Utility Solutions Zoot North Star
Public Water System

PWS ID# MT0004284

Source Water Delineation & Assessment Report

Report Date: July 2012

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EXECUTIVE SUMMARY

Utility Solutions is a privately owned public utility. Its central water and wastewater systems serve many subdivisions and properties in the greater Four Corners area of Gallatin County, Montana. Figure 1 identifies the Utility Solutions Water and Wastewater Service Area Boundary. Within a portion of the Utility Solutions, LLC service area is the Four Corners County Water and Sewer District. The Four Corners County Water and Sewer District provides water and sewer services to property within its boundaries and, on a case by case basis, to properties outside of its boundaries. The District acquires water and sewer services, in bulk, from Utility Solutions, LLC.

Three public water systems (PWSs) Utility Solutions Inc., Zoot Enterprises, and North Star Subdivision joined and became Utility Solutions Zoot North Star Public Water System. The Department of Environmental Quality (DEQ) Public Water System Identification Number for this PWS is MT0004284.

Morrison-Maierle, Inc. completed the original PWS-6 Reports (delineation and assessment reports) for the water systems. Information contained in the previous reports completed by Morrison and Maierle, Inc. and updated information compiled by Carolyn DeMartino, a Water Quality Specialist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Program (SWPP) have been assembled into one document entitled "Utility Solutions Zoot North Star Public Water System (PWS) Source Water Delineation and Assessment Report (SWDAR)". The current document is intended to meet the technical requirements of the Montana Source Water Protection Program (DEQ, 1999) and the Federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

Utility Solutions Zoot North Star Community Public Water System is located about seven miles west of Bozeman in the Four Corners area where Highways 191 and 84 intersect. This PWS is classified as a Community PWS because it serves a population equal to or greater than 25 of the same persons for more than 60 days of the year (Montana DEQ). The source of water for this PWS is groundwater. Six Utility Solutions Zoot North Star PWS wells supply water to approximately 900 individuals through approximately 150 service connections. See Table 1 for a summary of the PWS wells. Appendix A contains copies of the well logs. In addition to the six wells, the PWS consists of two common headers, three treatment plants for disinfection, two steel above ground storage tanks, two pumping facilities, and 3 pressure control facilities.

Groundwater quality in the alluvial aquifer that supplies water to the Utility Solutions Zoot Northstar PWS is generally very good. Monitoring data for the PWS shows that the drinking water meets all the requirements as established by the federal Safe Drinking Water Act. More information can be found by accessing the PWS Annual Water Quality Report through http://www.utilsolutionsmt.com/reports.html.

Sanitary Wastes are treated at centralized wastewater systems. The treated wastewater is discharged directly to groundwater either by rapid infiltration or infiltration/ percolation. This provides recharge to area groundwater. Utility Solutions has five water and sewer service areas. Service Area 1 is the Elk Grove Subdivision and adjacent unconnected properties. The Utility Solutions Elk Grove Water System will be discussed in a separate source water delineation and assessment report. Service Areas 2 through5 consist of properties served through the Four Corners County Water & Sewer District and unconnected properties that have the potential to be served by the Utility Solutions Northstar-Zoot Water System.

Two source water protection areas are delineated for the Utility Solutions Zoot North Star PWS wells. The first is a 100-foot radius control zone surrounding each of the PWS wells. The second protection area is the inventory region. The inventory region is based on hydrogeologic mapping and information in the original Morrison-Maierle, Inc. reports. Copies of the original reports for this PWS are available at DEQ Public Water Section files in Helena.

The Utility Solutions Zoot North Star PWS Wells are completed in unconfined Quaternary-aged gravel and Tertiary-aged sediments that were deposited by the Gallatin River. The aquifer has a high sensitivity to potential contaminant sources overlying the aquifer. Potential contaminant sources were identified within the control zones and inventory region of the wells. Susceptibility rankings for each potential contaminant source were identified based on their hazard ranking and the presence or lack of barriers. Management recommendations are also presented.

Table of Contents

Chapter 1: Background

Introduction

This delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). Carolyn DeMartino, a Water Quality Specialist with the Montana Department of Environmental Quality (DEQ) prepared the final report. Information on land use and potential contaminant sources comes from a variety of sources including preliminary land cover data (including sanitary surveys), and other sources of public information. A web-based GIS application, called the Source Water Protection Program Query System, was also used to generate maps to support the report text. This application is available at the following internet address: http://nris.state.mt.gov/wis/swap/swapquery.asp . The application provides access to data from the U.S.EPA, DEQ, Montana Bureau of Mines and Geology (MBMG), and other sources.

Purpose

The purpose of this delineation and assessment report is to assess the threat of potential contaminant sources to the Utility Solutions Zoot North Star Public Water Supply (PWS) using information obtained from published reports and the PWS operator. Delineation is a process whereby areas that contribute water to aquifers or surface waters used as drinking water sources are identified on a map. Specific source water protection management areas are delineated based on the hydrogeologic setting and type of system, in accordance with the requirements of the Montana SWAP (DEQ, 1999). Assessment involves identifying the location of potential contaminant sources within the source water protection areas that may impact water quality under "worst-case" conditions. The potential for contamination to the drinking water source is evaluated based on the amount and toxicity of the potential contaminants and barriers that may be present to mitigate the effects in case of a spill or accident.

PWS Information

The Utility Solutions Zoot North Star PWS is located about 7 miles west of Bozeman near the Four Corners area where Highways 191 and 84 intersect (Figure 1). The source of water for the PWS is groundwater. The system consists of 6 wells (see Table 1), two common headers, three treatment plants for chlorine disinfection, two above – ground storage tanks, two pumping facilities, and three pressure control facilities operated through a central SCADA system. Distribution of water, through C900 PVC pipe, is to a mixed population of residential and commercial users totaling an average population of about 900 customers through approximately 150 service connections. Based on the number of non-transient individuals served; the Utility Solutions Zoot North Star PWS is classified as a Community PWS.

Sanitary Wastes are treated by centralized wastewater systems. The treated wastewater is discharged directly to groundwater either by rapid infiltration or infiltration/ percolation. This provides recharge to area groundwater. Utility Solutions has five water and sewer service areas. Service Area 1 is the Elk Grove Subdivision and adjacent unconnected properties. The Utility

Figure 1. Utility Solutions Zoot North Star PWS Vicinity

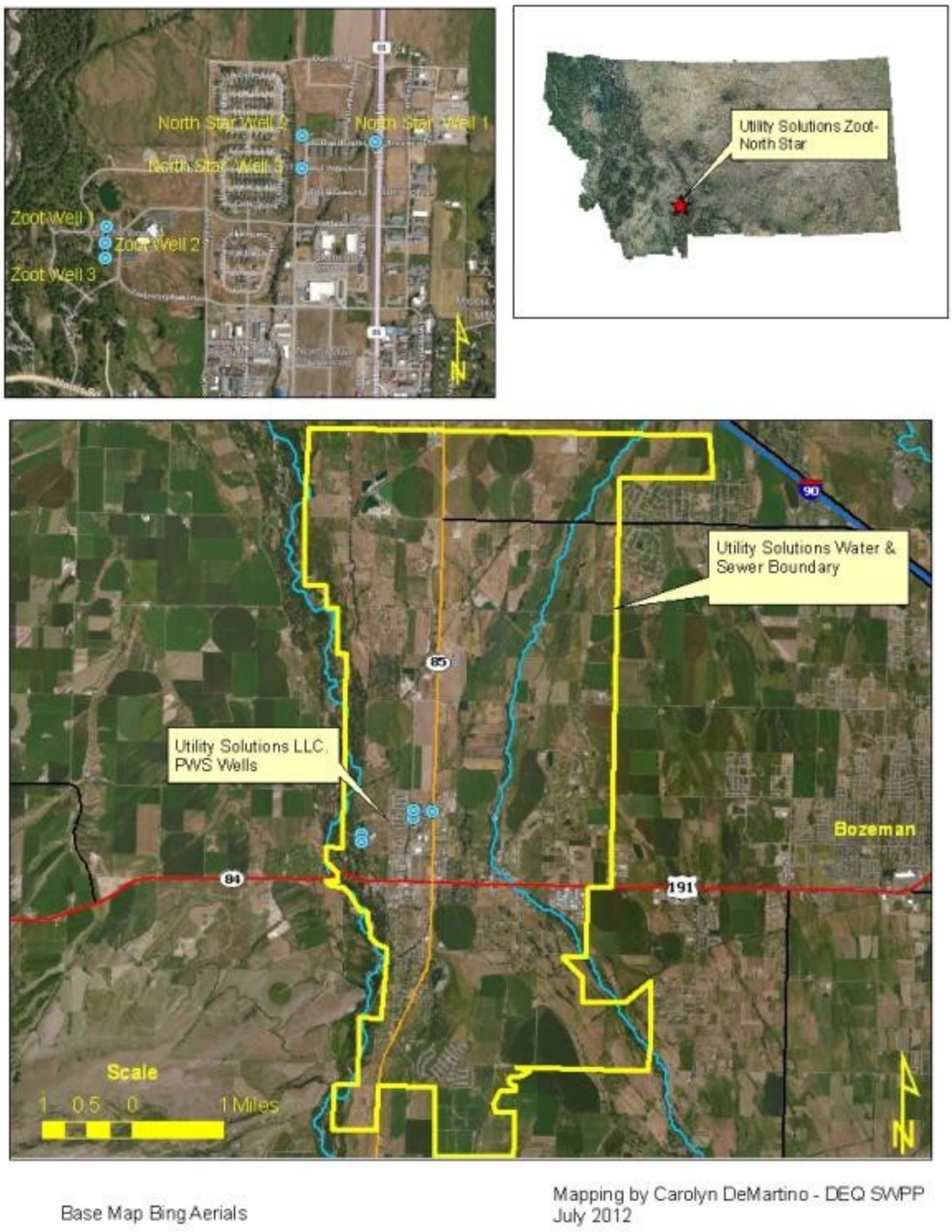


Table 1. Well Information Summary

Well Name	Zoot Well 1	Zoot Well 2	Zoot Well 3	North Star Well 1	North Star Well 2	North Star Well 3
PWS Source Code	WL002	WL003	WL004	WL005	WL006	WL007
Well Location (T, R, Sec)	T. 2S. R.4E. Sec. 11 SE¼NE¼NW¼SW¼	T. 2S. R.4E. Sec. 11 NE¼NE¼NW¼SW¼	T. 2S. R.4E. Sec. 11 NW¼SW¼	T. 2S. R.4E. Sec. 11 SE¼NE¼NE¼	T. 2S. R.4E. Sec. 11 SE¼NE¼	T. 2S. R.4E. Sec. 11 SW¼NE¼NE¼
Longitude	-111.2008	-111.202	-111.202	-111.1865	-111.1896	-111.1904
Latitude	45.6768	45.678	45.6773	45.6827	45.6759	45.6812
GWIC ID No.	193117	193116	237945	223292	232362	237307
Water Right No.	---	---	---	---	---	---
Date Well Completed	12/12/2001	12/19/2001	4/11/2007	1/26/2006	10/18/2006	2/5/2007
Well Depth (feet)	60	78.5	75	77.5	96	76
Perforated Interval (feet)	36 - 55	34 – 72.5	35-48,52-59, 59-62	52.5 - 68	55 - 80	48.5 – 68.5
Grout Seal	0 – 30	0 - 25	0 -25	0 -27	0 - 26	0 - 27
Static Water Level	8.5	8	8	20.38	20.2	22.3
Pumping Water Level	28	28	----	30.58	52.5	22.3
Drawdown	19.5	20	----	10.2	32.3	55.3
Test Pumping Rate (GPM)	425	425	----	560	1005	1100
Specific Capacity	21.8	21.25	----	55	31.11	20
Geologic Formation	Alluvium	Alluvium	Alluvium/ Tertiary Sediments	Alluvium	Alluvium	Alluvium

Note: Information obtained from the MBMG GWIC well logs. Some latitudes and longitudes have been corrected and may differ from what is on the well log.

Solutions Elk Grove Water System (MT0004248) is described in a separate SWDAR. Service Areas 2 through 5 consists of properties served through the Four Corners County Water & Sewer District and unconnected properties that have the potential to be served by the Utility Solutions Northstar-Zoot Water System.

Water Treatment

Water for this PWS is treated in three treatment plants. Table 2 summarizes this information.

Treatment Plant Name	Treatment Plant PWSID No.	Treatment Type	Application Method	Contact Time Area
Zoot	TP001	Calcium hypoclorite	Accu-tab pellet chlorinator	Buried contact chamber
North Star	TP002	Calcium hypoclorite	Accu-tab pellet chlorinator	750,000 gallon storage tank
Middle Creek	TP003	Calcium hypoclorite	Accu-tab pellet chlorinator	500,000 gallon storage tank

Water Quality

Groundwater quality in the alluvial aquifer that supplies water to this PWS is generally very good. Monitoring data for the Utility Solutions Zoot Northstar PWS shows that the drinking water meets all the requirements as established by the federal Safe Drinking Water Act. More information can be found by accessing the PWS Annual Water Quality Report through http://www.utilsolutionsmt.com/reports.html.

The Utility Solutions Zoot North Star PWS water system is classified as a Community PWS and is required to test for microbiological pathogens as well as a host of organic and inorganic compounds. This PWS has been in service since 2006. Since that time, the water supply has had only one water sample that tested positive for Coliform bacteria. Repeat samples did not detect any further Coliform bacteria. Total trihalomethane, a disinfection by-product, was detected March 25, 2008, in a water sample at a concentration of 103 parts per billion (ppb). The maximum concentration level (MCL) mandated by the Environmental Protection Agency (EPA) is 80 ppb. In the past five years, nitrate concentrations in the Utility Solutions Zoot North Star PWS groundwater samples have ranged from a low of 0.17 milligrams per liter (mg/L) in March 2006 to a high of 2.17 mg/L in March of 2010. While these concentrations are below the EPA's MCL of 10 mg/L; a continued increase over time may necessitate further investigation to determine the cause. (DEQ SDWIS, 2012).

Chapter 2: Delineation

The source water protection areas for the Utility Solutions Zoot North Star PWS are delineated in this chapter. The purpose of delineation is to map the sources of Helena's drinking water supply and to define areas within which to prioritize source water protection efforts.

Two types of management regions are delineated for the Utility Solutions Zoot North Star PWS wells. They are the control zone and the inventory region. The control zone is an area with a 100-foot radius around the wells (Figure 2). The management goal of the control zone, also known as the exclusion zone, is to protect against the direct introduction of contaminants into the wells or in the immediate area surrounding each well. The inventory region represents the zone of contribution to the wells (Figure 3). The management goal of the inventory region is to focus on pollution prevention activities at significant potential contaminant sources and to prevent contaminants from reaching a well before natural processes reduce their concentrations. The recharge region represents the entire portion of the aquifer that contributes water to the Utility Solutions Zoot North Star PWS wells. Management within the recharge region focuses on maintaining and improving the quality of groundwater that could reach the wells over longer timeframes or with increased usage.

Hydrogeological Conditions

The Gallatin Valley extends over roughly 520 square miles of southwestern Montana. The valley is bounded by the Horseshoe Hills to the north, the Gallatin and Madison ranges to the south, the Bridge range to the east, and the Western Three Forks Valley to the west (Kendy and Tresch, 1996). The valley is drained by the Gallatin River and its tributaries.

Quaternary flood-plain alluvium generally is the most permeable material in the basin, and the most reliable source of ground water. Transmissivity values range from 5,100 to 90,000 ft^2/day, and average 27,000 ft^2/day for alluvium of the Gallatin River. Quaternary and Tertiary alluvial-fan deposits have a wide range of hydraulic characteristics, indicating that they can provide sufficient supplies for many water uses including domestic, livestock, and irrigation. Until the 1960's, it was not known that Tertiary sediments beneath the Gallatin Valley could produce large enough yields for irrigation. East of the Madison Plateau, wells completed in these sediments typically have low production capabilities. Wells drilled deep into the Madison Plateau tap a permeable zone capable of yielding sufficient amounts of water. The bedrock has a low permeability and therefore does not transmit ground water readily for irrigation purposes. Basin-fill aquifers are unconfined throughout the Gallatin Valley. Bedrock is not an important aquifer in the basin. Regional groundwater flow direction in the valley is north-northwest.

The valley is an east-tilted downdropped fault block (a graben). Precambrian rocks probably floor the valley, but the majority of the basin is filled with Tertiary sedimentary rocks, over which Quaternary sand and gravel (alluvium) was deposited. Near Bozeman Hot Springs, the alluvial cover is estimated to be approximately 70 feet thick (Kendy and Tresch, 1996). The mountains surrounding the basin are composed of metamorphic, sedimentary and igneous

Figure 2. Utility Solutions Zoot North Star PWS Well Control Zones (100-foot)

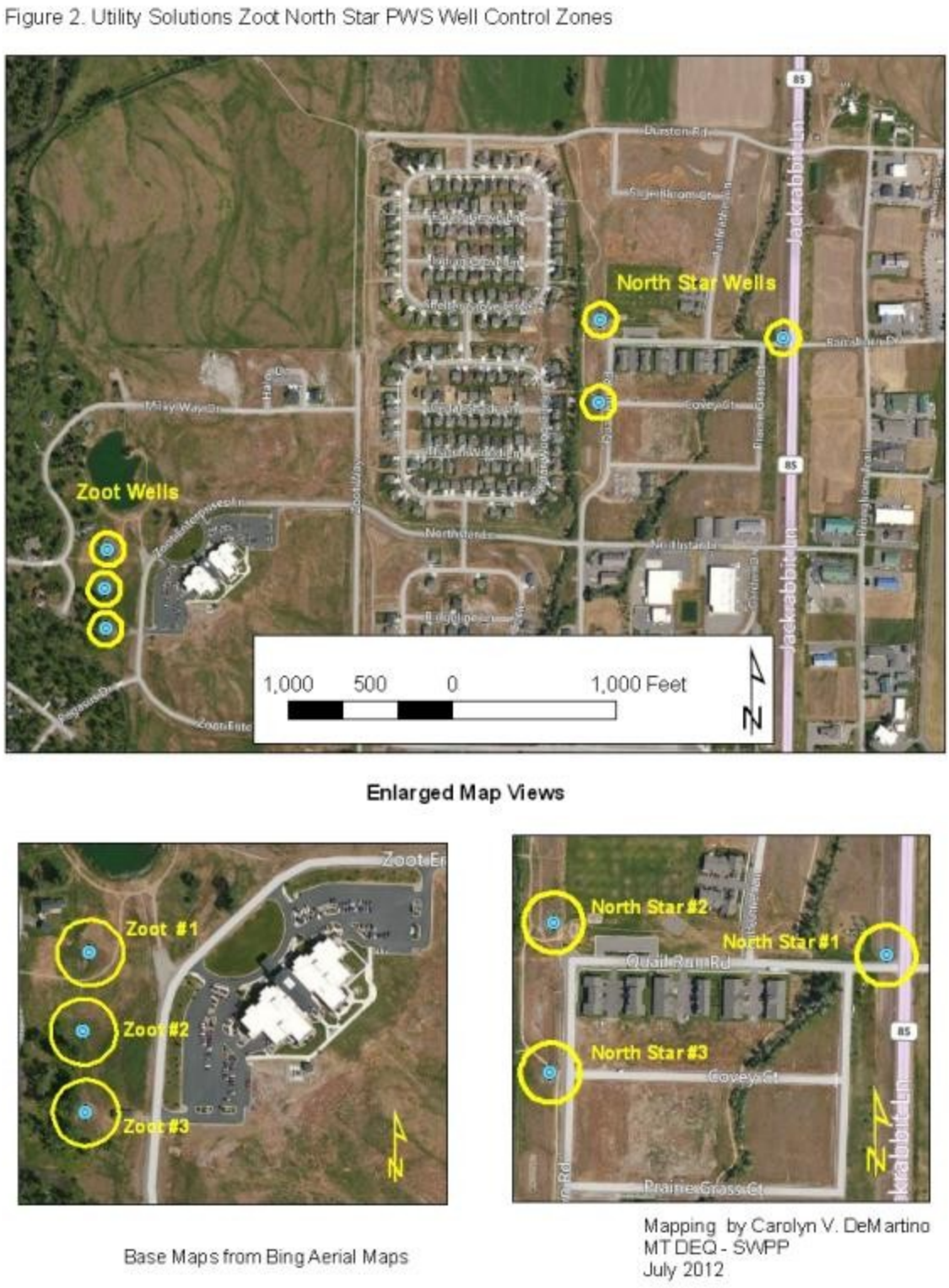
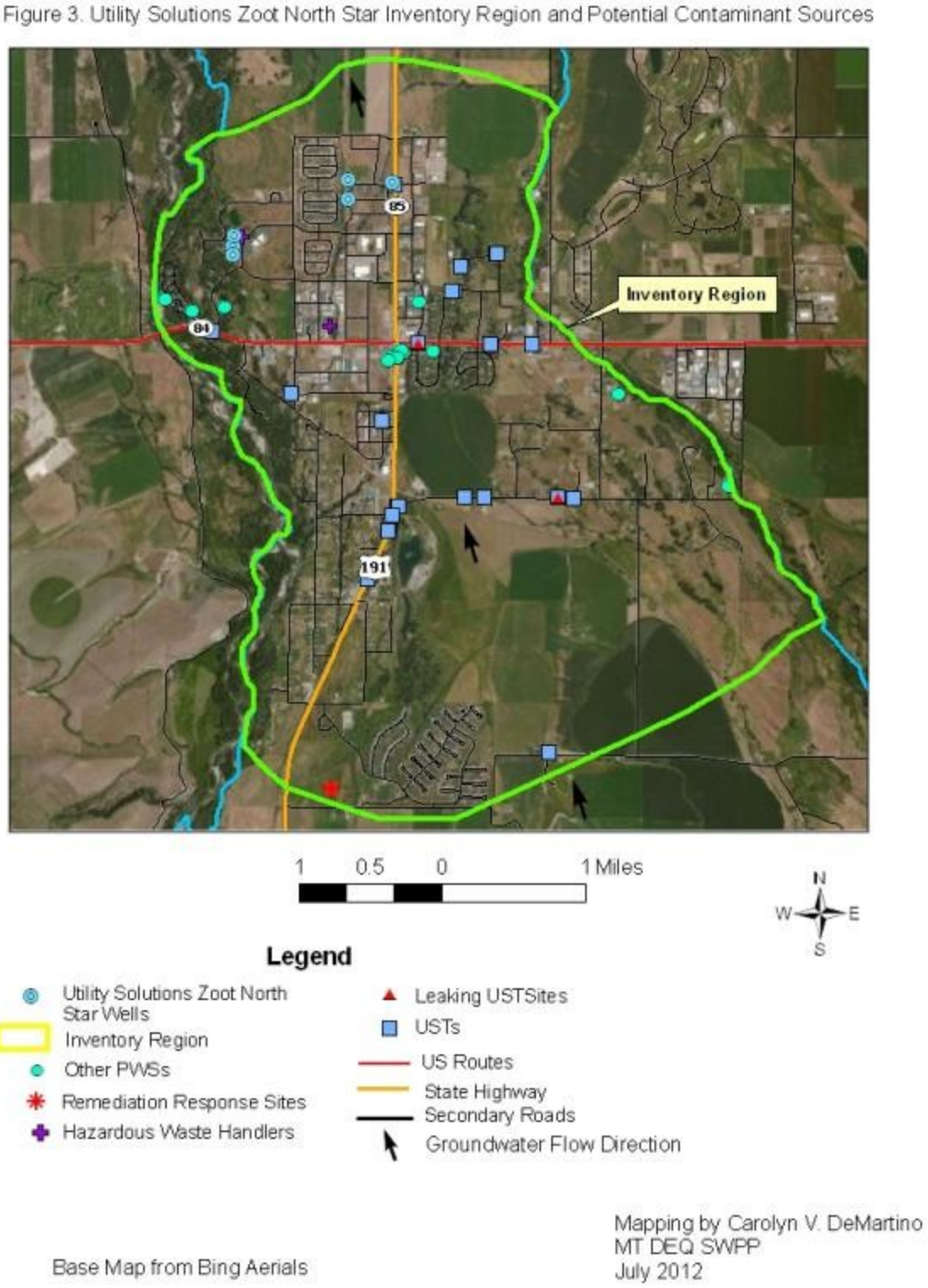


Figure 3. Utility Solutions Zoot North Star Inventory Region and Potential Contaminant Sources



bedrock. The bedrock is generally less permeable than the unconsolidated basin sediments, although fractures or carbonate dissolution features create significant local flow conduits.

The Utility Solutions Zoot Northstar wells are completed in unconfined alluvium and tertiary sand and gravel. According to the Source Water Protection Program (DEQ, 1999) Table 1; the source of water to the wells is considered to have a **moderate to high sensitivity** to potential contamination since the source aquifers are composed of unconsolidated silt, sand, and gravel.

Table 1. Source Sensitivity Criteria (DEQ, 1999)

Source Water Sensitivity
High Source Water Sensitivity
Surface water and GWUDISW
Unconsolidated Alluvium (unconfined)
Fluvial-Glacial Gravel
Terrace and Pediment Gravel
Shallow Fractured or Carbonate Bedrock
Moderate Source Water Sensitivity
Semi-consolidated Valley Fill sediments
Unconsolidated Alluvium (semi-confined)
Low Source Water Sensitivity
Consolidated Sandstone Bedrock
Deep Fractured or Carbonate Bedrock

Conceptual Model and Assumptions

The Utility Solutions Zoot North Star PWS is located south of Belgrade in the Four Corners area of the Gallatin Valley. The Belgrade area is a 67 square mile alluvial plain consisting of coarse gravel with lesser amounts of sand, silt, and clay. The alluvium is underlain by Tertiary-aged clays, silts, gravels and sands. Underlying the Tertiary sediments is Precambrian-aged, metamorphic bedrock.

Recharge to the Gallatin Valley is from irrigation ditch leakage, seepage from the West Gallatin River, and groundwater flow from the upgradient areas in the Valley. Groundwater flow direction is generally to the north.

Methods and Criteria

DEQ's Source Water Protection Program specifies the methods and criteria used to delineate subregions of the source water protection area for Utility Solutions Zoot North Star.

A 100-foot control zone (Figure 2) was delineated around each of the PWS wells. A single inventory region, based on hydrogeologic mapping, was delineated around the wells (Figure 3). The Gallatin River was delineated as the western inventory region boundary and Hyalite Creek was delineated as the eastern inventory region boundary. The northern (down gradient) boundary of the inventory region was based on an arbitrary distance of one-half mile down-gradient of the

wells. The southern boundary of the inventory region is based on a one-mile inventory radius.

Delineation Limitations

Delineation of the source water protection areas for the Utility Solutions Zoot North Star PWS wells is based on hydrogeologic mapping, data located in the most recent sanitary survey, previously published reports; and the sub-surface materials described in the well logs. The total amount of recharge to the aquifer from irrigation canal leakage, seepage from area streams, and groundwater flow from the upgradient areas in the Gallatin Valley is unknown. Recharge to the groundwater system from streams and irrigation canals can vary seasonally.

Chapter 3: Inventory

The Montana Source Water Protection Program (Montana DEQ, 1999) requires that land uses and all potential contaminant sources within PWS control zones and inventory regions be identified. These inventories assess the susceptibility of the Utility Solutions Zoot North Star PWS wells to contamination; and help to identify priorities for source water protection planning.

Analysis of the area surrounding Utility Solutions Zoot North Star PWS wells reveals that the predominant land uses are low to moderate intensity development and cultivated cropland. Only significant potential contaminant sources that pose the most threat to human health were selected for detailed inventory. The most significant potential contaminant sources in the Utility Solutions Zoot North Star PWS inventory region include: USTs, leaking USTs, centralized public sewer systems, individual septic systems, cultivated cropland, highways 84, 85, and 191, and two hazardous waste generators (Figure 4). Figure 5 depicts the five Utility Solutions Service Areas.

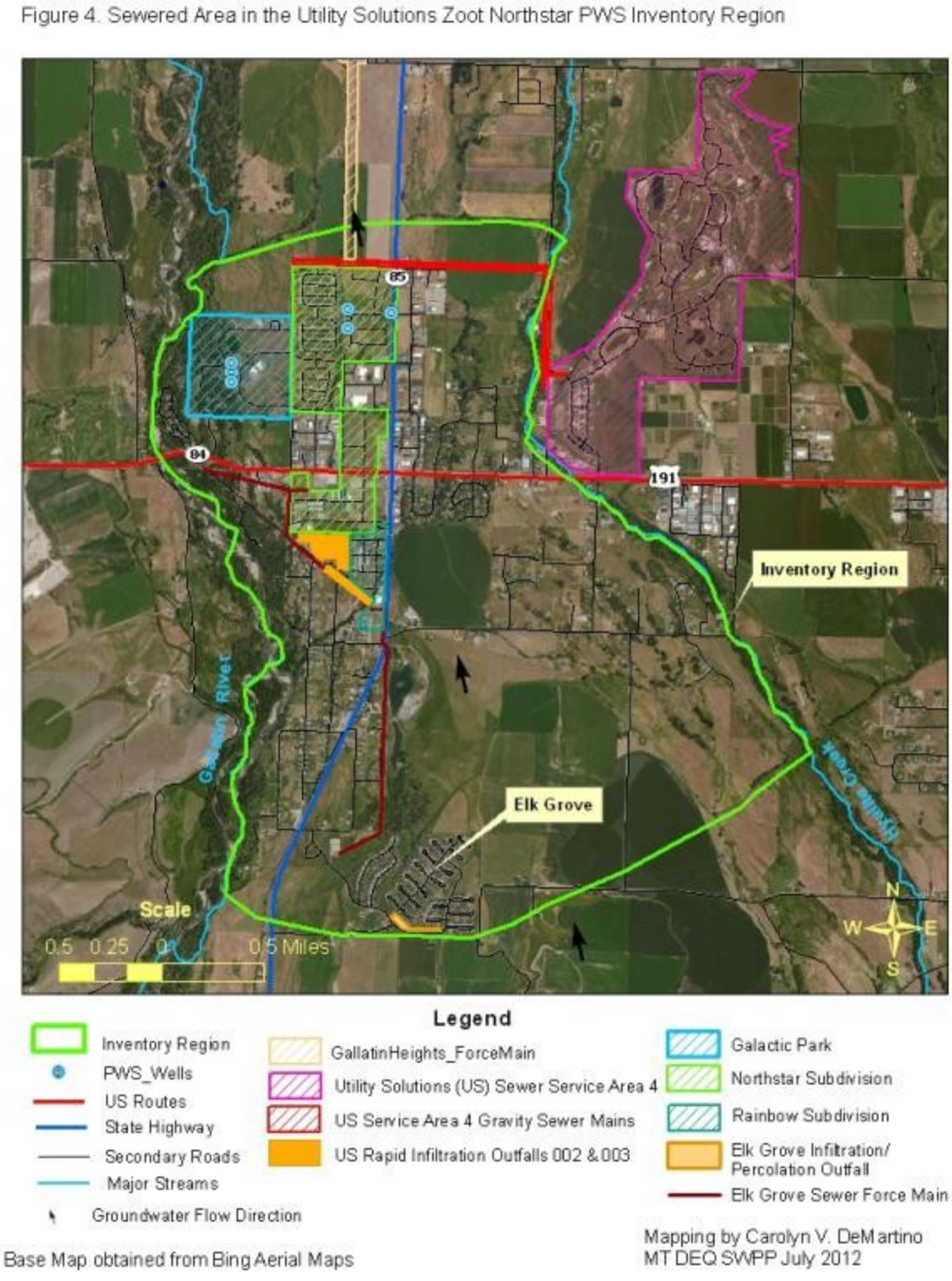
Inventory Method

Available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. Potential contaminant sources are designated as significant if they fall into one of the following categories:

- Large quantity hazardous waste generators
- Landfills
- Hazardous waste contaminated sites
- Underground storage tanks
- Major roads or rail transportation route
- Cultivated cropland
- Animal feeding operations
- Wastewater lagoons or spray irrigation
- Septic systems
- Sewered residential areas
- Storm sewer outflows
- Floor drains, sumps, or dry wells
- Abandoned or active mines

Figure 4. Significant Potential Contaminant Sources in the Utility Solutions Zoot Northstar PWS Inventory Region

Figure 5. Sewered Areas in the Utility Solutions Zoot Northstar PWS Inventory Region



Inventory Results/ Control Zone

No significant potential contaminant sources were identified in the control zones of the PWS wells.

Inventory Results/ Inventory Region

Table 2 identifies the PCSs and their associated contaminants in the Utility Solutions Zoot North Star PWS inventory region. The table also contains a description of the hazards posed to the PWS wells by the contaminants.

Table 2. Inventory Results/ Inventory Region

Significant Potential Contaminant Sources	Contaminants	Hazard
Sewer Mains	Nitrate and pathogens	Untreated effluent leaching into area groundwater that is used for drinking water
Individual Septic Systems	Nitrates and pathogens	Untreated effluent leaching into area groundwater that is used for drinking water
Garden Center Sewer Mains	Nitrate and pathogens	Ruptured mains could allow untreated effluent into area groundwater
USTs	VOCs	Migration of VOCs into area groundwater if a spill were to occur
Leaking USTs	VOCs	Migration of VOCs into area groundwater due to tank overfill or tank failure
Cultivated Cropland	Nitrates, pathogens, SOCs	Over application or improper handling of agricultural chemicals and excessive irrigation could allow contaminants to migrate into area groundwater
State Highways	VOCs, SOCs	Accidental spills and releases of hazardous chemicals due to traffic accidents could migrate into groundwater
Hazardous Waste Generators	VOCs, hazardous chemicals	Improper storage and handling could allow hazardous chemicals to migrate into area groundwater used for drinking water

Inventory Update

The certified operator should 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 the source water delineation and assessment report remains current.

Inventory Limitations

The potential contaminant inventory was conducted using various databases to acquire readily available information. Consequently, unregulated activities or unreported contaminant releases may have been unintentionally overlooked. The use of multiple sources of information, however, should ensure that the major threats to the Utility Solution Zoot Northstar PWS wells have been identified.

Chapter 4: 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 the Utility Solutions Zoot Northstar PWS.

The goal of source water management is to protect the source water by 1) controlling activities in the control zone and 2) managing significant potential contaminant sources within the inventory region. Management priorities are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Management recommendations to reduce susceptibility are also described in this chapter.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers (Table 3). Barriers can be anything that decreases the likelihood that contaminated water will leach into the aquifer that supplies water to the Helena wells or flow into the Helena surface intakes.

Table 3. Susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

	High Hazard	Moderate Hazard	Low Hazard
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

Table 4 on the following page describes the criteria that determine the hazard presented to the PWS wells by potential sources of contaminants located in the Utility Solution Zoot Northstar PWS inventory region. Hazard ratings for septic systems, municipal sewer mains, and cropped agricultural land are based on the density of these potential contaminant sources within the inventory region.

Table 4. Hazard of potential contaminant sources associated with proximity to a PWS well, intake, or density within a PWS inventory or spill response region.

Type of Contaminant Source		High Hazard	Moderate Hazard	Low Hazard
SURFACE WATER	Point Sources of Nitrate or Microbes	Potential for direct discharge to source water	Potential for discharge to groundwater hydraulically connected to source water	Potential contaminant sources in the watershed region
	Point Sources of VOCs, SOCs, or Metals	Potential for direct discharge of large quantities from roads, rails, or pipelines	Potential for direct discharge of small quantities to source water	Potential for discharge to groundwater hydraulically connected to source water
WELLS	**Point Sources of All Contaminants** (Unconfined)	Within 1-year TOT	1 to 3 years TOT	Over 3 years TOT
	Point Sources of All Contaminants (Confined)	PWS well is not sealed through the confining layer	Well(s) in the inventory region other than the PWS well are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
ALL	Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
	Municipal Sanitary Sewer (% land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
	Cropped Agricultural Land (% land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Hazard ratings for each significant potential contaminant source and their associated contaminants in the Utility Solutions Zoot Northstar control zone and inventory region are presented in Table 5 on the following page.

Table 5. Susceptibility Assessment for the Utility Solutions Zoot North Star PWS Inventory Region

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Individual Septic Systems	Nitrate and pathogens	Untreated effluent leaching into area groundwater that is used for drinking water	Moderate	None	**High**	Encourage neighboring property owners to conduct periodic operation and maintenance of their septic systems
Cultivated Cropland	Pathogens and Nitrate, Pesticides and Herbicides (SOCs)	Non-point source contamination, spills or miss-application, w/ contaminants leaching into ground water	Moderate 20-50% of Inventory Region	None	**High**	Encourage area producers to use Agricultural Best Management Practices to prevent contaminants from entering groundwater.
Underground Fuel Storage Tank (UST) Sites	SOCs and VOCs associated with petroleum hydrocarbons	Leaks, spills of petroleum hydrocarbon compounds migrating into area groundwater	High	Spill response plans Secondary containment Regulated by DEQ, and must operate under permits. All spills have mandatory reporting and cleanup requirements.	**Moderate**	Check with the site managers to ensure active sites have spill response procedures in-place and have adequate resources to initiate cleanup if surface spills occur. Promote good housekeeping for these fuel handling and storage sites.
Small Quantity Hazardous Waste Generator	SOCs and VOCs	Leaks, spills of hazardous chemicals migrating to area groundwater	High	Spill response plans Regulated by DEQ/ Permits. All spills have mandatory reporting and cleanup requirements.	**Moderate**	Check with the site managers to ensure active sites have spill response procedures in-place and have adequate resources to initiate cleanup if surface spills occur. Promote good housekeeping for these fuel handling and storage sites.

Table 5. Susceptibility Assessment for the Utility Solutions Zoot North Star PWS Inventory Region

Leaking USTs	SOCs and VOCs associated with petroleum hydrocarbons	Documented spills of petroleum hydrocarbon compounds migrating to area groundwater	Moderate	Spill response plans Secondary containment Regulated by DEQ All spills have mandatory reporting and cleanup requirements	**Low**	Check with the site managers to ensure that spills have been remediated to DEQ standards
Centralized Wastewater Treatment Facilities/ Sewer Mains	Nitrate and pathogens	Leaks occurring from cracked water mains and untreated wastewater reaching groundwater	Moderate	Cross-gradient from wells Newer construction Regulated by DEQ	**Low**	Periodically inspect all pipes and replace as needed.

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Safe Drinking Water Act (SDWA) Amendments of 1996 [U.S. Code Title 42, Chapter 6A, Subchapter XII, Part E, §300J-13-(a) Source Water Assessment].

United States Geological Survey, 1996, Water-Resources Investigations Report 96-4025, Geographic, Geologic, and Hydrogeologic Summaries of Intermountain Basins of the Northern Rocky Mountains, Montana. Kendy, E. and Tresch R.E.

Appendix A. Well Logs

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MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

View scanned well log (3/31/2007 2:05:52 PM)

Site Name: ZOOT ZOOT SOUTH WELL 1
GWIC Id: 193117
DNRC Water Right:

Section 1: Well Owner

Owner Name		
ZOOT		
Mailing Address		
1115 N 7TH		
City	**State**	**Zip Code**
BOZEMAN	MT	59715

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	SE¼ NE¼ NW¼ SW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.676762	111.200762	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, December 12, 2001

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	30	12
30	55	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	36	8	0.322		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
36	55	8			SS SCREEN

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	BENTONITE	

Section 7: Well Test Data

Total Depth: 60
Static Water Level: 8.5
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
425 gpm pump rate with _ feet of drawdown after 24 hours of pumping.
Time of recovery 0.01 hours.
Recovery water level 9 feet.
Pumping water level 28 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	3	TOPSOIL
3	45	GRAVEL
45	47	CLAY GRAVEL MIX
47	55	GRAVEL
55	60	CLAY BOUND GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAGGERTY DRILLING
License No: WWC-353
Date Completed: 12/12/2001

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

View scanned well log (3/31/2007 2:05:36 PM)

Site Name: ZOOT ZOOT WELL2
GWIC Id: 193116
DNRC Water Right:

Section 1: Well Owner

Owner Name
ZOOT

Mailing Address
1115 N. 7TH

City	State	Zip Code
BOZEMAN	MT	59715

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	NE¼ NE¼ NW¼ SW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.677655	111.200762	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, December 19, 2001

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	12
25	78.5	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	35	8	0.322		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
34	72.5	8			SS SCREEN

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	BENTONITE	
33	33	K PACKER	

Section 7: Well Test Data

Total Depth: 78.5
Static Water Level: 8
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
425 gpm pump rate with _ feet of drawdown after 24 hours of pumping.
Time of recovery 0.01 hours.
Recovery water level 9 feet.
Pumping water level 28 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

PWS 2 STARTED OUT 4

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	4	TOPSOIL
4	59	GRAVEL
59	78.5	CLAY GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAGGERTY DRILLING
License No: WWC-353
Date Completed: 12/19/2001

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

View scanned well log (8/30/2007 11:06:17 AM)

Site Name: ZOOT ZOOT WELL 3
GWIC Id: 237945

Section 1: Well Owner

Owner Name
ZOOT

Mailing Address
1115 N. 7TH

City	State	Zip Code
BOZEMAN	MT	59715

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	NW¼ SW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.676316	111.202603	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, April 11, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	12
25	75	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	36	8	0.375		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
35	48	8		120	SCREEN-CONTINUOUS-STAINLESS
52	59	8		70	SCREEN-CONTINUOUS-STAINLESS
59	62	8		100	SCREEN-CONTINUOUS-STAINLESS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	35	K	
0	25	BENTONITE	

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 8
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	2	TOP SOIL
2	46	GRAVEL
46	52	CLAY / GRAVEL MIX
52	62	GRAVEL
62	75	CLAY / GRAVEL MIX

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: KEVIN HAGGERTY
Company: KEVIN HAGGERTY DRILLING INC
License No: WWC-353
Date Completed: 4/11/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

Site Name: UTILITY SOLUTIONS, .
GWIC Id: 223292 NORTH STAR WELL 1

Section 1: Well Owner

Owner Name
UTILITY SOLUTIONS
Mailing Address
P.O. BOX 10098

City	State	Zip Code
BOZEMAN	MT	59719

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	SE¼ NE¼ NE¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.682565	111.186645	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot
NORTH STAR		

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Thursday, January 26, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	27	12
27	77.5	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-3	54	8	0.322		WELDED	A53B STEEL
68	77.5	6	0.280		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
52.5	68	8		.100	SCREEN-CONTINUOUS-STAINLESS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	27	BENTONITE	

Section 7: Well Test Data

Total Depth: 77.5
Static Water Level: 20.38
Water Temperature:

Pump Test *

Depth pump set for test 50 feet.
560 gpm pump rate with 10.2 feet of drawdown after 24 hours of pumping.
Time of recovery 24 hours.
Recovery water level 20.5 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

PWS #1-FOR MORE PUMP TEST INFORMATION PLEASE CONTACT MORRISON & MAIERLE INC. KHD INC. STARTED WELL ON MAY 18 2005

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	2	TOPSOIL
2	67.5	GRAVEL
67.5	77.5	TERTIARY CLAYS

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: KEVIN HAGGERTY DRILLING INC
License No: WWC-353
Date Completed: 1/26/2006

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

Site Name: UTILITY SOLUTIONS LLC.
GWIC Id: 232362 **NORTH STAR WELL 2**

Section 1: Well Owner

Owner Name
UTILITY SOLUTIONS, LLC.

Mailing Address
P.O. BOX 10098

City	State	Zip Code
BOZEMAN	MT	59719

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	SE¼ NE¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.679887	111.187873	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
PUBLIC WATER SUPPLY (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, October 18, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	26	20
26	96	16

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	56	16	0.375		WELDED	A53B STEEL
80	96	14	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
55	60	14		.105	SCREEN-CONTINUOUS-STAINLESS
60	63	14		.160	SCREEN-CONTINUOUS-STAINLESS
63	68	14		.105	SCREEN-CONTINUOUS-STAINLESS
68	80	14		.050	SCREEN-CONTINUOUS-STAINLESS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	26	BENTONITE	

Section 7: Well Test Data

Total Depth: 96
Static Water Level: 20.2
Water Temperature:

Pump Test *

Depth pump set for test 85 feet.
1005 gpm pump rate with 32.3 feet of drawdown after 72 hours of pumping.
Time of recovery 72 hours.
Recovery water level 20 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
PSW #3 - P1

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	80	GRAVEL
80	96	CLAYBOUND GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: KEVIN HAGGERTY
Company: KEVIN HAGGERTY DRILLING INC
License No: WWC-353
Date Completed: 10/18/2006

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map

Site Name: UTILITY SOLUTIONS LLC.
GWIC Id: 237307 **NORTH STAR WELL 3**

Section 1: Well Owner

Owner Name

UTILITY SOLUTIONS, LLC.

Mailing Address

P.O. BOX 10098

City	State	Zip Code
BOZEMAN	MT	59719

Section 2: Location

Township	Range	Section	Quarter Sections
02S	04E	11	SW¼ NE¼ NE¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.682116	111.190168	TRS-TWN	NAD27

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Monday, February 05, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	27	20
27	76	16

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	51	16	0.375		WELDED	A53B STEEL
68.5	76	14	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
48.5	53.5	14		.000	SCREEN-CONTINUOUS-STAINLESS
53.5	57.5	14		.100	SCREEN-CONTINUOUS-STAINLESS
57.5	68.5	14		.200	SCREEN-CONTINUOUS-STAINLESS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	27	BENTONITE	

Section 7: Well Test Data

Total Depth: 76
Static Water Level: 22.3
Water Temperature:

Pump Test *

Depth pump set for test 60 feet.
1100 gpm pump rate with 33 feet of drawdown after 69 hours of pumping.
Time of recovery 72 hours.
Recovery water level 22.8 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

P4 - PSW #7

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	76	GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: KEVIN HAGGERTY
Company: KEVIN HAGGERTY DRILLING INC
License No: WWC-353
Date Completed: 2/5/2007