

# **Town of Big Timber**

**PWSID MT0000463**

## ***Source Water Delineation and Assessment Report***

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## INTRODUCTION

This Source Water Delineation and Assessment Report, also known as a SWDAR, was completed by Jim Stimson, Hydrogeologist with Montana Department of Environmental Quality (DEQ).

### **Purpose**

This report is intended to meet the technical requirements for completion of the delineation and assessment report 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 whereby areas that contribute water to aquifers or surface water bodies that are used to supply drinking water are identified on a map. These areas are called source water protection areas. Assessment involves identifying locations in the delineated 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 Big Timber protect their drinking water source.

### **Limitations**

This report was prepared to assess threats to the Big Timber public water system 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 Big Timber public water system and not any other public or private water system. Also, not all of the potential or existing sources of ground water or surface water contamination in the area are identified. Only potential sources of contamination in areas that contribute water to Big Timber public water system wells are considered.

The term “contaminant” is used in this report to refer to constituents for which Maximum Contaminant 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

Big Timber is the county seat of Sweet Grass County and the town is located near the Boulder River's confluence with the Yellowstone River ([Figure 1](#)). Big Timber is approximately 35 miles east of Livingston and 40 miles west of Columbus. The town has a population of about 1,700. Big Timber's population has grown by about a 6% since the 1990 census (Census and Economic Information Center, 2002). Sweet Grass County has a population of about 3,600 and the county's population has increased about 14% since 1990. There are 4 public water supplies (PWSs) in the Big Timber area ([Figure 3](#)). One of the PWSs is classified as community systems that serve 25 or more year round residences and the remainder are non-community transient PWSs that serve a transient population. Table 1 below lists the PWSs and the source of water they use.

PWSID	Primary Name	Class	Source Name	Source Type	Resident Pop.	Non-Res Pop.
MT0000125	Strobel Trailer Court	Community	W Well #1	Groundwater	100	0
MT0001681	Spring Creek Campground and Trout Ranch	Transient	Office Well #1	Groundwater	2	75
MT0003794	Super 8 Motel	Transient	East Well #1	Groundwater	0	100
MT0001689	Crazy Janes Family Eatery	Transient	Well #1	Groundwater	0	250

**Table 1 – Public Water Supplies in the Big Timber Area.**

### Geographic Setting

Big Timber is located between the Yellowstone and Boulder river valleys ([Figure 1](#) and [Figure 3](#)). This location is about 4,700 feet above sea level and is within the Upper Yellowstone Watershed (HUC # 10070002). The Yellowstone River Valley is approximately 1 mile wide near Big Timber and the Boulder River Valley is about ½ to ⅔ mile wide.

The average daily high and low temperatures at Big Timber are 85.7 °F and 51°F in August and 37°F and 16°F in January ([Figure 2](#)). Precipitation averaging 15.22 inches annually is heaviest in May and June. Average annual snowfall is 46.3 inches with the largest average accumulation coming in January (Western Regional Climate Center).

### General Surface- and Ground-water Setting

Big Timber obtains its public water supply from two infiltration galleries located within the Boulder River alluvium. The primary infiltration gallery is located about 7 miles south of Big Timber and a secondary gallery that is used seasonally is located near the southern edge of town ([Figure 1](#) and [Figure 3](#)). The secondary gallery is used mostly during the summer months. Both galleries use multiple infiltration lines buried in the Boulder River alluvium. The alluvium consists primarily of coarse gravel and boulders with some interbedded sand lenses. According to the most recent sanitary survey both galleries are classified as ground water and they are not considered to be ground water under the direct influence of surface water. However, the alluvial aquifer serving the two infiltration galleries is interpreted in this report to be shallow and unconfined and is hydraulically connected to surface water. According to the Source Water Protection Program criteria, an unconfined aquifer is considered highly sensitive to potential sources of contamination (Montana DEQ, 1999).

### The Public Water Supply

According to the most recent sanitary survey, the two infiltration galleries serving Big Timber can provide a maximum of 2.4 million gallons per day (mgd) but normally produce between 350 and 400,000 gallons per day (gpd). Water from the primary infiltration gallery located 7 miles south of town is collected in a clear well and then piped to a 650,000 gallon storage tank just south of town. Chlorine is added to this source at the clear well prior to transfer to the storage tank. The building and clear well at the primary gallery are

separated from the river by a concrete wall. The wall serves to protect the site from flooding although the site was flooded by at least one “freak” flood event. Water from the secondary infiltration gallery located on the southern edge of town is used mostly during the summer months. When in use water is pumped from the secondary gallery at a rate ranging from 350 to 400 gpm. The water is pumped directly into the distribution system and by-passes the storage tank. Chlorine is added at the secondary gallery site. The storage tank is located just south of town and was reported as being cleaned in 1997 by Liquid Engineering.

### **Water Quality**

Big Timber’s Public Water Supply is classified as community system and is required to conduct routine monitoring of the drinking water for contaminants in accordance with the Federal Safe Drinking Water Act. Parameters such as coliform bacteria, lead, copper, nitrate, nitrite, volatile organic chemicals (VOCs) including hydrocarbons and chlorinated solvents, inorganic chemicals including metals, synthetic organic chemicals including pesticides, and radiological contaminants must be monitored in accordance with schedules specified in the Administrative Rules of Montana. All contaminant concentrations detected in the required samples must comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act.

According to the DEQ PWS Database there have been no detections of coliform bacteria in Big Timber’s drinking water within the past five years. Within the past five years the highest concentration of nitrate detected in the drinking water is 0.26 mg/L, well below the MCL of 10 mg/L (SDWIS). All other contaminants analyzed for in the water supply are below detection limits and therefore comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act. Water quality monitoring data for water samples submitted by Big Timber are presented in Appendix A.

## CHAPTER 2 - DELINEATION

The source water protection areas for the Big Timber public water system are delineated in this chapter. The purpose of delineation is to map the source of drinking water for the public water supply and to define areas within which to prioritize source water protection efforts. Normally for a public water supply using ground water, three source water protection regions are delineated. They include: 1) a 100 foot control zone, 2) a 3-year Time-Of-Travel (TOT) inventory region, and 3) a recharge region corresponding to the watershed that surrounds the public water supply. For ground water sources that are located close to streams, like wells and some infiltration galleries, a surface water buffer region is also routinely delineated.

For Big Timber, the infiltration galleries collect ground water from alluvium within the Boulder River Valley and a 3-year TOT inventory region would essentially occupy the same area as the surface water buffer region. For this reason, the inventory and the surface water buffer regions are combined and will be used to focus the inventory for potential contaminant sources. For Big Timber, three source water protection and management regions are mapped. They are 1) the 100-foot control zone around each infiltration gallery site, 2) a surface water buffer region extending ½ mile down stream from the secondary infiltration gallery and 10 miles upstream from the primary infiltration gallery. This surface water buffer region extends ½ mile from each bank of the Boulder River. The third region delineated is 3) the recharge region corresponding to the watershed surrounding the Boulder River ([Figure 1](#), [Figure 3](#), [Figure 7](#), and [Figure 8](#)).

The goal of management in the control zone is to avoid introducing contaminants directly into the water supply's infiltration lines or immediate surrounding areas. The surface water buffer region (inventory region) should be managed to prevent contaminants from reaching the infiltration galleries before natural processes reduce their concentrations. The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

### Hydrogeologic Conditions

#### *Geologic Setting:*

Within the Yellowstone and Boulder River valleys, there are five distinct alluvial terraces with varying thicknesses of gravel ([Figure 4](#)). Some of the terraces are more extensive than others and they are distinguished from each other by their elevation above the modern Yellowstone and Boulder River flood plains. Some of the gravel deposits within the terraces function as aquifers where they receive recharge from irrigation canals and flood irrigated fields.

Big Timber's infiltration galleries are imbedded in the modern alluvial deposits within the Boulder River Valley ([Figure 1](#), [Figure 3](#), and [Figure 4](#)). The modern alluvium consists primarily of coarse gravel and boulders with some interbedded lenses of sand. Based on lithology information from logs from wells near the infiltration galleries, the alluvium is on the order of 40 to 60 feet thick. The modern alluvium and the terrace deposits lie on top of the Cretaceous Hell Creek Formation ([Figure 4](#)). Sandstone beds within the Hell Creek also function as aquifers in some places although wells completed in this bedrock aquifer are usually not as productive as wells completed in the modern alluvium.

### The Occurrence of Ground Water:

Ground water occurs within the older bedrock, the terraces, and the modern alluvium. As in many other areas of the state, the most productive wells tend to be those completed in the modern alluvial deposits that flank and under lay the larger rivers and streams. Recharge for the aquifers in the Big Timber area comes from a combination of precipitation, snowmelt runoff, irrigation return flows, and leakage from rivers, streams and irrigation canals.

Well information for 183 wells located in the recharge region for the Big Timber Public Water Supply was retrieved from the Ground Water Information Center (GWIC) at the Montana Bureau of Mines and Geology (MBMG) for this report on May 28, 2004. [Figure 5](#) shows a frequency distribution of total depth of these wells. [Figure 5](#) indicates that the majority of wells are relatively shallow. Eighty-four percent are less than 100 feet deep, and 40% are less than 50 feet deep. The average depth for all of the wells in the recharge region is 74 ft. below land surface (ft. bls) and the maximum depth is 350 ft. bls. Average static water level for these wells is 23 ft. bls. Pumping water level average is 27 ft. bls and average yield for wells in this area is 28 gallons per minute (gpm) with a maximum yield listed at 450 gpm. Well logs show that the majority of the wells are completed in gravel deposits.

## **Conceptual Model**

The infiltration galleries collect water from modern alluvial deposits adjacent and beneath the Boulder River. Ground water within the area moves from upland areas toward the Boulder and Yellowstone rivers. Ground water within the Boulder River Valley moves toward and parallel to the river. The aquifer providing water to the infiltration galleries is interpreted to be shallow and unconfined. Recharge originates primarily from streamflow losses from the Boulder River channel and from irrigation return flows within the valley.

## **Delineation**

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). Source water protection areas delineated for Big Timber include a control zone around each infiltration gallery site, a surface water buffer region that will be used as the inventory region, and a recharge region based on the 11 digit hydrologic unit 10070002090.

*Control Zones* - 100-foot radius control zones are delineated each infiltration gallery site; all sources of potential contaminants should be excluded in this region. All potential contaminant sources are identified within the control zone.

*Surface Water Buffer and Inventory Region* – This region extends one half mile from each bank of the Boulder River ([Figure 1](#), [Figure 3](#), and [Figure 7](#)). The region also extends one half mile below the secondary infiltration gallery, referred to as Well 1 in the sanitary survey. The surface water buffer region also extends ten miles upstream from the primary infiltration gallery, referred to as the Boulder River Infiltration Gallery in the sanitary survey. All potential contaminant sources are identified within the surface water buffer region.

*Recharge Region* – The watershed encompassing the Boulder River drainage is delineated as the recharge region. Potential sources of nitrate and pathogens are inventoried within this region. The inventory generally includes landuse and larger facilities that could potentially impact water quality.

## CHAPTER 3 – INVENTORY

An inventory of potential contaminant sources was conducted to assess the susceptibility of Big Timber’s infiltration galleries to contamination and to provide a foundation for source water protection planning. The inventory focuses on facilities that generate, use, or store potential contaminants and certain land uses in the source water protection regions delineated in the previous section. Sources of all primary drinking water contaminants and cryptosporidium are identified, although only potential sources of contaminants that pose the greatest threat to human health were selected for detailed inventory.

### Inventory Method

Databases were searched to identify businesses and land uses that are potential sources of regulated contaminants. The following steps were followed:

Step 1: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (USGS, 2000). Land cover types in this dataset were mapped from satellite imagery at 30-meter resolution using a variety of supporting information.

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, sources of nitrate and microbial contaminants were identified in the surface water buffer, 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 runoff
- 12) Floor drains, sumps, or dry wells

## **Inventory Results/Control Zones**

*Primary Infiltration Gallery:* Land within the control zone is undeveloped woodland within the river's riparian area. Some of the land near this location is used as pasture for livestock. Apart from the pastureland, there does not appear to be any other potential source of contamination within this control zone ([Figure 3](#)).

*Secondary Infiltration Gallery:* The control zone around the secondary infiltration gallery includes a section of state highway 298, about half of the residential area within town, and undeveloped riparian land adjacent the Boulder River. There is a small irrigation ditch running just south of the site and within the control zone ([Figure 3](#)).

## **Inventory Results/ Surface Water Buffer-Inventory Region**

The majority of the significant potential contaminant sources are located outside the Boulder River Valley or within the city limits ([Figure 3](#)). This means they are located in a down gradient position from the secondary infiltration gallery. In other words, the ground water flow beneath Big Timber would carry potential contaminants away from the secondary infiltration gallery not towards it. As a consequence, potential contaminant sources shown in [Figure 3](#) and located west, north, and northeast of the secondary gallery do not pose a threat to the public water supply or the source water. This is also the case for the city sewer lines and main lines, and a moderate septic density area, located north of the secondary infiltration gallery ([Figure 3](#)).

One small area of high septic density is shown to exist about ¼ mile southwest of the secondary gallery. Ground water near the high septic density area would flow generally toward the infiltration gallery. However, the high septic density area is relatively small and is more than 1,000 feet away from the gallery. For these reasons, the high septic density area is not considered to pose a serious threat to the public water supply or the source water. That being said, it would be prudent to connect this high septic density area to the city sewer service sometime in the future and eliminate concern that water provided by the secondary infiltration gallery could be impacted by septic effluent.

Some development is occurring within the Boulder River Valley upstream from the primary infiltration gallery but it appears to be low-density development on relatively large lots. Some land within the Boulder River Valley is used for grazing cattle and horses, and for irrigated agriculture. Agricultural land accounts for about 16% of the land area within the surface water buffer region. It is worth noting that the bulk of the ag-land is located between the primary and secondary infiltration galleries ([Figure 7](#)). This means that the secondary gallery would be more susceptible to the potential impacts from the agricultural land. The concern here is the potential for mismanagement or over-application of fertilizers and/or pesticides on the agricultural lands that could result in SOCs entering the Boulder River.

Highway 298 runs the length of the Boulder Valley between the two infiltration galleries and the Eight-Mile Bridge is located about one mile above the Primary Infiltration gallery ([Figure 1](#) and [Figure 3](#)). The highway is not a major transportation corridor and is not routinely used by large trucks hauling hazardous material. The most serious potential threat to the source water and public water supply appears to be the interstate highway that passes about 0.1 miles south of the secondary infiltration gallery ([Figure 3](#)). Spills and releases of a variety of hazardous materials could occur if accidents involving large trucks occurred on the interstate. The portion of the interstate that passes Big Timber is a relatively long straight away that would appear to have a lower probability of contributing to accidents than other stretches of highway where the road is curved or passes over a curved bridge. The same could be said of the State Highway 298 overpass that crosses the interstate just south of town. In addition, for a spill to threaten the secondary infiltration gallery, the accident would need to occur in a relatively short segment of the interstate between

the state highway over-pass and the Boulder River ([Figure 3](#)). While accidents involving large truck in this area cannot be totally discounted, they would seem to be less likely due to the fact that the interstate is so straight through this area. For this reason, the hazard presented by the interstate is considered to be moderate instead of high. Nevertheless, it is important for residents, public water supply operators, and emergency response personnel to be alert and responsive to any accidents involving large tanker trucks on the interstate in the vicinity of the secondary infiltration gallery.

No other businesses that use or generate hazardous chemicals were identified in the surface water buffer-inventory region. Table 2 below summarizes the significant potential contaminant sources identified for the Big Timber Public Water Supply.

**Table 2. Significant potential contaminant sources in the inventory region of Big Timber Public Water System.**

Source	Contaminants of Concern
Interstate 90 where it crosses the Boulder River	Variety of hazardous materials
Agricultural lands within the Boulder River Valley	Fertilizers, herbicides, and pesticides (VOCs, and SOCs)
Municipal sewer lines and main lines	Microbial contaminants and nitrate
Individual Septic Systems	Microbial contaminants and nitrate
State Highway 298	Variety of hazardous materials
Class V Injection Wells	Nitrate, pathogens, VOCs, and SOCs, and others

### **Inventory Result/ Recharge Region**

Land cover in the recharge or watershed region is 42 percent forestland, 51 percent grassland, and only 2% percent agricultural land ([Figure 7](#)). Forest and grasslands are not considered potential contaminant sources. Agricultural land is considered a potential contaminant sources due to the use of fertilizers, pesticides and herbicides. As mentioned previously, the concern here is the potential for mismanagement or over-application of fertilizers and/or pesticides on the agricultural lands that could result in SOCs entering the Boulder River up-stream from the infiltration galleries. However, the percent of agricultural land in the area is small and is not considered to pose a threat to the source water.

A small number of oil and gas exploration wells and mine sites are located within the recharge region ([Figure 8](#)). Because there are so few exploration wells and mine sites in the recharge region they are not considered to pose a threat to the source water.

### **Inventory Update**

The certified water system operator will update the inventory for his records every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years.

### **Inventory Limitations**

The potential sources of contaminants described above are identified from 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 source water have been identified.

## CHAPTER 4 - SUSCEPTIBILITY ASSESSMENT

The susceptibility of Big Timber’s infiltration galleries to contamination is assessed in this chapter. Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will reach source water. In addition, the proximity of a potential contaminant source to the source water or the density of non-point potential contaminant sources is also considered in determining the threat of contamination, referred to here as hazard (Table 3 for surface water sources, Table 4 for ground water sources).

For the infiltration galleries, hazard is based on whether a potential contaminant source is located within the surface water buffer-inventory region, its size and proximity to the galleries, and on the toxicity of the hazardous material handled or used at the site. Point source hazard is also dependent on the health affects associated with potential contaminants. Hazard ratings for point and nonpoint sources are assigned based on criteria listed in Table 4.

Barriers can be anything that decreases the likelihood that contaminated water will reach the Big Timber infiltration galleries. Barriers can be engineered structures, management actions or natural conditions. Examples of engineered barriers are spill catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices can be considered management barriers. Thick clay-rich soils, a deep water table or a thick saturated zone above the well intake can be natural barriers. For a surface water intake examples of barriers include: a vegetated riparian area, protective forest management practices, and dilution. Table 5 shows how barriers are used to reduce the susceptibility rating applied to a given potential contaminant source.

**Table 3. Hazard of potential contaminant sources for PWSs using surface water sources**

Potential Contaminant Sources	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
<b>Point Sources of Nitrates or Pathogens</b>	Potential for direct discharge to surface water	Potential for discharge to groundwater hydraulically connected to surface water	Potential contaminant sources in the watershed region
<b>Point Sources of VOCs, SOCs, or Metals</b>	Potential for direct discharge of large quantities from roads, rails, or pipelines	Potential for direct discharge of small quantities to surface water	Potential for discharge to groundwater hydraulically connected to surface water
<b>Septic Systems (density)</b>	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
<b>Municipal Sanitary Sewer (percent land use)</b>	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
<b>Cropped Agricultural Land (percent land use)</b>	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

**Table 4. Hazard of potential contaminant sources for PWSs using ground water.**

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Within 1 year TOT	Between 1 to 3 years TOT	Over 3 years TOT
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

**Table 5. Susceptibility to potential contaminant sources based on 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

Big Timber’s infiltration galleries are located up gradient and up-stream from the town and the majority of identified potential contaminant sources ([Figure 3](#), and [Figure 7](#)). As a result, those potential contaminant sources do not pose a threat to the public water supply or the source water. Table 6 on the next page summarizes the results of the susceptibility analysis for the Big Timber Public Water Supply.

**Table 6. Susceptibility Assessment for Significant Potential Contaminant Sources in the Surface Water Buffer-Inventory, and Watershed Regions for the Big Timber Public Water Supply.**

Source	ID Number on Map in <a href="#">Figure 3</a>	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
<b>Interstate 90</b>	<b>Not Numbered on the map</b>	Variety of hazardous materials	Spills and releases related to accidents	<b>Moderate</b>	-Emergency Response	<b>Moderate</b>	Remain vigilant to accidents and spills especially those involving tanker trucks near the Secondary Infiltration Gallery.
<b>Cultivated Croplands</b> (16% ag-land in the spill response-inventory region; 2% in the recharge region)  -Main concern would be for the secondary infiltration gallery.	<b>Not Numbered on the map</b>	Pathogens, nitrate, fertilizers, SOCs	Over-application, spills or releases resulting in infiltration to ground water or runoff to surface water bodies.	<b>Low</b>	None	<b>Moderate</b>	Encourage and support city and county efforts to provide educational information, materials and resources to land owners on the proper application and storage of pesticide and fertilizers; implement agricultural BMPs.
<b>Municipal Sewer Lines</b>	<b>Not Numbered on the map</b>	Pathogens and nitrate, household hazardous waste	Infiltration into shallow ground water that is hydraulically connected to surface water.	<b>Low</b>	-Area within surface water buffer region-inventory region appears to be down-gradient from the secondary infiltration gallery.	<b>Low</b>	-Conduct routine inspections to detect leaks and deteriorating lines. -Repair leaks and replace old lines. - Provide educational information, materials and resources to business owners and the public on proper waste disposal and recycling
<b>Individual Septic Systems</b>	<b>Not Numbered on the map</b>	Pathogens and nitrate, household hazardous waste	Infiltration into shallow ground water that is hydraulically connected to surface water.	<b>Moderate</b>	- Relatively small area of high septic density within the spill response-inventory region	<b>Low</b>	- Encourage and support city and county efforts to extend the city sewer and promote maintenance of septic tanks and distribution lines. -Support effort to maintain low density development within the Boulder River Valley.
<b>State Highway</b>	<b>Not Numbered on the map</b>	Variety of hazardous materials	Spills and releases related to accidents	<b>Low</b>	-Emergency Response Planning -Low truck traffic	<b>Low</b>	-Remain vigilant to accidents and spills especially those involving tanker trucks and cars.
<b>Class V Injection Wells</b>	<b>Not Numbered on the map</b>	Nitrate, pathogens, VOCs, and SOCs, and others	Infiltration of contaminants into aquifer	<b>Unknown</b>	None	<b>Unknown</b>	-Inventory; -Provide educational information, materials and resources to business owners and the public on proper waste disposal and recycling

## **Hazard and Susceptibility Result Discussion:**

***Interstate 90*** – Spills and releases of a variety of hazardous materials could occur if accidents involving large trucks occurred on the interstate. While accidents involving large truck on this segment of interstate cannot be totally discounted, they would seem to be less likely due to the fact that the interstate is so straight through this area. In addition, spills or accidents would have to occur in a relatively short segment of the interstate between the state highway over-pass and the Boulder River in order to pose a threat to the secondary infiltration gallery. For these reasons hazard is assigned as moderate and with emergency response recognized as a barrier. Susceptibility is assigned as moderate. As noted above, it will be important for the town to be vigilant and responsive to any accidents involving large tanker trucks on the interstate in the vicinity of the secondary infiltration gallery.

***Cultivated Cropland*** – Sixteen percent of the land area within the surface water buffer-inventory region consists of agricultural land. In accordance with Table 4 above, 16% ag-land is assigned a low hazard rating. It is worth noting that the ag-land is located between the two infiltration galleries and up-stream of the secondary gallery ([Figure 7](#)). This means that the secondary gallery would be more susceptible to the potential impacts from the agricultural land. There is a potential for over- application of fertilizers and/or pesticides on the agricultural lands resulting in ag-chemicals entering the Boulder River up-stream from the secondary infiltration gallery. Hazard is assigned as low and with no barriers identified, susceptibility is assigned as moderate.

***Municipal Sewer System*** – The potential hazard imposed by pathogens, nitrate, and household hazardous wastes originating from the city’s municipal sewer and storm water mains located near the secondary infiltration gallery is low. Susceptibility to leaks from the mains is also rated low with the ground-water gradient used as a barrier.

***Septic Systems*** – A relatively small area of high septic density is located within the surface water buffer-inventory region ([Figure 3](#)). The high-density area likely does not pose a threat to any of the water supply. Hazard is low and susceptibility to pathogens and nitrate from septic systems is also rated as low.

***State Highway*** – Highway 298 runs the length of the Boulder Valley between the infiltration galleries. The highway does not handle a high volume of traffic and is assigned a low hazard rating. Susceptibility is rated as low.

***Class V Injection Wells*** – The potential hazard imposed by VOCs, SOCs, pathogens, nitrate, and other contaminants originating from the class V injection wells cannot be determined due to the fact that an inventory of Class V well has not been completed for most of Montana or the current inventory is inadequate. The susceptibility of the intake to contaminants originating from this source is unknown.

## CHAPTER 5 - MONITORING WAIVERS

### **Waiver Recommendation:**

It does not appear that the city of Big Timber has water quality monitoring waiver at this time. However, based on past monitoring results and the susceptibility assessment of the infiltration galleries, the Big Timber PWS may be eligible for monitoring waivers. In particular, the Phase 5 waiver may be applicable and includes Antimony, Thallium, Beryllium, and Nickel. Prior to requesting additional waivers, the PWS Operators would be encouraged to carefully review the following section on Monitoring Waiver Requirements. If after reviewing this section it is determined that an additional waiver is feasible, the Big Timber PWS should submit a letter with the proper documentation to DEQ requesting monitoring waivers. The PWS also needs to provide additional information to DEQ regarding chemical use within the inventory region.

### **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.

#### *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 mile 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 mile 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 well 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. DEQ's PWS Section and DEQ's Source Water Protection Program will conduct review of an organic chemical monitoring waiver application. 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 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.

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## FIGURES

**Figure 1 – Site Location Map**

**Figure 2 – Climate data summary**

**Figure 3 – Inventory map with other public water supplies in the area.**

**Figure 4 – General Geology**

**Figure 5 – Well Depth Histogram for area wells**

**Figure 6 – Land Cover in the Surface Water Buffer-Inventory Region**

**Figure 7 – Land Cover in the Recharge Region**

**Figure 8 – Recharge Region Inventory Map**

## APPENDICIES

**Appendix A – DEQ Water Quality Monitoring Data for Big Timber**



## Appendix B - Sanitary Survey

**Appendix C - Concurrence Letter & Other Correspondence**

## GLOSSARY\*

**Acute Health Effect.** An adverse 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.

**Best Management Practices (BMPs).** Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

**Coliform Bacteria.** Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

**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 that inhibits the flow of water.

**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.

**Delineation.** A process of mapping source water management areas.

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

**Hazard.** A measure of the potential of a contaminant leaked from a facility to reach a public water system source. Proximity or density of significant potential contaminant sources determines hazard.

**Hydraulic Conductivity.** A coefficient of proportionality describing the rate at which water can move through an aquifer.

**Inventory Region.** A source water management area that encompasses the area expected to contribute water to a public water system within a fixed distance or a specified ground water travel time.

**Maximum Contaminant Level (MCL).** Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water system. Set by EPA under authority of the Safe Drinking Water Act.

**Nitrate.** An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are septic tanks, feed lots and fertilizers.

**Nonpoint-Source.** Pollution sources that are diffuse and do not have a single point of origin.

**Pathogens.** A bacterial organism typically found in the intestinal tracts of mammals, capable of producing disease.

**Point-Source.** A stationary location or fixed facility from which pollutants are discharged.

**Public Water System.** A system that provides piped water for human consumption to 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.** A source water management region that is generally the entire area that could contribute water to an aquifer used by a public water system. 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.

**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 Protection Area.** For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water system.

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

**Susceptibility (of a PWS).** The 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.

**Transmissivity.** The ability of an aquifer to transmit water.

**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.

**Volatile Organic Compounds (VOC).** Any organic compound which evaporates readily to the atmosphere.

\* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations