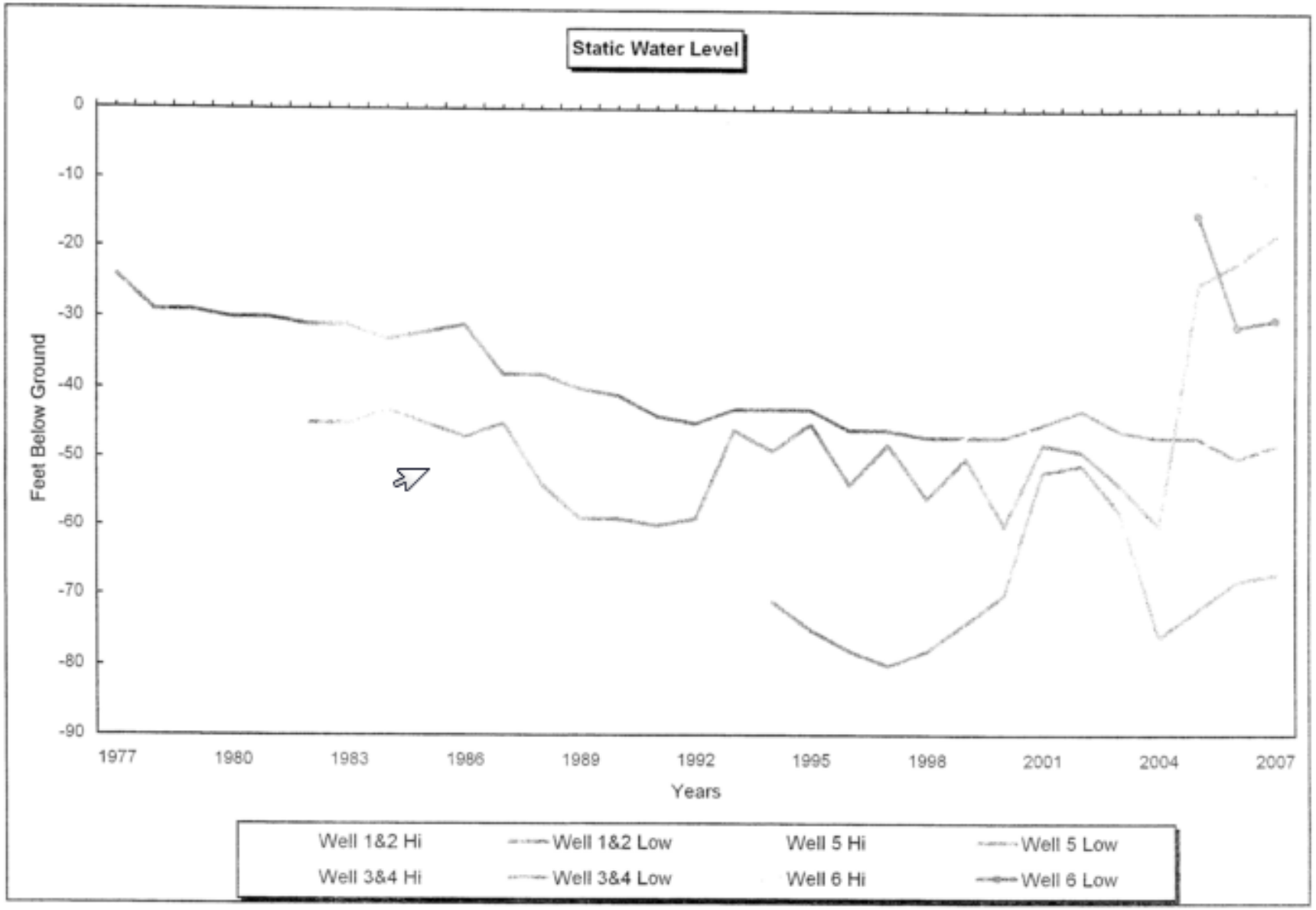
The plan will be reviewed by the Council according to the sequence outlined in Minnesota Statutes 473.175. **Prior to submittal to the Council, the plan must be submitted to adjacent governmental units for a 60-day review period.** Following submittal, the Council determines if the plan is complete for review within 15 days. If incomplete, the Council will notify the community and request the necessary information. When complete the Council will complete its review within 60 days or a mutually agreed upon extension. The community officially adopts the plan after the Council provides its comments.

Plans can be submitted electronically to the Council; however, the review process will not begin until the Council receives a paper copy of the materials. Electronic submissions can be via a CD, 3 ½" floppy disk or to the email address below. Metropolitan communities should submit their plans to:

Reviews Coordinator
Metropolitan Council
390 Robert St,
St. Paul, MN 55101

electronically to:
watersupply@metc.state.mn.us

Attachment "A"



Attachment "B"

Part II EMERGENCY RESPONSE PROCEDURES

A. EMERGENCY TELEPHONE LIST.

Police 911 Fire 911	**Ambulance 911**
Marshall County Sheriff	1 218 745-5411 Office
Polk County Sheriff	1 218 281-0431 Office or 218 281-0435
Warren Police Dept.	1 218 745-5412 Office
Warren Fire Dept.	1 218 745-5255 Fire Hall
East Grand Forks Police Dept.	1 218 773-1104 Office
East Grand Forks Fire Dept.	1 218 773-2403 Station # 1
East Grand Forks Fire Dept.	1 218 773-1109 Station # 2
Crookston Police Dept.	1 218 281-3111 Office
Crookston Fire Dept.	1 218 281-4584 Fire Chief
Marshall & Polk Rural Water System	1 218 745-5471 Office & Emergency
Toll Free	1 800 569-1367 Office & Emergency
Larry Murphy, Manager -	1 218 201-0067 Cell Phone
Jason Hillman	1 218 201-0068 Cell Phone
Tony Deschene	1 218 201-0065 Cell Phone
Virlynn Hanson, Bookkeeper	1 218 745-5456 Home
Pribula Engineering, Engineer	1 701 772-7058 Office
Jerry Pribula	1 218 773-9300 Home
Jerry Pribula	1 701 741-3900 Cell Phone
City of Oslo	1 218 695-2321 Water Plant
	1 218 695-3841 City hall
	1 218 695-2421 Fire Hall
	1 218 289-3366 City Cell Phone
Ron Korynta	1 218 695-3921 Home
Scott	1 701 360-5666 Cell Phone
Scott	1 701 352-9090 Home
City of Alvarado	1 218 965-4911 City hall
	2 218 965-4501 City Shop
	1 218 965-4523 Fire Hall
Ken Dagoberg	1 218 965-4628 Home
Ken Dagoberg	1 218 289-3411 Cell Phone
City of Fisher	1 218 891-2207 City hall
	1 218 746-2569 Fire Hall
Monte Ruch	1 218 891-2271 Home
Monte Ruch	1 218 270-9066 Cell Phone
Dan's Excavating, Leak Repair -	1 218 773-2677 Office
Steve Snyder	1 701 594-4351 Home
Steve Snyder	1 218 779-1154 Cell Phone
Steve Snyder	1 701 780-7031 Pager
Brad	1 218 773-6625 Home
Brad	1 701 740-9861 Cell Phone
Grand Forks Excavating	1 218 773-1055 Shop / Home
Jim Pribula	1 701 772-7181 Cell Phone
Trudell Contracting – Directional boring	1 218 745-4261 Shop
Randy Trudell	1 218 201-0733 Cell Phone
Higher Ground	1 218 773-1853 Shop
Paul Zavoral	1 701 740-6147 Cell Phone
Andy Zavoral	1 218 791-5622 Cell Phone
North Holt Electric – Directional Boring	1 218 773-1251 Shop
Tom Holt	1 701 739-3662 Cell Phone

PKM Electric Coop, Electrical Supplier -	1 218 745-4711 Office & Emergency
Toll Free	1 800 522-7366 Office & Emergency
Red River Power, Electrical Supplier -	1 218 456-2139 Office & Emergency
Toll Free	1 800 788-7784 Office & Emergency
Ottertail Power, Electrical Supplier -	1 218 281-3632 Office & Emergency
Toll Free	1 800 257-4044 Office & Emergency
Ed Heggen	1 218 437-8407 Home
Edman Electric, Electrician -	1 218 745-4396 Office
Roley Electric, Electrician -	1 218 745-5361 Office
Rick Roley	1 218 201-0056 Cell Phone
Rick Roley	1 218 745-4220 Home
Miller Electric, Electrician -	1 218 201-1970 Cell Phone
Mike Miller	1 218 745-5259 Home
Eagle Electric of Grand Forks, Inc.	1 701 746-0449 Office
Darryl Beauchamp	1 218 773-1826 Home
InControl, Electrical Controls -	1 763 783-9500 Office
John Kurtti	1 763 783-0845 Cell
Randy Prigge	1 612 802-5363 Cell
Insight Technology Computer Network	1 701 775-5512
Toll Free	1 800 279-4796
Hawkins Inc. - Chemical	1 701 293-9618 Office
Emergency- Spills, Leaks & Exposure	1 800 424-9300 24 Hr. Response
LTP Enterprises, Inc., Well Drillers -	1 701 232-8928 Office
Toll Free	1 800 347-0090 Office
Emergency Service	1 701 282-7388
Emergency Service	1 701 282-5982
Emergency Service	1 701282-3511
Ziegler Generator Service	1 218 736-2680 Anytime
Toll Free	1 800 346-7649
Shawn Erlandson	1 218 731-8771 Cell
Northern Water Works Supply, Supplies -	1 701 293-5511 City Desk
Toll Free	1 800 437-4362 City Desk
Bob Shelstad	1 701 282-4194 Home
Fargo Water Equipment, Pipe Supplies -	1 701 237-0222 City Desk
Toll Free	1 800 342-4676 City Desk
Tim Stetz	1 701 238-7259 Cell
Border States Electric, Electrical Supplies	1 701 772-3477 City Desk
Emergency	1 800 800-0199 Help Line
Dakota Electric Supply, Elect. Supplies	1 701 746-7373 City Desk
Toll Free	1 800 633-2211 City Desk
Dale Hammer	1 701 739-1930 Cell
Dale Hammer	1 701 746-7761 Home
Minnesota Rural Water Association -	1 218 685-5197 Office
Tool free	1 800 367-6792 or 1 800 for MRWA
Department of Health , Bemidji -	1 218 755-3820 Office
Todd Johnson	1 218 308-2110 Cell

Attachment "B" Continued

Beth S. Kluthe	1 218 755-6315 Office
Minnesota Pollution Control Agency, -	1 651 296-6300 St Paul
Toll Free	1 800 657-3864 St. Paul
Toll Free	1 800 657-3724 Hazardous Waste
Northwest Region	1 218 847-1519 Detroit Lakes
OSHA – Dept. of Labor & Industry	1 218 723-4678 Duluth Office
Rural Development – Andrew Gag	1 218 847-9362 Ext #4 Detroit Lakes Office
Gopher State One Call	1 800 252-1166
Kittson Marshall Rural Water, Scott	1 218 466-2835 Office
Scott Flatland	1 218 843-1064 Cell Phone
Lincoln Pipestone Rural Water, Dennis	1 507 368-4248 Office
North Kittson Rural Water, Todd	1 218 754-6161 Office
Red Rock Rural Water, Dominic	1 507 628-4201 Office
Rock County Rural Water, Dan	1 507 283-8886 Office
Grand Forks Traill Water District	1 701 599-2963 Office
Randy, Manager	1 701 775-0397 Home
Randy	1 218 791-1919 Cell Phone
Neil	1 218 791-1918 Cell Phone
North Valley Water Assoc., Gordy	1 701 265-8503 Office
Gordy, Manager	1 701 265-5623 Mobile
Agassiz Water Users,	1 701 869-2690 Office
Gus	1 218 791-1523 Cell Phone
Marshall County, Highway Dept.	1 218 745-4381 Engineer
Highway Dept.	1 218 745-4691 Shop
Auditor	1 218 745-4851 Office
Polk County Highway Dept.	1 217 281-3952 Engineer
Auditor	1 218 281-2554 Office
Coordinator	1 218 281-5408 Office
Zoning	1 218 281-5700 Office
Viking Gas, Natural Gas Transmission Co.	1 218 745-5082 Angus
Emergency	1 800 867-7473 24 Hour Dispatch
Portal Pipeline Co.,	
QWest, Telephone	1 800 573-1311 Repairs
Frontier, Telephone	1 218 745-4111
Eric	1 218 289-4732 Cell Phone
Halstad Telephone Co., Telephone	1 218 456-2125 Office
Toll Free	1 800 457-2125 Office
Outages	1 888 891-3006
Sjoberg's, Warren Cable TV	1 218 681-3044 Office
Toll free	1 800 828-8808 Office
Tech Support	1 866 467-9792
Minnesota Dept. of Transportation	1 218 281-6069 Crookston Office
Earl Hill	1 218 277-7964
Roger Hille	1 218 277-7963
Brad Knutson	1 218 277-7965
Minnesota Dept. of Transportation	1 218 681-0934 TRF Office
Minnesota Dept. of Transportation	1 612 681-0943 Highway Patrol
Burlington Northern Rail Road	
Sooline Rail Road	

APPENDIX IV
SCOPING DOCUMENTS

MINNESOTA MDH DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

July 17, 2012

Mr. Jason Hillman
Manager - Marshall-Polk Rural Water System
401 North Main Street
Warren, Minnesota 56762

Dear Mr. Hillman

Subject: Second Scoping Decision Notice - Marshall-Polk Rural Water System - PWSID 1450005

This letter provides notice of the results of a scoping meeting I held with you and your consultant Teri Osterman on June 19, 2012, at Marshall-Polk Rural Water System's office in Warren, Minnesota, regarding wellhead protection (WHP) planning. During the meeting we discussed the data elements that must be included and used to prepare the part of the WHP plan related to the management of potential contaminants in the approved drinking water supply management area. The enclosed Scoping 2 Decision Notice lists the data elements that were discussed at the meeting.

Marshall-Polk Rural Water System has met the requirements to distribute copies of the first part of the wellhead protection plan to local units of government and hold an informational meeting for the public. Marshall-Polk Rural Water System will have until July 3, 2012, to complete its wellhead protection plan.

If a data element is marked on the enclosed notice as a data element that must be used and it does not exist, it is helpful if your plan notes this. Your consultant will be working with you to develop a draft of the remainder of the wellhead protection plan. I will be contacting you to review the progress of the development of Part II of your plan. If you have any questions regarding the enclosed notice, contact me by email at george.minerich@state.mn.us or by phone at 320/223-7314.

Sincerely,

George E. Minerich, Planner
Environmental Health Division
3333 West Division Street - Suite 212
St. Cloud, Minnesota 56301

GEM:kmc
Enclosures
cc: Todd Johnson, MDH Engineer, Bemidji District Office
Byron Adams, Water Monitoring Section, Minnesota Pollution Control Agency
Joe Richter, Division of Waters, Minnesota Department of Natural Resources
Ron Struss, Minnesota Department of Agriculture
Eric Mohring, Hydrologist, Board of Water and Soil Resources

DRAFT SCOPING 2 DECISION NOTICE

➤ **Remainder of the Wellhead Protection Plan**

Name of Public Water Supply:		**Date:**
Marshall-Polk Rural Water System PWSID: 1450005		July 17, 2012
Name of the Wellhead Protection Manager:		
Mr. Jason Hillman, Manager		
Address:	**City:**	**Zip:**
401 North Main Street	Warren	56762
Unique Well Numbers:		**Phone:**
240757 (Well 1), 240758 (Well 2), 513019 (Well 5), 473633 (Well 6) 163384 (Well 3 - Emergency*), 166210 (Well 4 - Emergency*)		218/745-5471

*Emergency wells only use the IWMZ Form for data collection.

Instructions for Completing the Scoping 2 Form

N	R	S	
X			**N = Not required.** If this box is checked, this data element is **NOT** necessary for your wellhead protection plan because it is not needed or it has been included in the first scoping decision notice. **Please go to the next data element.**

N	R	S	
	X		**R = Required for the remainder of the plan.** If this box is checked, this data **MUST** be used for the "**remainder of the plan.**"

N	R	S	
		X	**S = Submit to MDH.** If this box is checked, this data element **MUST** be included in your **wellhead protection plan and submitted to MDH.** If there is **NO** check mark in the **"S"** box but there is an "x" in the **"R"** box, this data element **MUST** be included in your plan, but should **NOT be submitted to MDH.** This box will only be checked if MDH does not have access to this data element. This will help to reduce the cost by reducing the amount of paper and time to reproduce the data element.

Note: Any data elements required in the first scoping decision notice must also be used to complete the remainder of the wellhead protection plan.

DATA ELEMENTS ABOUT THE PHYSICAL ENVIRONMENT

PRECIPITATION

N	R	S	
X			An existing map or list of local precipitation gauging stations.

Technical Assistance Comments:

N	R	S	
X			An existing table showing the average monthly and annual precipitation in inches for the preceding five years.

Technical Assistance Comments:

GEOLOGY

N	R	S	
	X		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: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

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

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		Existing borehole geophysical records from wells, borings, and exploration test holes.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		Existing surface geophysical studies.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

SOILS

N	R	S	
X			Existing maps of the soils and a description of soil infiltration characteristics.

Technical Assistance Comments:

N	R	S	
X			A description or an existing map of known eroding lands that are causing sedimentation problems.

Technical Assistance Comments:

WATER RESOURCES			
N	R	S	An existing map of the boundaries and flow directions of major watershed units and minor watershed units.
X			
Technical Assistance Comments:			
N	R	S	An existing map and a list of public waters as defined in Minnesota Statutes, section 103G.005, subdivision 15, and public drainage ditches.
X			
Technical Assistance Comments:			
N	R	S	The shoreland classifications of the public waters listed under subitem (2), pursuant to part 6120.3000 and Minnesota Statutes, sections 103F.201 to 103F.221.
X			
Technical Assistance Comments:			
N	R	S	An existing map of wetlands regulated under chapter 8420 and Minnesota Statutes, section 103G.221 to 103G.2373.
X			
Technical Assistance Comments:			
N	R	S	An existing map showing those areas delineated as floodplain by existing local ordinances.
X			
Technical Assistance Comments:			

DATA ELEMENTS ABOUT THE LAND USE

LAND USE			
N	R	S	An existing map of parcel boundaries.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
N	R	S	An existing map of political boundaries.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
N	R	S	An existing map of public land surveys including township, range, and section.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			

N	R	S	
	X	X	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: The inventory, mapping, and management of land uses and potential sources of contamination for all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements, as follows:

Low Vulnerability - 1) All potential contaminant sources and facility designations as listed on the attachment, 2) a land use/land cover map and table, and 3) an inventory of the Inner Wellhead Management Zone (IWMZ).

As a starting point, MDH will provide a 1992 or 2001 land cover map and table from federal data bases. This data set must be used unless an alternative electronic data set that is more current and detailed is available.

Management strategies must be developed for all land uses and potential sources of contamination.

N	R	S	
	X	X	An existing comprehensive land-use map.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element. Include any urban fringe planning areas.

N	R	S	
	X	X	Existing zoning map.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.

PUBLIC UTILITY SERVICES

N	R	S	
X			An existing map of transportation routes or corridors.

Technical Assistance Comments:

N	R	S	
X			An existing map of storm sewers, sanitary sewers, and public water supply systems.

Technical Assistance Comments:

N	R	S	
X			An existing map of the gas and oil pipelines used by gas and oil suppliers.

Technical Assistance Comments:

N	R	S	
X			An existing map or list of public drainage systems.

Technical Assistance Comments:

N	R	S	
	X		An existing record of construction, maintenance, and use of the public water supply well(s) and other wells within the drinking water supply management area.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

DATA ELEMENTS ABOUT WATER QUANTITY

SURFACE WATER QUANTITY

N	R	S	
X			An existing description of high, mean, and low flows on streams.

Technical Assistance Comments:

N	R	S	
X			An existing list of lakes where the state has established ordinary high water marks.

Technical Assistance Comments:

N	R	S	
X			An existing list of permitted withdrawals from lakes and streams, including source, use, and amounts withdrawn.

Technical Assistance Comments:

N	R	S	
X			An existing list of lakes and streams for which state protected levels or flows have been established.

Technical Assistance Comments:

N	R	S	
X			An existing description of known water-use conflicts, including those caused by groundwater pumping.

Technical Assistance Comments:

GROUNDWATER QUANTITY

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

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		An existing description of known well interference problems and water use conflicts.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		An existing list of state environmental bore holes, including unique well number, aquifer measured, years of record, and average monthly levels.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.

DATA ELEMENTS ABOUT WATER QUALITY

SURFACE WATER QUALITY

N	R	S	
X			An existing map or list of the state water quality management classification for each stream and lake.

Technical Assistance Comments:

N	R	S	
X			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; and 6. excessive growth or deficiency of aquatic plants.

Technical Assistance Comments:

GROUNDWATER QUALITY

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

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		An existing list of water chemistry and isotopic data from wells, springs, or other groundwater sampling points.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		An existing report of groundwater tracer studies.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.

N	R	S	
	X		An existing site study and well water analysis of known areas of groundwater contamination.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.

N	R	S	
	X		An existing property audit identifying contamination.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.

N	R	S	
	X		An existing report to the Minnesota Department of Agriculture and the Minnesota Pollution Control Agency of contaminant spills and releases.

Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.

SCOPING 2 DECISION NOTICE ADDEMDUM

During the June 19, 2012, Scoping 2 meeting several items of interest were considered for inclusion in the plan. It is recommended (not mandatory) that the following issues be considered in the Marshall-Polk Rural Water System wellhead protection plan:

1. MDH hydrologist to set well depth priority for other wells that may be potential contaminant sources (this is less work for you to inventory, basically ignore shallower wells).
2. Track high-capacity well pumping in your well area; see if there are impacts to your wells' water quality and quantity. Set up in action item so MDH lab does analysis.
3. Monitor impacts on aquifer – research and determine if you need an observation well (DNR may require).

MAY 2 5 2012

COPY

MARSHALL-POLK RURAL WATER
APPROVED PART I LETTER TO LGUs/PUBLIC INFORMATION MEETING NOTICE

Date: May 23, 2012

To:

Deb Myrfield, Mayor, Warren Minnesota
Curtis Carlson, Chairperson, Marshall County Board
Jan Kaspari, Water Planner, County of Marshall
Josh Johnston, Polk County Planning & Zoning
Aaron Knoll, Chairperson, Comstock Township Board
Wayne Torgerson, Chairperson, Brislet Township Board
Leif Aakre, Chairperson, Marshall Soil and Water Conservation District
Roger Hille, Chairperson, Middle Snake Tamarack Watershed District
Leon Heath, Director, Region Northwest Development Commission
George Minerich, Planner, Minnesota Department of Health

From: Jason Hillman, Manager
Marshall - Polk Rural Water System
401 North Main
Warren, MN 56762

Marshall - Polk Rural Water System is in the process of developing a wellhead protection plan for its drinking water supply wells. As required by the Minnesota Wellhead Protection Rule (part 4720.5330, subpart 6), the Minnesota Department of Health approved Part 1 of the wellhead protection plan for our system. This portion of the plan includes information pertaining to:

1. The delineation of the wellhead protection area,
2. The drinking water supply management area boundary, and
3. The well and drinking water supply management area vulnerability assessment.

Enclosed please find the items listed above. If you would like a complete copy of the Part 1 report containing the technical information used to delineate the wellhead protection area, drinking water supply management area, and vulnerability of the wells and aquifer, please contact me (218) 745-5471

Consistent with the Wellhead Protection Rule (part 4720.5330, subpart 7), a Public Information Meeting has been scheduled on Tuesday, June 19, 2012 at 8:00PM. The meeting will be held at the Marshall - Polk Rural Water System Office, 401 North Main, Warren, MN 56762 to discuss issues and concerns with this portion of the plan. We welcome your participation at this event.

If you have any questions concerning this matter, please contact me.

cc: Danny Thorstad, Manager, Marshall Soil and Water Conservation District
Mike Strodtman, Groundwater Technician, Minnesota Rural Water Association
Nick Drees, Middle Snake Tamarack Watershed District
Trudi Witkowski, Minnesota Department of Health

Attachment II.

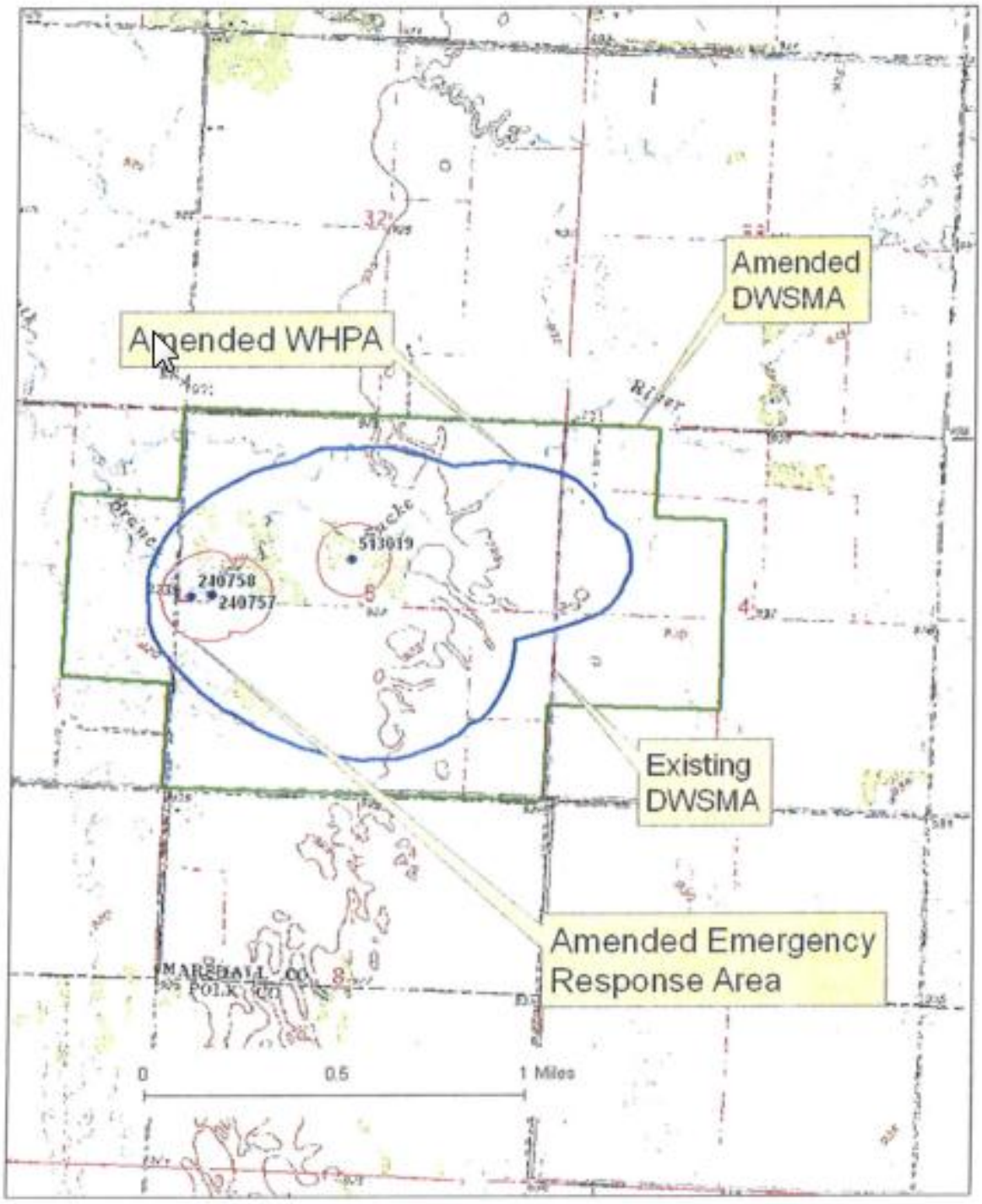


Figure 1A - Amended WHPA and DWSMA for Wells 1 (240757), 2 (240758), and 5 (513019)

Attachment IV.

Well Vulnerability Assessment

The MDH has developed a database of community and non-community non-transient public water supply wells in Minnesota which stores information pertinent to well vulnerability and rates the vulnerability of individual wells. A score is calculated for each well based on factors such as well construction, geology at the well site and chemical data, and higher scores correlate to greater perceived vulnerability. A numeric cutoff is used to identify vulnerable from nonvulnerable wells (MDH, 1993). Vulnerable wells are also identified based on the presence of contamination, such as nitrate-nitrogen in excess of 10 mg/l, or young (post-1953) water, as indicated by the presence of 1 tritium unit or greater in the well water. The results of this assessment for the Marshall and Polk Rural Water System Wells are described below. A printout from the MDH vulnerability database is shown in Appendix II.

Each of the Marshall and Polk Rural Water System Wells have been determined to be relatively non-vulnerable to contamination from activities at the land surface. This evaluation is based primarily on 1) the presence of a thick confining layer of clay-rich glacial till over each of the aquifers used by wells in the system, 2) the fact that each of the wells meet state standards for construction and maintenance, and 3) the absence of tritium from samples taken from Wells Nos. 1, 4 and 5 in June, 1997 (detection limit was 0.8 TU). The tritium result indicates that post-1953 recharge was not detectable in the well water. Aquifers that receive such slow rates of recharge are generally considered relatively well protected from contaminants released at the land surface. Results from routine sampling of effluent from Marshall and Polk Rural Water System treatment plants conducted by the MDH over the period 1993–2000 showed no violations of any parameters monitored under the Safe Drinking Water Act. No synthetic or volatile organic compounds have been detected, and nitrate has only been detected at very low levels (0.17 mg/l or less).

Drinking Water Supply Management Area Vulnerability Assessment

The aquifers that supply water to the Marshall and Polk Rural Water System wells were evaluated for their vulnerability to contamination throughout the extent of their DWSMAs on the basis of 1) geologic logs from wells in the area, 2) the tritium data from Wells Nos. 1, 4 and 5, and 3) the chemical data noted above. Geologic records for most wells in the vicinity of the Warren and Euclid well fields indicate that clay-rich glacial till is present at the land surface and extends to a depth of approximately 100 feet before significant thickness of sand are encountered. The overlying till provides a significant measure of protection to the buried sand and gravel aquifers, as suggested by the absence of tritium at Wells Nos. 1, 4 and 5 and the absence of contaminants routinely monitored for under the Safe Drinking Water Act. As a result, the aquifers used by the Marshall and Polk Rural Water System wells are considered to have a very low level of vulnerability to contamination throughout their DWSMAs.

References:

Minnesota Department of Health, 1993, Methodology for Phasing Wells into Minnesota=s Wellhead Protection Program.

Source:

Wellhead Protection Plan for Marshall and Polk Rural Water System
Part I
Delineation of Wellhead Protection Areas and Vulnerability Assessments
July, 2001
James F. Walsh
Minnesota Department of Health

APPENDIX V
DATA ELEMENTS

DATA ELEMENTS, ASSESSMENT

I. REQUIRED DATA ELEMENTS

A. Physical Environment Data Elements

1. Precipitaion --This data element does not apply because there is not a direct hydraulic connection between surface waters and the aquifer serving this water supply system.

2. Geology –The water supply(s) for Marshall & Polk Rural Water system show the presence of a thick confining layer of clay-rich glacial till over each of the aquifers used by wells in the system, and each of the wells meet state standards of construction and maintenance. Additional information regarding the geology in the Marshall & Polk Rural Water system can be found in the Part I.

3. Soils – This data element does not apply because there is not a direct hydraulic connection between surface waters and the aquifer serbing this water supply system.

4. Water Resources – A discussion of the implications of surface waters on the management of potential contaminant sources within the DWSMA is not required since there is no direct hydraulic connection betwwen the land surface and the aquifer used by the wells of Marshall & Polk Rural Water system.

B. Land Use Data Elements

1. Land Use – Due to the information contained in Part I and the Amendments, which indicates that the public water supply is not vulnerable to most land-use activities, only an inventory of other wells located within the DWSMA is required. A listing of wells inventoried with the DWSMA(s) and a map showing their locations are included in Appendix II.

2. Public Utility Services -- Records of well construction and maintenance apply to this portion of the plan due to the information provided about the well(s) and the quality and quantity of the water supplying this system. A discussion of the implications of other types of public utilities sucah as transportation corridors, pipelines, and the one drainage ditch on the management of potential contaminanct sources within the DWSMA is not needed because there is not a direct hydraulic connection between the land surface and the aquifer used by wells.

C. Water Quantity Data Elements

1. Surface Water Quantity -- This data element does not apply because there is not a direct hydraulic connection between surcae waters and the aquifer serving this water supply system.

2. Groundwater Quantity -- Groundwater levels are adequate for the amounts which Marshall & Polk Rural Water system is currently permitted for under the groundwater appropriations program that is administered by the MN Dept of Natureal Resources. There are curredntly no other high-capacity wells within the DWSMA for which well interference complaints with the system's well(s) have been documented. At this time, there appears to be

sufficeient groundwater quantity, based upon existing pumping capacity of the well(s) completed in the aquifer used by the system.

D. Water Quality Data Elements

1. Surface Water Quality – This data element does not apply because there is not a direct hydraulic connection between surface waters and the aquifer serving this water supply system.

2. Groundwater Quality -- This data element applies to the water quality for Marshall & Polk Rural Water system.Groundwater quality information was used to determine that other wells are the primary potential source(s) that need to be inventoried and managed. Changes in the general chemistry of the well water may indicate that the aquifer is receiving recharge from different geological materials.

II. ASSESSMENT OF DATA ELEMENTS

A. Use of Well -- The Marshall and Polk RWS provides water to parts of the rual areas of Kittson, Marshall and Polk Counties. The groundwater supplied by the Marshall & Polk Rural Water system is obtained from two well field sites. The Euclid Well Field (wells 1,2, & 5) and the Schuster Well (well #6). General information describing this public water suppy system is presented in the Source Water Assessment found in Part I of this Plan.

B. Wellhead Protection Area Delineation Criteria -- See Part I of this Plan for documentation regarding how the following delineation criteria were applied to determine the boundaries od the WHPA:

1. Tine of Travel – 10 years
2. Flow Boundaries – geologic information
3. Daily Volume – provided by the system
4. Groundwater Flow Field – delineation method
5. Aquifer Transmissivity – aquifer test plan

C. Quality and Quantity of Water Suppling the Public Water Supply Well – Water quality monitoring results indicate no evidence of contamination from 1) human origin, such as fuel and fuel break-down products, pesticides, or commercial fertilizer, or 2) naturally occurring contaminants such as arsenic and boron. At this time problems with water quality are not an issue, as the system has enjoyed water quality that meets or exceeds standares in the Federal Safe Drinking Water Act.

D. Groundwater Uses in the Drinking Water Supply Management Area -- The management strategies selected and documented in the Plan of Action Table 9 of this Plan will focus on activities that have the most potential to impact the aquifers this system is using for its drinking water supply. For a non-vulnerable system, other wells are the most likely potential impact to the aquifer.

APPENDIX VI

RELATED DOCUMENTS

1. MDH Municipal Well Records

PWSID: **1450005**
PWS Name: **Marshall-Polk Rural Water System**
PWS Type: **Community**
PWS Status: **Active**

Public Water Supply Sources: Information from MNDWIS and CWI (sorted by Sample Point ID)
Source Type Codes: **GW** = Ground water; **SW** = Surface water; **GUI** = Ground water under influence
Location Source: **MGS** = digitized by the MN Geological Survey; * indicates imcomplete records

MNDWIS PWS SOURCES IN FLOW														
Source Info							MNDWIS Data				CWI Data			
Sample Point ID	Name	Type	Availability	Status	Well No. (link to Well Log(s))	Location Info (link to Map)	Drill Year	Depth (in feet)	Case Depth (in feet)	Case Diam. (in inches)	Drill Date	Depth Completed (in feet)	Case Depth (in feet)	Case Diam. (in inches)
S01	**Well #1**	GW	Primary	Active	240757	07/17/2000 (L. Cole)	1976	171	156	8	06-02-1976	171.00	156.00	8.00
S02	**Well #2**	GW	Primary	Active	240758	07/17/2000 (L. Cole)	1976	197	182	8	06-16-1976	197.00	182.00	8.00
S03	**Well #3**	GW	Emergency	Out Short Term	163384	03/16/1993 (L. Cole)	1981	124	104	8	03-19-1981	124.00	104.00	8.00
S04	**Well #4**	GW	Emergency	Out Short Term	166210	03/16/1993 (L. Cole)	1981	123	103	**8**	09-21-1981	123.00	103.00	**0.00**
S05	**Well #5**	GW	Primary	Active	513019	03/11/1993 (L. Cole)	1992	419	393	8	09-22-1992	419.00	393.00	8.00
S07	**Well #6**	GW	Primary	Active	473633	12/11/2002 (J. Walsh)	1990	375	335	16	12-12-1990	375.00	335.00	16.00

MNDWIS and CWI data value discrepancies in preceding tables are shown in **RED** (0 or null values excepted).

Unverified Wells

The following tables show information on wells whose existence (or previous existence) has not yet been confirmed.

UNVERIFIED Well Data - no data found.

UNVERIFIED Well Data - the following data are from RAW HYDRO spreadsheets, and need to be processed accordingly.													
Reference in Record	Name(s)	Unique Well Number	Drilled Depth (ft.)	Completed Depth (ft.)	Depth Cased (ft.)	Casing Diameter (in.)	Year Constructed	Construction Type	Year Out of Service	Sealing Record?	Year Sealed	Location Info	Comments
Databases Searched					**Trivia**								
Unverified Well Data Compiled By: **Jim Walsh** Compiled Date: **8/2/2005**													

Source: MN Dep't. of Health - 5/16/2013

MARSHALL & POLK RURAL WATER SYSTEM — 2011 DRINKING WATER REPORT —

The Marshall & Polk Rural Water System is issuing the results of monitoring done on its drinking water for the period from January 1 to December 31, 2011. The purpose of this report is to advance consumers' understanding of drinking water and heighten awareness of the need to protect precious water resources.

Source of Water

The Marshall & Polk Rural Water System provides drinking water to its residents from the following groundwater sources:

- Four wells ranging from 171 to 419 feet deep, that draw water from the Quaternary Buried Artesian Aquifer.
- Purchases treated water from the Grand Forks-Traill Water District, which obtains its water from 15 wells in the Elk Valley Aquifer.

The water provided to customers may meet drinking water standards, but the Minnesota Department of Health has also made a determination as to how vulnerable the source of water may be to future contamination incidents. If you wish to obtain the entire source water assessment regarding your drinking water, please call 651-201-4700 or 1-800-818-9318 (and press 5) during normal business hours. Also, you can view it online at www.health.state.mn.us/divs/eh/water/swp/swa.

Call 218-745-5471 or 1-800-569-1367 if you have questions about the Marshall & Polk Rural Water System drinking water or would like information about opportunities for public participation in decisions that may affect the quality of the water.

Results of Monitoring

No contaminants were detected at levels that violated federal drinking water standards. However, some contaminants were detected in trace amounts that were below legal limits. The table that follows shows the contaminants that were detected in trace amounts last year. (Some contaminants are sampled less frequently than once a year; as a result, not all contaminants were sampled for in 2011. If any of these contaminants were detected the last time they were sampled for, they are included in the table along with the date that the detection occurred.)

Key to abbreviations:

MCLG — Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MCL — Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MRDL — Maximum Residual Disinfectant Level.

MRDLG — Maximum Residual Disinfectant Level Goal.

AL — Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirement which a water system must follow.

90th Percentile Level — This is the value obtained after disregarding 10 percent of the samples taken that had the highest levels. (For example, in a situation in which 10 samples were taken, the 90th percentile level is determined by disregarding the highest result, which represents 10 percent of the samples.) Note: In situations in which only 5 samples are taken, the average of the two with the highest levels is taken to determine the 90th percentile level.

pCi/l — PicoCuries per liter (a measure of radioactivity).

ppb — Parts per billion, which can also be expressed as micrograms per liter (ug/l).

ppm — Parts per million, which can also be expressed as milligrams per liter (mg/l).

nd — No detection.

N/A — Not Applicable (does not apply).

Compliance With National Primary Drinking Water Regulations

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.

Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.

Pesticides and herbicides, which may come from a variety of sources, such as agriculture, urban storm water runoff and residential uses.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems.

Radioactive contaminants, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the U.S. Environmental Protection Agency (EPA) prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons, such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at 1-800-426-4791.

TEST RESULTS: (Samples collected throughout the System)

Contaminant	Units	MCLG	AL	90% Level	# sites over AL	Water Supply Reporting	Meets Regulations	Typical Source of Contaminant
Copper (2010)	ppm	N/A	1.3	.74	0 out of 10	A, B	✓	Corrosion of household plumbing systems; Erosion of natural deposits.
(2011)	ppm	N/A	1.3	0.08	0 out of 20	C	✓	
Lead (2010)	ppb	N/A	15	3.3	0 out of 10	A, B	✓	Corrosion of household plumbing systems; Erosion of natural deposits.
(2011)	ppb	N/A	15	No Detect	0 out of 20	C	✓	

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Marshall & Polk Rural Water System is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

TEST RESULTS FOR:

A = Warren Well Site, B = Euclid Well Site, C = Supplied by Grand Forks Traill

A = Warren Well Site, B = Euclid Well Site, C = Supplied by Grand Forks Traill								
				Level	Found	See System map for area served by each water supply		
Contaminant (Last Tested)	Units	MCLG	MCL	Range (2011)	Ave. Result*	Water Supply Reporting	Meets Regulations	Typical Source of Contaminant
Fluoride (2011)	ppm	4	4	1.4-1.7	1.5	A, B	✓	State of Minn. Requires all municipal water systems to add fluoride to the drinking water to promote strong teeth; Erosion of natural deposits; Discharge from fertilizer and aluminum factories.
(2008)	ppm	4	4	N/A	1.41	C	✓	
Zinc (2008)	ppm		N/A	N/A	0.001	C	✓	
Barium (2006)	ppm	2	2	N/A	.13	A	✓	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits.
(2010)	ppm	2	2	N/A	.45	B	✓	
(2008)	ppm	2	2	N/A	0.014	C	✓	
Nitrate + Nitrite (As N) (2011)	ppm	10	10.4	nd-1.2	1.2	A	✓	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits.
(2010)	ppm	10	10.4	.05	.05	B	✓	
(2011)	ppm	10	10	1.02	1.02	C	✓	
Nitrate (As N) (2007)	ppm	1	1	N/A	.02	B	✓	
Arsenic (2010)	ppb	0	10	NA	1.15	B	✓	Erosion of natural deposits; Runoff from orchards; Runoff from glass and electronics production wastes.
Radon 2007)	pCi/l			N/A	202	B	✓	Erosion of natural deposits.
Combined (2003)	pCi/l			N/A	2.29	A	✓	Erosion of natural deposits.
Radium (2010)	pCi/l	0	5.4	N/A	2.0	B	✓	
(2009)	pCi/l			N/A	0.11	C	✓	
Alpha Emitters (2003)	pCi/l			N/A	1.45	A	✓	Erosion of natural deposits.
(2010)	pCi/l	0	15.4	N/A	6.1	B	✓	
(2009)	pCi/l			N/A	0.53	C	✓	
Haloacetic Acids (HAA5) (2010)	ppb	0	60	N/A	14.2	A	✓	By-product of drinking water disinfection.
(2011)					2	C	✓	
Trihalomethanes TTHM, Total(2010)	ppb	0	80	N/A	25.1	A	✓	By-product of drinking water disinfection.
(2008)	ppb		80	N/A	13	C	✓	
Mercury (Inorganic) (2007)	ppb	2	2	N/A	.06	B	✓	Erosion of natural deposits; Discharge from refineries and factories; Runoff from landfills; Runoff from cropland.

average of all the detected values. If it is an average, it may contain sampling results from the previous year.

Radon is a radioactive gas which is naturally occurring in some groundwater. It poses a lung cancer risk when gas is released from water into air (as occurs during showering, bathing, or washing dishes or clothes) and a stomach cancer risk when it is ingested. Because radon in indoor air poses a much greater health risk than radon in drinking water, an Alternative Maximum Contaminant Level (AMCL) of 4,000 picoCuries per liter may apply in states that have adopted an Indoor Air Program, which compels citizens, homeowners, schools, and communities to reduce the radon threat from indoor air. For states without such a program, the Maximum Contaminant Level (MCL) of 300 pCi/l may apply. Minnesota plans to adopt an Indoor Air Program once the Radon Rule is finalized.

Contaminant (units)	MRDLG	MRDL	****	*****	Water Supply Reporting	Meets Regulations	Typical Source Of Contaminant
Chlorine (ppm) (2011)	4	4	.15-4	1.64	A, B	✓	Water additive used to control microbes
(2011)	4	4	0.3- 0.8	0.4	C	✓	

****Highest and Lowest Monthly Average *****Highest Quarterly Average

(Consumer Confidence Report continued on page Seven)

TEST RESULTS: (Consumer Confidence Report, continued from page Three)

Some contaminants do not have Maximum Contaminant Levels established for them. These unregulated contaminants are assessed using state standards known as health risk limits to determine if they pose a threat to human health. If unacceptable levels of an unregulated contaminant are found, the response is the same as if an MCL has been exceeded; the water system must inform its customers and take other corrective actions. In the table that follows are the unregulated contaminants that were detected:

		Level	Found			
Contaminant	Unit	Range (2010)	Ave./ Result	Water Supply Reporting	Meets Regulations	Typical Source of Contaminant
Sodium (2008)	ppm	N/A	130	A	✓	Erosion of natural deposits.
(2010)			192	B	✓	
(2008)			7.2	C	✓	
Sulfate (2008)	ppm	N/A	81.4	A	✓	Erosion of natural deposits.
(2010)			17.6	B	✓	
(2008)			15	C	✓	