Springvale Subdivision
Public Water System

PWSID# MT0001823

Source Water Delineation and Assessment Report

Report Date: April 3, 2006

PWS Contact:

John Plenke
3240 Rosebush Lane
Belgrade, Montana 59714

Phone: (406) 388-0168

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EXECUTIVE SUMMARY

The Springvale Subdivision is located in Gallatin County, approximately 3 miles east of Belgrade. Drinking water for the Springvale Subdivision Public Water System (PWS) is supplied by two wells located in the SE¼SW¼NW¼SW¼ (CBCD) of Section 3, Township 1 South, Range 5 East. This Source Water Delineation and Assessment Report (SWDAR) was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is conducting these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Inventory Region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

Based on the Springvale Subdivision PWS well logs, the wells are completed in alluvial sediments of the East Gallatin River. In accordance with the Montana Source Water Protection Program criteria (1999), the alluvial aquifer is considered to have a high sensitivity to potential contaminant sources because it is composed of unconfined and unconsolidated alluvium. Sensitivity is defined as the relative ease that contaminants can migrate to source water through natural materials.

Recharge to the alluvial aquifer is predominantly from the direct infiltration of precipitation into the aquifer, leakage from area irrigation canals,

As part of this assessment, three source water protection management areas were identified for the Springvale Subdivision Public Water System (PWS). They are: the control zone, the inventory region, and the recharge region. Potential sources of contamination were identified within each of these three protection areas and the results follow:

- The control zone is delineated as a 100-foot radius around the well and all sources of significant potential contaminants should be excluded in this region. No potential contaminant sources were identified in the control zone.

- The inventory region was delineated based on a one mile radius around the wellheads. The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. Significant potential contaminant sources identified within the inventory region include: On-site septic systems, other area septic systems, cultivated cropland, and an underground fuel storage tank on a private ranch.

- The goal of management in the recharge region is to maintain and improve water

quality over long periods of time or increased usage. Potential contaminant sources identified within the recharge region include: Montana Rail Link Railroad, I-90, U.S. 191, and the City of Bozeman with all its residences, services, and industries.

The Springvale Subdivision PWS a high susceptibility to the on-site septic systems and a moderate susceptibility to other area septic systems and cultivated cropland. Low risk potential sources and potential sources located outside the Inventory Region, but within the Recharge Region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for the Springvale Subdivision. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this report will help increase public awareness about the relationship between land use activities and drinking water quality.

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was prepared for the Springvale Subdivision Public Water Supply (PWS) located in Gallatin County. It was completed by Carolyn DeMartino of the Source Water Protection Program at the Department of Environmental Quality (DEQ).

Purpose

The primary purpose of this source water delineation and assessment report is to provide information that helps the Springvale Subdivision protect its drinking water source. A major component of the Montana Source Water Protection Program is delineation and assessment. Delineation is the process of identifying areas that contribute water to aquifers or surface water bodies used as drinking water supplies. The delineated areas are referred to as source water protection areas. Assessment involves identifying and inventorying potential sources of contamination within the source water protection areas, and then determining the potential for contamination of drinking water by these sources. This report is intended to meet the technical requirements for the completion of a source water delineation and assessment report for the Springvale public water system (PWS), as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 104-182). The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination.

Limitations

This report was prepared to assess threats to Springvale Subdivision PWS, 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 the source of the Springvale Subdivision’s drinking water supply, and not to any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the vicinity of the Springvale Subdivision public water supply are identified. Potential sources of contamination are considered only in areas that contribute water to the source of the public water supply.

The term ‘contaminant’ is used in this report to refer to constituents for which maximum concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to potentially represent health threats.

CHAPTER 1
BACKGROUND

The Community

Springvale Subdivision is located in Gallatin County of southwestern Montana approximately three miles east of Belgrade, Montana (Figure 1). According to the Census Bureau, the population of Gallatin County in 2000 was 67,831. The Springvale Subdivision PWS provides water to 138 residents through 57 active connections. Springvale Subdivision residents utilize on-site individual septic systems to treat and dispose sanitary wastes.

Geographic Setting

Springvale Subdivision is located, approximately one-half mile east of the East Gallatin River, in Section 3, Township 1 South, Range 5 East (Figure 2). The East Gallatin River is a tributary of the Gallatin River which originates in Yellowstone National Park and flows northward about 80 miles through a bedrock canyon before entering the Gallatin Valley near Gallatin Gateway. The Springvale Subdivision is bounded by the Bridger Range to the northeast, the Gallatin Range to the south, and the western Three Forks Valley on the west (Kendy and Tresch, 1996). The elevation in the Springvale Subdivision vicinity is at approximately 4,465 feet above mean sea level.

Climate

The climate data for the Springvale Subdivision is based on the nearest weather station at the Belgrade Airport. The Belgrade area is typical of mid-elevation intermontane basins of the Northern Rocky Mountains east of the Continental Divide. Based on Western Regional Climatic Center data for the period of record; the annual average maximum temperature is 84.1° F in July and the annual average minimum temperature is 5.6° in January. Annual precipitation in the Belgrade area averages 14.08 inches. Monthly average precipitation ranges from 0.46 inches in February to 2.56 inches in May. Summer thunderstorms and winter snows provide a majority of the precipitation in the area. The annual average snowfall in the Belgrade area is 47.1 inches. A summary of the available climatic data for the Belgrade area is presented in Table 1.

Figure 1. Springvale Subdivision Vicinity Map

Figure 2. Springvale Subdivision PWS Well Locations

Table 1. BELGRADE AIRPORT, MONTANA (240622)

Period of Record Monthly Climate Summary
Period of Record: 1/ 2/1941 to 9/30/2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	29.4	35.3	42.6	54.7	64.4	72.8	84.1	82.8	70.6	58.5	41.5	32.2	55.8
Average Min. Temperature (F)	5.6	11.8	18.4	28.7	37.0	43.9	48.8	47.4	38.5	29.3	17.8	9.0	28.0
Average Total Precipitation (in.)	0.61	0.46	0.93	1.31	2.24	2.56	1.15	1.13	1.36	1.03	0.75	0.57	14.08
Average Total SnowFall (in.)	8.5	5.6	9.1	6.0	2.3	0.0	0.0	0.0	0.6	2.3	5.6	7.2	47.1
Average Snow Depth (in.)	4	3	2	0	0	0	0	0	0	0	1	2	1

Percent of possible observations for period of record.
Max. Temp.: 93% Min. Temp.: 93% Precipitation: 93.6% Snowfall: 80.8% Snow Depth: 82.2%
Check Station Metadata or Metadata graphics for more detail about data completeness.
Western Regional Climate Center, wrcc@dri.edu

Public Water Supply

The Springvale Subdivision PWS supplies drinking water to 138 year-round residents through 57 active service connections. The Springvale Subdivision is classified as a community public water supply because it serves 25 or more persons per day year-round. Water demand is approximately 13,800 gallons per day assuming 100 gallons per day per resident (EPA, 1991). According to the May 12, 2004 sanitary survey, both Well #1-South and Well #2 - North are located in the well house (T. Moore, May 14, 2004). The well house is located in an open area of the subdivision (Figure 3). Based on the well logs, both wells appear to be installed in stream deposited alluvium. Copies of the well logs are located in Appendix A.

Well #1 - South was drilled April 23, 1975, to a depth of 130 feet below ground surface (bgs). The well is constructed of 8-inch 23-pound steel casing. The casing is slotted with .07 slots from 112 to 127 feet bgs. The well was pump tested for 24 hours at 310 gallons per minute (gpm). The pump was replaced in 2001 due to transformer/ voltage problems. Well #1 is currently used as the backup well.

Well #2 – North was drilled March 10, 1975, to a depth of 127 feet bgs. The well is constructed of 6-inch, 17-pound steel casing. The drill hole is open from 119 to 127 feet. This well was pump tested for three hours at 60 gpm.

The water system is also comprised of 16 captive air tanks. Four were replaced in 2001. According to the 2004 sanitary survey all the tanks were in good condition. The tanks can be isolated from the system, generally in groups of four, for replacement. Pressure is maintained in a range of 60 to 70 pounds. A copy of the most recent sanitary survey is included in Appendix B.

Figure 3. Aerial View of the Springvale Subdivision Wells

Both wells are connected together (but isolatable), tied to the air tanks, with associated pressure regulator, gauge, relief valve, and exits through a water meter out to the distribution system. The distribution system was reported to be 4-inch PVC.

According to the May 2004, sanitary survey the well house was very well maintained and clean. All diagrams, procedures, and contacts are kept posted on the interior walls of the building.

General Description of the Source Water

This section provides an overview of the geology in the vicinity of the Springvale Subdivision. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers to potential contamination sources.

The following is primarily drawn from Kendy and Tresch (1996). The Springvale Subdivision is located in the Gallatin Basin. A series of steep normal faults along the fronts of the Bridger and Gallatin Ranges bound it on the east and there are no obvious faults bounding it on the north, south, or west. Precambrian bedrock forms most of the basin and Tertiary sediments of the Bozeman Group fill the entire basin. Where these sediments are not exposed, they are covered by Quaternary and/or Tertiary aged alluvium. In general, the Tertiary sediments are composed of finer-grained, tuffaceous siltstone and sandstone. The Springvale Subdivision pumps its water from two wells drilled into the overlying Quaternary alluvium (Figure 4). Quaternary deposits cover more than half of the basin. These deposits consist of a heterogeneous mixture of coarse and fine-grained sediments. Quaternary flood-plain alluvium underlies the Gallatin River and extends across the large plain between the Gallatin and East Gallatin rivers. Moderately sorted cobbles, pebbles, and gravel compose a majority of the alluvium, but sand, silt, and clay are also present in places. Estimates of the thickness of the alluvium range from 70 feet near Bozeman Hot Springs to more than 800 feet near Belgrade.

Water Quality

Every PWS is required to perform regular sampling of their water supply to detect any contamination. The analytical parameters include: coliform bacteria and other pathogenic organisms, nitrates, metals, petroleum hydrocarbons, and other organic chemicals. The monitoring schedule depends on factors such as the size and source water of a PWS, the number of supplies (e.g. wells), and the population served. Each PWS has a specific monitoring program tailored to their system that follows the general protocols defined by DEQ for operation of a PWS.

Figure 4. Geology of the Springvale Subdivision

Within the past five years Springvale Subdivision has had only one coliform bacteria detection on June 15, 2000. Subsequent monitoring results have not indicated any further coliform bacteria in the drinking water. Within the past five years, nitrate plus nitrite as nitrogen was detected in the drinking. The concentration ranged from a high of 3.03 milligrams per liter (mg/L) in August 2002 to a low of 1.96 mg/L in July 2005 (DEQ SDWIS Database). These concentrations are below the EPA mandated Maximum Contaminant Level (MCL) of 10 mg/L.

CHAPTER 2
DELINEATION

This report delineates three source water management areas. The goal of source water management is protecting 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 major land use activities or other significant activities in the recharge region pose minimal threat to the source water.

Hydrogeologic Setting

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 Bridger 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. The underlying bedrock has a low permeability and therefore does not transmit ground water readily for production purposes hence bedrock is not an important aquifer in the basin. Basin-fill aquifers are unconfined throughout the Gallatin Valley.

The valley is an east-tilted graben (a down dropped fault block). Precambrian rocks probably floor the valley, but the majority of the basin is filled with Tertiary sedimentary rocks, over which Quaternary 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 bedrock. The bedrock is generally less permeable than the unconsolidated basin sediments, although fractures or carbonate dissolution features create significant local flow conduits. Quaternary alluvium is the source of water for the Springvale Subdivision PWS.

According to the Source Water Protection Program criteria (DEQ, 1999) located in Table 2 the aquifer for these wells is considered to have high source water sensitivity to potential contamination, since the source aquifer materials are composed of unconsolidated alluvium.

Table 2. Source Water Sensitivity Criteria
High Source Water Sensitivity
Surface water and GWUDISW
Unconsolidated Alluvium (unconfined)
Fluvial-Glacial Gravel
Terrace and Pediment Gravels
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
Semi-consolidated Valley Fill Sediments (confined)

Conceptual Model and Assumptions

Springvale Subdivision's PWS wells are located in the Upper Missouri Sub-basin, which is located within Montana's Upper Missouri Watershed (Heath, 1984). Quaternary alluvium is the source of groundwater for the Springvale Subdivision wells. Recharge to the alluvial aquifer is most likely from direct precipitation, irrigation return flow, losses from area streams, and from some upward gradient flow from the bedrock.

Well Information

Well information for the Springvale Subdivision PWS Wells is summarized in Table 3.

Table 3. Springvale Subdivision Well Information

Information	Well #1 South	Well #2 North
PWS Source Code	WL002	WL003
Well Location (T, R, Sec)	T. 1 S., R. 5 E., Sec 3 CBCD (SE¼SW¼NW¼SW¼)	T. 1 S., R. 5 E., Sec 3 CBCD (SE¼SW¼NW¼SW¼)
Latitude/ Longitude	45.7769 / -111.0994	45.7769 / -111.0994
MBMG #	91342	91341
Water Right #	P005579-00	C005630-00
Well Completion Date	4/23/1975	3/10/1975
Total Depth (feet)	130	127
Perforated Interval (feet)	112 - 127	Open Hole
Static Water Level (feet)	19	19
Pumping Water Level (feet)	110	127
Drawdown (feet)	91	108

Table 3. Springvale Subdivision Well Information

Information	Well #1 South	Well #2 North
Test Pumping Rate (GPM)	310	60

Methods and Criteria

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). A 100-foot control zone, an inventory region based on three year time of travel and using the East Gallatin River as a hydrologic boundary, and a recharge region including the Gallatin River and its tributaries were delineated for the Springvale Subdivision wells.

Delineation Results

A 100-foot control zone was delineated around both of the Springvale Subdivision PWS wells (Figure 5). An inventory region was delineated based on a three-year time-of-travel (TOT) for groundwater to flow to the well and then modified using the East Gallatin River as a hydrogeologic boundary (Figure 6). The inventory region is broken into two areas the one year TOT area and the three year TOT area. Significant potential contaminant sources in the one year TOT area are the most critical. Significant potential contaminant sources will be discussed in greater detail in Chapter 3. See Appendix C for TOT equations. The input parameters used in the TOT calculations are summarized in Table 4. The recharge region for the well was delineated using hydrogeological mapping.

Table 4. Estimates of input parameters used to delineate the Springvale Subdivision PWS Well Inventory Region

Input Parameter	Range of Values/ Units	Well #1 North Values	Well #2 South Values
PWS Source Code	N/A	WL002	WL003
Transmissivity (ft^2/day)	$1x10^4 – 1x10^5$	27,000	27,000
Aquifer Thickness (feet)	100 – 150	111	108
Hydraulic Conductivity (ft/day)	$1 – 10^4$	210	216
Hydraulic Gradient	0.005 - 0.010	0.006	0.006
Flow Direction	N-NW		
Effective Porosity (%)	15 – 30	20	20
Pumping Rate (gpm)	100 – 200	100	100
1-Year TOT* (feet)	----	2314	2380
3-Year TOT* (feet)	----	6915	7113

***** Time-of-Travel

PWS Source Code - is the specific identification code for the Springvale Subdivision PWS Wells # 1 and #2. The code is obtained from the DEQ Public Water Supply Section

Figure 5. **Springvale Subdivision PWS Well 100-foot Control Zone**

Figure 6. **Springvale Subdivision PWS Well Inventory Region**

SDWIS database.

Transmissivity (T) - is the rate of groundwater flow through an aquifer cross-section of unit width over the entire saturated thickness of the aquifer under a unit hydraulic conductivity. This value was obtained from Kendy and Tresch.

Thickness - denotes the aquifer thickness, in feet, that was indicated on the Springvale Subdivision well logs.

Hydraulic Conductivity (K) - is the rate at which a porous material (e.g. sand and gravel) transmits water. The value was derived using aquifer thickness and average Transmissivity.

Hydraulic Gradient (i) - is the change in water level over distance. The value for the hydraulic gradient was obtained from Slagle, 1995.

Flow Direction - is the direction that groundwater is flowing. This information was obtained from previous studies.

Effective Porosity - as applied to aquifer materials, it is the ratio of the volume of water that the aquifer, which after being saturated, will yield by gravity to its own volume. The value was obtained from Driscoll, 1986.

The delineation for the Springvale Subdivision PWS recharge region is based on hydrogeologic mapping. Contaminant transport rates and concentrations will vary depending on the physical and chemical characteristics of the aquifer and the contaminants. The amount of recharge from precipitation, leakage from irrigation canals, and area stream loss is unknown and can vary seasonally.

Limiting Factors

Time-of-travel (TOT) distances represent the time required for groundwater to travel through a specified aquifer to the public water supply well. These distances do not represent the time required for contaminants to reach a public water supply well. Travel times for the migration of free-phase contaminants that are not dissolved in the groundwater vary tremendously from groundwater travel times. Free-phase contaminant migration rates are influenced by: the characteristics of the vadose (root) zone, contaminant density, the slope of the water table, the slope of the base of the aquifer, aquifer porosity, how similar subsurface materials are, and the extent and duration of contamination.

Travel times for dissolved contaminant migration also differ from ground-water travel times. Dissolved contaminants are affected by advection, or the component of solute movement attributed to transport by flowing groundwater (Freeze and Cherry, 1979). However, the migration of dissolved contaminant plumes is also affected by many additional factors, including the characteristics of the vadose zone, the extent and duration of the contamination event, the specific physical properties of the contaminant, and the rate at which groundwater is being pumped from the aquifer.

Inventory regions delineated using TOT calculations should be used as a planning tool to identify areas within which the potential for contaminants to reach a public water supply source is highest. Groundwater TOT calculations should not be used to estimate contaminant migration rates.

CHAPTER 3
INVENTORY

Inventory Method

Significant potential contaminant sources in the source water management areas were inventoried to assess the susceptibility of Springvale Subdivision's proposed well to contamination, and to provide a foundation for source water protection planning. The inventory for Springvale Subdivision focuses on facilities or features that generate, use, store, or transport potential contaminants, as well as certain land uses in the inventory and recharge regions. It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of drinking water sources is less likely when potential contaminants are properly used and managed.

The inventory focus is slightly different in each of the delineated management areas. The inventory for Springvale Subdivision focuses on all activities in the control zones for the well; certain types of facilities and land uses in the inventory region; potential sources of nitrates and pathogens in the surface water buffer; and general land uses and large facilities in the Recharge Region. Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases, described below. The process for completing the inventory included several steps, which are summarized as follows:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's (USGS) Geographic Information Retrieval and Analysis System <http://nris.state.mt.us/gis/datalist.html>. Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

Step 2: The US Environmental Protection Agency's (EPA) Envirofacts System <http://www.epa.gov/enviro/> was queried to identify EPA-regulated facilities located in the management areas. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: Montana DEQ databases were queried to identify any of the following in the management areas:

- Underground storage tanks (USTs)

http://www.deq.state.mt.us/UST/USTDownloads.asp>

- Hazardous waste contaminated sites, above ground storage tanks (ASTs), landfills, and abandoned and active mines, including gravel pits <http://nris.state.mt.us/gis/bundler/>

Any information on past releases and present compliance status was noted.

Step 4: Major road and rail transportation routes were identified throughout the inventory region: <http://nris.state.mt.us/gis/gisdatalib/gisDataList.aspx>.

Potential contaminant sources are designated to be significant if they fall into one or more of the following categories:

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

Inventory Results/ Control Zone

The control zone includes the pump house and an open area of land in the subdivision. No significant potential contaminant sources were identified in the control zone.

Inventory Results/ Inventory Region

Land use within the Springvale Subdivision inventory region consists primarily of agricultural land that has been taken out of production and subdivided into residential land. The Bridger Lake Meadows Subdivision and the Outlaw Country Subdivision are located upgradient of the Springvale Subdivision. Approximately 60% of the one year TOT inventory region contains moderate septic density due to the individual on-site septic systems that are located within the inventory region (Figure 7). Significant potential contaminant sources are summarized in Table 5 and identified on Figure 8.

Figure 7. Septic Density in the Springvale Subdivision PWS Inventory Region

Figure 8. Significant Potential Contaminant Sources in the Springvale Subdivision PWS Well Inventory Region

Table 5. Significant potential contaminant sources in the Springvale PWS Control Zone and Inventory Region			
Significant Potential Contaminant Sources	**Figure**	**Contaminants**	**Hazard**
On-site Individual Septic Systems	Figure 7	Nitrates and pathogens	If not properly operated and maintained untreated effluent may enter into and impact area groundwater used for drinking water
Other Area Septic Density	Figure 7	Nitrates and pathogens	If not properly operated and maintained untreated effluent may enter into and impact area groundwater used for drinking water
Cultivated Cropland	Figure 8	Nitrates, pathogens, SOCs	Over application or improper handling of agricultural chemicals may impact area groundwater. Excessive irrigation may cause transport of contaminants into area groundwater
UST	Figure 8	VOCs	Spills or improper handling of stored fuel may impact area groundwater

Inventory Results/ Recharge Region

Potential contaminant sources in the recharge region in addition to those already identified in the inventory region include: Montana Rail Link Railroad, Interstate 90, U.S. Highway 191, and the eastern portion of the City of Bozeman with its services and industries and their associated potential contaminants.

Inventory Update

To make this SWDAR a useful document for the years to come, the certified water system operator should review the inventory every year. Changes in land uses or potential contaminant sources should be noted and additions made as appropriate. The complete inventory should be submitted to DEQ every five years to ensure the source water delineation and assessment remains current.

Inventory Limitations

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal 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]. The following limitations should be noted:

Not every source of contamination to the PWS well has been identified. Consideration was limited to potential sources of contamination within the inventory region. Additionally, sources of contaminants that are not regulated for were not inventoried or assessed. No site inspection was performed, and the inventory was developed from available sources of information, including DEQ files and NRIS.

The potential contaminant sources described in the inventory are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. Some management recommendations are fairly site-specific and can be implemented by the public water supply. However, other management options can only be implemented by federal, state, county or local governmental entities. When the latter options are mentioned, it is not implied or suggested that this public water supply should lead or spearhead the effort to implement the management option. It is assumed that representatives from this public water supply would participate in the public process sponsored by various governmental entities to develop and implement any of these management options.

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 Springvale Subdivision residents.

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 within 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 the Springvale Subdivision PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers (Table 6). Barriers can be anything that decreases the likelihood that contaminated water will flow to the Springvale Subdivision PWS Wells

Table 6. 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

Proximity or density of significant potential contaminant sources and the nature of contaminants determines hazard (Table 7). Point source hazard is also dependent on the health affects associated with potential contaminants. Hazard ratings for non-point sources are assigned based on criteria listed in Table 7for septic systems, sanitary sewers, and cropped agricultural land.

Table 7. Hazard of potential contaminant sources associated with proximity to a PWS well or intake or density within a PWS inventory or spill response region.

Contaminant Source Type		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

Table 8 identifies the individual hazard ratings for significant potential contaminant sources and each associated contaminant in the Springvale Subdivision PWS Well Inventory Region.

Table 8. Hazard of significant potential contaminant sources for the Springvale PWS Wells Inventory Region

Significant Potential Contaminant Sources	Figure / Map ID#	Contaminants	Hazard	Hazard Rating
On-site Septic Systems	Figure 7	Nitrates and pathogens	Untreated effluent from malfunctioning tanks, piping, or drain field leaching into area groundwater	High
Other Area Septic Systems	Figure 7	Nitrates and pathogens	Untreated effluent from malfunctioning tanks, piping, or drain field leaching into area groundwater	Moderate

Table 8. Hazard of significant potential contaminant sources for the Springvale PWS Wells Inventory Region				
Significant Potential Contaminant Sources	**Figure / Map ID#**	**Contaminants**	**Hazard**	**Hazard Rating**
Cultivated Cropland (Approximately 15%)	Figure 8	Agricultural chemicals, nitrates, and pathogens	Over-application or improper handling of agricultural chemicals; excessive irrigation causing transport of contaminants or sediments to groundwater/ surface water through runoff	Low
UST	Figure 8	Nitrates and pathogens	Spills or improper handling of stored fuel may impact area groundwater	Low

Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant. The susceptibility of each well to each potential contaminant source is assessed separately. Table 9 identifies the susceptibility assessment results for each significant potential contaminant source in the Springvale Subdivision PWS Well Inventory Region.

Table 9. Susceptibility assessment for significant potential contaminant sources in the Springvale Subdivision PWS Well Control Zone and Inventory Region

Contaminant Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
On-site Septic Systems	Nitrates and pathogens	Untreated effluent from malfunctioning tanks, piping, or drain field leaching into area groundwater	High	Newer Construction	High	Encourage all septic tank owners in the subdivision to periodically inspect their septic systems and conduct regular maintenance
Other Area Septic Systems	Nitrates and pathogens	Untreated effluent from malfunctioning tanks, piping, or drain field leaching into area groundwater	Moderate	Newer Construction	Moderate	Encourage area septic tank owners to periodically inspect their septic systems and conduct regular maintenance
Cultivated Cropland (Approximately 15%)	Agricultural chemicals, Nitrates, and pathogens	Over-application or improper handling of agricultural chemicals; excessive irrigation causing transport of contaminants or sediments to groundwater/ surface water through runoff	Low	None	Moderate	Encourage area producers to use Best Management Practices (BMPs).
UST- on private ranch		Nitrates and pathogens	Low	Secondary containment, leak detection, distance from the wells	Very Low	Periodically check with the DEQ Petroleum Response Section to ensure a spill or leak has not occurred or if one has occurred that it is being properly cleaned up

Susceptibility Results

The susceptibility results for each significant potential contaminant source and their associated contaminants are identified as follows:

On-Site Septic Systems - Hazard is ranked high for potential contamination from the individual on-site septic systems as the Springvale Subdivision PWS wells are surrounded by an area of high septic density. The overall susceptibility of the wells to contamination is moderate as one barrier to contamination was identified.

Area Septic Systems - Hazard is ranked moderate for potential contamination from area septic systems. The overall susceptibility of the PWS wells to contamination is moderate as one barrier to contamination was identified.

Cultivated Cropland – Hazard is ranked low for this potential contaminant source as it only covers approximately 15% of the inventory region. The overall susceptibility is ranked moderate, as no barriers to contamination were identified.

UST – Hazard is ranked low for the private underground storage tank due to its distance from the Springvale PWS Wells. The overall susceptibility of the wells to the UST is very low as multiple barriers to contamination were identified.

Management Recommendations

The Springvale Subdivision PWS Source Water Delineation and Assessment Report has been prepared to assist the PWS operator. The report provides information concerning the wells that supply water to the Springvale Subdivision PWS wells identifies the control zones, inventory region, and the recharge region, and within each of these protection areas identifies the significant potential contaminants that may impact the Springvale Subdivision PWS drinking water source. Also provided in the table are recommendations regarding how the potential contaminants could be better managed to prevent impacts in the vicinity of the Springvale Subdivision PWS well. If these management recommendations are implemented, they too may be considered additional barriers that will reduce the susceptibility of the Springvale Subdivision PWS Wells to specific sources and contaminants.

Management recommendations fall into the following categories:

Sewage disposal system maintenance and leak detection – Proper operation and maintenance of both on-site and other area septic systems will reduce the susceptibility of the Springvale Subdivision PWS wells to contamination from septic systems. Installation of advanced treatment septic systems such as sand filters can limit contamination from new rural residential development.

Agricultural Best Management Practices (BMPs). BMPs that address application and mixing of fertilizers and pesticides are a viable alternative to prohibition of their use. BMPs are voluntary but their implementation can be encouraged through education and technical assistance. BMPs may also be utilized to minimize surface runoff and soil

erosion on cultivated fields

Education. Educational workshops provided to the general public by the county or state will promote the safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designate emergency personnel would promote the efficiency and effectiveness of emergency responses to hazardous material spills. Educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. Educational materials covering these topics are available to the public and can be obtained from the US EPA and the State of Montana.

Emergency Response Plan. If one does not already exist, the Springvale Subdivision PWS should develop and implement an emergency spill response plan. Coordination with county and state emergency response personnel would greatly benefit the plan. The plan should identify the procedures the water operator and other emergency personnel should follow in the event that there is a traffic accident in the vicinity of the well and an imminent threat that the contaminants would reach the PWS well. The emergency response plan should be updated annually to reflect changes in emergency contacts, phone numbers, and resources available within the Towns of Belgrade and Bozeman or Gallatin County to respond to an emergency situation that may impact the Springvale Subdivision PWS.

Chapter 5
MONITORING WAIVERS

Monitoring Waiver Requirements

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers. Following is a description of a use waiver. A waiver recommendation for the Springvale Subdivision follows this description.

Use Waivers

A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific organic chemicals were not used, manufactured, or stored in the area of a water source (or source area). If certain organic chemicals have been used, or if the use is unknown, the system would be determined to be vulnerable to organic chemical contamination and ineligible for a Use Waiver for those particular contaminants.

Waiver Recommendation

Currently, the Springvale Subdivision has a waiver for Phase 2 inorganics. For additional waiver consideration, based on monitoring history or a demonstration that certain chemicals were/ are not used in the inventory region, the Springvale Subdivision PWS operator will need to send a letter to the DEQ Public Water Supply Section requesting monitoring waivers. Additional information regarding chemical use on adjacent properties in the inventory region must accompany the waiver request letter.

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GLOSSARY

Acute Health Effect. A negative health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source

Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing non-point source pollution.

Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.

Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.

Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters (e.g. dry well). The receiving unit for an injection well typically represents the aquifer, or water-bearing interval.

Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.

Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). A database that provides information about specific sites through the EPA Envirofacts website.

Confined Animal Feeding Operation (CAFO). Any agricultural operation that feeds animals within specific areas, not on rangeland. Certain CAFOs require permits for operation.

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit. A geologic formation present above a confined aquifer that inhibits the flow of water and maintains the pressure of the groundwater in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

Delineation. The process of determining and mapping source water protection areas.

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

Geographic Information Systems (GIS). A computerized database management and mapping system that allows for analysis and presentation of geographic data.

Hardness. Characteristic of water caused by presence of various calcium and magnesium salts. Hard water may interfere with some industrial processes and prevent soap from lathering.

Hazard. A relative measure of the potential of a contaminant from a facility or associated with a land use to reach the water source for a public water supply. The location, quantity and toxicity of significant potential contaminant sources determine hazard.

Hydraulic Conductivity. A constant number or coefficient of proportionality that describes the rate water can move through an aquifer material.

Hydrology. The study of water and how it flows in the ground and on the surface.

Hydrogeology. The study of geologic formations and how they effect groundwater flow systems.

Inventory Region. A source water management area for groundwater systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year groundwater travel time.

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

Large Capacity Septic System. Defined by Underground Injection Control regulations as an on-site septic system serving 20 or more persons.

Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.

Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.

Montana Bureau of Mines and Geology – Groundwater Information Center (MBMG/GWIC). The database of information on all well drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national permitting system that utilizes a database to track entities that discharge wastewater into waters of the United States.

Nitrate. An important plant nutrient and type of inorganic fertilizer that can be a potential contaminant in water at high concentrations. In water the major sources of nitrates are wastewater treatment effluent, septic tanks, feed lots and fertilizers.

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Examples of nonpoint- source pollution include agriculture, forestry, and run-off from city streets. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of these chemicals into surface and/or groundwaters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Phase II (and IIb) Rules. EPA updated or created legal limits on 38 contaminants. The rules became effective July 30, 1992 and January 1, 1993. Some of these contaminants are frequently-applied agricultural chemicals such as nitrate and others are industrial solvents.

Phase V Rule. EPA set standards for 23 contaminants in addition to those addressed by the Phase II Rules. The Phase V Rule became effective January 17, 1994. Some of these contaminants include inorganic chemicals such as cyanide and other Phase V contaminants are pesticides that enter water supplies through run-off from fields where farmers have applied them or by leaching through the soil into groundwater. Six are probable cancer-causing agents. Others can cause liver and kidney damage, or problems of the nervous system and brain.

Point Source. A stationary location or a fixed facility from which pollutants are discharged. This includes any single identifiable source of pollution, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fracture, container, rolling stock (tanker truck), or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource (e.g. groundwater used for drinking water).

Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.

Public Water System (PWS). A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

Resource Conservation and Recovery Information System (RCRIS). Is a database that provides information about specific sites through the EPA Envirofacts website.

Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.

Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.

Source Water. Any surface water, spring, or groundwater source that provides water to a public water supply.

Source Water Delineation and Assessment Report (SWDAR). A report for a public water supply that delineates source water protection areas, provides an inventory of potential contaminant sources within the delineated areas, and evaluates the relative susceptibility of the source water to contamination from the potential contaminant sources under "worst-case" conditions.

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For groundwater sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

Static Water Level (SWL). Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Total Maximum Daily Load (TMDL). The total pollutant load to a surface water body from point, nonpoint, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

Toxicity. The quality or degree of being poisonous or harmful to plants, animals, or humans.

Toxicity Characteristic Leachate Procedure. A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals that evaporate readily to the atmosphere.

Watershed. The region drained by, or contributing water to, a stream, lake, or other water body of water.

* With the exception of the definitions for Lacustrine, Phase II and Phase V Rules, and Standard Industrial Classification Code, definitions were adapted from EPA's Term References System (formerly known as Glossary of Selected Terms and Abbreviations) which can be found at: http://www.epa.gov/trs/index.htm . The definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

The definitions for Phase II and Phase V Rules were adapted from:
http://www.epa.gov/OGWDW/source/therule.html#PhaseII
http://www.epa.gov/OGWDW/source/therule.html#PhaseV

The definition for Standard Industrial Classification Code was adapted from:
EPA/Office of Enforcement and Compliance Assurance: Guide to Environmental Issues: Glossary of Terms & Acronyms *Term Detail*

APPENDICES

Appendix A: Well Logs

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
SPRINGVALE SUBDIVISION Well #1

Plot this site on a topographic map

Location Information

GWIC Id:	91342	Source of Data:	LOG
Location (TRS):	01S 05E 03 CBCD	Latitude (dd):	45.7769
County (MT):	GALLATIN	Longitude (dd):	-111.0994
DNRC Water Right:	P005579-00	Geomethod:	MAP
PWS Id:	01823002	Datum:	NAD27
Block:		Altitude (feet):	4460.00
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	130.00	How Drilled:	CABLE
Static Water Level (ft):	19.00	Driller's Name:	JONES
Pumping Water Level (ft):	110.00	Driller License:	WWC017
Yield (gpm):	310.00	Completion Date (m/d/y):	4/23/1975
Test Type:	PUMP	Special Conditions:	
Test Duration:	24.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	111ALVM
Recovery Time (hrs):		Well/Water Use:	IRRIGATION PUBLIC WATER SUPPLY

Well Notes:

Hole Diameter Information

From	To	Diameter
0.0	130.0	8.0

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	113.0	8.0				23 LB STEEL

Annular Seal Information

From	To	Description
0.0	0.0	LEAD PACKER

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
112.0	127.0	8.0			.07 SLOTS

Lithology Information

From	To	Description
0.0	2.0	TOPSOIL
2.0	28.0	COARSE GRAVEL
28.0	60.0	GRAVEL WITH SILT AND CLAY
60.0	95.0	CLAYBOUND GRAVEL

96.0	100.0	MOSTLY CLAY AND SILT WITH SOME GRAVEL
100.0	105.0	CLEAN FINE GRAVEL
105.0	130.0	FINE GRAVEL WITH SILT AND CLAY

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
SPRINGVALE SUBDIVISION Well #2

Plot this site on a topographic map

Location Information

GWIC Id:	91341	Source of Data:	LOG
Location (TRS):	01S 05E 03 CBCD	Latitude (dd):	45.7769
County (MT):	GALLATIN	Longitude (dd):	-111.0994
DNRC Water Right:	C005630-00	Geomethod:	MAP
PWS Id:	01823003	Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	127.00	How Drilled:	CABLE
Static Water Level (ft):	19.00	Driller's Name:	JONES
Pumping Water Level (ft):	127.00	Driller License:	WWC017
Yield (gpm):	60.00	Completion Date (m/d/y):	3/10/1975
Test Type:	PUMP	Special Conditions:	
Test Duration:	3.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	111ALVM
Recovery Time (hrs):		Well/Water Use:	PUBLIC WATER SUPPLY
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	127.0	6.0

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	119.0	6.0				17 LB STEEL

Annular Seal Information

No Seal Records currently in GWIC.

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
119.0	127.0	0.0			OPEN HOLE

Lithology Information

From	To	Description
0.0	2.0	TOPSOIL
2.0	28.0	COARSE GRAVEL
28.0	60.0	GRAVEL WITH SILT AND CLAY
60.0	95.0	CLAYBOUND GRAVEL
95.0	100.0	MOSTLY CLAY AND SILT WITH SOME GRAVEL

100.0	105.0	CLEAN FINE GRAVEL
105.0	127.0	FINE GRAVEL WITH SILT AND CLAY

[1] - All diameters reported are **inside** diameter of the casing.

Appendix B: Sanitary Survey

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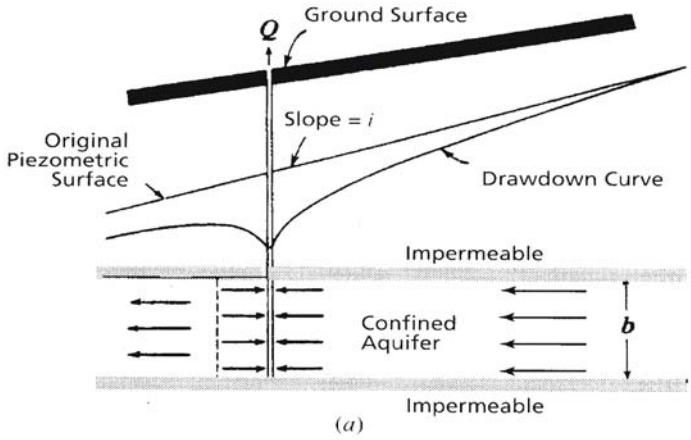
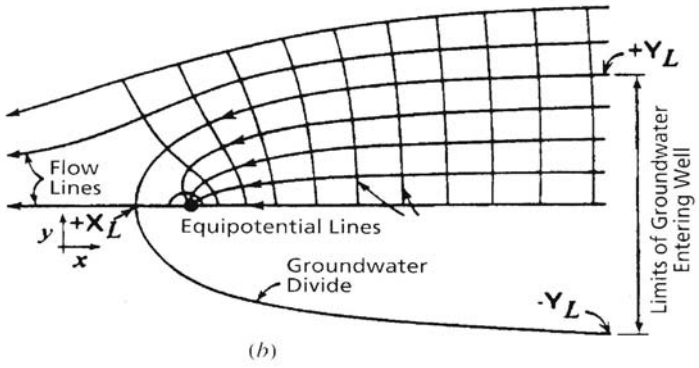
Appendix C: TOT Calculations

UNIFORM GROUNDWATER FLOW EQUATION

Flow to a well penetrating a confined aquifer having a sloping plane piezometric surface - vertical section and plan view (Todd, 1980).



(a)



(b)

$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)$$

Uniform-Flow Equation

$$X_L = -\frac{Q}{2\pi Kbi}$$

Distance to Down-Gradient Null Point

$$Y_L = \pm\frac{Q}{2Kbi}$$

Boundary Limit

Legend:

- Pumping Well

Where:

Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

TIME-OF-TRAVEL CALCULATION METHOD

The time of travel for water to move along a line parallel to the hydraulic gradient, from a point to a pumping well (EPA 1991).

$$T_X = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi} \ln\left(1 + \frac{2\pi kbi}{Q} X_L\right)\right]$$

T_X	=	travel time from point x to a pumping well
n	=	porosity
X_L	=	distance from pumping well over which groundwater travels in T_X
Q	=	discharge
K	=	hydraulic conductivity
b	=	aquifer thickness
i	=	hydraulic gradient

Appendix D: Concurrence Form

Source Water Protection Section
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59602-0901

RE: Source Water Delineation & Assessment Report

Dear Carolyn:

The Springvale Subdivision Public Water System (PWS) has reviewed the Springvale Subdivision Source Water Delineation and Assessment Report (SWDAR) dated April 3, 2006. We concur that the delineation component appears to describe current conditions at the water system based on reasonably available information and that the susceptibility assessment identifies the origins of regulated contaminants to the extent practical.

We understand that the Springvale Subdivision PWS SWDAR will be made available to the public by DEQ as described in the Montana Source Water Protection Program. Also, we will make a copy of the report available for the public to view during our normal office hours and describe the results in subsequent releases of our consumer confidence report.

Signed,

[signature] 04/20/2006 [signature] 04/20/2006
Administrator Date Water Operator Date