# White Sulphur Springs Public Water System

**PWSID #** MT0000360

# *SOURCE WATER DELINEATION AND ASSESSMENT REPORT*

**Date of Report:** 12/09/02


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Final Document

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# INTRODUCTION

Carolyn DeMartino, a Water Quality Specialist with the Montana Department of Environmental Quality, completed the White Sulphur Springs (PWSID# 00360) Source Water Delineation and Assessment Report (SWDAR).

**Purpose**

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for the completion of the delineation and assessment for the White Sulphur Springs Public Water Supply System (PWSS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is “delineation and assessment”. Delineation is a process of mapping source water protection areas, which contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps White Sulphur Springs complete a source water protection plan to protect its drinking water source.

**Limitations**

This report was prepared to assess threats to the White Sulphur Springs public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the White Sulphur public water supply and not any other public or private water supply. Also, not every potential or existing source of groundwater or surface water contamination in the White Sulphur Springs area has been identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

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 be significant health threats.

# CHAPTER 1
# BACKGROUND

The Community

White Sulphur Springs is located in Meagher County in southwestern Montana (Figure 1). The town, located near the Smith River Canyon, was named after the white deposits that were formed by the hot springs that are located in the city park. According to the Census Bureau the population of Meagher County in 2000 was 1,932 of which 984 people live in White Sulphur Springs. White Sulphur Springs' economy is based primarily upon agriculture. Other area businesses include gas stations, a post and pole company, trucking company, hospital, and other service related businesses.

The major transportation routes in the White Sulphur Springs area include US Route 89 and U.S. Route 12.

White Sulphur Springs is served by a municipal sanitary sewer system. The facultative sewage treatment lagoons are located on the southwest side of town (Figure 2). The receiving water for the treated wastewater discharge is Lone Willow Creek.

Geographic Setting

White Sulphur Springs is located in the Smith River Valley of southwestern Montana in Section 7 and 17, Township 9 Nouth, Range 7 East (Figure 1). Climate in the White Sulphur Springs area is considered semi-arid. Average daily high and low temperatures in White Sulphur Springs are 80.5° F and 47.5° F in August and July, respectively, and 32.2° F and 11.4° F in January. Annual precipitation averages 13.41 inches. Rainfall occurs year round with May and June being the wettest months. The annual average snowfall of 36.2 inches is received in the White Sulphur Springs area mainly September to April (Western Regional Climate Center, Monthly Climate Summary 12/1/1978 to 12/31/2001).

Major streams in the White Sulphur Springs vicinity include the Smith River, Lone Willow Creek, and Willow Creek. Irrigation canals are also in the White Sulphur Springs vicinity. South Side Canal is located approximately one mile east of White Sulphur Springs.

In addition to the springs located within the City of White Sulphur Springs park, Hanson Spring is located to the northwest, Trinity Springs to the northeast, Carlin Springs and Rankin Springs to the south of White Sulphur Springs.

The three mountain ranges that surround White Sulphur Springs include the Little Belt Mountains to the northeast, the Castle Mountains to the southeast, and the Big Belt Mountains to the southwest. The headwaters for Willow Creek, the White Sulphur Springs PWS surface water source, are located in the Castle Mountains.

General description of the Source Water

The City of White Sulphur Springs obtains its water from both groundwater and surface water sources. Groundwater is obtained from two 200-foot wells (Figure 2) completed in fractured siltstone (Figure 3). Well logs are located in Appendix A. Surface water is obtained from a slow sand filter/ infiltration gallery system located in Willow Creek. The slow sand filter and infiltration gallery are located approximately five miles southeast of town (Figure 4).

## The Public Water Supply

The White Sulphur Springs PWS provides water to approximately 1,000 residents through 520 active service connections. Each service connection is metered. The water supply system consists of a 200-foot well (Well #1-WL003) that was drilled in 1986 and a slow sand filter/ infiltration gallery system (IN002) located in Willow Creek. A newer well (Well #2-WL004), drilled in 1998, functions only as a back-up well if the need arises (DEQ, 1999 Sanitary Survey). Three buildings at the PWS system include the chlorination room and well house, located at the well head; a chlorinate analyzer building, located on the transmission main from the storage tank; and a chlorination and valve building at the storage tank.

A 60 horse power submersible pump with a peak flow of 800 gallons per minute (gpm) is located in well 1 at about 180 feet below ground surface. Groundwater is pumped directly into the distribution system, and during periods of low use excess pressure in the distribution system lifts water to a 450,000 –gallon concrete storage tank located approximately two miles east of White Sulphur Springs. The water from the tank is then gravity fed back to the distribution system as demand increases. The storage tank is connected to the distribution system with approximately two miles of 12-inch steel transmission main. The steel transmission line is scheduled to be replaced with 12-inch PVC pipe.

The slow sand filter system, located approximately five miles from town consists of a concrete dam with earthen sides and approximately 4.5 feet of masonry sand as the filter media with collectors below. An infiltration gallery is used in conjunction with the slow sand filter to help collect water. Water from Willow Creek and trenches is collected through perforated pipe wrapped in filter paper. The dam creates a pond, holding approximately 314,160 gallons of water, above the slow sand filter when Willow Creek is diverted into the slow sand filter (DEQ, 1999 Sanitary Survey). Water from the slow sand filter is gravity fed into the storage tank through approximately three miles of 6-inch PVC pipe. Because the slow sand filter requires the use of supplemental pumping to drain and it is difficult to clean, filtered water frequently has a higher turbidity than water in the creek before filtration. Future improvements are planned for the White Sulphur Springs slow sand filter system located in Willow Creek.

Groundwater from the wells and surface water from Willow Creek are treated with gas chlorine that is injected at the well house and at the storage tank.

The daily average demand for groundwater well #1 is approximately 300,000 gallons per day (gpd), and about 150,000 gpd for the slow sand filter. The production from the Willow Creek system limited by water rights during irrigation season as the irrigation water rights have priority. During irrigation season withdrawal from Willow Creek is limited to approximately 112 gpm.

## Water Quality

White Sulphur Springs water quality is routinely monitored for compliance with drinking water standards. Bacteriological monitoring is conducted monthly. Compliance with other drinking water standards is based on additional sampling on a variety of schedules. Nitrate plus nitrite as nitrogen in Willow Creek over the past five years has ranged from 0 to 0.11 milligrams per liter (mg/L). Monitoring results for nitrate plus nitrite as nitrogen in groundwater within the past five years indicate the range of detections is from 0.11 mg/L to 0.81 mg/L.  These detections remain well below the maximum contaminant level of 10 mg/L (DEQ SDWIS database). Within the past five years there have been coliform bacteria detections in water utilized by the White Sulphur Springs PWS. Within the past five years turbidity exceedances have also been detected and have prompted the initiation of future improvements to be considered on the slow sand filter.

Willow Creek is located in the Smith River sub-basin of the Upper Missouri River Watershed. The U.S. Geological Survey hydrologic unit code for Willow Creek is 10030103. The Willow Creek drainage to the White Sulphur Springs intake is classified as A-1 water meaning, waters are to be maintained suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities. This stream segment is not listed on the 303D List of Impaired Streams.

A nearby stream gage is not available in the vicinity of the White Sulphur Springs PWS. No further ambient water quality data is available for this segment of Willow Creek.

# CHAPTER 2
# DELINEATION

The source water protection area, the land area that contributes water to the White Sulphur Springs PWS wells, is identified in this chapter. Management areas identified within the source water protection area for wells 1 and 2 include the control zone, inventory region, and recharge region. For the purposes of this report, the recharge region is included within the watershed region for the Willow Creek surface water intake. The control zone is an area at least 100-foot radius around the well. The management goal of the control zone, also known as the exclusion zone, is to protect against the direct introduction of contaminants into the wells or in the immediate area surrounding each well. The inventory region (Figure 5) represents the zone of contribution to the wells. The management goal of the inventory region is to focus on pollution prevention activities at potential contaminant sources where it is likely that contaminated water would flow into the wells within a relatively short time. The recharge region represents the entire portion of the aquifer that contributes water to the White Sulphur Springs wells. Management within the recharge region should focus on maintaining and improving the quality of groundwater that could reach the wells over longer timeframes or with increase usage.

Management areas identified within the source water protection area for the White Sulphur Springs surface water intake include the spill response region (Figure 6) and the watershed region (Figure 7). The spill response region represents the area of surface water upstream of the White Sulphur Springs PWS in which contaminants could be drawn into the intake in a relatively short period of time. The watershed region represents the entire region that is upstream of, and contributes water to the White Sulphur Springs PWS.

Hydrogeologic Conditions

Tertiary basin fill sediments underlie the City of White Sulphur Springs. White Sulphur Springs PWS wells 1 and 2 are completed in deep fractured siltstone and appear to be confined (Appendix A). Regional groundwater flow in the White Sulphur Springs vicinity is to the west with a relatively flat gradient (Maxim, July 1997).

Several thrust faults are located nearby and north and east of White Sulphur Springs. Water flowing from the hot springs for which the City of White Sulphur Springs is named, is the result of deep water circulation along the Willow Creek Thrust Fault, in high permeability zones of the Mississipian Mission Canyon Limestone or the Pre-Cambrian Newland Limestone beneath the thrust fault zone, or both (D. Smith 1983). The water temperature is approximately 115 ° F. The sulfur odor given off by the springs is caused by hydrogen sulfide gas escaping to the atmosphere (Groff, 1965). The springs are used for the pools and baths in a local spa hotel and for the heating system at a local bank (Grove and Dunn, 1980).

The surface water intake for the White Sulphur Springs PWS is located in Willow Creek. The headwaters for Willow Creek are located in the Castle Mountains, which are located southeast of White Sulphur Springs. The Castle Mountains were formed approximately 50 million years ago when movement of area faults occurred and the magma that formed these granite mountains moved upward along the faults (Alt and Hyndman, 1986). As the granite mountains weather, castle-like turrets are formed thus giving rise to their name.

Sedimentary rocks ranging in age from Precambrian to Cretaceous that cover a large part of the White Sulphur Springs vicinity were uplifted during the formation of the Castle Mountains and another igneous extrusion composed of diorite. The Castle Mountains and diorite extrusions produced numerous fractures in the overlying layers.

Recharge to the White Sulphur Springs wells mostly likely results from water percolating into more permeable zones of area limestones or fractured bedrock along area faults. Recharge to Willow Creek appears to be from precipitation entering directly into the creek or from runoff that eventually flows into the creek.

Table 1 below is used to determine source water/ aquifer sensitivity.

**Table 1.** Source Water Sensitivity Criteria (DEQ, 1999)

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

The White Sulphur Springs wells are completed in deep fractured siltstone. Based on this information the siltstone aquifer that supplies water to the White Sulphur Springs PWS wells has a low sensitivity to potential contaminant sources (Table 1).

Water obtained via the slow sand filter/ infiltration galley intake system in Willow Creek is classified as having a high sensitivity to potential contaminant sources. Because the groundwater and surface water are blended in the storage tank, the overall sensitivity of the White Sulphur Springs PWS to potential contaminant sources is moderate.

<u>Conceptual Model and Assumptions</u>

Tertiary basin fill sediments underlie the City of White Sulphur Springs. Areas nearby and to the north and east of White Sulphur Springs were highly faulted. Hot springs located in the city park are the result of deep water circulation along the Willow Creek Thrust Fault, in high permeability zones of the Mississipian Mission Canyon Limestone or the Pre-Cambrian Newland Limestone beneath the thrust fault zone, or both (Smith 1983). White Sulphur Springs PWS wells 1 and 2 are completed in deep fractured siltstone and appear to be confined. Regional groundwater flow in the White Sulphur Springs vicinity is to the west with a relatively flat gradient (Maxim, July 1997). Recharge to the wells is potentially from water percolating into more permeable limestones or fractured bedrock along area faults.

Surface water is also utilized by the White Sulphur Springs PWS. The water is obtained via a slow sand filter/ infiltration gallery system in Willow Creek. Contaminants, if spilled directly into Willow Creek upstream or in the immediate vicinity of the White Sulphur Springs intake, could potentially reach the intake before the water operator could close it. Over a longer time-frame, contaminants that accumulate throughout the watershed could be flushed into Willow Creek during periods of spring high flow runoff.

<u>Well Information</u>

Data for the White Sulphur Springs wells is summarized in Table 2.
**Table 2** Well information for the White Sulphur Springs PWS.

| Information | Well #1 | Well #2 |
|---|---|---|
| **PWS Source Code** | WL003 | WL004 |
| **Well Location (T, R, Sec)** | T. 9 N., R. 7 E., Sec. 07 SW¼ SE¼SE¼ (DDC) | T. 9 N., R. 7 E., Sec. 07 SW¼ SE¼SE¼ (DDC) |
| **Latitude/ Longitude** | 46.5498/110.8899 | 46.5482/ 110.8883 |
| **MBMG #** | NA | 172711 |
| **Water Right #** | NA | C061342-00 |
| **Date Well was Completed** | 06/23/86 | 04/21/1999 |
| **Total Depth** | 200 | 201 |
| **Perforated Interval** | 90’ - 200’ | 145’ – 195’ |
| **Static Water Level** | 19 | 22 |
| **Pumping Water Level** | 42 | 58 |
| **Drawdown** | 23 | 36 |
| **Test Pumping Rate** | NA | NA |
| **Specific Capacity** | 35 | 28 |

Well 1 is used mainly along with water obtained via the Willow Creek surface water intake to supply White Sulphur Springs with drinking water. Well 2 is used as a backup well as needed depending on water demand.

<u>Surface Water Intake Information</u>

The slow sand filter system, located approximately five miles southeast of town in Willow Creek, consists of a concrete dam with earthen sides and approximately 4.5 feet of masony sand as the filter media with collectors below. An infiltration gallery is used in conjunction with the slow sand filter to help collect water. Water from Willow Creek and trenches is collected through perforated pipe wrapped in filter paper. The dam creates a pond, holding approximately 314,160 gallons of water, above the slow sand filter when Willow Creek is diverted into the slow sand filter (DEQ, 1999 Sanitary Survey). Because the slow sand filter requires the use of supplemental pumping to drain and it is difficult to clean, filtered water has a higher turbidity than water in the creek before filtration. Future improvements are planned for the White Sulphur Springs slow sand filter system located in Willow Creek.

## Methods and Criteria

DEQ's Source Water Protection Program specifies methods and criteria used to delineate subregions of the source water protection area for the White Sulphur Springs PWS. Because the White Sulphur Springs PWS obtains water from both groundwater wells and a surface water intake, a control zone, and inventory region have been delineated for the wells. A spill response region has been identified for the Willow Creek surface water intake. A combined recharge/ watershed region has been delineated for both the wells and surface water intake

## Delineation Results

Because wells 1 and 2 are only about 20-feet apart, a one hundred-foot radius control zone was delineated around both of the wells. A 1000-foot fixed radius inventory region was also delineated around both of the wells.

The spill response region for the Willow Creek intake extends ½-mile downstream and ten miles upstream (or at the watershed boundary) from the intake and, includes ½-mile wide buffers adjacent to all shorelines.

The delineation of the recharge/watershed region for the White Sulphur Springs PWS wells and surface water intake is based on hydrogeological mapping.

## Limiting Factors

Delineation for the wells is based on a 1000-foot fixed radius inventory region. Uncertainty exists concerning the vertical and lateral extent of potential confining layers. Also, the total amount of recharge to the system from area streams and nearby irrigation canals is unknown and can vary seasonally.

# CHAPTER 3
# INVENTORY

Inventory of potential contaminant sources was conducted within the White Sulphur Springs PWS well control zones, inventory region, and recharge region. Inventory of potential contaminant sources was also conducted within the spill response region and watershed region of the PWS intake on Willow Creek. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for the detailed inventory. Significant potential contaminants in the White Sulphur Springs inventory region and spill response region include nitrate, pathogens, fuels, solvents, agricultural chemicals, and metals.

The potential contaminant source inventory for White Sulphur Springs focuses on all activities in the control zone, certain sites or land use activities in the inventory region, and general land uses and large facilities in the recharge region. In the spill response region potential contaminant sources that have the potential to impact the intake are identified. General land uses and large facilities within the watershed region are identified.

Inventory Method

Available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. The following steps were followed:

Step 1: Urban and agricultural land uses were identified using the United States Geological Survey National Landcover Dataset 2000.

Step 2: EPA’s Envirofacts System was queried to identify EPA regulated facilities. This system accesses the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), Permit Compliance System (PCS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility is a significant potential contaminant source.

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST), hazardous waste contaminated sites, landfills, and abandoned mines.

Step 4: A business phone directory was consulted to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by SIC code.

Step 5: Major road and rail transportation routes were identified.

Step 6. All significant potential contaminant sources were identified in the inventory region and land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region.

Potential contaminant sources are designated as significant if they fall into one of the following categories:

1) Large quantity hazardous waste generators
2) Landfills
3) Hazardous waste contaminated sites
4) Underground storage tanks
5) Major roads or rail transportation routes
6) Cultivated cropland
7) Animal feeding operations
8) Wastewater lagoons or spray irrigation
9) Septic systems
10) Sewered residential areas
11) Storm sewer outflows
12) Floor drains, sumps, or dry wells
13) Abandoned or active mines

Inventory Results/Control Zone

White Sulphur Springs Wells 1 and 2 are located on the northeast side of town. The City controls the land within the 100-foot control zone (Personal Communication, December 2002, Rick Cottingham, DEQ Drinking Water Section).

Inventory Results/Inventory Region

Land cover within the inventory region for the White Sulphur Springs PWS is predominantly grassland at 44% and residential land at 40% (Figure 8). Additional land use types and their percentages are also identified on Figure 8. Septic system density in the inventory region is low. The municipal sewer system covers approximately 40% of the inventory region (Figure 9).

Significant potential contaminant sources in the inventory region are listed in Table 3 and indicated on Figure 10. A list of the additional potential contaminant sources within White Sulphur Springs is contained in Appendix B.

**Table 3.** Significant Potential Contaminant Sources in the White Sulphur Springs PWS Inventory Region

| Significant Potential Contaminant Sources | Figure/ Map ID | Contaminants | Hazard |
|---|---|---|---|
| Municipal Sewer System | Figure 10 #1 | Nitrates and pathogens | Main line breaks and contents leaching into groundwater |
| US Highway 12 & 89 | Figure 10 #2 | VOCs, SOCs, nitrates, pathogens | Accidental spills with migration of contaminants to groundwater |
| Septic Systems | Figure 9 | Nitrates and pathogens | Effluent leaching into area groundwater |
| Pasture Hay Land | Figure 8 | Nitrates and pathogens | Agricultural chemicals leaching into groundwater |
| Class V Injection Wells | Uknown | VOCs, SOCs, metals | Infiltration of contaminated water into groundwater |

**Municipal sewer system** - Municipal sewer lines underlay approximately 40% of the inventory region. A sewer main break could allow nitrates and pathogens to enter area groundwater.

**Transportation routes -** Spills of fertilizers, pesticides, volatile organic compounds (VOCs), and synthetic organic compounds (SOCs) could occur along US Highways 12 and 89.

**Septic systems –** Septic system malfunctions could cause nitrates and pathogens to leach into area groundwater.

**Agricultural land -** Nitrates and pathogens found in fertilizers and manure applied to pasture/hay land could potentially leach into area groundwater.

**Class V Injection wells –** Locations have not been determined to date for this type of discharge. However, if any are located in the inventory region they could allow infiltration of contaminated water into area groundwater.

Inventory Results/Surface Water Intake Spill Response Region

Land cover within the Willow Creek Spill Response Region includes 92% forests, 7% grassland, and 1% bare rock and decidous trees (Figure 11). Septic density within the spill response region is low.

A past producing mine, the Ringling Mine, appears to be located upgradient of the Willow Creek intake. While no confined animal feeding operations have been identified, cattle from area ranches graze in the vicinity of Willow Creek.

Inventory Results/ Watershed-Recharge Region

Land cover in the White Sulphur Springs watershed/recharge consists predominantly of 48% grasslands and 40% forests (Figure 12). Additional land use types and percentages are also identified on Figure 12. Residential land covered less than one percent of land area and was not broken out in the pie chart.

Septic density in the watershed region is low. The only significant potential contaminant sources identified in the watershed region in addition to those mentioned in the inventory region and spill response region are scattered mines (Figure 13).

Inventory Limitations

The potential contaminant inventory was conducted using various databases to acquire readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information, however, should ensure that the major threats to the White Sulphur Springs PWS wells and surface water intake in Willow Creek have been identified.

Inventory Update

To make this SWDAR a useful document in the years to come, the owners, managers, or the certified water system operator(s) for the White Sulphur Springs PWS should update the inventory for their records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ at least every 5 years to ensure that this report stays current in the public record.

# 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 local entities, in this case White Sulphur Springs.

The goal of Source Water Management is to protect the sources of the White Sulphur Springs PWS water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region for the wells and in the spill response region for the intake, and 3) ensuring that land use activities in the Recharge/ Watershed Regions pose minimal threat to the source water. Management priorities in the Inventory Region for the wells and Spill Response Region for the intake 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 White Sulphur Springs PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard ranking for each potential contaminant source and the existence of barriers that may decrease the likelihood that contaminated water will flow to the White Sulphur Springs wells and surface water intake (Table 4).

**Table 4. Relative 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 nature of contaminants determines hazard (Table 5).

**Table 5.** Hazard of potential contaminant sources associated with proximity to a PWS well or intake or density within a PWS inventory or spill response region.

| **Type of Contaminant Source** | | **High Hazard** | **Moderate Hazard** | **Low Hazard** |
|---|---|---|---|---|
| SURFACE WATE | 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 | Potential for direct discharge of small quantities to source water | Potential for discharge to groundwater hydraulically connected to source |

**Table 5.** Hazard of potential contaminant sources associated with proximity to a PWS well or intake or density within a PWS inventory or spill response region.

| Type of Contaminant Source | | High Hazard | Moderate Hazard | Low Hazard |
|---|---|---|---|---|
| R | | pipelines | | 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 |

Susceptibility rankings are presented individually for each significant potential contaminant source and each associated contaminant in Table 5 and in text following the table. Management recommendations that indicate how significant potential contaminant sources could be better managed to prevent impacts to the White Sulphur Springs wells and surface water intake are also provided in Table 5.

**Table 5. Susceptibility assessment for significant potential contaminant sources in the White Sulphur Springs Inventory and Spill Response Regions**

| Potential Contaminant Sources | Potential Contaminants | Hazard | Hazard Ranking | Barriers | Susceptibility | Management Recommendation |
|---|---|---|---|---|---|---|
| **Inventory Region** | | | | | | |
| **Municipal Sewer (40%)** | Nitrates and pathogens | Main breaks and contaminated water mixing with groundwater | Moderate | Well intake depth, upward groundwater gradient | Very Low | Periodic inspection and upgrades of older sewer mains |
| **US Highway 12 & 89** | VOCs, SOCs, nitrates | Accidental spills | Low | Well intake depth, upward groundwater gradient | Very Low | Spill Response Plan |
| **Septic Systems** | Nitrates and pathogens | Effluent leaching into groundwater | Low | Well intake depth, upward groundwater gradient | Very Low | Proper maintenance |
| **Pasture Hay Land** | Nitrates and pathogens | Spills, over application, surface runoff leaching into groundwater | Low | Well intake depth, upward groundwater gradient | Very Low | Use Best Management Practices |
| **Stormwater Discharges** | VOCs, SOCs, metals | Infiltration into | Unknown at this time | Not available | Unknown at this time | Work with EPA to identify locations and |

**Table 5. Susceptibility assessment for significant potential contaminant sources in the White Sulphur Springs Inventory and Spill Response Regions**

| Potential Contaminant Sources | Potential Contaminants | Hazard | Hazard Ranking | Barriers | Susceptibility | Management Recommendation |
|---|---|---|---|---|---|---|
| **Inventory Region** | | | | | | |
| Class V Injection Wells | | groundwater | | | | appropriate response |
| **Spill Response Region** | | | | | | |
| **Mines** Ringling Mine | VOCs, SOCs, nitrates, metals | Leaching into area surface water | High | Dilution | High | Revegetation, tailings management |

**Municipal Sewer –** Hazard is ranked moderate because the municipal sewer system underlies approximately 40% of the inventory region. The susceptibility of the wells is ranked low based on the depth of the well intakes and there appears to be an upward groundwater flow gradient.

**U.S. Highway 12 and 89 –** Hazard is ranked low for these transportation routes. The overall susceptibility is very low based on the depth of the well intakes and there appears to be an upward groundwater flow gradient.

**Septic Systems –** Hazard is ranked low based on the low density of septic systems in the inventory region. The susceptibility of the wells is ranked low based on the depth of the well intakes and there appears to be an upward groundwater flow gradient.

**Pasture Hay Land –** Hazard is ranked low because this agricultural land occupies only 6 percent of the inventory region. The susceptibility of the wells is ranked low based on the depth of the well intakes and there appears to be an upward groundwater flow gradient.

**Storm Water Discharges (Class V Injection Wells) –** Hazard has not been ranked because the location and quantity of Class V Injection Wells in White Sulphur Springs is unknown. The have been identified in this report because if present, they have the potential to discharge into area groundwater. The susceptibility is also unknown at this time.

**Mines (Ringling Mine) –** Hazard is ranked high in the Willow Creek Spill Response region. The past producing Ringling Mine appears to be upgradient of the Willow Creek intake. The overall susceptibility is high based on dilution.

## Management Recommendations

The White Sulphur Springs PWS Source Water Delineation and Assessment Report was prepared to assist the City of White Sulphur Springs. The report provides information concerning the wells and Willow Creek intake that supply water to White Sulphur Springs, identifies the source water protection areas and within each of these protection areas identifies the significant potential contaminants that may impact the source of water to White Sulphur Springs. Also provided in the table are recommendations regarding how the potential contaminant could be better managed to prevent impacts in the vicinity of the White Sulphur Springs wells and surface water intake. If these management recommendations are implemented, they may be considered additional barriers that will reduce the susceptibility of White Sulphur Springs' wells and intake to specific sources and contaminants.

Management recommendations fall into the following categories:

**Sewer maintanence and leak detection.** Early leak detection and scheduled replacement of older sewer lines will reduce the susceptibility of Great Falls intake to contamination from sanitary wastes.

**Sewer extension.** Annexation and extension of sewers is the only way to reduce contamination from existing unsewered developments.

**Agricultural Best Management Practices.** 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

**Stormwater Management.** Stormwater planning should address source and drainage control. Source control can be accomplished through educational programs focusing on residential and commercial chemical use, disposal, and recycling. Drainage control and pollutant removal can be accomplished through the use of vegetated retention basins at outfall locations.

**Education.** Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated 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.** This is a management recommendation that White Sulphur Springs itself could develop and implement. Coordination with county and state emergency response personnel would greatly benefit the plan. The plan should identify the procedures the water operators and other emergency personnel should follow in the event that there is an imminent threat that contaminants would reach the PWS wells or intake. The emergency response plan should be updated annually to reflect changes in emergency contacts, phone numbers, and resources available within the city and county to respond to an emergency situation, such as a hazardous material spill.

# 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 are descriptions of the different types of waivers. Monitoring waiver recommendations for White Sulphur Springs follows these descriptions.

**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.

**Susceptibility Waivers**

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. Susceptibility is based on prior analytical or vulnerability assessment results, environmental persistence, and transport of the contaminants, natural protection of the source, wellhead protection program efforts, and the level of susceptibility indicators (such as nitrate and coliform bacteria). The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals. Shallow groundwater sources under the direct influence of surface water (GWUDISW) should use the same area of investigation as surface water systems; that is, the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the point of diversion. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include will logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; Time-of-Travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. Review of an organic chemical monitoring waiver application will be conducted by DEQ's PWS Section and DEQ's Source Water Protection Program. Other state agencies may be asked for assistance.

## Susceptibility Waiver for Confined Aquifers

Confined groundwater is isolated from overlying material by relatively impermeable geologic formations. A confined aquifer is subject to pressures higher than atmospheric pressure that would exist at the top of the aquifer if the aquifer were not geologically confined. A well that is drilled through the impervious layer into a confined aquifer will enable the water to rise in the borehole to a level that is proportional to the water pressure (hydrostatic head) that exists at the top of a confined aquifer.

The susceptibility of a confined aquifer relates to the probability of an introduced contaminant to travel from the source of contamination to the aquifer. Susceptibility of an aquifer to contamination will be influenced by the hydrogeologic characteristics of the soil, vadose zone (the unsaturated geologic materials between the ground surface and the aquifer), and confining layers. Important hydrogeologic controls include the thickness of the soil, the depth of the aquifer, the permeability of the soil and vadose zones, the thickness and uniformity of low permeability and confining layers between the surface and the aquifer, and hydrostatic head of the aquifer. These factors will control how readily a contaminant will infiltrate and percolate toward the groundwater.

The Susceptibility waiver has the objective of assessing the potential of contaminants reaching the groundwater used by the PWS. A groundwater source that appears to be confined from surface infiltration in the immediate area of the wellhead may eventually be affected by contaminated groundwater flow from elsewhere in the recharge area. Contaminants could also enter the confined aquifer through improper well construction or abandonment where the well provides a hydraulic connection from the surface to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. Regional conditions that define the confinement of a groundwater source must be demonstrated by the PWS in order to be considered for a confined aquifer susceptibility waiver. Confinement of an aquifer can be demonstrated by pump test data (storage coefficient), geologic mapping, and well logs. Site specific information is required to sufficiently represent the recharge area of the aquifer and the zone of contribution to the PWS well. The following information should be provided:

- Abandoned wells in the region (zone of contribution to the well),
- Other wells in the region (zone of contribution to the well),
- Nitrate/Coliform bacteria analytical history of the PWS well,
- Organic chemical analytical history of the PWS well,

## Susceptibility Waiver for Unconfined Aquifers

Unconfined aquifers are the most common source of usable groundwater. Unconfined aquifers differ from confined aquifers in that the groundwater is not regionally contained within relatively impervious geologic strata. As a result, the upper groundwater surface or water table in an unconfined aquifer is not under pressure that produces hydrostatic head common to confined aquifers.

Unconfined aquifers are usually locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers reflect surface topography, and the residence time of water in the aquifer is comparatively shorter than for water in confined aquifers. Similar water chemistry often exists between unconfined groundwater and area surface water, and physical parameters and dissolved constituents can be an indicator of the hydraulic connection between groundwater and surface water. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface to groundwater.

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration from the surface to the unconfined aquifer. The general procedures make use of a combination of site specific information pertaining to the location and construction of the source development, monitoring history of the source, geologic characteristics of the unsaturated soil and vadose zones, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The zone of contribution of the unconfined groundwater source must be defined and plotted. This should describe the groundwater flow directions, gradients, and a 3-year time-of-travel. All surface bodies within a 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and those nearby should be provided as well.

**Waiver Recommendation**

Currently, White Sulphur Springs has a Phase II inorganic monitoring waiver for the common header for wells 1& 2. A Phase II and Phase V inorganic monitoring waiver is also in effect for the surface water intake.  Based on past monitoring results and the susceptibility assessment for the wells and the surface water intake, White Sulphur Springs may be eligible for additional monitoring waivers.  For further monitoring waiver consideration, the White Sulphur Springs PWS should submit a letter to DEQ requesting additional monitoring waivers.  The PWS also needs to provide additional information to DEQ regarding chemical use within the inventory and spill response regions.

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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. 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.

**Community.** A town, neighborhood or area where people live and prosper.

**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 ground water 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 ground water flow systems.

**Inventory Region.** A source water management area for ground water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year ground water 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 an 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 – Ground Water Information Center (MBMG/GWIC).** The database of information on all wells 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 ground waters 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 ground water. 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 ground water 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 ground water 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

## WELL LOG REPORT Well #1 WL003

*State law requires that this form be filed by the water well driller within 60 days after completion of the well*

1. WELL OWNER
Name City of White Sulphur Springs

2. CURRENT MAILING ADDRESS

3. WELL LOCATION
County
Township 09 N/S Range 07 E/W
SW¼ SE¼ SE¼ Section 7
Lot Block
Subdivision

4. PROPOSED USE Domestic ☐ Stock ☐ Irrigation ☐
Other ☐ specify

5. DRILLING METHOD ___ cable, ___ bored,
X forward rotary, ___ reverse rotary, ___ jetted,
___ other (specify)

6. WELL CONSTRUCTION AND COMPLETION

| Size of drilled hole | Size and weight of casing | From (feet) | To (feet) | Perforations and/or Screen X 100 Slot: Kind Size | From (feet) | To (feet) |
|---|---|---|---|---|---|---|
| 18" | 365 16" | 0 | 30 | SS403 | 90 | 200 |
| 14" | 365 10" | 0 | 90 | 10" PS | | |

Was casing left open end? ___ Yes X No
Was a packer or seal used? X Yes ___ No
If so, what material BENTONITE
Was the well gravel packed? X Yes ___ No
Was the well grouted? X Yes ___ No
To what depth? 88'
Material used in grouting CEMENT
Well head completion: Pitless adapter
___ Yes ___ No
Top of casing 12 in. or greater above grade
X Yes ___ No

7. WHAT IS THE TEMPERATURE OF THE WATER?
45 Degrees Fahrenheit
☐ Measured ☒ Estimated

8. WATER LEVEL
Static water level 19 feet below land surface
If flowing; closed-in pressure ___ psi
___ gpm
Controlled by: ___ valve, ___ reducers
___ other, (specify) ___

9. WELL TEST DATA X pump ___ bailer
___ other, (specify)
Pumping water level below land surface:
42 ft. after 24 hrs. pumping 900 gpm
___ ft. after ___ hrs. pumping ___ gpm

10. WAS WELL PLUGGED OR ABANDONED? ___ Yes ___ No
If yes, how?

11. DATE COMPLETED 6-23-86

12. WELL LOG

| Depth (ft.) From | To | Formation |
|---|---|---|
| 0 | 19 | FINE SAND |
| 19 | 200 | FRACTURED SILT STONE |

(use separate sheet if necessary)

13. DRILLER'S CERTIFICATION
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Date

Firm Name

Address

Signature License No.

**MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION DNRC**
32 SOUTH EWING HELENA, MONTANA 59620 444-6610

**Montana Bureau of Mines and Geology**
**Ground-water Information Center Site Report**
**CITY OF WHITE SULPHUR SPRINGS**

Plot this site on a topographic map

## Location Information

| | |
|---|---|
| GWIC Id: | 172711 |
| Location (TRS): | 09N 07E 07 DDC |
| County (MT): | MEAGHER |
| DNRC Water Right: | C061342-00 |
| PWS Id: | |
| Block: | Not Reported |
| Lot: | Not Reported |
| Certificate of Survey: | Not Reported |
| Source of Data: | LOG |
| Latitude (dd): | 46.5482 |
| Longitude (dd): | -110.8883 |
| Geomethod: | TRS-TWN |
| Datum: | 1927 |
| Addition: | Not Reported |
| Type of Site: | WELL |

## Well Construction and Performance Data (measurements are reported below land surface)

| | |
|---|---|
| Total Depth (ft): | 201.00 |
| Static Water Level (ft): | 22.00 |
| Pumping Water Level (ft): | 58.00 |
| Yield (gpm): | 1000.00 |
| Test Type: | PUMP |
| Test Duration: | 10.00 |
| Drill Stem Setting (ft): | |
| Recovery Water Level (ft): | 22.00 |
| Recovery Time (hrs): | .03 |
| How Drilled: | ROTARY |
| Driller's Name: | BUSH |
| Driller License: | WWC597 |
| Completion Date: | Apr 21, 1999 |
| Special Conditions: | None Reported |
| Is Well Flowing?: | No |
| Shut-In Pressure: | |
| Geology/Aquifer: | Not Reported |
| Well/Water Use: | Not Reported |

### Hole Diameter Information

No hole diameter records were found.

### Casing Information

| From (ft) | To (ft) | Dia (in) | Description |
|---|---|---|---|
| 0.0 | 201.0 | 10.0 | STEEL |

### Annular Seal Information

| From (ft) | To (ft) | Description |
|---|---|---|
| 0.0 | 35.0 | NEAT CEMENT |

### Completion Information

| From (ft) | To (ft) | Dia (in) | Description |
|---|---|---|---|
| 145.0 | 195.0 | 10.0 | 3/16X1 AIR MECHANICAL |

## Lithology Information

| From (ft) | To (ft) | Description |
|---|---|---|
| 0.0 | 3.0 | TOPSOIL |
| 3.0 | 11.0 | DRY SANDY CLAY |
| 11.0 | 28.0 | MOIST SANDY CLAY |
| 28.0 | 31.0 | MUDSTONE BROWN 2 GPM |
| 31.0 | 55.0 | HARDER BROWN SILTSTONE 20 GPM |
| 55.0 | 75.0 | BROWN SILTSTONE W/INTERMITTENT LAYER OF A HARD GREEN BROWN SILTSTONE 40 GPM |
| 75.0 | 201.0 | FRACTURED SILTSTONE |

# APPENDIX B

Potential Contaminant Sources In The
White Sulphur Springs Inventory Region

# APPENDIX C

# Concurrence Letter