# TOWN OF ENNIS

# PUBLIC WATER SYSTEM

**PWS ID No. MT0000208**

## SOURCE WATER DELINEATION & ASSESSMENT REPORT

PREPARED BY:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE WATER PROTECTION PROGRAM

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# EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared as required by the Federal Safe Drinking Water Act, according to a detailed Source Water Assessment Plan developed by a statewide Montana citizens' advisory committee, and approved by the US Environmental Protection Agency. The Department of Environmental Quality (DEQ) is completing assessment and delineation reports for all public water systems in Montana. Source water assessment is the first step towards source water protection. These reports are intended to provide information so that the public water system staff/operator, consumers, and community citizens can develop strategies to protect drinking water sources. The information provided includes the delineation of the area most critical to maintaining safe drinking water (the inventory region), an inventory of significant potential sources of contamination within this area, and an assessment of the relative threat that these sources pose to the water system.

The Town of Ennis subdivision's drinking water is supplied by two wells. The water source is groundwater. According to the Source Water Protection Program (DEQ, 1999) the source aquifer for the well is considered to have **moderate sensitivity** to potential contamination, since the aquifer is composed of Tertiary basin fill sediments, and is semi-confined.

As part of this assessment, three types of source water protection management areas were mapped. They are: the control zone, the inventory region, and the recharge region. The control zone (sometimes called the exclusion zone) is a 100-foot radius circle around each wellhead. The goal of management in the control zone is to avoid introducing contaminants directly into the wells or immediate surrounding areas. Drainage should be directed away from the wellheads, and caution should be exercised to ensure that all contaminant sources are removed from the control zones. The inventory region is the area that is expected to contribute groundwater to the wells over the next three years (DEQ, 1999). For this aquifer, this is mapped to a distance of one mile upgradient of the wells. The recharge region represents the full upgradient extent of the aquifer. Potential sources of contamination were inventoried within the control zone and inventory region and the results are as follows:

- No potential sources of contamination were identified within the control zones.
- The inventory region includes sewered portions of Ennis, as well as areas of low, moderate and high septic system density. No irrigated agricultural land was identified within the inventory region, although possible hayfields are apparent on aerial photos. Grazing land is present at the edges of the inventory region. No active underground storage tanks (USTs) were identified within the inventory region. Numerous UST records were identified within the inventory region, but all of these represent out-of-service residential tanks. It is possible that UST or LUST locations may be improperly mapped.

The operator should take care that surface drainage is directed away from the wellheads. Wells completed into the deep confined aquifer are generally less vulnerable to contamination, but without annular seals, the wells could be compromised at the wellheads. Well 1 is reportedly grouted to 19 feet below grade (ftbg), and Well 2 is reportedly grouted to 30 ftbg.

Contaminant sources are not inventoried within the recharge region. Land use patterns are identified and evaluated. The recharge region is mapped as the extent of basin-fill sediments in the Madison Valley. The majority of the recharge area is sparsely developed and populated. The primary land cover is shrub and grassland.

Low risk potential sources and potential sources located outside the inventory region, but within the recharge region, may still pose a threat over time. These are not considered in this assessment, however. The susceptibility analysis is intended to provide the operator with information on where the greatest risk

occurs. To this end, the assessment is focused on potential contaminant sources that the Source Water Protection Section has determined to be significant. These are detailed in Chapter 4.

Mitigating and managing potential sources of contamination identified within the inventory region are often beyond the scope of what an operator of a relatively small PWS may accomplish.

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

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# 1.0 INTRODUCTION

The primary purpose of this source water delineation and assessment report (SWDAR) is to provide information that helps the Town of Ennis public water supply (PWS) protect its drinking water sources. Source water assessment is the first step towards source water protection. The Montana Source Water Protection Program is intended to be a preventative, practical, and cost-effective approach to protect public drinking water supplies.

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Town of Ennis Public Water System 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].

This report was completed by Eric Sivers, a hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Section. A draft wellhead protection plan prepared by Montana Rural Water Systems, Inc. (MRWS) and Ennis PWS operator Duane Martian provided background. Additional information on the PWS was obtained from the most recent sanitary survey (February 2005). Other references are detailed at the end of this report.

# 2.0 BACKGROUND

The Town of Ennis PWS is classified as a community PWS, as it serves more than 25 year-round residents. Ennis is located in Madison County in southwestern Montana, along the Madison River (Figure 1). According to the Census Bureau, the population of Madison County in 2000 was 6,851, 840 of whom lived within Ennis. In accordance with the wellhead protection plan drafted by MRWS, this report uses an estimated population of 1,600.

## 2.1 PHYSICAL SETTING

### 2.1.1 Geography and Geology

Ennis is located in the Madison River valley, on the western bank of the Madison River. The town's elevation is approximately 4,950 feet above mean sea level.

The Madison River valley extends over 350 square miles of southwestern Montana. The valley is bounded by the Madison Range to the east, the Gravelly Range and Tobacco Root Mountains to the west and northwest, Ennis Lake to the north, and Raynolds Pass to the south (Kendy and Tresch, 1996). It is a structural basin, created as the valley floor dropped relative to the synchronously uplifted Madison Range. The downdropped basin has been filled with Tertiary and Quaternary sediments, which are thickest along the fault at the eastern margin of the valley. The mountains surrounding the basin are composed of bedrock varying in age from Archean (pre-Belt series) to Tertiary (Kellogg and Williams, 2005). These bedrock units are generally less permeable than the unconsolidated basin sediments, although fractures or carbonate dissolution features create significant local flow conduits. The aquifer is recharged by infiltration of precipitation and of surface water and at the edges of the basin. Groundwater flows from the margins of the basins towards the center of the basin, where it turns northward, generally parallel to the Madison River.

More detailed information on the hydrogeology of the study area is provided in Section 2.1.3.

### 2.1.2 Climate

Climate in the area is typical of intermontane valleys in southwest Montana, with mild summers and cold winters. Average annual precipitation is 12.46 inches, and is most abundant in May and June. The area receives an annual average of 33 inches of snow, mainly from October to April. The climate summary is based upon records from the climate station at Ennis. Climate data is provided by the Western Regional Climate Center, operated by the Desert Research Institute of Reno, Nevada. See Table 1 for additional climate information.

***Table 1. Monthly Climate Summary: Ennis Climate Station (242793)***

Period of Record: 07/02/1948 to 09/30/2005

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ave. Max. Temp (F) | 33.1 | 38.4 | 45.2 | 55.6 | 65.5 | 73.6 | 82.7 | 81.5 | 71.2 | 59.6 | 43.4 | 34.8 | 57.0 |
| Ave. Min. Temp. (F) | 14.4 | 17.8 | 22.3 | 29.2 | 36.7 | 43.2 | 47.7 | 46.0 | 38.5 | 31.5 | 23.4 | 16.9 | 30.6 |
| Ave Tot. Precip. (in.) | 0.38 | 0.40 | 0.71 | 1.12 | 2.04 | 2.35 | 1.24 | 1.21 | 1.16 | 0.90 | 0.55 | 0.42 | 12.46 |
| Ave. Tot. Snowfall (in.) | 5.9 | 4.4 | 5.9 | 3.3 | 1.1 | 0.1 | 0.0 | 0.0 | 0.2 | 2.0 | 4.7 | 5.2 | 33.0 |
| Ave Snow Depth (in.) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

### 2.1.3 Source Water

The source aquifer is composed of Tertiary basin-fill deposits. This aquifer includes layers of fine-grained sediments that were shed from the surrounding highlands into the valley. Volcanic and volcaniclastic deposits are also present. Up to 15,000 feet of sediment have accumulated in the deepest parts of the basin (Kendy & Tresch, 1996), although the depth to bedrock is probably half that over much of the basin. The aquifer is heterogeneous, and includes bodies of both high and low permeability. The cumulative effect of many low-permeability bodies produces a semi-confined aquifer. Coarse-grained deposits are less common than fine-grained deposits, and the basin fill aquifer has the reputation of being relatively impermeable. Ennis' wells are unusually productive for the Tertiary aquifer.

The primary source of recharge is stream loss, particularly at the valley margins where streams cross from the less permeable bedrock to more permeable basin fill deposits. Leakage from irrigation canals contributes additional recharge. Finally, some recharge is expected from by infiltration of snowmelt and rainfall. Comparison of the low arsenic concentrations in the PWS water (Section 2.3.1.) to the higher concentrations reported from surface water (Tuck *et al.*, 1997) suggests that the Madison River does not contribute significantly to the Ennis source water. The recharge region (extent of the aquifer) is illustrated on Figure 3.

## 2.2 THE PUBLIC WATER SUPPLY

### 2.2.1 Water Supply System

Two wells supply the PWS. The wells are indicated on Figure 1 and Figure 2. The PWS distributes water through 506 service connections, serving an estimated population of 1,600. Storage is currently provided by a 530,000+ gallon tank.

### 2.2.2 Supply Well Information

There has been some confusion over the PWS well logs. The MRWS report (O'Connell, 2002) describes two wells, completed in 1979 and 1978. The description of Well 1(GWIC ID

108663) is actually that of Well 2, according to the copy of the original driller's log attached to the sanitary survey.

Well 1 was drilled in 1960. Well 1 is cased with 8-inch steel to a depth of 165 feet below grade (ftbg). The well is grouted to 19 ftbg, and perforated in two intervals: 100-107 ftbg and 130-160 ftbg. Well 1 yields 200 gallons per minute (gpm).

Well 2 was drilled in 1978. The well is 140 feet deep, and is 12-inch diameter over the full depth. The well is grouted from grade to 30 ftbg. The well is perforated over four intervals: 75-85 ftbg, 97-105 ftbg, 112-120 ftbg, and 130-140 ftbg. The static water level is reported to be 28 ftbg, with a pumping water level of 105 ftbg. The well yields 400 gpm.

## 2.3 WATER QUALITY

Each PWS performs regular sampling of its water supply to detect contamination. The analytical parameters for a community PWS include: coliform bacteria, nitrates, metals, petroleum hydrocarbons, synthetic organic chemicals, and radionuclides. The monitoring schedule depends on factors such as the type of PWS, type of source water (surface water or groundwater), the number of supplies (e.g. wells, springs or intakes), and the population served. Monitoring programs are tailored to each system, following the general protocols defined by DEQ and the US EPA. Monitoring schedules are available online at: <http://nris.state.mt.us/wis/swap/swapquery.asp>. The Ennis PWS monitoring data from DEQ's database for the past five years was reviewed and is summarized in this section. Analytical results are reported in units of milligrams per liter (mg/L, equivalent to one part per million) or micrograms per liter (µg/L, equivalent to one part per billion). The results are compared to quality standards established by the US EPA. Maximum Contaminant Levels (MCLs) are enforceable standards limiting the amount of a contaminant in drinking water. National Secondary Drinking Water Standards (known as SMCLs) are non-enforceable guidelines regarding contaminants that may cause aesthetic (color, odor, taste) or cosmetic (staining, skin/tooth discoloration) issues.

### 2.3.1 Public Water Supply Monitoring Results

Each well has an entry point, and are therefore sampled individually. The water quality is comparable. Coliform bacteria have not been detected in the PWS water within the past five years. Nitrate concentrations are consistently low, with the highest reported level of 0.97 mg/L (from Well 1), below the MCL of 10 mg/L. No organic chemicals have been detected at either well. Dissolved solids detected from both wells are low: arsenic (0.002 mg/L), barium (0.110 mg/L), and fluoride (1.05 mg/L). Additionally, chromium was detected at Well 1 (0.001 mg/L) and antimony was detected at Well 2 (0.006 mg/L).

The Madison River is noted for (naturally) elevated arsenic levels due to the volcanic rocks in its Yellowstone caldera headwaters. Despite this, the PWS water is below the new EPA MCL of 0.010 mg/L.

The water quality summary report is attached as Appendix B.

### 2.3.2 Background Water Quality Monitoring Results

Background water quality data was not identified for the subject PWS. Background water quality typically includes general water quality parameters: major dissolved ions (calcium, magnesium, sodium, potassium, iron, manganese, silica, bicarbonate, carbonate, chloride, sulfate, nitrate, fluoride and orthophosphate), trace elements, and metals. Since the PWS

does not disinfect, the water quality summarized above is generally indicative of the source water.

# 3.0 MANAGEMENT AREA DELINEATION

This report delineates three source water management areas. The goal of source water management is protection of the source water by 1) controlling activities in the control zone(s), 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. Methods and criteria for delineating source water protection areas for public water supplies are specified in the Montana Source Water Protection Program (DEQ, 1999).

## 3.1 DELINEATION

*Control Zone* – A 100-foot radius control zone is delineated around the wellheads.

*Inventory Region* – The inventory region is generally the area that is expected to contribute to the water supply over three years; this is sometimes referred to as a three-year capture zone. The inventory region for the Town of Ennis PWS was delineated an estimate of groundwater time-of-travel distance. The distance was estimated using the uniform flow equation (Appendix C), as recommended by EPA. Aquifer properties were estimated according to DEQ protocol for non-degradation analysis (also attached in Appendix C), using available data from the well logs. The estimated three-year time-of-travel distance varies from 1,940 to 6,270 feet, depending on the values used. In consideration of the number of assumptions and variables involved, the inventory region was mapped to a distance of one mile from the wells, according to presumed groundwater flow directions (as described above in Section 2.1.1).

*Recharge Region* – The recharge area is delineated as the extent of basin fill deposits upgradient of the PWS (Figure 3), as illustrated on a geologic map by Kellogg and Sears (2005).

# 4.0 INVENTORY

Prior to assessing PWS susceptibility to contamination, an inventory of potential contaminant sources must be created. To this end, potential contaminant sources in the control zone and inventory region were inventoried. The inventory focuses on facilities or features that generate, use, store, or transport potential contaminants, as well as certain land uses. The methods and data sources used in the inventory process are explained below. It is important to remember that the sources 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 managed.

## 4.1 INVENTORY METHOD

Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases. The process for completing the inventory includes the following:

- Step 1: The Montana State Library Natural Resources Information System (NRIS) GIS database was queried to identify septic land application sites, wastewater treatment plants, animal feeding operations, septic system density, sewer systems, and agricultural land uses.
- Step 2: The DEQ PWS files were reviewed to identify agricultural activities or wastewater treatment in the vicinity of the PWS.

- Step 3: 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 System (TRIS), 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 4: Montana DEQ databases were queried to identify any of the following in the management areas:

  Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) <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.

Potential contaminant sources are considered 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

## 4.2 INVENTORY RESULTS

### 4.2.1 Control Zone Inventory Results

No potential contaminants were identified within the control zones. However, an inventory on this scale is difficult to complete accurately without a site visit.

### 4.2.2 Inventory Region Results

*Point Sources*: Identified point sources were identified within the inventory region are limited to USTs. All identified USTs are for residential use, and none are currently active, according to the DEQ database. No LUST facilities were identified within the inventory region. Unlisted or improperly mapped USTs or LUSTs may be present.

*Nonpoint Sources*: The inventory region includes municipal sewers and regions of high, moderate and low septic system density. No irrigated agricultural land is mapped within the inventory region. What appears to be a hayfield is evident on aerial photographs. The PWS' organic waiver application reports that there are hayfields in the vicinity, and that glyphosate

and 2,4-D are in use. Grazing land is present on the upgradient end of the inventory region. No animal feeding operations were apparent within the inventory region.

The PWS' susceptibility to these potential contaminant sources will be assessed in Section 5, and presented in Table 2.

### 4.2.3 Recharge Region Results

Contaminant sources are not inventoried within the recharge region. However, land use patterns are identified and evaluated. The primary land use within the recharge region is timber, with minor amounts of industrial uses. The majority of the recharge region is forested, and includes parkland and wilderness.

## 5.0 SUSCEPTIBILITY ASSESSMENT

*Susceptibility* is the degree of likelihood for a public water supply to be impacted by inventoried contaminant sources. Susceptibility is determined in accordance with the DEQ Source Water Protection Program (DEQ, 1999). This guidance document is available on the DEQ Source Water Protection website (see the Reference section), or by request.

Susceptibility is determined by considering the *hazard* that a significant potential contaminant source presents to the PWS source water, relative to any *barriers* to the contaminant. Hazard is determined by the proximity or density of significant potential contaminant sources, according to a formula laid out in the Source Water Protection Program (DEQ, 1999). Accordingly, point sources of contaminants within the inventory region would be rated high hazards. The septic system density presents a moderate hazard. Barriers to contamination are anything that decreases the likelihood of contaminants reaching a water source. No natural barriers are credited for this PWS.

Inventory results and management recommendations for the Town of Ennis PWS are provided in Table 2. In some cases the 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 does not imply or suggest that this PWS should lead or spearhead the effort to implement the management option. It is assumed that representatives from this PWS would participate in the public process sponsored by various governmental entities to develop and implement any of these management options.

***Table 2. Susceptibility Assessment of Significant Potential Contaminant Sources***

| Potential Contaminant Source | Potential Contaminants | Hazard | Hazard | Barriers | Susceptibility | Management Recommendations |
|---|---|---|---|---|---|---|
| *Inventory Region* | | | | | | |
| Municipal sewers | Pathogens, nitrate ($NO_3$) | Discharge of pathogens; failure leading to discharge of untreated septage. | High | None | High | Maintain sewers in good working order. |
| Septic systems | Pathogens, nitrate ($NO_3$) | Discharge of pathogens; failure leading to discharge of untreated septage. | Moderate | None | Moderate | Participate as a stakeholder in debates over water quality and local water quality districts. Promote advanced septic systems, public education. |
| *Other Potential Contaminant Sources, not rated significant* | | | | | | |
| USTs | VOCs | Leaching of VOCs to groundwater from historic releases. | Low | None | Low | Maintain water quality sampling according to schedule. Participate as a stakeholder in debates over water quality and local water quality districts. |
| Grazing land | Pathogens, nitrate ($NO_3$) | Infiltration of pathogens, nitrate loading | Low | None | Low | Maintain water quality sampling according to schedule. Participate as a stakeholder in debates over water quality and local water quality districts. |

While it is not considered a barrier, the semi-confined nature of the aquifer probably affords some degree of protection from shallow contaminants. This is recognized in the 'moderate' sensitivity rating assigned to this type of aquifer.

These ratings are derived from the procedures established by the DEQ Source Water Protection Program (DEQ, 1999). The 'high' susceptibility rating for the sewers is probably conservative, in light of the low nitrate concentrations. However, wells located in town will always have elevated susceptibility to this potential contaminant source. A high susceptibility rating for the sewers is not a prediction of contamination. Instead, it identifies the most likely sources of contaminants, so that these may be managed and problems may be prevented.

While no active USTs were identified within the inventory region, there is always the possibility that a tank is unregistered or is not mapped to the proper location. The operator should be aware of the potential risks posed by a hydrocarbon release, and be mindful of any facilities in the area that may include a UST.

The current land uses identified within the recharge region do not generally pose a risk to the PWS' groundwater quality.

# 6.0 LIMITATIONS

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Town of Ennis 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 [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 potential or existing source contamination in the Town of Ennis area has been identified. Consideration was limited to potential sources of contamination that are within the inventory region and of a type determined by the DEQ to be significant.
- Potential sources of contamination were identified using online databases and available overhead and map imagery. Field surveys and inspections of the inventory region were not conducted. It is highly recommended that the operator or other persons knowledgeable about the community review the inventory, and revise it as necessary.
- The inventory region was delineated on the basis of a time-of-travel estimate. Many input parameters needed to be estimated. As far as possible, the estimates were based on commonly published values or interpretation of available information for the study area. After evaluating results based on varying parameters, a reasonable moderate value (1 mile) was used. This is intended to provide a starting point for the purposes of source water assessment, and detailed field investigations are beyond the scope of this report.
- Delineation of the recharge region is considered a first-order approximation, and may not be accurate. In order to accurately delineate a truly representative recharge region, a detailed field study would be required. Such a study is beyond the scope of this report.
- The potential contaminant sources described in the inventory are identified from readily available information, as described in Chapter 4. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. Multiple data sources are used to increase the likelihood that major threats to the source water are identified. The inventory is not exhaustive. Absence of a potential contaminant in the inventory or susceptibility assessment of this report does not mean that the potential for contamination does not exist, or that there is no threat.
- This report is not, and should not be construed as, a guarantee, warranty or certification that the PWS will not be impacted by potential contaminant sources given a low susceptibility.

# 7.0 CONCLUSIONS

The Town of Ennis subdivision's drinking water is supplied by two wells. The water source is groundwater. According to the Source Water Protection Program (DEQ, 1999) the source aquifer for the well is considered to have **moderate sensitivity** to potential contamination, since the aquifer is composed of Tertiary basin fill sediments, and is semi-confined.

As part of this assessment, three types of source water protection management areas were mapped. They are: the control zone, the inventory region, and the recharge region. The control zone (sometimes called the exclusion zone) is a 100-foot radius circle around each wellhead. The goal of management in the control zone is to avoid introducing contaminants directly into the wells or immediate surrounding areas. Drainage should be directed away from the wellheads, and caution should be exercised to ensure that all contaminant sources are removed from the control zones. The inventory region is the area that is expected to contribute groundwater to the wells over the next three years (DEQ, 1999). For this aquifer, this is mapped to a distance of one mile upgradient of the wells. The recharge region represents the full upgradient extent of the aquifer. Potential sources of contamination were inventoried within the control zone and inventory region and the results are as follows:

- No potential sources of contamination were identified within the control zones.
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The operator should take care that surface drainage is directed away from the wellheads. Wells completed into the deep confined aquifer are generally less vulnerable to contamination, but without annular seals, the wells could be compromised at the wellheads. Well 1 is reportedly grouted to 19 feet below grade (ftbg), and Well 2 is reportedly grouted to 30 ftbg.

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Low risk potential sources and potential sources located outside the inventory region, but within the recharge region, may still pose a threat over time. These are not considered in this assessment, however. The susceptibility analysis is intended to provide the operator with information on where the greatest risk occurs. To this end, the assessment is focused on potential contaminant sources that the Source Water Protection Section has determined to be significant. These are detailed in Chapter 4.

Mitigating and managing potential sources of contamination identified within the inventory region are often beyond the scope of what an operator of a relatively small PWS may accomplish. The SWP section recommends that whenever possible, the operator should illustrate to residents the potential hazards associated with the onsite septic systems, and the need for regular maintenance.

# 8.0 REFERENCES

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# 9.0 GLOSSARY

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.

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.

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.

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.

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.

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

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 wells drilled in Montana, including stratigraphic data and well construction data, when available.

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.

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).

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 in a well when the pump is operating.

Sensitivity. The relative ease with which contaminants can migrate to source water through the natural materials

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.

Static Water Level (SWL). Water level 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.

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.

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

**FIGURES**

# APPENDIX A

# PWS SANITARY SURVEY

# APPENDIX B

# WATER QUALITY ANALYTICAL REPORT

# APPENDIX C

# GROUNDWATER TIME-OF-TRAVEL CALCULATIONS

# APPENDIX D

# MONITORING WAIVER RECOMMENDATIONS

## MONITORING WAIVERS

***Waiver Recommendation***

The PWS currently has waivers for Phase II inorganics (barium, cadmium, chromium, fluoride, mercury and selenium) and SOCs (excluding EPA Method 515). Diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), polychlorinated biphenyls (PCBs), cyanide and asbestos (at the source) are excluded from monitoring requirements by statewide waivers.

The monitoring history suggests the PWS may be eligible for a Phase V inorganic (antimony, thallium, beryllium and nickel) waiver. Under these waivers, the monitoring schedule for these parameters is reduced to every nine years, rather than every three years. The wells' urban setting precludes eligibility for VOC waivers.

The PWS must be in compliance with DEQ regulations to be considered for monitoring waivers. Written waiver requests must be sent to DEQ at the address below:

Greg Butts
Montana DEQ, PWS Section
109 Cooperative Way
Suite 105
Kalispell, MT 59901

Upon receipt of a waiver request, DEQ will review the system's compliance history, historical monitoring results and source water setting. If waivers are considered appropriate, DEQ will provide the operator with application forms, guidance and technical assistance. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. A site visit may be required to further investigate VOC and SOC use within the inventory region.

# APPENDIX D

# CONCURRENCE LETTER