

Town of Boulder Public Water System

PWSID # MT0000158

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Report Date: 04/12/2005

PWS Contact:

Gregory B. Gill
Director of Public Works
Certified Operator #1836

Box 68
Boulder, MT 59632

Phone: (406) 225-3381

Table of Contents

EXECUTIVE SUMMARY	1
INTRODUCTION	4
Purpose.....	4
Limitations	4
BACKGROUND	5
The Community	5
Geographic Setting	5
General Description of the Source Water	6
The Public Water Supply	6
Water Quality.....	7
DELINEATION.....	8
Hydrogeologic Conditions.....	8
Conceptual Model.....	9
Well Information.....	10
PWS Source Code	10
Methods and Criteria	11
Delineation Results	11
Limiting Factors.....	11
INVENTORY	12
Inventory Method	12
Inventory Results/Control Zone.....	13
Inventory Results/Inventory Region.....	13
Inventory Results/ Surface Water Buffer.....	14
Inventory Results/ Recharge Region	14
Inventory Update	15
Inventory Limitations	15
CHAPTER 4	16
SUSCEPTIBILITY ASSESSMENT	16
CHAPTER 5	21
MONITORING WAIVERS.....	21
Monitoring Waiver Requirements	21
Use Waivers	21
Waiver Recommendation.....	21
REFERENCES	22
GLOSSARY*	23
APPENDICES	28
APPENDIX A: 1994 Well Head Protection Plan.....	29
APPENDIX B: WELL LOGS.....	30
APPENDIX C: Potential Contaminant Sources	37
APPENDIX D: Concurrence Letter.....	39

Figures

- [Figure 1. Boulder PWS Vicinity Map](#)
- [Figure 2. Aerial View of Boulder](#)
- [Figure 3. Boulder PWS Well Locations](#)
- [Figure 4. Geologic Cross-Section of the Boulder Area](#)
- [Figure 5. Boulder Area Geology](#)
- [Figure 6. Boulder PWS Inventory Regions](#)
- [Figure 7. Boulder River Surface Water Buffer](#)
- [Figure 8. Boulder Recharge Region](#)
- [Figure 9. Land Cover In The Boulder Inventory Region](#)
- [Figure 10. City Sewer and Septic Density In The Boulder Inventory Region](#)
- [Figure 11. Significant Potential Contaminant Sources In The Boulder Inventory Region](#)
- [Figure 12. Land Cover in the Boulder River Surface Water Buffer](#)
- [Figure 13. Potential Contaminant Sources in the Boulder River Surface Water Buffer](#)
- [Figure 14. Land Cover in the Boulder Recharge Region](#)

Tables

Table 1. Climatic Summary	6
Table 2. Source Water Sensitivity Criteria	9
Table 3. Boulder PWS Well Information	10
Table 4. Significant Potential Contaminant Sources In The Boulder Inventory Region...	14
Table 5. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.	16
Table 6. Hazard of potential contaminant sources associated with proximity to a PWS well or intake or density within a PWS inventory or spill response region.....	17
Table 7. Susceptibility assessment for significant potential contaminant sources in the Boulder PWS Inventory Region	18

EXECUTIVE SUMMARY

Drinking water for The Town of Boulder Public Water System (PWS) is supplied by 4 wells located on the southwest side of Capital Hill, in the Boulder River Valley of southwestern Montana in Sections 32 and 33, Township 6 North, Range 4 West. This Source Water Delineation and Assessment Report was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is conducting these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Inventory Region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

In 1994, the Montana Rural Water Association prepared a Wellhead Protection Plan for the Town of Boulder. The plan was prepared prior to the 1996 Amendments to the Safe Drinking Water Act (P.L. 104-182) and the creation of the Montana Source Water Protection Program (November 1999). A copy of the document is included in Appendix A for reference.

Based on the September 26, 2000 sanitary survey, well logs, and the depth of wells, it appears that unconfined, Quaternary-aged, alluvial (from stream outwash) sand and gravel is providing water to the PWS wells. In accordance with the Montana Source Water Protection Program criteria (1999), groundwater within this type of aquifer is considered to have a high sensitivity to potential contaminant sources since it is unconfined unconsolidated alluvium. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Four types of source water protection management regions for the Boulder PWS were mapped as part of this assessment. They are the control zone, inventory region, and the recharge region. A surface water buffer was also delineated around the Boulder River and its major tributaries that are upgradient of Boulder. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- The goal of management in the control zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. The control zone is delineated as a 100-foot radius around the wells and all sources of potential contaminants should be excluded in this region. Potential contaminant sources identified within the control zones include: municipal sewer mains.
- The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region includes the area of land overlying the unconfined sand and gravel that supplies drinking water to the wells. The inventory region was based on hydrogeological boundaries, mapped section lines, and man-made features such as the interstate. Significant potential contaminant sources identified within the inventory region include: municipal sewer mains, underground fuel storage tanks (USTs) and leaking USTs (LUSTs), Montana Highway 69, and U.S. Interstate 15. Class V injection wells have also been identified as

significant potential contaminant sources although no locations have been specifically identified to date. Further investigation is to be conducted by the U.S. EPA to determine the locations of Class V injection wells and their fate.

- The goal of management in the surface water buffer is to identify general land uses and sources of microbial contaminants that may enter into groundwater via surface water that is hydraulically connected to the groundwater that supplies drinking water to a PWS. Significant potential contaminant sources within the surface water buffer include: those potential contaminant sources identified in the inventory region, both active and inactive mines, septic systems in the Basin, MT area, an additional UST, and a state Superfund cleanup site. It should also be noted that a catastrophic fire in the upper reaches of the Boulder River might cause an increase in sediments in surface water runoff to enter the Boulder River due to erosion.
- The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage. The topographic divide that represents the Jefferson Watershed boundary (based on the 11-digit USGS hydrologic unit) was used to delineate the recharge region for the PWS well. Recharge to the wells is likely from infiltration precipitation and snowmelt, surplus irrigation water, leakage from area irrigation canals, subsurface flow from bedrock, and infiltration from the Boulder River and its tributaries. Potential contaminant sources identified within the recharge region include: all those potential contaminant sources previously identified in the control zone, inventory region, and surface water buffer.

The Boulder PWS has also had a history of copper exceedences. Currently, Boulder is out of compliance with the Montana Lead and Copper Rule. Naturally occurring stray electric current in the soil that is in contact with the copper water service lines is causing copper to be dissolved into the drinking water. Follow-up water sampling was conducted to verify the results. To date, Boulder has not submitted the results of the most recent sampling event to the Public Water Supply Section (S. Martinez, personal communication, October 2004).

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. 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 flow to the public water supply well intakes. The Boulder PWS has a very high susceptibility to municipal sewer mains, a high susceptibility to Montana Highway 69, and a moderate susceptibility to USTs/LUSTs. Low risk potential sources and potential sources located outside the Inventory Region, but within the Recharge Region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for the Boulder PWS. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of their valuable drinking water resource.

The costs associated with contaminated drinking water are high. Developing an approach to protect that resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Region) and have identified potential sources of contamination within that area. In addition,

recommendations are provided, i.e., Best Management Practices, regarding the proper use and practices associated with some common potential contamination sources. The Montana Source Water Protection Section believes public awareness is a powerful tool for protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality.

INTRODUCTION

Carolyn DeMartino, a Water Quality Specialist with the Montana Department of Environmental Quality, completed the Boulder (PWSID# 00158) 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 Boulder Public Water System (PWS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (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 Boulder to protect its drinking water source.

Limitations

This report was prepared to assess the susceptibility of the Boulder PWS to significant potential contaminant sources, and is based on published information and information obtained from individuals familiar with the community. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the Boulder 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 Boulder area have 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

The Town of Boulder is located in Jefferson County in southwestern Montana ([Figure 1](#)) approximately 25 miles south of Helena and 30 miles east of Butte. Boulder is the county seat of Jefferson County. According to the Census Bureau, the population of Jefferson County in 2000 was at 10,049 with 1,300 individuals residing in Boulder.

Boulder's current economy is based primarily upon agriculture and service industries. Area services include the Boulder Hot Springs Hotel, the Sunshine Health Mine, Riverside Youth Correctional Facility, schools, churches, Town Pump gas station, and other service related businesses.

The major transportation routes in the Boulder area include, Interstate 15 and Montana Highways 69.

Boulder utilizes a municipal sanitary sewer to treat and dispose of sanitary wastes. The three-cell facultative sewage treatment and disposal lagoon is located southeast of town ([Figure 2](#)). Treated wastewater is discharged to the Boulder River.

Geographic Setting

The Town of Boulder is located on the southwest side of Capital Hill, in the Boulder River Valley of southwestern Montana in Sections 32 and 33, Township 6 North, Range 4 West ([Figure 3](#)). The Boulder River Valley is a north-northwest-trending higher elevation intermontane basin that covers approximately 124 square miles. The basin is bounded by Bull Mountain on the west and the Elkhorn Mountains on the east. From its headwaters near the Continental Divide, the Boulder River flows east toward the Town of Boulder, then southward through the basin, to the confluence with the Jefferson River. North of Boulder, the surrounding mountains rise abruptly from the alluvial plain, which is about three miles wide. South of Boulder, the Boulder River meanders within a well-defined, sometimes swampy, floodplain about one-half to one mile wide. Flanking the flood plain are large, grass and sage covered hills that have been uplifted and subsequently eroded. Stream outwash fans are also present in this area and they too are crosscut by streams and gently slope away from the mountains. The Boulder River Valley ranges in elevation from about 4,300 feet where the Boulder River flows out of the basin, to an elevation of about 6000 feet (Kendy and Tresch, 1996). The elevation at Boulder is approximately 4,900 feet above mean sea level.

In the Boulder vicinity, water is diverted from the Boulder River into two irrigation canals. One canal flows through the north portion of Boulder and north of the PWS wells. The other irrigation canal flows through the south portion of Boulder and south of the Boulder PWS wells.

Climate in the Boulder area is considered semi-arid and is typical of western Montana intermontane basins. Based on climate data from weather station 241318, the average maximum and minimum temperatures in this area are 82.4° F and 47.7° F in July and 33.2° F and 9.2° F in January. Annual total precipitation averages 11.01 inches. Rainfall occurs April through September with May and June being the wettest months. An annual average of 31.3 inches of snow is received in the Boulder area mainly November to

April (Western Regional Climate Center, Monthly Climate Summary 7/1/1948 to 7/31/2003). See Table 1 for additional climate information.

Table 1. Climatic Summary

Boulder, Montana (241008)

Period of Record Monthly Climate Summary

Period of Record: 7/ 1/1948 to 12/31/2003

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.2	38.6	44.5	54.8	64.4	72.8	82.4	82.0	71.1	59.4	42.8	34.9	56.7
Average Min. Temperature (F)	9.2	14.0	18.8	27.1	35.2	42.5	47.7	46.0	36.9	28.1	18.2	11.4	27.9
Average Total Precipitation (in.)	0.47	0.33	0.51	0.79	1.73	2.04	1.37	1.23	1.01	0.56	0.51	0.45	11.00
Average Total SnowFall (in.)	7.4	3.7	6.3	3.7	0.4	0.1	0.0	0.0	0.1	0.5	3.8	5.3	31.3
Average Snow Depth (in.)	3	2	1	0	0	0	0	0	0	0	1	2	1

Percent of possible observations for period of record.

Max. Temp.: 99% Min. Temp.: 98% Precipitation: 99% Snowfall: 76.1% Snow Depth: 68.3%

Check [Station Metadata](#) or [Metadata graphics](#) for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

General Description of the Source Water

Groundwater, located in Quaternary alluvium that directly overlies granitic rocks of the Boulder Batholith, supplies drinking water to the four Boulder PWS wells ([Figure 4](#)). The unconfined alluvial aquifer consists of gravel, sand, and some silt.

The Public Water Supply

The Boulder PWS provides water to approximately 1,316 residents through 464 active service connections. According to the most recent sanitary survey (Engle, September 29, 2002), the water supply system consists of the distribution system (Source 001), two water storage facilities, and four wells.

The Boulder PWS does not use any form of treatment to disinfect the water supply.

A 500,000- gallon steel storage tank built around 1976 and a 75,000- gallon concrete storage tank constructed in about 1953, provide Boulder’s water storage. Average daily use indicated in the most recent sanitary survey is about 800,000 gallons per day (gpd) in the summer and approximately 350,000 gpd in the winter (Engle, 2000).

Water Quality

Boulder's 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.

During the September 26, 2000 sanitary survey inspection, several items were noted at each well that could allow contamination to enter into the water system. After the inspection, it was learned that during construction near the ball field near Well 4, a sanitary sewer line collapsed during backfilling. Water sample results from Well 4 had positive detections for coliform bacteria and the well was taken off-line temporarily.

Within the past five years coliform bacteria and fecal coliform bacteria have been detected in the Boulder PWS. September 26, 2000, Boulder was placed on a boil order because *E. coli* bacteria were detected in a water sample that had been collected a week earlier. *E. coli* bacteria live in large numbers in the intestines of humans and other warm-blooded animals. Their presence in drinking water can be serious and is an indication that the drinking water has been contaminated with human or animal waste.

Within the past five years nitrate plus nitrite as nitrogen detected in Well 1 ranged from 0.52 milligrams per liter (mg/L) to 0.84 mg/L. The range detected in Well 2 was 0.57 mg/L to .72 mg/L, in Well 3 the range detected was .43 to .60 mg/L, and in Well 4 the range detected was .60 to .93 mg/L. All values remain well below the maximum contaminant level of 10 mg/L (DEQ SDWIS database).

The Boulder PWS has also had a history of copper exceedences. Currently, Boulder is out of compliance with the Montana Lead and Copper Rule. Follow-up water sampling was conducted to verify the results. To date, Boulder has not submitted the results of the most recent sampling event to the Public Water Supply Section (S. Martinez, personal communication, October 2004).

Additional sources of groundwater contamination in the Boulder PWS vicinity include fuel releases from leaking underground storage tanks (LUSTs). These potential contaminant sources will be discussed in greater detail in Chapter 3 Inventory and in Chapter 4 Susceptibility Assessment.

CHAPTER 2 DELINEATION

The source water protection area, the land area that contributes water to the Boulder PWS wells, is identified in this chapter. The management areas identified within the source water protection area included the control zone, inventory region, surface water buffer, and recharge region. 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 represents the zone of contribution of the wells. Hydrogeologic mapping was used to delineate the inventory region. 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 frame. A surface water buffer zone is delineated around the mainstream of a river and its major tributaries to account for the interaction of surface water and groundwater. The surface water buffer includes ½-mile buffers around associated surface waters for 10 miles upstream of the groundwater zone of contributions or to watershed limits, whichever distance is shorter. The management goal of the surface water buffer is to protect against the introduction of pathogens and nitrates into the wells through surface water-groundwater interaction. The recharge region represents the entire portion of the aquifer that contributes water to the PWS wells. Management in the recharge region should focus on maintaining and improving the quality of groundwater that could reach each well over longer timeframes or with increased water usage.

Hydrogeologic Conditions

The headwaters of the Boulder River are near the Continental Divide, west of Bull Mountain. The Boulder River Valley was most likely formed by erosional processes related to mountain building that took place in the Late Cretaceous to middle Eocene periods (Kendy and Tresch, 1996). The ancestral Boulder River most likely drained to the east, toward the present day Western Three Forks Valley. Westward flow began in about the late Miocene period in response to uplift along the eastern margin of the basin. The western basin margin is delineated by several poorly discernable faults with minor offset. The Boulder Valley continued to subside until late Pliocene or early Pleistocene time, when the present erosional surfaces formed. There is no evidence to support that faulting occurred in the Boulder River Valley during this time period.

North of Boulder, Quaternary alluvium covers the entire three-mile width of the basin and directly overlies the granitic rocks of the Boulder Batholith. South of Boulder, the alluvium is confined to a narrow floodplain that typically overlies Tertiary Sediments. Near the center of the basin, alluvium, approximately 50 feet thick, overlies Mississippian-aged limestone. In some areas more than 100 feet of alluvium overlie Tertiary sediments. Previous studies indicate that the depth to bedrock is greatest in the central Boulder Valley, west of the Boulder River, where basin fill is more than 4,000 feet thick (Kendy and Tresh, 1996). See [Figure 4](#) for a generalized geologic cross-section of this area.

Based on the lithology identified on the well logs for Boulder PWS Well #2 and Well #4, the wells appear to be installed in unconfined Quaternary alluvium consisting of sand, gravel, and silt ([Figure 5](#)). According to the criteria listed in Table 2, the Boulder PWS wells would have high source water sensitivity to potential contaminant sources.

Table 2. Source Water Sensitivity Criteria

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

In the Boulder area groundwater flows south from the uplands then southeast paralleling the Boulder River. Groundwater recharge occurs through precipitation and snowmelt, surplus irrigation water, leakage from the two irrigation canals, subsurface flow from bedrock, and infiltration from the Boulder River and its tributaries (Kendy and Tresch, 1996).

Conceptual Model

Boulder is located in the Boulder River Valley, an intermontane basin located in southwestern Montana. The basin was formed by faulting that occurred in the Cenozoic Era and by the intrusion of the Highland Mountains (Boulder Batholith) into the surrounding area. Based on younger fault scarps and the disruption of present day drainages, studies indicate that the area still remains seismically active.

Groundwater, located in Quaternary-aged alluvial sand, gravel, and silt supplies drinking water to the Boulder PWS wells. North of Boulder, the Quaternary alluvium covers the entire three-mile width of the basin and directly overlies the granitic rocks of the Boulder Batholith. South of Boulder, the alluvium is confined to a narrow floodplain that typically overlies Tertiary Sediments. Near the center of the basin, alluvium overlies Mississippian-aged limestone. The alluvium in this area is approximately 50 feet thick. In some areas more than 100 feet of alluvium overlie Tertiary sediments. The exact depth of these sediments within the Boulder River Valley is unknown but is estimated to be over 6,000 feet deep.

Groundwater flow in the Boulder vicinity appears to be south-southeast, generally flowing from the uplands toward the flood plain, and then parallels the Boulder River. The alluvial aquifer is recharged by precipitation and snowmelt, surplus irrigation water, leakage from area irrigation canals, subsurface flow from bedrock, and infiltration from the Boulder River and its tributaries.

Well Information

The following information was obtained from the most recent sanitary survey (Engle, 2000) and from the well logs.

Well 1 (Source WL002) was drilled in 1953 to a depth of 110 feet. At the time the well was drilled, the static water level was at 110 feet below ground surface (bgs). The yield from Well 1 is approximately 630 gallons per minute (gpm).

Well 2 (Source WL003) was drilled in 1960 to a depth of 90 feet. At the time the well was drilled, the static water level was at 20 feet bgs. The yield from Well 2 is estimated to be approximately 600 gpm. The casing appears to be perforated at a depth of 90 feet. The annular space is filled to a depth of 6.5 feet below ground surface with very tight gravel.

Well 3 (Source WL004) was drilled in 1961 to a depth of 90 feet. At the time the well was drilled, the static water level was at 90 feet bgs. The yield from Well 3 is estimated to be 575 gpm.

Well 4 (Source WL005) was drilled in 1973 to a depth of 100 feet. At the time the well was drilled, the static water level was at 23 feet bgs. The annular space is grouted to a depth of 12 feet with cement. The casing is perforated from 40 to 86 feet bgs. Yield from Well 4 is estimated to be about 600 gpm.

Information for each well is summarized in Table 3.

Table 3. Boulder PWS Well Information

Information	Well #1	Well #2	Well #3	Well#4
PWS Source Code	WL002	WL003	WL004	WL005
Well Location (T, R, Sec)	Sec. 32 AAAA, T. 6 N., R. 4 W.	Sec. 32 AABD, T. 6 N., R. 4 W.	Sec. 33 BBB, T. 6 N., R. 4 W.	Sec. 33BBDB, T. 6 N., R. 4 W.
Latitude/ Longitude	46.2353/-112.1213	46.2348/-112.1235	46.2351/-112.1208	46.2332/-112.1159
MBMG #	53385	53389	53405	53406
Water Right #	W005590-00	Unknown	Unknown	P000053-00
Well Completion Date	9/1/1953	6/10/1960	7/1/1961	9/21/1973
Total Depth (feet)	Unknown	90	90	100
Perforated Interval (feet)	Unknown	at 90	Unknown	40 - 86
Static Water Level (feet)	110	20	Unknown	23
Pumping Water Level (feet)	Unknown	30	Unknown	28
Drawdown (feet)	Unknown	10	Unknown	5

Test Pumping Rate (gpm)	450	600	575	600
Specific Capacity (gpm/ft)	Unknown	60	Unknown	120

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 Boulder PWS wells. One hundred-foot radius control zones were delineated around each well. An inventory region, surface water buffer, and recharge region were delineated around the Boulder PWS wells.

Delineation Results

A single inventory region, based on hydrogeologic mapping, was delineated for the four Boulder PWS wells ([Figure 6](#)). The surface water buffer was delineated around the Boulder River and its major tributaries for 10 miles upstream of the Boulder PWS wells ([Figure 7](#)). The recharge region was delineated based on the Jefferson Watershed boundaries ([Figure 8](#)).

Limiting Factors

This delineation is based on hydrogeological mapping, estimated groundwater flow and pumping conditions. 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 irrigation canals is unknown and can vary seasonally.

CHAPTER 3 INVENTORY

An inventory of potential contaminant sources was conducted within the Boulder PWS well control zones, and inventory regions, and recharge region. 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 Boulder inventory regions include nitrate, pathogens, fuels, solvents, agricultural chemicals, and metals.

The significant potential contaminant source inventory for Boulder 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.

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

Land cover within the control zones for both Boulder PWS wells consists of both residential and business activities. City streets are located within the 100-foot control zones. Municipal sewer mains surround the area underlying each control zone.

Inventory Results/Inventory Region

Land cover within the inventory region for Boulder PWS wells is primarily grassland, and residential land at 48% and 20%, respectively ([Figure 9](#)). Additional land cover types in the inventory region and their percentages are also identified on [Figure 9](#).

The municipal sewer system covers approximately 75% of the inventory region. Septic system density within the inventory region is low ([Figure 10](#)). Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) are located in the Boulder PWS inventory region. U.S. Interstate 15 and Montana Highway 69 and are located in the inventory region. Class V Injection wells may be located in Boulder but none have been identified to date. Future work is to be conducted by the EPA to identify Class V Injection Wells. These significant potential contaminant sources are listed in Table 4 and indicated on [Figure 11](#). Appendix C contains an expanded list of identified potential contaminant sources within the inventory region.

No petroleum pipelines, concentrated animal feeding operations, or State Superfund sites were identified in the inventory region.

Table 4. Significant Potential Contaminant Sources In The Boulder Inventory Region			
Significant Potential Contaminants	Figure ID Number	Contaminant	Hazard
Municipal Sewer Mains	Figure	Nitrates and pathogens	Untreated effluent leaking from damaged pipes and entering area groundwater
USTs/LUSTs	Figure	VOCs	Spills or leaks of petroleum products may impact the area groundwater
MT Highway 69	Figure	VOCs, SOCs, nitrates, and pathogens	Spills and releases of petroleum products and other chemicals due to traffic accidents may impact area groundwater
Septic System Density	Figure	Nitrates and pathogens	System failure could allow untreated effluent to enter area groundwater
U.S. Interstate 15	Figure	VOCs, SOCs, nitrates, and pathogens	Spills and releases of petroleum products and other chemicals due to traffic accidents may impact area groundwater
Class V Injection Wells	----	VOCs, SOCs, and metals	Discharge of petroleum products, solvents, and other hazardous chemicals to groundwater

Inventory Results/ Surface Water Buffer

Land cover within the surface water buffer consists mainly of forested land ([Figure 12](#)). It should be noted that a catastrophic fire in the upper reaches of the Boulder River might cause an increase in sediments in surface water runoff to enter the Boulder River due to erosion. Overall, septic density in the surface water buffer is low. However, there is an area of high and moderate septic density upstream in the Basin, Montana area ([Figure 13](#)). Additional potential contaminant sources in the surface water buffer include numerous active and inactive mine sites, and additional UST site, and the Boulder River Railroad state Superfund site. Some of the mine sites are designated as priority mine cleanup sites.

Inventory Results/ Recharge Region

Land cover in the recharge region for the Boulder PWS wells consists primarily of evergreen forest at 48%, grassland at 28%, and shrubland at 18% ([Figure 14](#)). It should be noted that a catastrophic fire in the upper reaches of the Boulder River might cause an increase in sediments in surface water runoff to enter the Boulder River due to erosion. Additional land cover types and their percentages are identified on [Figure 14](#).

In addition to the potential contaminant sources identified in the inventory region, there are numerous inactive mines and one mining storm water discharge.

Inventory Update

The Boulder PWS certified operator should update the inventory 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 every five years to ensure the source water delineation and assessment report remains current.

Inventory Limitations

The potential contaminant inventory was conducted using various databases to acquire readily available information. Information was also obtained where possible, from individuals familiar with Boulder. 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 Boulder wells have been identified.

CHAPTER 4 SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case Boulder.

The goal of Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the Boulder to reduce susceptibility are recommended.

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 flow to the Boulder wells (Table 5).

Table 5. 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. See Table 6.

Table 6. 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
S U R F A C E	Point Sources of Nitrate or Microbes	Potential for direct discharge to source water	Potential for discharge to groundwater hydraulically connected to source water	Potential contaminant sources in the watershed region
	Point Sources of VOCs, SOCs, or Metals	Potential for direct discharge of large quantities from roads, rails, or pipelines	Potential for direct discharge of small quantities to source water	Potential for discharge to groundwater hydraulically connected to source water
W A T E R	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
A L L	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 ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 7). The susceptibility of each well to each potential contaminant source is assessed separately. Susceptibility rankings are also described in text following the table. Management recommendations that indicate how significant potential contaminant sources could be better managed to prevent impacts to the Boulder wells are also provided in Table 7.

Table 7. Susceptibility assessment for significant potential contaminant sources in the Boulder PWS Inventory Region							
Potential Contaminant Sources	Figure ID Number	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Municipal Sewer Mains	Figure 10	Nitrates and pathogens	Untreated effluent leaking from damaged pipes and entering area groundwater	High	None	Very High	Periodically inspect all sewer mains to ensure there are no leaks, replace older sections as needed.
Montana Highway 69	Figure 11	VOCs, SOCs, nitrates, and pathogens	Fuel spills, routine weed spraying, storm water runoff, and infiltration into area groundwater	High	Emergency spill response	High	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground
USTs/LUSTs	Figure 11	VOCs	Spills or leaks of petroleum products may impact the area groundwater	High	Leak detection, site cleanup, on-going groundwater monitoring	Moderate	Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, best management practices (BMPs)
Septic Density	Figure	Nitrates and pathogens	System failure could allow untreated effluent to enter area groundwater	Low	No septic systems in the vicinity of the wells	Low	Encourage septic system owners to periodically inspect their septic systems
U.S. Interstate 15	Figure 11	VOCs, SOCs, nitrates, and pathogens	Fuel spills, routine weed spraying, storm water runoff, and infiltration into area groundwater	Low	Emergency spill response, dilution	Very Low	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground

Table 7. Susceptibility assessment for significant potential contaminant sources in the Boulder PWS Inventory Region							
Potential Contaminant Sources	Figure ID Number	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Class V Injection Wells	----	VOCs, SOCs, metals	Infiltration into groundwater	Unknown at this time	Not available	Unknown at this time	Work with EPA to identify locations and appropriate response

Municipal sewer mains – Hazard is ranked high for potential contamination from sewer main failure because 75% of the inventory region is underlain by the sewer mains. The overall susceptibility is very high as no barriers to contamination were identified.

Montana Highway 69 – Hazard is ranked high from this potential contaminant source due to its proximity to the wells. The overall susceptibility is also high, as only one barrier to contamination emergency spill response was identified.

USTs/LUSTs – Hazard is ranked high for these potential contaminant sources, as they are located upgradient/upstream of the wells. The overall susceptibility is moderate as multiple barriers to contamination were identified.

Septic Density – Hazard is ranked low, as the percentage of septic system use in the inventory region is low. Overall, the susceptibility from this potential contaminant source is low, as there is no apparent septic system usage in close proximity to the wells.

U.S. Interstate 15 – Hazard is ranked low because although the interstate is located in the inventory region it is not in close proximity to the wells. The overall susceptibility is very low as multiple barriers to contamination were identified.

Class V Injection Wells – The hazard has not been ranked because the location and quantity of Class V Injection Wells in Boulder is unknown. They have been identified in this report because they have the potential to discharge into groundwater supplying the Boulder PWS wells. The overall susceptibility of the wells is unknown at this time. Future work to identify their locations is to be conducted by the U.S. EPA.

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 the Town of Boulder follow 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.

Waiver Recommendation

Currently, Boulder has a Phase 2 and Phase 5 inorganic monitoring waiver. For additional waiver consideration, based on monitoring history or a demonstration that certain chemicals were/ are not used in the inventory region, the Boulder PWS will need to send a letter to the DEQ Public Water Supply Section requesting monitoring waivers. Additional information regarding chemical use on adjacent properties in the inventory region must accompany the waiver request letter.

REFERENCES

Driscoll, Fletcher, 1986, Groundwater and Wells, Johnson Filtration Systems, St. Paul, MN, 1108 p.

Freeze, R. Allan and Cherry, John A., 1979, Groundwater.

Kendy, Eloise and Tresch, Ruth E., August 1996, Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana. U.S. Geological Survey Water Resources Investigations Report 96-4025.

Montana Bureau of Mines and Geology, Groundwater Information Center.

Montana Department of Environmental Quality Public Water Supply Program Safe Drinking Water Information System (SDWIS).

Montana Department of Environmental Quality Underground Storage Tank Program web-site.

Perry, Eugene S., 1933, Possibilities of Ground-Water Supply For Certain Towns and Cities of Montana. Montana School of Mines, Butte, Montana.

Ross, Clyde P., Andrews, David A., and Witkind, Irving J., 1955, Geologic Map of Montana, Montana Bureau of Mines and Geology.

United States Census Bureau, 2000

United States Environmental Protection Agency “Envirofacts Data Warehouse and Applications”.

United States Geological Survey. 1992. National Landcover Dataset, Montana. 30-meter electronic digital landcover dataset interpreted from satellite imagery.

Western Regional Climate Center wrcc@dri.edu, Montana Climate Summaries.

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.

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

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

Montana Bureau of Mines and Geology – 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.

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.

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).

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. A source water management region that is generally 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 which evaporate readily to the atmosphere.

Watershed. The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

* 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: 1994 Well Head Protection Plan

APPENDIX B: WELL LOGS

Location Information

GWIC Id: 53385	Source of Data: LOG\GW4
Location (TRS): 06N 04W 32 AAAA	Latitude (dd): 46.2353
County (MT): JEFFERSON	Longitude (dd): -112.1213
DNRC Water Right: W005590-00	Geomethod: MAP
PWS Id: 00158003	Datum: NAD27
Block:	Altitude (feet):
Lot:	Certificate of Survey:
Addition:	Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft):	How Drilled: UNKNOWN
Static Water Level (ft): 110.00	Driller's Name: UNKNOWN
Pumping Water Level (ft):	Driller License:
Yield (gpm): 450.00	Completion Date (m/d/y): 9/1/1953
Test Type:	Special Conditions:
Test Duration:	Is Well Flowing?:
Drill Stem Setting (ft):	Shut-In Pressure:
Recovery Water Level (ft):	Geology/Aquifer: Not Reported
Recovery Time (hrs):	Well/Water Use: PUBLIC WATER SUPPLY
Well Notes:	

Hole Diameter Information

No Hole Diameter Records currently in GWIC.
Annular Seal Information

No Seal Records currently in GWIC.

Lithology Information

No Lithology Records currently in GWIC.

Casing Information¹

No Casing Records currently in GWIC.
Completion Information¹

No Completion Records currently in GWIC.

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

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

Location Information

GWIC Id: 53389
 Location (TRS): 06N 04W 32 AABD
 County (MT): JEFFERSON
 DNRC Water Right:
 PWS Id: 00158002
 Block:
 Lot:
 Addition:

Source of Data: LOG
 Latitude (dd): 46.2348
 Longitude (dd): -112.1235
 Geomethod: MAP
 Datum: NAD27
 Altitude (feet):
 Certificate of Survey:
 Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 90.00
 Static Water Level (ft): 20.00
 Pumping Water Level (ft): 30.00
 Yield (gpm): 600.00
 Test Type: AIR
 Test Duration: 5.00
 Drill Stem Setting (ft):
 Recovery Water Level (ft):
 Recovery Time (hrs):
 Well Notes:

How Drilled: CHURN
 Driller's Name: PRICE & LINDSAY
 Driller License:
 Completion Date (m/d/y): 6/10/1960
 Special Conditions:
 Is Well Flowing?:
 Shut-In Pressure:
 Geology/Aquifer: 120SDMS
 Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-3.0	90.0	13.0				50 LB STEEL

Annular Seal Information

From	To	Description
0.0	6.5	VERY TIGHT GRAVEL

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
90.0	90.0	13.0		1/2X2	MILLS KNIFE

Lithology Information

From	To	Description
0.0	2.0	LOOSE SAND AND GRAVEL SOME TOPSOIL
2.0	20.0	TIGHT COURSE GRAVEL
20.0	28.0	TIGHT COARSE GRAVEL AND SOME CLAY
28.0	58.0	MEDIUM SIZE FIRM GRAVEL- SOME SAND
58.0	62.0	LOOSE COARSE SAND AND FINE GRAVEL
62.0	74.0	FAIRLY TIGHT FINE TO MEDIUM SIZE SAND & GRAVEL.
74.0	85.0	VERY TIGHT MEDIUM SIZE SAND AND GRAVEL
85.0	87.0	FIRM MEDIUM SAND AND GRAVEL
87.0	90.0	DECOMPOSED GRANITE

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

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

Location Information

GWIC Id: 53405
 Location (TRS): 06N 04W 33 BBB
 County (MT): JEFFERSON
 DNRC Water Right:
 PWS Id:
 Block:
 Lot:
 Addition:

Source of Data: GW4
 Latitude (dd): 46.2351
 Longitude (dd): -112.1208
 Geomethod: TRS-TWN
 Datum: NAD27
 Altitude (feet):
 Certificate of Survey:
 Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 90.00
 Static Water Level (ft): 90.00
 Pumping Water Level (ft):
 Yield (gpm): 575.00
 Test Type:
 Test Duration:
 Drill Stem Setting (ft):
 Recovery Water Level (ft):
 Recovery Time (hrs):
 Well Notes:

How Drilled: UNKNOWN
 Driller's Name: UNKNOWN
 Driller License:
 Completion Date (m/d/y): 7/1/1961
 Special Conditions:
 Is Well Flowing?:
 Shut-In Pressure:
 Geology/Aquifer: Not Reported
 Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	90.0	12.0				

Annular Seal Information

No Seal Records currently in GWIC.

Completion Information¹

No Completion Records currently in GWIC.

Lithology Information

No Lithology Records currently in GWIC.

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

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

Location Information

GWIC Id: 53406
 Location (TRS): 06N 04W 33 BBDB
 County (MT): JEFFERSON
 DNRC Water Right: P000053-00
 PWS Id: 00158004
 Block:
 Lot:
 Addition:

Source of Data: LOG\DEO
 Latitude (dd): 46.2332
 Longitude (dd): -112.1159
 Geomethod: MAP
 Datum: NAD27
 Altitude (feet):
 Certificate of Survey:
 Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 100.00
 Static Water Level (ft): 23.00
 Pumping Water Level (ft): 28.00
 Yield (gpm): 600.00
 Test Type: AIR
 Test Duration: 8.00
 Drill Stem Setting (ft):
 Recovery Water Level (ft):
 Recovery Time (hrs):
 Well Notes:

How Drilled: CABLE
 Driller's Name: LINDSAY
 Driller License: WWC038
 Completion Date (m/d/y): 9/21/1973
 Special Conditions:
 Is Well Flowing?:
 Shut-In Pressure:
 Geology/Aquifer: Not Reported
 Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	100.0	12.0

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.0	95.0	12.0				54 LB STEEL

Annular Seal Information

From	To	Description
0.0	12.0	CEMENT

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
40.0	86.0	12.0			5/16X1 1/2 PERF

Lithology Information

From	To	Description
0.0	8.0	TOPSOIL AND COURSE GRAVEL
8.0	28.0	BOULDERS AND GRAVEL
28.0	40.0	CLAY AND GRAVEL
40.0	51.0	COARSE GRAVEL
51.0	56.0	SAND
56.0	86.0	GRAVEL (CLEAR)
86.0	95.0	DECOMPOSED BEDROCK
95.0	100.0	SEMI HARD GRANITE

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

the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

APPENDIX C: Potential Contaminant Sources

Note: Business listings came from telephone directories / databases and other public sources. Being listed in this table does not indicate that these businesses are current polluters, but is simply listing them as potential contaminant sources based on experience with and the chemicals handled by similar types of businesses.

Other Potential Contaminant Sources In the Boulder PWS Well Inventory Region

NAME	ADDRESS	CITY	STATE	ZIP	SIC1	SIC2	LATITUDE	LONGITUDE	County
Boulder Chiropractic Ctr	101 S Main St	Boulder	MT	59632	804101	799999	46.236540	-112.11930	Jefferson
Boulder Grade School	205 S Washington St	Boulder	MT	59632	821103		46.239240	-112.11984	Jefferson
Boulder Parts Supply	221 S Main	Boulder	MT	59632	553111		46.234560	-112.12008	Jefferson
Boulder Tire Brake & Alignment	315 N Main St	Boulder	MT	59632	753801	553123	46.234020	-112.12026	Jefferson
Hawk Contracting Inc	PO BOX 1186	Boulder	MT	59632-1186	152103		46.169400	-112.02618	Jefferson
Jefferson County Supt Schools	2 Centennial	Boulder	MT	59632	821103		46.169400	-112.02618	Jefferson
Jefferson High School	312 S Main St	Boulder	MT	59632	821103		46.234080	-112.12026	Jefferson
M S Molitor Trucking Inc	65 Old Highway 91	Boulder	MT	59632	769999		46.232880	-112.13892	Jefferson
Molitor Trucking	803 W Centennial	Boulder	MT	59632	421309		46.236180	-112.13178	Jefferson
Padgett Business Svc		Boulder	MT	59632	738999		46.169400	-112.02618	Jefferson
Rs Giulio Contractor	707 N Main	Boulder	MT	59632	179403		46.169400	-112.02618	Jefferson
Town Pump	701 N Main St	Boulder	MT	59632	541103	554101	46.169400	-112.02618	Jefferson
Vossler Excavating Inc	317 N Main	Boulder	MT	59632	179403		46.234020	-112.12026	Jefferson

APPENDIX D: Concurrence Letter