

**Town of Melstone
PWSID # MT0000290**

Public Water System

**SOURCE WATER DELINEATION AND
ASSESSMENT REPORT**

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Melstone PWS Operator:

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INTRODUCTION

This Delineation and Assessment Report was prepared by Perri P. May, Hydrogeologist in the Source Water Protection Program of the Montana Department of Environmental Quality (DEQ). The public water supply (PWS) discussed in this report is located in Musselshell County, Montana. The DEQ PWS identification number, operator names, and contact number for the Town of Melstone PWS appear on the title page of this report.

Purpose

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report for the Town of Melstone 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 the protection of public drinking water supplies from contamination. The primary purpose of this source water delineation and assessment report is to provide information to assist the Town of Melstone PWS operators in the identification of potential contaminant sources near their surface water intake, and the need for a source water protection plan to protect the Town of Melstone drinking water source. A source water protection plan is warranted for this PWS, as its source water is highly susceptible to a number of identified potential contaminant sources.

Delineation and assessment constitute major components of the Montana Source Water Protection Program. Delineation entails mapping the boundaries of source water protection areas, which encompass ground water and/or surface waters contributing to public water supply sources. Assessment involves identifying locations or regions within source water protection areas where contaminants may be generated, stored, transported, or disposed, and determining the relative susceptibility of drinking water to contamination from these sources.

Limitations

This report was prepared to assess threats to the identified public water supplies, and is based on published data and information obtained from local residents familiar with the community. The terms “drinking water supply” and “drinking water source” refer specifically to the sources of the public water supplies, and not any other public or private water supply. Also, not all potential or existing sources of ground -water or surface-water contamination in the area of the surface water intake are identified. Only potential sources of contamination in areas that contribute water to the identified drinking water sources 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 carcinogenic or toxic constituents that do not have MCLs but are considered to be significant health threats.

CHAPTER 1

BACKGROUND

The Community

Melstone is located approximately 82 miles southeast of Lewistown in Musselshell County ([Figure 1](#)).

Melstone was founded as a Milwaukee Railroad station (Cheney, 2000). The town was named after an Associated Press reporter, Melvin Stone. He accompanied the president of the railroad during a tour when the president was assigning names to towns along the tracks. The first post office was established in Melstone in 1908 (<http://www.visitmt.com>). Dry land farmers settled the lands surrounding the town, but were largely unsuccessful due to inadequate water supplies. Coal mining was initiated on a commercial scale in the Muselshell drainage in 1907, shortly following the completion of the Chicago, Milwaukee & St. Paul railway (Ellis and Meinzer, 1924). Currently, the acreage in the vicinity of Melstone is predominantly utilized for oil production (Cheney, 2000).

The population of Melstone was estimated at 136, based on tallies conducted during the 2000 U.S. Census. The Melstone population has declined from an estimate of 170, based on data collected in the 1990 U.S. Census. U.S. 12 connects Melstone with Forsyth to the east and Roundup to the west. The Chicago, Milwaukee, and St. Paul railroad continues to service the town today.

Climate

The climate in the vicinity of Melstone is semi-arid.(See [Figure 2](#)) Based on Western Regional Climatic Center data for the July 1, 1948 to December 31, 2001 period of record, annual precipitation averages 14.34 inches. Monthly average precipitation ranges from 0.45 inches in February to 2.59 inches in June. Intense, localized thunderstorms commonly occur from May through July. The annual mean snowfall in Melstone is 47.6 inches. Periodic drought cycles (as defined by moving annual precipitation averages less than 10 inches) occur in the region at approximately 10 to 20 year intervals. Evaporation rates are high, averaging 25 to 35 inches per year.

Geographic Setting

Melstone is located in the Musselshell River valley at 46.5986° North Latitude and – 107.8721° West Longitude at 2,920 feet above mean sea level. The town is situated in the Great Plains physiographic province of North America (Rocky Mountain Association of Geologists, 1972), and the glaciated central ground-water region of the United States (Heath, 1984).

Multiple episodes of tectonic compression have formed large and small fold structures and numerous associated faults in the Paleozoic and Mesozoic sedimentary rocks that underlie the area. Bedrock benches in the area are commonly capped by Quaternary gravel deposits sloping south to southeast towards the Musselshell River (Porter and Wilde, 1999).

The terrain around Melstone consists of rolling plains and high benches. The benches are deeply dissected by the Musselshell River and its tributaries, and are bound on the northwest by the Little Snowy Mountains (Porter and Wilde, 1999). The plains are underlain by alternating beds of sandstone and shale that have been folded and differentially eroded. As a result, the plains are characterized by flat shale lowlands separated by sandstone ridges (Ellis and Meinzer, 1924). Terrace gravels that rise gradually and become more continuous towards the Snowy Mountains blanket the highest surfaces of the plains (Bowen, 1918). The Bull Mountains bound the Musselshell Valley plains to the south. These mountains consist of a group of mesas formed via erosion of the surrounding plains (Ellis and Meinzer, 1924). The flat tops of the mesas are edged by steep slopes and cliffs. The mesas are cored by alternating sandstone and shale units, which have been preserved in part due to the burning of coal beds, which hardened the sandstone and shale units, rendering them resistant to erosion (Ellis and Meinzer, 1924).

The Town of Melstone's surface water intake and distribution system are located in the Middle Musselshell watershed. The U.S. Geological Survey hydrologic unit code for this watershed is 10040202. The Musselshell drainage is oriented northeast-southwest near Melstone, with a flow direction to the northeast.

Geology

This section provides an overview of the geology and hydrology of the area in the vicinity of the Town of Melstone's surface water intake. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers and surface waters to potential contamination sources.

Numerous sedimentary bedrock formations are exposed in the Musselshell River watershed ([Figure 3](#)). To the north, bedrock formations exhibit northwest-trending folds and faults of the Central Montana uplift (Miller, 1988). To the south, bedrock formations

dip into the Bull Mountain Basin. To the east, bedrock formations dip to the east. The Cretaceous Judith River, Bearpaw Shale, Fox Hills and Hells Creek formations, the Paleocene Fort Union formation, and Musselshell River Quaternary alluvium outcrop in the vicinity of Melstone (Miller, 1988). The Town of Melstone and the Town's surface water intake are situated on the Quaternary alluvium of the Musselshell River Valley. The alluvium is underlain by Cretaceous Bearpaw shale, which is also exposed just north and south of the Musselshell River floodplain (Figure 3). The Hell Creek formation, composed of gently south-dipping sandstones and shales, outcrops just south of the Bearpaw shale. The Fort Union formation, composed of massive sandstones, shales, and coals, is exposed just south of the Hell Creek formation, and underlies the Musselshell River alluvium two miles upstream from Melstone's intake location. The Judith River and Clagett formations crop out northwest of Melstone (Figure 3).

The Quaternary alluvium blanketing the Musselshell alluvium is composed of gravels, sands, silts, and clays (Ellis and Meinzer, 1924). Where the alluvium is composed of coarse-grained sediments such as gravel and sands, ground-water yields are appreciable. In areas where the alluvium is predominantly composed of silts and clays, both yields and water quality are poor (Ellis and Meinzer, 1924). The Paleocene Fort Union formation in the Musselshell Valley consists of beds of massive resistant sandstone, clay, shale, and coal (Ellis and Meinzer, 1924). This formation is water-bearing, but yields are generally small, and sandstone lenses and coal units comprise the principal water sources in the formation. The Cretaceous Bearpaw shale in the Valley is predominated by shale containing calcareous concretions, and some sandstone units near the base of the formation. This formation is generally not water-bearing (Ellis and Meinzer, 1924). The Cretaceous Hell Creek formation in the vicinity of Melstone consists of alternating beds of massive sandstone and shales. This formation is generally water-bearing, with principal water sources in the sandstone beds, particularly the basal sandstone member (Ellis and Meinzer, 1924). The Cretaceous Judith River formation is composed of sandstones and shales. This formation generally yields adequate supplies of water for domestic and stock use (Ellis and Meinzer, 1924). The Clagett formation consists of shale with some minor sandstone units, and similarly to the Bearpaw shale, this formation is generally not water-bearing.

General Description of the Source Water

The source water for the Town of Melstone is obtained through a surface water intake on the Musselshell River. The intake is located approximately one mile south of Melstone on the river (Figure 4).

Snowmelt in the Crazy Mountains, the Castle Mountains the Little Belt Mountains, and the Big Snowy Mountains in the headwaters of the basin is an important source of water for the Musselshell River. The drainage has a total area of 8000 square miles (Vining et al., 1996). Irrigation is the principal water use in the basin. Water is used to irrigate approximately 47,000 acres of cropland in the drainage (Vining et al., 1996). Serious

water shortages occur during some years due to the large natural variability of streamflows in the basin.

Downstream from Martinsdale, where the river emerges onto broad, flat plains, and continuing east to Melstone, tributaries to the Musselshell are predominantly intermittent and subject to large variations in flow. These intermittent channels respond quickly to sporadic but intense rainstorms during the spring and summer months (Vining et al., 1996).

Due to successive years of drought conditions and the natural variability in streamflows in the Musselshell drainage, Melstone has experienced severe water shortages over the past few years (Montana Engineering and Administration, 2002). Musselshell River flows have been further depleted by numerous upstream water withdrawals for irrigation. In July, 2002, the Musselshell River was completely dry at the Town of Melstone's intake (Montana Engineering and Administration, 2002). As a result, the Town has been pursuing alternative water sources, and recently drilled a new water supply well to potentially supplement the drinking water supply.

Raw water from the Musselshell River has seasonally high turbidity and total dissolved solids (TDS). Ground waters are a major source of dissolved solids, especially during baseflow, or low conditions from late summer through late winter (Ellis and Meinzer, 1924). Intense summer rain events also flush poor quality water high in suspended sediment concentrations from intermittent streams during spring snowmelt and rainstorm events.

The Public Water Supply

The Town of Melstone PWS is classified as a community system under the Federal Safe Drinking Water Act, because the system serves at least 25 year-round residents through at least 15 service connections. The PWS services 181 residents via 77 active service connections.

The Musselshell River is the primary water supply source. The latitude of the surface water intake location is 48.5852°N, and the longitude is -107.8683°W. Musselshell River water is drawn into a single inlet line via two pumps operating on an alternating sequence (Midwest Assistance Program, 2002). In 2001, the Town installed a fire pump inside the intake to more efficiently draw on lower Musselshell River flows. Typically, the Town initiated pumping when the standing water level in the intake was between 16 and 20 inches (Montana Engineering and Administration, 2002). The raw water is pumped directly from the inlet into two pre-sedimentation basins. Alternatively, raw water is pumped into two large holding reservoirs prior to the pre-sedimentation basins during low river flow periods. Water is then pumped from the pre-sedimentation ponds into a caisson housing two submersible pumps, and on to the Town's dual train conventional package treatment plant (Midwest Assistance Program, 2002).

The Town of Melstone’s source water treatment facility utilizes conventional filtration with coagulation and flocculation via the addition of liquid alum and cationic polymer (Midwest Assistance Program, 2002). Flocculation is followed by clarification and chlorination using two sodium hypochlorite (13%). The treated water is then pumped through multimedia filters, and into a clearwell. Finished water is then pumped from the plant to the distribution system and 0.275 million-gallon storage tank (Midwest Assistance Program, 2002).

Water Quality

Public water systems must conduct routine monitoring for contaminants in accordance with Federal Safe Drinking Water Act requirements. Parameters such as coliform bacteria, lead, copper, nitrate, nitrite, volatile organic chemicals (including hydrocarbons and chlorinated solvents), inorganic chemicals (including metals), synthetic organic chemicals (including pesticides), and radiological contaminants must be sampled in community PWSs and non-community, non-transient PWSs in accordance with schedules specified in the Administrative Rules of Montana. Transient, non-community PWSs are required to conduct routine monitoring for pathogens (including coliform bacteria), nitrate, and nitrite. All contaminant concentrations detected in required samples must comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act.

Background Water Quality Data for the Musselshell River Upstream of Melstone’s Intake

Water quality data for the Musselshell River are available from the U.S. Geological Survey Musselshell River at Musselshell #06127500 gaging station located approximately 14 miles upstream from Melstone’s surface water intake.

Table 1. Constituent concentrations in the Musselshell River for samples collected at the Musselshell River at Musselshell U.S.G.S. gaging station

Constituent	Sampling Dates	Concentration	MCL (dissolved conc. in mg/l)	MCLG (dissolved conc. in mg/l)	Secondary Standard (dissolved conc. in mg/l)
Specific Conductance (µS/cm)	11/08/82 to 06/19/01	580 – 3700	NA	NA	NA
Dissolved Oxygen (mg/l)	11/10/87 to 09/06/91	6.2 – 11.9	NA	NA	NA
Nitrite + Nitrate (as N), total	11/10/87 to 09/06/91	≤0.01 – 0.3	Nitrate = 10 Nitrite = 1	Nitrate = 10 Nitrite = 1	NA
Sulfate (mg/l)	11/10/87 to 09/06/91	200 – 1900	NA	NA	250
Fluoride,	11/10/87 to	0.2 – 0.7	4.0	4.0	2.0

dissolved (mg/l)	09/06/91				
Arsenic, total (µg/l)	06/28/88 to 07/23/91	1 - 6	0.05	NA	NA
Cadmium, total (µg/l)	06/28/88 to 07/23/91	≤1.00 – 1.00	0.005	0.005	NA
Chromium, total recoverable (µg/l)	06/28/88 to 07/23/91	1 - 30	0.1 (total conc)	0.1 (total conc)	NA
Iron, dissolved (µg/l)	11/10/87 to 09/06/91	≤10 - 40	NA	NA	0.3
Lead, total recoverable (µg/l)	06/28/88 to 07/23/91	≤5 - 25	0	TT; action level = 0.015	NA
Selenium, total (µg/l)	06/28/88 to 07/23/91	≤1.0 – 2.0	0.05	0.05	NA
Picloram, total recoverable (µg/l)	06/28/88 to 07/23/91	≤0.01 – 0.05	0.5	0.5	NA
2,4-D, total (µg/l)	06/28/88 to 07/23/91	≤0.01 – 0.11	0.07	0.07	NA
Dicamba, total (µg/l)	06/28/88 to 07/23/91	≤0.01 – 0.04	NA	NA	NA
Suspended sediment (mg/l)	11/10/87 to 09/06/91	27 - 1320	NA	NA	NA
Mercury, total recoverable (µg/l)	06/28/88 to 07/23/91	≤0.10 – 0.04	0.002	0.002	NA

The State of Montana classifies the Musselshell River drainage waters from the headwaters to Deadman’s Basin diversion canal above Shamut (except for the mainstem from Hopley Creek to Deadman’s Basin diversion canal) as B-1 surface water bodies. B-1 waters are considered suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supplies pursuant to the Administrative Rules of Montana 17.30.623. The State of Montana classifies the Musselshell River mainstem from Hopley Creek to Deadman’s Basin diversion canal as a B-2 surface water body. B-2 waters are considered suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes

and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supplies pursuant to the Administrative Rules of Montana 17.30.624.

The State of Montana classifies the Musselshell River drainage waters below Deadman's Basin diversion canal above Shamut (except for Deadman's Basin Reservoir, Careless Creek, Swimming Woman Creek, Flatwillow Creek above US Highway 87 crossing south of Grassrange, and South Willow Creek above the county road bridge in T10N, R24E, Section 7) as C-3 surface water bodies. C-3 waters are considered suitable for bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers. The quality of these waters is naturally marginal for drinking, culinary and food processing purposes, agricultural and industrial water supplies pursuant to the Administrative Rules of Montana 17.30.629.

The quality of water in the Musselshell River watershed varies considerably from place to place, mostly because of differences in geology, erosion rate, and land uses. Within the Middle Musselshell watershed, the segment of the Musselshell River mainstem from the watershed boundary at Roundup downstream to the Flatwillow Creek confluence is included on Montana's 2000 303(d) list of water-quality impaired water bodies. DEQ has determined that aquatic life and warm water fishery uses are partially supported on this segment of the river. The probable causes of impairment have been identified as flow alteration, other habitat alterations, and riparian degradation. The probable sources of impairment have been identified as agriculture, hydromodification, channelization, flow regulation/modification, habitat modification, and bank/shoreline modification.

In the Upper Musselshell watershed, the segment of the Musselshell River mainstem from the North and South Fork confluence downstream to the Deadman's Basin diversion is also included on Montana's 2000 303(d) list of water-quality impaired water bodies. DEQ has determined that aquatic life, cold water fishery, and primary contact/recreational uses are partially supported in this stretch of the river. Use for drinking water is fully supported on this segment. The probable causes of water-quality impairment have been identified as bank erosion, flow alteration, nutrients, other habitat alterations, and siltation. The probable sources of impairment have been identified as agriculture, crop-related sources, grazing-related sources, hydromodification, and channelization.

The segment of the upper Musselshell River mainstem from the Deadman's Basin diversion downstream to Roundup is also included on Montana's 2000 303(d) list of water-quality impaired water bodies. DEQ has determined that aquatic life and warm water fishery uses are partially supported in this stretch of the river. The probable causes of water-quality impairment have been identified as flow alteration, nutrients, other habitat alterations, riparian degradation, and siltation. The probable sources of impairment have been identified as agriculture, hydromodification, crop-related sources, grazing-related sources, and channelization.

Careless Creek in the Upper Musselshell watershed is also included on Montana's 2000 303(d) list of water-quality impaired water bodies. DEQ has determined that aquatic life

and warm water fishery uses are partially supported in this stream. The probable causes of water-quality impairment have been identified as flow alteration, other habitat alterations, riparian degradation, and siltation. The probable sources of impairment have been identified as agriculture, hydromodification, flow regulation/modification, grazing-related sources, habitat modification, and bank/shoreline modification.

Painted Robe Creek in the Upper Musselshell watershed is also included on Montana's 2000 303(d) list of water-quality impaired water bodies. DEQ has determined that aquatic life and warm water fishery uses are partially supported in this stream. The probable causes of water-quality impairment have been identified as nutrients, other habitat alterations, riparian degradation, and salinity/TDS/sulfates. The probable sources of impairment have been identified as agriculture, grazing-related sources, and crop-related sources.

Town of Melstone PWS Water Quality

Within the past five years, no positive fecal coliform samples were collected during routine contaminant monitoring. No maximum contaminant level (MCL) exceedances were noted for any other constituents monitored over the past five years, but detections of fluoride, uranium, nitrate + nitrite, bromodichloromethane, chlorodibromomethane, and chloroform were noted.

CHAPTER 2 DELINEATION

The source water protection area, or the land area that contributes water to the Town of Melstone's surface water intake, is delineated in this chapter. The purpose of delineation is to map the source of Melstone's drinking water and to define areas within which to prioritize source water protection efforts.

Source water protection areas for surface water sources are subdivided into spill response and watershed regions, each with separate management goals. The spill response region encompasses an area upstream of the Town of Melstone intake in which contaminants can be drawn into the intake with little lag time. The watershed region encompasses a portion of the Middle Musselshell watershed upstream of the Town of Melstone's surface water intake.

Hydrogeologic Conditions

The headwaters of the Musselshell River are alpine tributary streams located in the foothills of the Crazy, Castle, and Little Belt Mountains approximately 120 miles west of Melstone. Flow in the Musselshell River is augmented by diversion from the Yellowstone drainage and tributaries flowing from the Snowy Mountains. In total, the Musselshell River drains a total area of approximately 8,000 square miles (Vining et al., 1996).

Based on gaging data collected from 1928 through 2001 at the Musselshell River at Musselshell U.S.G.S. gaging station, mean monthly flows in the Musselshell River at this location range from a low of 71 cubic feet per second (cfs) in January to 587 cfs in June. Based on data collected at this station from 1946 through 1978, annual mean flows range from 30.6 cfs in 1961 to 654 cfs in 1975. The peak flow estimated at this station was 9,850 cfs on June 9, 1967. Musselshell River flows are highly variable. Flow is affected by annual and seasonal variations in runoff, and irrigation water diversion and storage.

Snowmelt, direct precipitation, surface runoff, diversions from neighboring drainages, and lateral inflow from alluvial and bedrock aquifers contribute to flow in the Musselshell River in the vicinity of the Town of Melstone intake. The Musselshell loses water to infiltration through the riverbed to underlying or adjacent aquifers, evapotranspiration, and water withdrawals. The majority of flow in the Musselshell River near Melstone comes from snowmelt in its headwaters and tributaries that flow southeast to northeast from the Crazy, Castle, Little Belt, and Snowy Mountains.

Using DEQ Source Water Protection Program criteria for ranking sensitivity (Table 2), the Town of Melstone's source water is considered highly sensitive to contamination. The sensitivity ranking is a result of the surface water source for the PWS.

Table 2. Source water sensitivity criteria (DEQ, 1999).

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)

Conceptual Model and Assumptions

If spilled or discharged directly into the Musselshell River a few miles upstream of Melstone, contaminants may be drawn into the surface water intake before plant operators can close it. Contaminants derived from sources farther removed from the intake throughout the watershed may be flushed into tributaries and subsequently into the Musselshell River during spring snowmelt or storm events, or may infiltrate aquifers which discharge to the river via hydraulic connections.

Delineation Results

Spill Response Region

Hydrogeologic mapping was utilized to delineate the spill response region for the Town of Melstone's intake ([Figure 4](#)). The region extends from the surface water intake along the Musselshell River upstream for a distance of 10 miles, in accordance with SWP guidance (DEQ, 1999). The region also encompasses a portion of the Musselshell watershed extending ½ mile from either side of the river channel centerline.

Watershed Region

The watershed region for the Town of Melstone PWS encompasses a portion of the Middle Musselshell watershed, which extends from the surface water intake upstream to the watershed boundary near Roundup ([Figure 5](#)). The U.S. Geological Survey hydrologic unit code for the Middle Musselshell watershed is 10040202.

Limiting Factors

The delineations for the Town of Melstone PWS spill response region and watershed region are based on fixed-distance and watershed mapping. The spill response region represents an approximation of the distance required for contaminants to reach the surface water intake with little lag time. Numerous assumptions are associated with the Source Water Protection Program (SWPP) criteria for spill response region delineations. Contaminant transport rates and concentrations will vary depending on river and reservoir flow conditions, ground water flux into the river and reservoir, contributions from overland flow, soil types, slope, characteristics of riparian vegetation, the extent of riparian vegetation buffer zones, the extent and duration of contamination, contaminant solution density, adsorption, mechanical dispersion, biological transformation, dilution, molecular diffusion, adsorption, precipitation, oxidation, complexation, and volatilization. As a result, some areas within the spill response region may be more conducive to contaminant transport than others, and should be designated as higher priority areas for source water protection efforts.

CHAPTER 3 INVENTORY

An inventory of potential sources of contamination was conducted to assess the susceptibility of the Town of Melstone PWS to contamination, and to identify priorities for source water protection planning. These inventories were conducted within the delineated spill response and watershed regions. The inventory for the Town of Melstone PWS focuses on facilities that generate, use, store, transport, or dispose potential contaminants, and on land types on which potential contaminants are generated, used, stored, transported, or disposed. Additionally, the inventory identifies potential sources of all primary drinking water contaminants and Cryptosporidium. Only significant potential contaminant sources were selected for detailed inventory. The significant contaminants posing potential threats to the Town of Melstone PWS include, pesticides, fertilizers, herbicides, petroleum hydrocarbons, VOCs, SOCs, nitrate, and pathogens. The inventory for the Town of Melstone PWSs also focuses on all activities in the spill response region, as well as general land uses and large potential contaminant sources in the watershed 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: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (U.S.G.S., 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 Standard Industrial Codes.

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

Inventory Results/Spill Response Region

Land covers within the spill response region for the Town of Melstone PWS include open water, commercial/industrial/transportation, forest, shrubland, grassland/herbaceous, small grains, row crops, and fallow ground ([Figure 6](#)). Predominant land covers in the region include small grains (25%), pasture/hay (24%), and grasslands/herbaceous (16%) ([Figure 6](#)). Cultivated cropland occupies 61% of the area of the spill response region.

Low on-site septic densities occur within the entire spill response region area, and there is no municipal sewer system located within the spill response region. No concentrated animal feeding operations are located in the spill response region.

Two oil and gas wells are located within the spill response region ([Figure 4](#)). Both of these wells are development wells, and neither has been used for the production of oil or gas. As a result, brine wastewater is not generated at any of these well locations, and they are not considered significant potential contaminant sources.

U.S. Highway 12 and the Chicago, Milwaukee & St. Paul Railway pass through the spill response region. Both of these transportation routes constitute significant potential contaminant sources in the event the spill of contaminants on the road or the tracks. Additionally, herbicides sprayed along these transportation corridors may pose a potential threat to the Town of Melstone's source water.

Numbers on the spill response region map ([Figure 4](#)) identify the locations of potential contaminant sources, and correspond to Map ID numbers in Table 3.

Table 3. Significant potential contaminant sources in the spill response region for the Town of Melstone PWS.

Source	Address Or Map ID Number	Potential Contaminants	Hazard
Cultivated Cropland	1	Fertilizers, pesticides, herbicides, pathogens, nitrate	surface runoff into Musselshell River; infiltration to shallow ground water and subsequent discharge to river
U.S. Highway 12	2	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river
Chicago, Milwaukee & St. Paul railway	3	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river

Inventory Results/Watershed Region

The watershed region for the Town of Melstone PWS encompasses the area of the Middle Musselshell River watershed upstream from Melstone’s surface water intake, and the entire Upper Musselshell River watershed ([Figure 5](#)). Predominant land covers in the watershed region include grasslands/ herbaceous (61%), forest (17%), and small grains/row crops (10%) ([Figure 7](#)). Cultivated cropland occupies 17 % of the watershed region. Seven permitted confined animal feeding operations are located in the watershed region. On-site residential septic densities throughout the watershed region are predominantly low. Low septic densities occupy 99.9% of the total watershed area. The Roundup, Lavina, Ryegate, and Harlowtown municipal sewer systems are located in the watershed region. All municipal sewer systems and several small areas of high density on-site septic systems are proximal to the Musselshell River, where residential development is concentrated in the valley.

U.S. Highway 12, U.S. Highway 87, U.S. Highway 191, Montana Route 3, and the Chicago, Milwaukee & St. Paul Railway pass through the watershed region ([Figure 5](#)). U. S. Highway 12 and the Milwaukee & St. Paul Railway roughly parallel the Musselshell

River corridor. U.S. Highway 87, U.S. Highway 191, and Montana Route 3 only pass through the river corridor at crossings. Herbicides are commonly sprayed along roadways and railways such as U.S. Highway 12 and the Chicago, Milwaukee & St. Paul Railway for weed control purposes. There is also a potential for pesticides, fertilizers, petroleum hydrocarbons, SOCs, and VOCs transported along these routes to spill onto the roadway or railway and adjacent soils, possibly infiltrating shallow ground water or running off into the Musselshell River. Due to the proximity of U.S. Highway 12 and the Chicago, Milwaukee & St. Paul Railway to the Musselshell River corridor, these transportation routes are considered significant potential contaminant sources. Likewise, U.S. Highway 87, U.S. Highway 191, and Montana Route 3 are considered significant sources due to their proximity to the river at crossings and the potential for spills occurring at these locations.

Numerous oil and gas wells are located in the watershed region ([Figure 5](#)). A number of these wells are currently utilized for oil and/or gas production. A few of the production wells are located proximal to the Musselshell River corridor in a field north of the river near the town of Delphia, between the towns of Melstone and Musselshell. Due to the location of this field proximal to the Musselshell River corridor and approximately 22 miles upstream from the Melstone surface water intake, the production wells are considered significant potential contaminant sources.

Two branches of the Continental crude oil pipeline cross the Musselshell River upstream of Melstone's intake within the watershed region ([Figure 5](#)). Due to the potential for pipeline ruptures, spills, or leaks in the vicinity of the crossings, the pipeline is considered a significant potential contaminant source.

Several hazardous materials spill sites are located in the Upper Mussel watershed ([Figure 5](#)). None of these sites are located close to the Musselshell River. As a result, none of these sites are considered significant potential contaminant sources.

Numerous underground storage tanks are located within the watershed region ([Figure 5](#)). Several of these tanks have been reported as leaking. The tanks are not considered significant potential contaminant sources, as they generally generate smaller quantities of petroleum hydrocarbon contaminants, and the tanks situated nearest to Melstone's intake are located approximately 37 miles upstream near Roundup. Any contamination generated from these tanks would likely undergo significant degradation through natural attenuation in the underlying soils, shallow ground water, and/or the Musselshell River before reaching the Town of Melstone's intake.

Several municipal landfills are located in the watershed region ([Figure 5](#)). The Musselshell landfill, located in the river corridor approximately 13 miles downstream of Melstone's intake, is the only significant landfill potential contaminant source, due to its proximity to the river and to the intake structure. This solid waste disposal area was a Class II landfill, which was closed in 1981.

Two Montana state Superfund sites are located in the watershed. The Roundup Municipal Landfill is designated as a low priority Superfund site. This site was a Class II landfill that was closed in 1994. This site is located northeast of Roundup and approximately three miles north of the Musselshell River ([Figure 5](#)). This site is not considered a significant potential due to its low priority and its considerable distance from the river over which contaminant concentrations would likely be naturally attenuated. The second State Superfund site in the watershed is the Harlowtown Milwaukee Roundhouse, located in Harlowtown. This site has been designated as having a medium remediation priority. It is an inactive railroad repair and maintenance facility. This site is located close to the Musselshell River and approximately 103 miles upstream from Melstone's surface water intake. This site is not considered a significant potential contamination source due to the extensive distance between Harlowtown and Melstone's surface water intake, over which contamination concentrations would likely be attenuated.

Numerous permitted point discharges are located in the watershed region, including several feedlot discharges; the Lavina, Ryegate, and Harlowtown municipal wastewater treatment plant discharges; and a discharge from the Harlowtown oil skimmer ([Figure 5](#)). Although several of the wastewater treatment plants discharge directly to the Musselshell River, they are far enough upstream of Melstone's intake that they do not appear to present a significant threat to the quality of Melstone's source water. However, one discharge from a cattle feedlot on Carpenter Creek is located approximately 11 miles upstream of Melstone's intake and approximately 0.5 miles outside of the spill response region ([Figure 5](#)). This feedlot discharge may pose a significant threat to Melstone's source water due to its close proximity to the intake.

Several mines are located in the watershed region, including excavations for coal, copper, iron, silver, clay, manganese, lead, zinc, titanium, and other rare earth elements. None of the mines appear to present a significant threat to the quality of Melstone's source water. Most of the hard rock mines are located in the headwaters of the drainage, and do not appear to pose a significant threat to Melstone's source water due to the considerable distances from the mines to the intake ([Figure 5](#)). A coal mine, located approximately 2.5 miles south of the Musselshell River and southeast of Roundup, is closest to the intake location.

Numbers on the watershed region map ([Figure 5](#)) identify the locations of potential contaminant sources, and correspond to Map ID numbers in Table 4.

Table 4. Significant potential contaminant sources in the watershed region for the Town of Melstone PWS.

Source	Address Or Map ID Number	Potential Contaminants	Hazard
Cultivated Cropland	1	Fertilizers, herbicides, pesticides, pathogens, nitrate	Spills, over application or misapplication of fertilizers, herbicides, or pesticides, surface runoff into Musselshell River
U.S. Highway 12	2	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river
Chicago, Milwaukee & St. Paul Railway	3	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river
U.S. Highways 87 and 191, and Montana Route 3	4, 5, 6	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river
Oil and Gas Production Wells	7	Total Dissolved Solids, Petroleum Hydrocarbons	Migration of brine wastewater into shallow ground water discharging to Musselshell River; surface runoff directly to river
Continental Crude Oil Pipeline	8	Petroleum hydrocarbons	Spills, leaks, and ruptures; Surface runoff into river, infiltration to shallow ground water discharging to river
Foster Ranch Feedlot	9	Nitrates, pathogens	Surface runoff into Carpenter Creek and Musselshell River, infiltration to shallow ground water discharging to Carpenter Creek and Musselshell River

Inventory Update

The certified operators of the Town of Melstone PWS 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 re-certification of the source water delineation and assessment report.

Inventory Limitations

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data readily available through state documents, published reports, and GIS data. Documentation may not be readily available on some potential sources. As a result, all potential contaminant sources may not have been identified. In some instances, inadequate location information precluded the inclusion of potential sources in the inventory.

CHAPTER 4 SUSCEPTIBILITY ASSESSMENT

Susceptibility of the Town of Melstone’s source water is determined by two factors: the potential of a contaminant reaching the intake and the resulting health hazard. Susceptibility is assessed in order to prioritize potential pollutant sources in the spill response region in order to guide management actions undertaken by local entities, in this case, the Town of Melstone and Musselshell County.

The goal of source water management is to protect the source water, manage significant potential contaminant sources in the spill response region, and ensure that land use activities in the watershed region pose minimal threats to the source water. Management priorities in the spill response 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 Town of Melstone PWS owners and operators to reduce susceptibility are also included in this section of the report.

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 the PWS intake (Table 5). The hazard presented by point sources of contaminants in Town of Melstone’s spill response region depends on whether contaminants can discharge directly to the Musselshell River. Point source hazard is also dependent on the health affects associated with potential contaminants (Table 6). Hazard ratings for nonpoint sources are assigned based on criteria listed in Table 6 for septic systems, sanitary sewers, and cropped agricultural land. Barriers can be anything that decreases the likelihood that contaminated water will reach Melstone’s surface water intake. Examples of barriers include: a vegetated riparian area, protective forest management practices, and dilution.

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

Table 6. Hazard ranking assigned to various potential contaminant sources.

	High Hazard	Moderate Hazard	Low Hazard
Point Sources of All Contaminants	Potential for direct discharge to source water	Potential for discharge to GW that is hydraulically connected to SW	Potential contaminant sources within the watershed
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 % of region	20 to 50 % of region	Less than 20 % of region
Cropped Agricultural Land (% land use)	More than 50 % of region	20 to 50 % of region	Less than 20 % 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 Assessment Results

The Town of Melstone’s source water is highly susceptible to potential contamination from U.S. Highway 12 and the Chicago, Milwaukee & St. Paul Railway. The Town of Melstone’s source water is moderately susceptible to potential contamination from cultivated cropland; U.S. Highways 87 and 191, and Montana Route 3; oil and gas production wells; the Continental Crude Oil Pipeline, and the Foster Ranch Feedlot. Table 7 displays the susceptibility assessment results for the Town of Melstone PWS surface water intake. The intake is susceptible to number of contaminants, including pathogens, nitrates, fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, and VOCs. Tables 3 and 4 list all the significant potential contaminant sources identified in the spill response and watershed regions for the Town of Melstone PWS.

The susceptibility results for each significant potential contaminant source identified follow:

U.S. Highway 12– The potential hazard imposed by pesticides, herbicides, fertilizers, VOCs and SOCs originating from U.S. Highway 12 is high. The road poses a high hazard because there is potential for a spill or an overapplication of herbicides originating on the road to directly discharge into the Musselshell River upstream from Melstone’s surface water intake. The susceptibility of the PWS to pesticides, fertilizers, VOCs and SOCs originating from this source is also high. The only barrier identified for this source is a riparian zone greater than 50 feet wide throughout most of the spill response region, which facilitates the degradation of contaminants before they reach the river.

Chicago, Milwaukee & St. Paul Railway– The potential hazard imposed by pesticides, herbicides, fertilizers, VOCs and SOCs originating from the railway is high. The railway poses a high hazard because there is potential for a spill or an overapplication of herbicides originating along the tracks to directly discharge into the Musselshell River upstream from Melstone’s surface water intake. The susceptibility of the PWS to pesticides, fertilizers, VOCs and SOCs originating from this source is also high. The only barrier identified for this source is a riparian zone greater than 50 feet wide throughout most of the spill response region, which facilitates the degradation of contaminants before they reach the river.

Cultivated cropland – The potential hazard imposed by pathogens, nitrate, pesticides, herbicides, and fertilizers originating from agricultural lands is moderate. Cultivated agricultural lands occupy 61% of the spill response region, and 17% of the watershed region. The hazard posed by this land use is considered moderate, as the average percent occupation of cultivated croplands in both source water protection regions falls between 20% and 50% of the total area. The susceptibility of the intake to these agricultural sources of contamination is also moderate due to the identification of only a single barrier: a riparian zone greater than 50 feet wide throughout most of the spill response region. This well established riparian zone filters out suspended particulates and enables microbial degradation of contaminants in surface runoff before it reaches the Musselshell River.

U.S. Highways 87 and 91, and Montana Route 3– The potential hazard imposed by pesticides, herbicides, fertilizers, VOCs and SOCs originating from these roads is moderate. The roads pose a moderate hazard because there is limited potential for a spill or an overapplication of herbicides originating on the roads to directly discharge into the Musselshell River upstream from Melstone’s surface water intake. There is a greater likelihood that spills or an overapplication of herbicides originating on these roads may infiltrate into the underlying shallow ground water and subsequently discharge to the river. The susceptibility of the PWS to pesticides, fertilizers, VOCs and SOCs originating from these sources is also moderate. The only barrier identified for these sources is natural attenuation.

Gas production wells – The potential hazard presented by oil and gas production wells located in the watershed region is moderate. Brine wastewaters produced by these wells may potentially migrate into shallow ground water and eventually discharge to the Musselshell River upstream from Melstone’s surface water intake. The susceptibility of the Melstone intake to this potential contaminant source is also moderate, due to the identification of only a single natural attenuation barrier. The reduction of contaminant concentrations through biological processes (aerobic and anaerobic biodegradation, plant and animal uptake), physical phenomena (advection, dispersion, dilution, diffusion, volatilization, sorption/desorption), and chemical reactions (ion exchange, complexation, abiotic transformation). is likely to occur over the distances between these sources and the Town of Melstone’s surface water intake.

Continental Crude Oil Pipeline – The potential hazard presented by the branches of the Continental crude oil pipeline located in the watershed region is moderate. Petroleum hydrocarbons from leaking or ruptured lines have a limited potential to discharge directly into the Musselshell River at pipeline crossings, or, more likely, to migrate into shallow ground water and eventually discharge to the Musselshell River upstream from Melstone’s surface water intake. The susceptibility of the Melstone intake to this potential contaminant source is also moderate, due to the identification of only a single natural attenuation barrier.

Foster Ranch Feedlot – The potential hazard presented by the feedlot located on Carpenter Creek in the watershed region is moderate. Nitrates and pathogens emanating from the feedlot may potentially runoff into Carpenter Creek and flow into the Musselshell River, or migrate into underlying shallow ground water and eventually discharge to the Musselshell River upstream from Melstone’s surface water intake. The susceptibility of the Melstone intake to this potential contaminant source is also moderate, due to the identification of only a single natural attenuation barrier.

Table 7. Susceptibility assessment for significant potential contaminant sources in the spill response and watershed regions for the Town of Melstone PWS surface water intake.

Source	Contaminant	Map ID Number	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
U.S. Highway 12	Herbicides, pesticides, fertilizers, petroleum hydrocarbons, VOCs, SOCs	2	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river	High	Filtration and degradation in riparian zone	High	Maintain preparedness of local emergency personnel through active training
Chicago, Milwaukee & St. Paul Railway	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	3	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river	High	Filtration and degradation in riparian zone	High	Maintain preparedness of local emergency personnel through active training
Cultivated Cropland	Fertilizers, herbicides; pesticides, pathogens, nitrate	1; See Figure 6 and Figure 7	Spills, over application or misapplication of fertilizers, herbicides, or pesticides, surface	Moderate	Filtration and degradation in riparian zone	Moderate	Educate landowners on the proper handling, storage, and disposal of pesticides and fertilizers; utilization of

			runoff into Musselshell River				agricultural best management practices
U.S. Highways 87 and 191, and Montana Route 3	Fertilizers, pesticides, herbicides, petroleum hydrocarbons, SOCs, VOCs	4, 5, 6	Spills; misapplication or over application of herbicides along transportation corridor; Surface runoff into river, infiltration to shallow ground water discharging to river	Moderate	Natural attenuation	Moderate	Maintain preparedness of local emergency personnel through active training
Gas production wells	Total Dissolved Solids, Petroleum Hydrocarbons	7	Migration of brine wastewater into shallow ground water discharging to Musselshell River; surface runoff directly to river	Moderate	Natural attenuation	Moderate	Proper disposal of brine wastewater
Continental Crude Oil Pipeline	Petroleum hydrocarbons	8	Spills, leaks, and ruptures; Surface runoff into river, infiltration to shallow ground water discharging to river	Moderate	Natural attenuation	Moderate	Operation and maintenance of leak detection systems; maintain preparedness of local emergency personnel through active training
Foster Ranch Feedlot	Nitrates, pathogens	9	Surface runoff into Carpenter Creek and Musselshell River, infiltration to shallow ground water discharging to Carpenter Creek and Musselshell River	Moderate	Natural attenuation	Moderate	Utilization of agricultural best management practices; compliance with conditions of CAFO permit

Management Recommendations

Management recommendations are included in the susceptibility table for the Town of Melstone PWS (Table 7). If these management recommendations are implemented, they may be considered additional barriers that will reduce the susceptibility of Melstone's intake to specific sources and contaminants.

Management recommendations fall into the following categories:

- Agricultural best management practices
- Education
- Emergency Response Plan

Agricultural best management practices (BMPs) – BMPs that address application and mixing of fertilizer and pesticides are a viable alternative to prohibition of their use. BMPs are generally voluntary but their implementation can be encouraged through education and technical assistance. BMPs may also be utilized to minimize surface runoff and soil erosion on cultivated fields, and to minimize riparian vegetation impacts from grazing.

Education - Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel will promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. The EPA and the State of Montana can provide educational materials on these topics.

Emergency Response Plan - An Emergency Response Plan should be compiled and adopted by the Town of Melstone and Musselshell County. The effectiveness of this response plan will be maximized if it is updated on an annual basis to reflect changes in emergency contacts, emergency numbers, and resources available within the county to respond to an emergency situation, such as a hazardous material spill.

The Town of Melstone PWS operators, the Town of Melstone administration, and the Musselshell County administration should consider these management recommendations. Should contamination reach the Town of Melstone intake, the Town and County will likely need to work cooperatively to address remediation or relocation of the surface water intake.

CHAPTER 5 MONITORING WAIVERS

Waiver Recommendation

Based on past monitoring results and the susceptibility assessment of the Town of Melstone PWS intake, the PWS is not likely eligible for additional monitoring waivers. See Table 8 for the effect of identified potential contaminant sources on monitoring waiver eligibility. Currently, Melstone has Phase II and Phase V inorganic chemical monitoring waivers. The Town of Melstone PWS is not likely eligible for volatile organics and semivolatile organics waivers. For further monitoring waiver consideration, the Town of Melstone PWS should submit a letter to DEQ requesting additional monitoring waivers. The PWS also needs to provide additional information to DEQ regarding chemical use within the spill response region. The following sections in this chapter describe Montana’s monitoring waiver procedures in more detail.

Table 8. Effect of identified potential contaminant sources on eligibility of the Town of Melstone PWS for monitoring waivers.

Source	Contaminant	Map ID Number	Susceptibility	Waiver Eligibility
U.S. Highway 12	Fertilizers, herbicides, pesticides, petroleum hydrocarbons, VOCs, SOCs	2	High	Will likely make PWS ineligible for VOC and SOC waivers
Chicago, Milwaukee & St. Paul Railway	Fertilizers, herbicides, pesticides, petroleum hydrocarbons, VOCs, SOCs	3	High	Will likely make PWS ineligible for VOC and SOC waivers
Continental Crude Oil Pipeline	Petroleum hydrocarbons	8	High	Will likely make PWS ineligible for VOC waiver
U.S. Highways 87 and 191, and Montana Route 3	Fertilizers, herbicides, pesticides, petroleum hydrocarbons, VOCs, SOCs	4, 5, 6	Moderate	May render PWSs ineligible for VOC and SOC waivers
Cultivated Cropland	Fertilizers, pesticides, pathogens, nitrate	1; See Figure 6 and Figure 7	Moderate	May render PWSs ineligible for SOC waivers
Oil and Gas Production Wells	Total dissolved solids, petroleum hydrocarbons	2	Moderate	May render PWSs ineligible for VOC waivers
Foster Ranch Feedlot	Nitrates, pathogens	9	Moderate	No waivers available for nitrate or pathogen monitoring (no effect on waiver eligibility)

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 miles as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals. Shallow groundwater sources under the direct influence of surface water (GWUDISW) should use the same area of investigation as surface water systems; that is, the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the point of diversion. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include 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. Review of an organic chemical monitoring waiver application will be conducted by DEQ's Public Water Supply Section and DEQ's Source Water Protection Program. Other state agencies may be asked for assistance.

Susceptibility Waiver for Surface Water

Shallow unconfined aquifers and surface water bodies are the most common source of usable groundwater in Montana. Unconfined aquifers and many surface water bodies are usually locally recharged by precipitation. In general, shallow 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. Residence time in surface water bodies such as streams and narrow lakes is considered small, as the water moves through the system rather quickly. Water contained in large lakes and reservoirs may have variable residence times based on seasonal turnover, inversions, stagnant depths or reaches of the lake water, and throughput of water in the water body. Similar water chemistry often exists between shallow unconfined groundwater and 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. Alternately, surface water bodies directly or indirectly receive a considerable percentage of their water from groundwater. Therefore, surface water can be susceptible to contamination by organic chemicals migrating from groundwater into the surface water.

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration of contaminants into surface water that is used as a source. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the water source development, monitoring history of the source, geologic/hydrologic characteristics of the source water, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The area of contribution to the surface water body at the PWS intake must be defined and plotted. This should describe the water flow directions, stream discharge and velocity, residence time of water in the lake or reservoir (if the information is available). All surface bodies within a 1,000 feet of the PWS well(s) must be plotted. The Montana DEQ Source Water Protection Program typically will delineate and assess a larger (more conservative) area called a Spill Response Region that extends 1/2 mile downstream and approximately 10 miles upstream of the PWS surface water intake. It encloses the shoreline of any lakes along the length of the region. The width of the region extends 1/2 mile surrounding any lakes and on either side of the primary stream tributaries. Analytical monitoring history of the PWS intake should also be provided as part of the susceptibility waiver application.

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APPENDICES

APPENDIX A

SANITARY SURVEYS AND PWS SITE PLAN

APPENDIX B

CONCURRENCE LETTER