Treasure State Acres
Public Water Supply

Source Water Delineation and Assessment Report (SWDAR)

Montana Public Water Supply ID# MT0002390

September 2003

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List of Acronyms

BMP - Best Management Practices

CAFO - Confined Animal Feeding Operation

CECRA - Comprehensive Environmental Cleanup and Responsibility Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

LUST - Leaking Underground Storage Tank

MCL - Maximum Contaminant Level

MBMG-GWIC - Montana Bureau of Mines and Geology – Ground Water Information Center

MPDES - Montana Pollutant Discharge Elimination System

NPDES - National Pollutant Discharge Elimination System

PWS - Public Water System.

RCRA - Resource Conservation and Recovery Act

SMCL - Secondary Maximum Contaminant Levels

SWDAR - Source Water Delineation and Assessment Report.

SWPP - Source Water Protection Plan

SWL - Static Water Level

SOC - Synthetic Organic Compounds

TMDL - Total Maximum Daily Load

UST - Underground Storage Tank

VOC - Volatile Organic Compounds

See glossary at end of text for definitions of acronyms and other terms used in this report

INTRODUCTION

The Safe Drinking Water Act (SDWA) Amendments of 1996 require states to develop and implement Source Water Assessment Programs (SWAP) to analyze existing and potential threats to the quality of the public drinking water supplies throughout the state. The Montana SWAP was formally approved by the US Environmental Protection Agency (EPA) in November 1999. The Montana SWAP was developed from the former Wellhead Protection Program, but includes surface water sources and requires a more rigorous inventory of potential contaminant sources. For communities that have already developed wellhead protection plans, SWAP revises these plans to meet the expanded requirements. DEQ also works with other groups such as Montana Rural Water Systems, Inc., and Midwest Assistance Programs to implement the program.

SWAP addresses only public water systems (PWS) regulated according to the Federal Safe Drinking Water Act. A public water supply system is defined, according to Federal and Montana regulations, as a system that supplies water for human consumption. A public water supply system has at least 15 service connections or regularly provides water to at least 25 persons daily for a minimum of 60 days in a calendar year. There are three types of public water supply systems:

- Community water systems provide water on a year-round basis, and have a minimum of 15 service connections or regularly serve at least 25 residents. In addition to incorporated towns, community systems may serve smaller areas such as housing subdivisions or trailer courts. The Treasure State Acres PWS is classified as a community PWS.
- Non-transient non-community systems do not serve communities, but provide water regularly to a minimum of 25 of the same people for at least 6 months of a year. These systems serve public buildings such as schools and hospitals, where people are employed but do not reside.
- Transient non-community systems do not serve communities, and do not regularly serve a minimum of 25 of the same people for at least 6 months of the year. These systems are usually seasonal, and are located in areas such as campgrounds and parks.

Source water protection is a common sense approach to guarding public health by protecting drinking water supplies. In the past, water suppliers have used most of their resources to treat water from rivers, lakes, and underground sources before supplying it to the public as drinking water. Source water protection means preventing contamination and reducing the need for treatment of drinking water supplies. Source water protection also means taking positive steps to manage potential sources of contaminants and contingency planning for the future by determining alternate sources of drinking water. Protecting source water is an active step towards safe drinking water; a source water protection program (along with treatment, if necessary) is important for a community's drinking water supply. A community may decide to develop a source water protection program based on the results of a source water assessment, which includes the delineation of the area to be protected and an inventory of the potential contaminants within that area.

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to help public drinking water supplies protect their water source from contamination.

The Montana Source Water Protection Program is responsible for completing delineation and assessment reports for all public water supplies in Montana. The Source Water Delineation and Assessment Report (SWDAR) compiles the appropriate data and other technical information about an area to allow communities to develop source water protection plans. Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying potential contaminant sources in delineated source water protection areas, and evaluating the potential for contamination of drinking water from these sources under "worst-case" conditions such as a flood, fire or human error. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Helena area communities and public water supply operators develop source water protection plans that meet their specific needs.

Scope and Purpose

This report presents the source water delineation and assessments for the public water supply for the Treasure State Acres located north of the City of Helena, in Lewis and Clark County, Montana. This report is intended to meet the technical requirements for the completion of the delineation and assessment report for this PWS, as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

This report addresses the public water supply area with a watershed-type approach, recognizing that potential contaminant sources may threaten more than one public water supply. The report presents information for the area near and upgradient from the PWS. This information will be used as a basis to develop SWDARs for additional public water supply sources in the area that have overlapping source water protection areas with similar threats.

Acknowledgements

This report was prepared by James Swierc with the University of Montana – Helena (UM-Helena) as part of a cooperative agreement with the Lewis and Clark Water Quality Protection District, using funding provided by the Source Water Protection Program of the Montana Department of Environmental Quality. Kathy Moore with the Lewis and Clark Water Quality Protection District provided support to completion of the report and project. The Helena Source Water Project was designed to evaluate all of the public water supplies in the Helena area. Inventory data for the project was researched and compiled by UM-Helena project interns April Navarro, Scott Smith, Heather DeMangelaere and Marc Reeves, including completion of a “windshield” survey for the project.

Limitations

This report was prepared to assess threats to Treasure State Acres public water supply and is based on published information, and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to sources for regulated public water supplies, and not any other type of water supply. The inventory of potential contaminant sources focuses on the management areas delineated for the

public water supplies in this report. As a result, other potential sources of contamination to surface and ground water in the area may not be identified.

The term "contaminant" is used in this report to refer to any chemical or biologic constituent in water that are listed as regulated under state and federal regulations. Water constituents are generally regulated based on health effects that may occur when ingested at certain levels. Water quality standards are based on maximum contaminant level goals (MCLGs) for a compound, which represents a concentration where adverse health effects are not considered likely to occur when ingested. However, as natural waters contain many dissolved constituents and MCLGs are frequently not attainable using economically viable water treatment alternatives, maximum concentration levels (MCLs) are used. MCLs represent concentrations that may result in chronic or acute health problems when ingested. MCLs are based on the relative risk, or likelihood that health problems may occur, and economics associated with a treatment technology for a specific constituent of water. In some cases, sources for constituents with Secondary MCLs are also evaluated in this report. Secondary MCLs are non-regulatory guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water.

BACKGROUND

The Community

Treasure State Acres is located north of the City of Helena. Helena is located in the southeastern part of Lewis and Clark County, in the southern part of the Helena Valley within the Lewis & Clark County Water Quality Protection District as shown in Figure 1. The population of Helena was estimated at 25,780 people in the 2000 census, with an estimated total population of 40,000 people in the Helena Valley. Helena is the state capitol and considered a major Montana city as the primary place of employment for many residents within the Helena Valley. The local economy is linked to the state government as a major employer in the area, with technical contractors and service industries supporting government functions. Many small businesses and a limited amount of industry are present in the valley. Agriculture is present in the area surrounding the developments outside of the greater Helena metropolitan area. Major industry in the area is located near central Helena and East Helena, south of the service area for Treasure State Acres. The primary roads through the area are I-15, which runs north-south through Helena, US 287 which connects Helena to the east and southeast, and US 12 which enters Helena from the west. North Montana Avenue is the major access road to the property.

Wastewater in Treasure State Acres is collected and treated with onsite septic systems. The City of Helena city municipal sanitary sewer system is present south of Treasure State Acres. The wastewater treatment plant is located east of Treasure State Acres. Areas outside of the Helena city limits are typically served by septic systems for wastewater treatment and disposal.

Geographic setting

Treasure State Acres is located at approximately 46.631º North latitude and 112.012º West longitude, in Section 17 of Township 10 North, Range 3 West. The Helena Valley is an intermontane basin in the Northern Rocky Mountains geographic province. The Helena Valley is bounded by the Big Belt Mountains to the east, the Scratch Gravel Hills to the west, the Elkhorn Mountains and Boulder Batholith to the south, and the "North Hills" to the north. The Treasure State Acres service area is located between the southern side of the Scratch Gravel Hills and north of the mountains south of Helena, in the western part of the Helena Valley. The elevation of the Helena is approximately 3,800 feet above sea level, with the elevation of Lake Helena about 3650 feet, the lowest point in the valley. The elevation of the mountains surrounding Helena rise as high as 9,000 feet above sea level.

All surface water in the Helena Valley flows towards Lake Helena, which discharges into Hauser Reservoir damned on the north flowing Missouri River (USGS HUC#100300101) in this area. Surface flow in the Treasure State Acres area is generally to the northeast, following topography. Tenmile Creek (USGS HUC#100300101130) with a watershed adjacent to the continental divide flows from the southwestern part of Lewis and Clark County eastward through the Helena Valley. Tenmile Creek flows north of the Treasure State Acres service area, with water flow related to the local ground water systems as discussed later in this document.

Prickly Pear Creek (USGS HUC#100300101120) flows from a watershed in the Elkhorn Mountains and Boulder Batholith south of Helena flows northward through East Helena into the valley. Silver Creek (USGS HUC#100300101140) enters the Helena Valley from the northwest,

north of the Scratch Gravel Hills and south of the "North Hills", with a watershed near Marysville and the Continental Divide northwest of Helena. The Helena Valley Irrigation Canal flows in a clockwise direction around the outside of the Helena Valley, from the Helena Regulating Reservoir to Lake Helena.

The climate in the area is typical for southwestern Montana. Weather data is reported for Helena, from a weather station near the Airport. Data for Helena is available from 1893 to 2001. Helena receives an average of 11.99 inches of precipitation annually, with the wettest months in May and June averaging 1.92 and 2.10 inches. The driest months are November through February, with averages between 0.48 and 0.62 inches per month. Helena receives an average total of 51.3 inches of snowfall per year. The temperature ranges from an average high of 82.4º F in July (minimum July average of 53.3º F) to an average of 29.5º F in January (minimum January average of 11.1º F).

General description of the Source Water

Treasure State Acres obtains water from two wells (Sources WL 002 and WL 003). The service area comprises the housing area northwest of the wells. The wells are located near the southeastern property boundary. Ground water flow in the Treasure State Acres area is generally to the north, towards Tenmile Creek and the lowest elevation of the valley in Lake Helena. Tenmile Creek flows eastward through the area. Water flow in Tenmile Creek responds to seasonal changes in ground water elevation. The aquifer is recharged from stream loss from Grizzly Gulch in Helena and Tenmile Creek as they cross from bedrock to alluvium in the Helena Valley, from the discharge of bedrock aquifers from the bedrock on valley margins into the alluvial aquifer in the subsurface, and from infiltration of precipitation. The Tenmile Creek watershed, considered as the recharge area for the aquifer for this assessment, is located southwest of Helena as depicted in Figure 2.

The Public Water Supply

Treasure State Acres PWS serves an estimated population of 550 residents through 156 service connections. The PWS uses two wells. Well 1, the north well, is located north of the pumphouse. Well 2, the south well, is located south of Well 1 in the southeastern corner of the property. Water from the wells is pumped directly into the distribution system. A copy of the most recent sanitary survey for the system is included in Appendix A. There are no well logs available for the PWS wells. Well logs from the MBMG-GWIC database for other wells in the area are included in Appendix B.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring parameters typically include coliforms (as an indicator of pathogenic organisms), nitrates, metals and multiple chemicals. The monitoring schedule depends on many factors such as the size of the system, the water source for the PWS, the number of sources (e.g. wells), and land use in the area. A specific monitoring program is designed for each PWS that follows the general protocols for operation of a PWS defined by DEQ following the guidelines originally established in the federal Safe Drinking Water Act. A review of the DEQ PWS database of monitoring results for Treasure State Acres PWS (Appendix A) indicates no violations or other problems during the past several years.

Water quality data for the Helena area was obtained electronically from the Montana Bureau of Mines and Geology (MBMG) database (GWIC). Appendix C lists the data for the sections proximal to Treasure State Acres PWS Wells. This data is considered to represent background concentrations for ground water near the PWS sources.

HYDROGEOLOGIC SETTING AND DELINEATION

The source water protection area, the land area that contributes water to Treasure State Acres PWS, is identified in this chapter. For the PWS sources, three management areas are identified within the source water protection area; the control zone, inventory region, and recharge region. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region for the well is delineated based on a three-year time of travel distance for ground water to the source. The recharge region represents the area where the aquifer is replenished. Since the aquifer may be in communication with the Helena Valley Irrigation Canals, a surface water buffer zone is delineated around the stream upstream from the inventory zone.

Hydrogeologic Conditions

The information presented in this section is based predominantly on the assessments of the hydrogeology of the area performed by the United States Geological Survey (USGS) and Montana Bureau of Mines and Geology (MBMG). This includes a study of the Helena Valley alluvial aquifer presented in Briar and Madison (1992), and Bedrock Aquifers in the Helena Area presented in Thamke (2000). Additional hydrogeologic information was obtained for the area proximal to the Scratch Gravel Landfill from documents obtained from DEQ. A geologic map of the Tenmile Creek Watershed Region showing the major units is depicted in Figure 4.

Ground water in the Helena Valley is present in an unconfined alluvial aquifer. The Helena Valley is a structural basin with bedrock boundaries. The central part of the valley is filled with up to 6,000 feet of sediments derived from the bedrock in the area. The valley is filled with a thick sequence of interlayered fine and coarse grained Tertiary sediments; overlain by up to 100 feet of Quaternary alluvium. The Tertiary beds and the alluvium are considered as a single aquifer in the area. Tertiary pediment surfaces are present in various areas along the margins of the valley, and may be considered part of the alluvial aquifer when present in sufficient thickness to represent a water bearing unit.

Ground water in the area near Treasure State Acres generally flows to the north, following topography in the direction of Tenmile Creek. There are some local variations in this general flow direction due to changes in local conditions. A potentiometric surface map showing the general direction for ground water flow in the area is presented in Figure 5. Water flow in the alluvium is primarily horizontal, with vertical hydraulic conductivities generally 1-3 orders of magnitude less (Briar and Madison, 1992). Recharge to the alluvial aquifer occurs from stream loss along the valley margins, direct infiltration of precipitation, leakage from irrigation canals, and from direct infiltration of water from bedrock aquifers in the subsurface. The depth to ground water in the area ranges from approximately 10 to 30 feet below the ground surface, and varies during the year.

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For Treasure State Acres PWS, water is obtained from an unconfined alluvial aquifer. A generalized cross section depicting the geology is shown in Figure 6. Ground water flow is generally to the north, following topography. Recharge to the aquifer occurs from stream loss

from Tenmile Creek, Sevenmile Creek and the Helena Valley Irrigation Canal; infiltration from precipitation; and from the bedrock along the southwestern margin of the valley. The unconfined alluvial aquifer is considered to have a ***high*** source water sensitivity to contamination.

Well Information

The wells for Treasure State Acres PWS are located north of the Helena city limits as depicted in Figure 3. No well logs are available for the PWS wells. Known well information is summarized in Table 1.

Table 1 - Source Well Information for Treasure State Acres

Information	Well 1	Well 2
PWS Source Code	002	002
Well Location	T10N, R3W, Sec 17 BAAA	T10N, R3W, Sec 17 BAAA
	Lat 46.6309 N Long 112.0117 W	Lat 46.6304 N Long 112.0117 W
MBMG/GWIC #	--	--
Water Right #	--	--
Date Installed	--	--
Total Depth	--	--
Perforated Interval	--	--
Static Water Level	--	--
Pumping Water Level	--	--
Test Pumping Rate/Yield	--	--
Specific Capacity	--	--

Methods and Criteria

The methods and criteria used to delineate the source water protection zones for Treasure State Acres water system are specified in the Montana Department of Environmental Quality Source Water Protection Program (DEQ, 1999). The criteria for unconfined aquifer systems was applied. The control zone was established using a fixed radius of 100 feet around each wellhead. The inventory zone was delineated based on a ground water time of travel distance of three years. This distance was determined using a simple ground water flow model using the uniform flow equation (EPA, 1991). Conservative estimates for aquifer properties were made using available data from published reports, as discussed in the following. The inventory zone for the wells were broadened to reflect potential changes in the flow system during seasonal periods of high and/or low flow. The recharge area for the alluvial aquifer is considered to be the Tenmile Creek Watershed above Treasure State Acres, as shown in Figure 2.

Model Input

The values selected for the calculation of time of travel represent conservative assumptions made to identify areas that may potentially impact Treasure State Acres PWS sources. The values for aquifer properties are based on published information characterizing the regional aquifer system (Briar and Madison, 1992). The criteria for selection of the values used for the delineation of the inventory zone are as follows:

Well Model Values:

- ***Thickness***: The value for the thickness of the aquifer (b) is estimated at 50 feet, based on the estimated thickness of the aquifer, and the depth to ground water from area well logs.
- ***Hydraulic Conductivity***: A hydraulic conductivity value of 150 feet/day is used, based on information from Briar and Madison (1992)
- ***Transmissivity***: The transmissivity value for the alluvium is estimated at 7,500 ft^2/day based on the relationship T = K*b.
- ***Hydraulic Gradient***: The hydraulic gradient was measured from the potentiometric surface map in Briar and Madison (1992) shown in Figure 5. The gradient shows an approximate value of 0.03.
- ***Flow Direction***: The flow direction is considered north, based on the map of Briar and Madison (1992).
- ***Porosity***: The value for effective porosity for the alluvium is estimated from (Todd, 1980) at 30%. The estimated value is considered representative of medium to coarse grained gravel.
- ***Pumping Rate***: The pumping rate for the wells was estimated at 100 gpm, which is a conservative estimate reflecting the needs of the system.

Delineation Results

The results of the calculations for the alluvial aquifer to the wells indicate an estimated distance of 5,550 feet (1.05 miles) for a one-year time of travel (TOT), and a distance of 16,550 feet (3.13 miles) for a three-year TOT. A summary of the time of travel calculations is included in Appendix D. The delineated inventory zone for the wells is depicted in Figure 7. The inventory zone comprises the alluvium present between the wells and the hills south of the central part of Helena. Part of the southern boundary of the inventory zone represents the limits of the alluvial aquifer as mapped by Stickney (1987). The surface water buffer zone is located around the Helena Valley Irrigation Canal and the Helena Regulating Reservoir. The recharge region is considered to be the Tenmile Creek Watershed area shown in Figure 2.

Limiting Factors

The interaction of surface water between the alluvial aquifer, Tenmile Creek and the Helena Valley Irrigation Canal is not well understood at this time due to the limited amount of data on the system. In particular, the changes in the flow regime under seasonal conditions of high and low flow are not known. The delineation was completed using conservative assumptions to help ensure that the inventory zone reflects the actual area where contamination to the system may occur. In all cases, the interpretations and conclusions on ground water flow in the aquifer(s) are based on general principles of hydrogeology, and the physical mechanics of ground water flow.

INVENTORY

An inventory of potential sources of contamination was conducted for the Treasure State Acres PWS sources within the control and inventory zones. Potential sources of all primary drinking water contaminants, including pathogens, were identified. However, only significant potential contaminant sources based on criteria outlined in the Montana Source Water Protection Program (DEQ, 1999) were selected for detailed inventory. The inventory for Treasure State Acres PWS focuses on all activities in the control zone, certain sites or land use activities in the inventory zone, sources of nitrate and pathogens in the surface water buffer zone, and general land uses and large facilities in the recharge region. The inventory results from the various steps (Appendix E) are summarized in Table 3. The significant potential contaminants in the inventory region for the wells includes nitrates and pathogens from septic systems and the Helena Municipal Sewer System; existing ground water contamination from LUST facilities, the former Helena Landfill (Bill Roberts Golf Course), the Montana Power Company former Manufactured Gas Plant (a CECRA site), and the Burlington Northern Rail Site (CECRA site).

Inventory Method

The initial inventory steps comprise querying existing state and federal electronic databases for regulated facilities that use, store or release regulated chemicals. The steps to the database searches, and the results from each step are listed in Appendix E. The assessment of agriculture land use and urban areas, and major transportation routes through the area are shown on Figure 8. The limits of the municipal sewer system and relative density of septic systems in the area are shown on Figure 9. The database search is supplemented and verified with a "windshield survey" and a business directory search of the delineated inventory zones for each PWS in the study area. The results of the business directory search are included in Appendix E. This method helps ensure the inventory is a complete data collection exercise to identify all potential contaminant sources.

The results of the inventory process are summarized in Table 2, which summarizes the properties or sites within the inventory zone study area. The potential contaminants are listed, with a description of the potential release mechanism for the site. In all cases, releases may occur due to unavoidable conditions such as flooding, lightning or fire. The sites where this is the primary potential release mechanism are identified as concerns resulting from such a disaster. For other sites where other release mechanisms may be more common, the potential for a release from such a disaster is assumed.

The results of the "windshield survey" were consistent with the results from database searches, and did not indicate any additional facilities to review. Storm water flows into drainage ditches through the area. While not observed in this area, storm water drains that discharge into infiltration galleries represent injection wells of surface water into shallow ground water. Class V injection wells are classified as waste disposal conduits that discharge directly to shallow ground water. The evaluation of the use of Class V injection wells in Montana is currently the responsibility of the EPA.

The Montana Source Water Protection Program identifies specific types of potential contaminant sources as significant, for further evaluation of the susceptibility of the water sources to these sources. The following categories of potential contaminant sources are considered significant:

1. Large quantity hazardous waste generators.
2. Landfills.
3. Underground storage tanks.
4. Underground injection wells.
5. Major roads or rail transportation routes.
6. Cultivated cropland greater than 20 % of the inventory region.
7. Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
8. Animal feeding operations.
9. Abandoned or active mines, and gravel pits.
10. Septic systems.
11. Sewer mains.
12. Storm sewer outflows.
13. Wastewater treatment facilities, sludge handling sites, or land application areas.

Inventory Results/Control Zone

The control zone represents the most critical point to protecting the integrity of the wellhead for ground water sources. The control zones for the wells include the area in the immediate vicinity of each well, the pumphouses. The control zones do not have fencing or other methods to limit access at the boundaries of 100 feet from the wellhead. Potential contaminant sources within the control zone include lawn maintenance chemicals and/or fertilizers, and nitrates and/or pathogens from septic systems.

Inventory Results/Inventory Region

The inventory region represents the area near the source well where any contamination spilled onto the ground or subsurface has the potential to migrate directly into the PWS source aquifer. A summary of the inventory results of significant potential contaminant sources are listed in Table 2. Completed inventory summary sheets for the significant potential contaminant sources are included in Appendix F.

The inventory region for the well is the area upgradient from the wellheads, defined by the distance ground water will travel to the wells in three years. Land use in this area is classified as predominantly urban, with little agriculture. The identified potential contaminant sources include the roads, railroad tracks, septic systems, the Helena Muncipal Sewer System, the former Helena Landfill (currently Bill Roberts Golf Course), the former Montana Power Manufactured Gas Plant, the Burlington Northern Railroad site, Underground Storage Tanks, Leaking USTs, and multiple businesses that use or store chemicals. The location of all of these potential sources is shown in Figure 10. Ground water contamination in the alluvial source aquifer is present or associated with several sites in the inventory zone. Trace levels of chlorinated solvents were detected at several wells downgradient from the closed Helena Landfill (Bill Roberts Golf Course). Petroleum Hydrocarbons are present at several LUST sites. Contamination is present at the former Montana Power Company manufactured gas plant, a CECRA site.

Inventory Results/Surface Water Buffer Zone

The surface water buffer zone is the area of one half mile on each side of the surface water bodies for a distance of ten miles upstream from the PWS sources. The delineated areas are shown in Figure 7. The inventory of the surface water buffer zone focuses on potential contaminants with acute health risks, such as pathogens or nitrates. The delineated zones include

septic systems and agricultural development with related potential contaminants. In addition, the buffer zone around the Helena Valley Irrigation Canal includes areas serviced by the City of Helena sewer system.

Inventory Results/Recharge Region

The recharge region for the wells is considered to be the Tenmile Creek Watershed, including the Grizzly Gulch watershed south of Helena. The Tenmile Creek Watershed is the source water area for the City of Helena PWS, and is currently a federal superfund site with ongoing remediation. The primary potential contaminant source(s) are from closed and/or abandoned mines which represent sources of heavy metals to the environment. The area within the watershed is predominantly national forest land, with a limited agriculture.

Table 2 - Summary of Inventory Results for Treasure State Acres PWS.

Source Type	***Potential Contaminants***	***Description/Concern***
Step 1 Results		
Urban Land Use	*Spills of various chemicals*	*Non-point source pollution, small spills of household chemicals*
City of Helena Municipal Sewer System	*Pathogens and Nitrates*	*Non-point source pollution, loading o f ground water system from leaking sewer pipes*
EPA Envirofacts Sites (Step 2)		
Multiple Faciliies	*Various Chemicals*	*See Appendix E for identification information*
EPA-PCSs Sites (Step 3)	*Included with Envirofacts, See Appendix E for identification information*	
DEQ Database (Step 4)		
UST/LUST Sites		
Criminal Justice Facility	*Petroleum Hydrocarbons*	*Active UST Site*
Noons #439	*Petroleum Hydrocarbons*	*Recently Closed UST Site*
Helena School District	*Petroleum Hydrocarbons*	*Active UST Site*
Town Pump – Capitol	*Petroleum Hydrocarbons*	*Active UST site*
US West Communications	*Petroleum Hydrocarbons*	*Active UST site*
Noons #438	*Petroleum Hydrocarbons*	*Recently Closed UST Site; LUST Facility*
EZ Stop at Malfunction Junction	*Petroleum Hydrocarbons*	*Active UST site; LUST Facility*
Jerry's Hiway Service	*Petroleum Hydrocarbons*	*Active UST site*
Town Pump #4	*Petroleum Hydrocarbons*	*Active UST site; LUST Facility*
Bulk Plant Location	*Petroleum Hydrocarbons*	*Active UST site*
Mergenthaler Transfer and Storage	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
G&L Transit	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
Noons #563	*Petroleum Hydrocarbons*	*Recently Closed UST Site, LUST Facility*
Prospect Conoco	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
Montana Mobile Homes	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
Thriftway Super Stop #9	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
Noons #412	*Petroleum Hydrocarbons*	*Recently Closed UST site*
College EZ Stop	*Petroleum Hydrocarbons*	*Active UST site*
Holiday Stationstore #270	*Petroleum Hydrocarbons*	*Active UST site*
Federal Reserve Bank, Helena Branch	*Petroleum Hydrocarbons*	*Active UST site*
Helena Dial Exchange	*Petroleum Hydrocarbons*	*Active UST site*
Town Pump Helena #1	*Petroleum Hydrocarbons*	*Active UST site*
Helena Cenex	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*

Table 2 - Summary of Inventory Results for Treasure State Acres PWS (Cont.)

Source Type	*Potential Contaminants*	*Description/Concern*
Swags Convenience Stop	*Petroleum Hydrocarbons*	*Active UST site*
Helena Service Center	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
Jolly O's Gas 'N Go	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
EZ Stop West	*Petroleum Hydrocarbons*	*Active UST Site*
McGaffick Service	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
First Presbyterian Church	*Petroleum Hydrocarbons*	*Inactive UST Site, LUST Facility*
Former Conoco Pop Inn	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
Sinclair Retail #25009	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
Noons #422	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
Tim's Exxon	*Petroleum Hydrocarbons*	*Active UST Site*
Friendly's Sinclair	*Petroleum Hydrocarbons*	*Active UST site, LUST Facility*
Terry's Convenient Foods	*Petroleum Hydrocarbons*	*Recently Closed UST Site*
Albertson's Express #2004	*Petroleum Hydrocarbons*	*Active UST Site*
CECRA Sites		
Landfill – Former Helena Lanfill (Bill Roberts GC)	*Various Chemicals*	*Contaminated ground water present*
Former Montana Power Company Plant	*Various Chemicals*	*Former Manufactured gas plant, with releases to ground water.*
Burlington Northern Railroad Facility	*Various Chemicals*	*Railroad Yard, release of fuels and metals*
Business – SIC Code Sites (Step 5)	*No sites identified as significant potential contaminant source not identified by other methodss, see Appendix E.*	
Miscellaneous Others, including Step 6		
Major Roads	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on Highway*
Railroad Lines	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on railroad line*
Yellowstone Pipeline	*Spill of petroleum hydrocarbons*	*Disaster – break in pipeline resulting in discharge of fuels*
Gravel Pits	*Various Chemicals*	*Direct discharge of chemical to shallow ground water system; located at several places within inventory zone*
Class V Injection Wells	*Various chemicals*	*Direct discharge of chemical to shallow ground water system*

* Note: Sites identified from multiple search queries are listed with the first step that identified the specific site. Individual sites identified are evaluated in Chapter 5.

Inventory Update

The operator for Treasure State Acres PWS will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The inventory is limited by the accuracy of information in databases used for the assessment. The windshield survey provides a level of quality assurance that the information presented reflects current conditions at the time of preparation of this report. The location of Class V injection wells is not complete at this time, and is currently being compiled by EPA for the area.

The data from the MBMG-GWIC database on wells in the area may not be complete, as not all wells are included in the database.

Table 3. Significant potential contaminant sources for Treasure State Acres PWS.

Source	*Contaminants*	*Description*
Agricultural Land Use	*Pathogens and Nitrate; Pesticide/Herbicides (SOCs)*	*Primary concern in cultivated and grazing lands in Tenmile Creek watershed upstream from wells.*
Urban Land Use	*Various*	*The majority of the Helena urban area is at a position away from the wells. Urban runoff concentrates organic chemicals and metals into streams and shallow ground water system.*
Sanitary Sewer Main	*Pathogens and Nitrate*	*The Helena city limits are sewered, within the inventory zone and surface water buffer zone. Concern from leaks and backfill around sewers providing a preferred conduit for other contaminants to migrate.*
Storm Water Discharge Points	*Various organic chemicals*	*Not inventoried at this time*
Former Helena Landfill – Bill Roberts Golf Course	*Various Chemicals*	*Located in northern part of inventory zone, within one-year time of travel distance.*
LUST Facilities (13 sites)	*Petroleum Hydrocarbon*	*Located in inventory zone between one and three year time of travel distances, existing impacts to ground water present*
UST Sites with no leaks (12 sites)	*Petroleum Hydrocarbons*	*Located in inventory zone between one and three year time of travel distances*
MPC Former Manufactured Gas Plant	*Various Chemicals*	*CECRA Site, located within inventory zone*
Burlington Northern Railroad Yard	*Various Chemicals*	*CECRA Site, located within inventory zone*
Yellowstone Pipeline	*Petroleum Hydrocarbons*	*Runs through southern part of inventory zone*
Major Roads	*Various Chemicals*	*Transportation corridors near PWS, concern over an accident and spill of any transported chemicals*
Railroad Lines	*Various Chemicals*	*Transportation corridors upgradient of PWS, concern over an accident and spill of any transported chemicals*
Gravel Pits	*Various Chemicals*	*Direct conduit into shallow aquifer, located at several positions within inventory zone.*
Class V Injection Wells	*Various organic chemicals*	*Not inventoried at this time (EPA responsibility); may provide conduits for chemicals into subsurface*

SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case Treasure State Acres PWS.

The goal of Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by Treasure State Acres PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to Treasure State Acres PWS sources (Table 4). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 6).

Table 4 - Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

For point sources, the relative hazard for the potential contaminant sources is assigned based on the type of aquifer. For unconfined aquifers, the relative hazards for point source are based on the location of the potential contaminant source relative to the wells. Potential sources within a one-year time of travel distance to the wells are assigned a relative hazard of high. Potential contaminant sources located between a one-year and thee-year time of travel distance are assigned a relative hazard of moderate. Any other potential contaminant sources within the recharge area are assigned a relative hazard of low.

After the relative hazard of a potential contaminant source is assigned, the relative susceptibility is determined based on the presence of barriers that may mitigate the potential for a contaminant source to impact a water source. Barriers may represent natural conditions, engineered barriers or management actions. Natural barriers include anything that can be demonstrated as effective in mitigating the migration of any chemicals released at the surface, such as thick clay-rich soils

or surface flowing artesian conditions. Engineered barriers represent man-made structure to contain chemicals if they are released, such as spill containment for underground storage tanks. Management barriers are plans that prohibit or control potentially polluting activities, but only if there is a plan or approach that has been formally implemented.

For Treasure State Acres PWS sources, no natural barriers were identified present due to the coarse grained and highly transmissive nature of the source aquifer. A management barrier for the facilities with active USTs is compliance with existing UST regulations.

For non-point sources, the relative hazard is assigned based on the relative concentrations present within the delineated inventory zone for the aquifers, following the criteria listed in Table 5.

Table 5 – Relative Hazards for Non-Point Potential Contaminant Sources

Source Type	*High Hazard*	*Moderate Hazard*	*Low Hazard*
Septic Systems	> 300 per sq. mi.	50 – 300 per sq. mi.	< 50 per sq. mi.
Municipal Sanitary Sewer (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region
Cropped Agricultural Land (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region

Susceptibility Assessment Results

The results of the susceptibility assessment for Treasure State Acres PWS are listed in Table 6. The primary threats identified within the one-year time of travel distance are agricultural land use and moderate density areas with septic systems. The CECRA sites and the former Helena Landfill (Bill Roberts Golf Course) are located near the upgradient end of the inventory zone, representing a high susceptibility to the aquifer. The location of roads and gravel pits within the area all represent potential threats with a very high susceptibility rating, where an accidental spill or leak could impact water quality in the source aquifer.

The summary information in Table 6 reviews the relative hazard, barriers and susceptibility ranking of each potential source. Management alternatives are recommended that can help reduce the relative susceptibility of each identified potential contaminant source to the PWS sources.

Table 6. Susceptibility assessment of significant potential contaminant sources.

Source	Contaminant	Hazard	Hazard Rating	Barriers	Suscept-ibility	Management
Inventory Zone						
Sanitary Sewer System	Pathogens and Nitrate	Infiltration	High	None	Very High	Monitor integrity of sewer lines
Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Promote the use and development of agricultural BMPs for the area
Septic Systems	Pathogens and Nitrate	Infiltration and Runoff	High	None	Very High	Monitor septic system performance
Former Helena Landfill (Bill Roberts GC)	Various Organic Chemicals	Infiltration and Runoff	High	None	Very High	Existing water contamination, Review landfill monitoring results
UST Sites (within 1 year time of travel)	Petroleum Hydrocarbons	Infiltration and Runoff	High	Compliance with UST regulations	High	Develop emergency response plan
UST Sites (within 3-year time of travel)	Petroleum Hydrocarbons	Infiltration and Runoff	Moderate	Compliance with UST regulations	Moderate	Develop emergency response plan
LUST Sites (within 3-year time of travel)	Petroleum Hydrocarbons	Infiltration and Runoff	Moderate	None	High	Review LUST Status, Develop emergency response plan
MPC Former Manufactured Gas Plant	Various Chemicals	Infiltration	Moderate	None	High	Monitor CECRA site progress
Burlington Northern Railroad Yard	Various Chemicals	Infiltration	Moderate	None	High	Monitor CECRA site progress
Yellowstone Pipeline	Petroleum Hydrocarbons	Spills	Moderate	Spill Response Plan	Moderate	Create emergency response plan
Gravel Pits	Various Chemicals	Direct Infiltration	High	None	Very high	Develop plan to limit access to gravel pits
Major Roads	Various Chemicals	Spills	High	None	Very high	Develop emergency response plan
Railroad Lines	Various Chemicals	Spills	Moderate	None	High	Develop emergency response plan

Table 6. Susceptibility assessment of significant potential contaminant sources (continued)

Source	Contaminant	Hazard	Hazard Rating	Barriers	Suscept-ibility	Management
Surface Water Buffer Zone						
Cropped Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	High	None	Very High	Promote the use and development of agricultural BMPs
Sanitary Sewer System	Nitrates and Pathogens	Infiltration and Runoff	High	None	Very High	Monitor sewer system performance
Septic Systems	Nitrates and Pathogens	Infiltration and Runoff	Moder	None	High	Monitor septic system performance
Recharge Area						
Tenmile Superfund Site (and other mines)	Metals	Infiltration and Runoff	Low	None	Moderate	Monitor progress of superfund remediation of area
Cropped Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Promote the use and development of agricultural BMPs for the area
Septic Systems	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Monitor septic system performance

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