SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Hill County Water District
Public Water System
PWSID #MT0000249

Report Date: March 15, 2001

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INTRODUCTION

The Source Water Delineation and Assessment Report for the Hill County Water District was completed by Russell L. Levens, Montan Department of Environmental Quality.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Hill County Water District 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 protection public drinking water supplies form 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 that 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 to help the Hill County Water District complete a source water protection plan to protect its drinking water source.

Limitations

This report was prepared to assess threats to the Hill County Water District public water system and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of Hill County Water District's public water system and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area served by the Hill County Water District are identified. Only potential source of contamination in areas that contribute water to its drinking water source are considered.

The terms "contaminant" and "toxin" are used in this report to refer to constituents for which maximum contaminant levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to be significant health threats.

CHAPTER 1
BACKGROUND

The Community

Hill County Water District provides water for approximately 1,700 people residing in rural areas and small communities along Highway 2 between Chester and Havre. Towns served by the district include Kremlin, Goldford, Hingham, Rudyard, Inverness, and Joplin (Figure 1). The population of Hill County is 17,050 according to 1998 census estimates of which 10,425 live in Havre. U.S. Highway 2 and the Burlington Northern Santa Fe Railroad are the major transportation routes through Hill County Water District's service area. The economy relies on agriculture and the highway and rail transportation corridor. Primary agricultural products are dryland grains, cattle, and hogs. Other natural resources found in the area include coal, oil and gas, and gold.

Municipal sewage treatment systems serve each community in the district and septic systems serve outlying areas. Facilities that store, use, or produce the largest quantities of chemicals or other toxins are agricultural chemical suppliers and retail gasoline outlets.

Geographic Setting

Hill County Water District covers a large area between approximately 48.25° and 48.6° north latitude and 109.9° and 110.8° west longitude. Elevation ranges from approximately 2,530 feet (ft) above sea level at Fresno Reservoir to approximately 3,400 feet above sea level near Inverness. The area served by the Hill County Water District consists of plains mantled by glacial sediments. Isolated mountain ranges of igneous intrusive rocks and alluvial valleys eroded by rivers and streams interrupt the plains. Fresno and Tiber reservoirs are irrigation control reservoirs on the Milk and Marias rivers, respectively. Both rivers are tributaries to the Missouri River.

The average daily high and low temperatures in Rudyard are 82.3°F and 52.2°in July and 26.5°F and 3.9°F in January. Precipitation averages between 10 and 11 inches in the district and increases to 10 inches on the Sweet Grass Hills to the northwest. Precipitation comes mostly in the late spring and during infrequent intense summer storms. Approximately 20 inches of snow falls annually with more in the nearby mountains. Snowmelt in the Sweet Grass Hills and Glacier National Park are the primary sources of water in the Milk and Marias rivers.

Hill County Water District Source Water

The Hill County Water District gets water from two sources, a surface water intake in Fresno Reservoir and an infiltration gallery along the Marias River. The headwater of both rivers are on the Blackfoot Indian Reservation and in Glacier National Park 200 miles west of Fresno Reservoir. Flow in the Milk at Fresno Reservoir is augmented by a diversion from the St. Mary River and by tributaries draining the north side of the Sweet Grass Hills. The district's infiltration gallery is recharged by a combination of leakage from the Marias River and bedrock aquifers.

Water Quality

Concentrations of common chemical constituents in water sampled from the Fresno Reservoir and Marias River infiltration gallery are listed in Table 1. The infiltration gallery has higher dissolved solids as indicated by specific conductance (Sc). Higher concentrations of sodium (Na), sulfate (SO_4), and bicarbonate (HCO_3) that account for most of the difference probably comes from groundwater that has been in contact with marine shale bedrock.

Table 1. Chemical analyses of water from the Hill County Water District's water sources (8-10-1988).

Source	pH	Sc µS/cm	Ca mg/L	Mg mg/L	Na mg/L	Fe mg/L	Mn mg/L	HCO_3 mg/L	Alk. mg/L	Hardness mg/L	SO_4 mg/L	NO_3 mg/L
Fresno Res.	7.98	285	27.1	10.8	15.8	0.06	0.01	130.5	107	112	31.8	0.03
Inf. Gallery	8.12	973	54.6	24.5	131	0.02	<0.005	237	301.3	237	291	0.28

Milk River

The quality of water in the Milk River watershed varies considerably, mostly because of differences in land uses and the quality of groundwater inflow. Approximately 195 miles of streams and 4000 acres of reservoir upstream from Fresno Reservoir have been identified as being in need of Total Maximum Daily Load (TMDL) development (see details in Appendix B). Selection of a stream for TMDL development is based on impairment of a specified use such as aquatic life, fisheries, agriculture, or drinking water. Fresno Reservoir is listed because of impairment of drinking water uses.

Saline seep is a water quality problem prevalent in many areas of the Milk River watershed and is related to geologic conditions and agricultural practices. Saline seeps form when water infiltrates downward through the surface layer of glacial till and flows to low-lying discharge points along bedrock comprised of impermeable marine shale. Salts leached from soil and underlying shale beds increases dissolved solids concentrations in surface waters.

Marias River

Water Quality of the Marias River is impacted by irrigation return flow and accelerated erosion from flow regulation. The Marias River and several tributaries and lakes in its watershed are targeted for Total Maximum Daily Load (TMDL) development (see details in Appendix B). Selection of a stream for TMDL development is based on impairment of a specified use such as aquatic life, fisheries, agriculture, or drinking water. Lake Elwell, the Marias River downstream from Tiber Dam, and Pondera Coulee, all immediately upstream from Riverview Colony's infiltration gallery, are listed because of impaired aquatic life support and coldwater fishery. The causes of impairment are siltation, flow and habitat alteration, nutrients, and salinity/Total Dissolved Solids (TDS)/Chloride. The sources of impairment are irrigated and non-irrigated crop production, rangeland, and flow alteration. These activities also can impact drinking water quality though drinking water use is not identified as impaired.

Monitoring and Enforcement Actions

The Hill County Water District's water is routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs once a month. Compliance with other drinking water standards is determined on the basis of additional sampling on a variety of schedules. Nitrate and coliform bacteria were the only regulated contaminant detected in the Hill County Water District's water in the past five years. Nitrate can come from human or animal wasted but also occurs naturally. The highest nitrate level detected in the Hill County District's water was 0.65 mg/L at the Marias River infiltration gallery, considerably below the maximum concentration level of 10 mg/L set by the U.S. Environmental Protection Agency (EPA). Non-fecal, coliform bacteria were detected three times during routine sampling over the past five years. Coliform bacteria are not harmful but their presence can indicate the presence of pathogenic organisms. The Hill County Water District was issued an Administrative Order May 18, 1994 requiring they provide filtration treatment of the Fresno Reservoir source. The administrative order is under appeal and has not been enforced.

CHAPTER 2
DELINEATION

Source water management areas for the Hill County Water District is delineated in this chapter. The nature of these management areas will differ between the district's two sources. The source water protection area for the Fresno Reservoir source is subdivided into spill response and watershed regions, each with separate management goals. Inventory and recharge regions and a surface water buffer are delineated for the Marias River infiltration gallery. Potential contaminant sources are identified in Chapter 3. Relative susceptibility to significant potential contaminant sources is evaluated and management solutions are recommended in Chapter 4.

Geologic and Hydrologic Conditions

Fresno Reservoir Intake

Fresno Reservoir is in the Upper Milk Watershed (HUC #10050002082) in the Lower Missouri Watershed Management Region. The headwaters of the Milk River are on the Blackfeet Indian Reservation and in Glacier National Park approximately 200 miles west of Fresno Reservoir. The Milk flows into Alberta Canada near its headwaters and then east until reentering Montana approximately 100 miles upstream from the Fresno Reservoir. Flow in the Milk is augmented by a diversion from the St. Mary River and tributaries flowing from the Sweet Grass Hills and the Bears Paw Mountains. In total the Milk River drains approximately 2,506 square miles upstream from Fresno Reservoir.

The average flow of the Milk River where it crosses into Montana upstream from Fresno Reservoir is 414 cubic feet per second (cfs), with a median flow of 116 cfs (Table 2). Flow is highly variable, however. Peak annual flows ranged from 280 to 12,000 cfs between 1910 and 1997 while flows less than 10 cfs were recorded several times during that period. Flow is affected by annual and seasonal variations in runoff and water storage for irrigation (Table 1).

Table 2. Stream flow for streams in the Milk River Watershed (USGS gaging stations).

Gaging Station (#of years)	Area (mi^2)	Average (cfs)	Maximum (cfs)	Minimum (cfs)
Milk near crossing into Canada (4)	325	83.4	5,780	0
North Milk River (tributary) (73)	60	24.7	1,320	1.7
Milk at crossing into Montana (81)	2,506	414	12,000	0
Milk at Havre (62)	5,785	377.4	16,000	0

Bedrock is variable in the Milk River Watershed (Figure 2). Sedimentary rocks found in Glacier National Park were faulted and stacked in response to continent-wide forces. The Sweet Grass Hills and Bears Paw Mountains were formed when masses of liquid rock rose thousands of feet along faults through layers of sedimentary rocks. These masses cooled and solidified below the surface and later were exposed when the overlying sedimentary rock was stripped away by erosion. Sedimentary formations dip gently east from the flanks of the Sweet Grass Hills. Glacial till and outwash deposits mantle the bedrock surface over much of the plains portion of the watershed. Fluvial deposits are found along streams that have eroded into glacial sediments.

Marias River Infiltration Gallery

The Hill County Water District's infiltration gallery is in the Marias River watershed (HUC #10030203170). The Marias River forms from convergence of the Two Medicine River and Cut Bank Creek that flow east from the Rocky Mountains. Tiber dam impounds Lake Elwell approximately 15 miles upstream from the district's infiltration gallery. The average flow of the Marias River near the district's infiltration gallery is 784 cubic feet per second (cfs), with a median flow of 574 cfs (Table 3). Flow is

affected by annual and seasonal variations in runoff and water storage for irrigation. Most of the flow in the Marias River comes from snowmelt in the Rocky Mountains and the Sweet Grass Hills. Overall, upstream from the district's infiltration gallery, the Marias drains approximately 6,000 square miles with over 5,000 feet of relief.

Table 3. Daily stream flows in the Marias River Watershed (data from U.S. Geological Survey).

Gaging Station	Area (mi^2)	Average (cfs)	Maximum (cfs)	Minimum (cfs)
Birch Creek near Valier	471	85	1,650	6
Dupuyer Creek near Valier	137	49	2,520	0
Two Medicine River near Browning	317	373	35,500	1.4
Cut Bank Creek at Cut Bank	1,041	163	5,000	1
Pondera Coulee near Chester	598	13	3,060	0
Willow Creek near Galata	839	11.5	1,110	0
Marias River near Shelby	3,242	787	16,700	26
Marias River near Chester	4,927	764	4,510	184

The following description of geologic conditions in the Marias River watershed is summarized from two reports. They are *Geology of the Lower Marias River Area, Chouteau, Hill, and Liberty Counties Montana* (Smith, Witkind, and Trimble, 1959) and *Water Quality Inventory and Management Plan, Marias River Basin* (Garvin and Botz, 1975). The central and eastern part of the Marias River watershed is underlain by sandstones and shales that are deformed into the Sweetgrass Arch, a broad uplift trending generally north-south on a line from Shelby to Great Falls. East-northeast dipping beds of the Eagle Sandstone and Virgelle Sandstone member outcrop along the Marias River in the vicinity of the district's infiltration gallery. Up to 200 ft of clay-rich glacial moraines, outwash channels, and lake sediments cover the surrounding bluffs.

Thin, modern alluvial deposits of sand, gravel, clay, and silt are found along stream channels. Alluvium of the Marias River is thin and capable of supplying small to moderate amounts of groundwater (Garvin and Botz, 1975). Approximately 19 ft of gravel alluvium was encountered in geotechnical wells drilled at the Moffat Bridge upstream from the district's infiltration gallery. Logs from these wells indicate the Marias River channel is downcut 15 to 16 ft into alluvium leaving as little as 1 to 2 ft of alluvium between the river bed and bedrock. Hill County Water District as well as South Chester Water Users Association, Riverview Hutterite Colony, and Loma County Water District have infiltration galleries in alluvium of the Marias River.

Conceptual Model

Fresno Reservoir Source

The immediate vicinity of Fresno Reservoir is of greatest concern for source water protection. Contaminants that spill into the reservoir or its tributaries can reach the district's intake before it can be closed. Contaminants in groundwater that enter the reservoir where it is hydraulically connected to glacial till or bedrock aquifers are of less concern. Activities in the remainder of the watershed contribute most of the dissolved solids transported by the Milk River, however they are less of a threat to the district's water users because mixing and residence time probably will reduce concentrations of contaminants to less harmful levels. The Fresno Reservoir is classified as surface water with high sensitivity to contamination.

Marias River Infiltration Gallery

The Hill County Water District's infiltration gallery draws water from a gravel aquifer adjacent to and beneath the Marias River. The alluvium is underlain by Eagle Santstone. Recharge to the aquifer if from precipitation, losses from the Marias River, and discharge from the Eagle Sandstone aquifer. Groundwater flow direction within the alluvium varies depending on local differences in recharge from, and discharge to, the Marias River. The infiltration gallery source is classified as unconsolidated alluvium (unconfined) with high sensitivity to contamination.

Facilities or activities that can release contaminants to the alluvium, outcrops of the Eagle Sandstone, or the Marias River near the district's infiltration gallery are of greatest concern. Contaminants released from sources such as wastewater treatment plants and cultivated cropland upstream from Tiber Dam contribute dissolved solids transported by the Marias River. However, mixing and residence time in Lake Elwell reduces the concentrations of contaminants from these sources to less harmful levels than those downstream from the dam.

Source Intakes and Distribution

Water from Fresno Reservoir is obtained from two intakes, one at the south end of the dam and one just below the spillway of the dam. Water is pumped from both intakes during summer months to 62 million-gallon capacity holding ponds in Kremlin. This capacity is generally sufficient to satisfy demand during winter months. Water at the infiltration gallery is pumped from a wet well connected to perforated laterals that run parallel to the Marias River to a second pump station six miles north to a second pump station. The second pump sends water 18 miles to Inverness. Each community in the district has storage tanks and pump stations to deliver water throughout the district (see Appendix D for a more complete description).

Delineation Results

Fresno Reservoir Intake

Management regions for the Fresno Reservoir Intake are the spill response region and the watershed region. The Montana Source Water Protection Program specifies that the spill response region include all surface waters and land within one-half mile on either side of reservoir such as Fresno (Figure 3). All land and water within the drainage basin upstream from Fresno Reservoir are included in the watershed region. The watershed region for Hill County Water Districts straddles the Canadian Border and includes parts of the Blackfeet Indian reservations and Glacier National Park.

Marias River Infiltration Gallery

The inventory region is bounded by the limits of alluvium and Eagle Sandstone outcrops adjacent to Hill County Water District's infiltration gallery (Figure 4). The surface water buffer includes all land and water within one-half mile of the Marias for 10 miles upstream and the lower reaches of tributary coulees (Figure 5). The recharge region includes the extent of alluvium along the Marias River and nearby outcrops of the Eagle Sandstone.

Limiting Factors

The spill response region extends one-half mile on either side of the center of the Mild River and its tributaries. During high water, the width may be significantly less than one-half mile. However, under most circumstances a minimum width of at least 1,000-ft should be maintained. This width should protect against most spill threats.

CHAPTER 3
INVENTORY

An inventory of potential contaminant sources was conducted to assess the susceptibility of the Hill County Water District's drinking water source to contamination. Sources of all primary drinking water contaminants and cryptosporidium were identified, however only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory. The contaminants of greatest concern to the district are nitrate, microbial contaminants, fuels, and pesticides.

The inventory for the Hill County Water District focuses on facilities that generate, use, or store potential contaminants and certain land uses in the spill response region for the Fresno Reservoir intake and the inventory region and surface water buffer for the infiltration gallery. General land uses, permitted discharges, and large spill threats are identified in the remainder of the Milk and Marias river watersheds.

Inventory Method
Available databases were searched to identify businesses and land uses that are significant potential sources of contaminants. The following steps were followed:

Step 1: Percentage of agricultural land use is estimated from a preliminary land cover GIS coverage released by the U.S. Geological Survey (U.S. Geological Survey, 2000).

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in 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).

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST)s, sites contaminated with hazardous wastes (DEQ hazardous waste site cleanup bureau), landfills, and abandoned mines in the inventory region. Any information on past releases and present compliance status was noted.

Step 4: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing or repair facilities, printing shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were identified as potential contaminant sources.

Step 5: Major road and rail transportation routes were identified throughout the inventory region.

Step 6: All land uses and facilities that generate, store, or use large quantities of potential contaminants were identified within the recharge region and identified on the base map.

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 treatment or spray irrigation lagoons
9) Septic systems
10) Sewered residential areas
11) Storm sewer outflows

Inventory Results
Significant potential contaminant sources for all source water management areas are listed in Table 4 and described below.

Fresno Reservoir Spill Response Region
Population density in the spill response region is less than one person per square mile with only a few recreational cabins near the south end of the reservoir. Land uses are primarily agricultural (Figure 6). Sixty-five percent of the land is grass and shrub rangeland and twenty-four percent is cropland, primarily small grains. Cropland is a potential source of nitrate, pesticides, and pathogens that can reach Fresno Reservoir through irrigation return flow.

No businesses that use or store hazardous chemicals were identified in the spill response region. Septic Systems at cabins along Fresno Reservoir are potential sources of nitrate and pathogens. Spills and discharge of fuels from motor boats is a potential source of VOCs.

Infiltration Gallery Inventory Region
Population density is less than one person per square mile in the inventory region. Eighty-eight percent of the land is grass and shrub rangeland and only eleven percent is cultivated cropland (Figure 7). Cropland is a potential source of nitrate, pesticides, and pathogens that can reach the infiltration gallery through irrigation return flow.

No businesses that use or store hazardous chemicals were identified in the inventory region. Spills or leaks from light vehicle use is a relatively minor potential contaminant source.

Infiltration Gallery Surface Water Buffer
Population density is less than one person per square mile in the surface water buffer. Land uses again are primarily agricultural (Figure 8). Sixty-three percent of the land is grass and shrub rangeland and thirty-five percent is cropland. Cropland consists primarily of grain fields that are concentrated in an intermittent drainage that joins the Marias River just upstream from the infiltration gallery. Cropland is a potential source of nitrate, an acute toxin that can reach the Marias River through irrigation return flow.

No businesses that use or store hazardous chemicals were identified in the spill response region. Spills resulting from vehicle accidents at the Highway 232 bridge over the Marias River are a relatively minor potential source of fuels or agricultural chemical contaminants. Accidents at the bridge are a relatively minor concern because the contaminants are not associated with acute health effects and spills probably will pass by the infiltration gallery quickly.

Table 4. Significant potential contaminant sources for the Hill County Water District.

Region	Significant Potential Contaminant Source	Description of Hazard
Spill Response	Cultivated cropland	Runoff and ground water contaminated by pesticides, nitrate, and pathogens
Spill Response	Septic systems	Groundwater contaminated by septic system effluent
Inventory	Cultivated cropland	Runoff and ground water contaminated by pesticides, nitrate, and pathogens
Surface Water Buffer	Cultivated Cropland	Runoff and ground water contaminated by pesticides, nitrate, and pathogens

Fresno Reservoir Watershed Region
Rangeland in the watershed region is concentrated along stream bottoms in agricultural areas and in the foothills of the Sweet Grass Hills, Bears Paw Mountains, and Glacier Park. Forested land is limited to the higher elevations of Glacier Park. Urban development is limited to a few small communities. Past mining in the Milk River Watershed includes base and precious metals mining in the Sweet Grass Hills and sand and gravel mining throughout the watershed. Oil exploration and production has occurred throughout the watershed most heavily on the north slopes of the Sweet Grass Hills.

Cropping practices can impact water quality by increasing saline seep and soil erosion. Nutrients and pesticides can be transported by irrigation return flows. Livestock grazing and logging in riparian areas can increase turbidity by increasing erosion. Livestock grazing also can contribute pathogens and organic carbon. Urban land uses may contribute contaminants to surface water through stormwater runoff.

Wastewater treatment plants and stream crossings by roads, railways, and pipelines are the potential contaminant sources of greatest concern in the watershed region (Table 5). Of particular concern is the Express crude oil pipeline that crosses the Milk River approximately 30 miles upstream from the Hill County Water District's intake. Nitrate and pathogens are the potential contaminants form wastewater treatment plants and VOCs are the potential contaminants from spills at stream crossings. Waste rock and mill tailings at abandoned mines and oil-well brine pits are other potential contaminant sources in the watershed region.

Infiltration Gallery Recharge Region
In this section, potential sources of large quantities of contaminants are identified within the entire Marias River watershed upstream from the Hill County Water District's infiltration gallery. The entire watershed is inventoried because contaminants released in this area can reach the recharge region through surface water drainage.

With the exception of the mountainous portions of the Two Medicine River and Cut Bank Creek drainages, the Marias River watershed is heavily farmed. Overall, 49 percent of the watershed is in small grains or fallow and 42 percent is grassland or pasture. Past mining in the Marias River watershed is limited to small base and precious metals mining in the Sweet Grass Hills and sand and gravel mining throughout the watershed; however, there are potentially mineable deposits of coal, iron, and titanium. Oil exploration and production has occurred throughout the watershed (most heavily along the Sweet Grass Arch.).

There are five concentrated animal feeding operations (CAFOs) with Montana Pollution Discharge Elimination System (MPDES) permits, and numerous other smaller hog or cattle feeding operations in the Marias River watershed upstream form the infiltration gallery (Table 6). Other potential point contaminant sources in the Marias River watershed include 19 sanitary landfills, one oil refinery, nine wastewater treatment facilities with MPDES permits, and numerous underground storage tanks and businesses that generate small quantities of hazardous waste. A regional crude oil pipeline traverses the watershed from northwest to southeast through Cut Bank and Conrad and several smaller feeder pipelines are in place in the oil fields near the Sweet Grass Hills. North-south Interstate 15, U.S. highway 89 and 2, and the BN-Santa Fe Railway also traverse the watershed. Potential contaminants such as motor fuel and agricultural chemicals are commonly transported along these routes.

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

Inventory Limitations

The potential sources of contaminant for Hill County Water District's public water supply are identified form data and reports that are readily available. Consequently, unregulated activities or unreported contaminant releases may have been missed. Also, there is very little information on potential contaminant source in the Canadian portion of the Watershed Region.

Table 5. Potential point sources of contaminants in the Milk River watershed.

Potential Contaminant Source	Description
Two RCRA Hazardous Waste Generators	Hazardous Waste Generators
Two Landfills	Solid waste disposal facilities
Road, Rail, and Pipeline Crossings	Crude Oil Pipeline

Table 6. Potential source of contaminants in the Marias River watershed.

Potential Contaminant Source	Description
Cultivated Crops	Small grains and hay
19 Landfills	Solid waste disposal facilities
5 CAFOs	Hog operations or cattle feedlots
Road, Rail, and Pipeline Crossings	Crude Oil Pipeline
Town of Conrad Wastewater Treatment Plant	MPDES Permit Holder
Town of Valier Wastewater Treatment Plant	MPDES Permit Holder
Town of Cut Bank Wastewater Treatment Plant	MPDES Permit Holder
Town of Cut Bank Water Treatment Plant	MPDES Permit Holder
Town of Browning Wastewater Treatment Plant	MPDES Permit Holder
Town of Sunburst Wastewater Treatment Plant	MPDES Permit Holder
Town of Kevin Wastewater Treatment Plant	MPDES Permit Holder
Town of Shelby	Facultative Lagoon
Brady Water and Sewer District	Facultative Lagoon

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

Susceptibility of Hill County Water District's source water is evaluated in this chapter. The purpose of assessing susceptibility is to prioritize significant potential contaminant sources for Hill County Water District to manage in order to minimize threats to their drinking water source.

Susceptibility is assessed for significant potential contaminant sources listed in Table 4. Susceptibility to individual point sources in the watershed region is considered to be low for the most part because dispersion and dilution of contaminants should reduce concentrations of contaminants below levels associated with adverse health affects. The Express Pipeline is an exception because of its relatively close proximity to Fresno Reservoir. Non-point contaminant sources in the watershed region do impact the district's water quality; however, managing these sources is beyond local control. Instead, source water protection efforts in the watershed need to be implemented through existing programs, primarily the TMDL program.

Susceptibility is determined under the Montana Source Water Protection Program by the hazard associated with a source and the existence of barriers to contamination. The hazard ratings for point contaminant sources in the district's spill response region and surface water buffer depend on whether contaminants can discharge directly to Fresno Reservoir and whether contaminants are associated with acute health effects (Table 7). Hazard for a point contaminant source in the inventory region is determined by its proximity to the district's infiltration gallery. Hazard for significant potential contaminant sources located within a one-year time-of-travel is rated high. Those located between one-year and three-year times-of-travel are rated moderate. Hazard for non-point contaminant sources in all regions is based on percent in the case of land use and population density in the case of septic tanks (Table 7). Barriers can be engineered physical structures, management actions, or natural conditions. Barriers lower susceptibility by decreasing the likelihood that contaminants will flow to one of the district's intakes (Table 8). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant.

Table 7. Hazard of potential contaminant sources in the spill response region and surface water buffer.

	High Hazard	**Moderate Hazard**	**Low Hazard**
POINT SOURCES FOR 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
Septic Systems (all regions)	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Cropped Agricultural Land (all regions) (% land use)	More than 50 percent of spill response region	20 to 50 percent of spill response region	Less than 20 percent of spill response region

Table 8. 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

The results of the susceptibility assessment for the Hill County Water District are summarized in Table 9. The following are brief descriptions of the susceptibility assessments for each significant potential contaminant source included in Table 4.

Spill Response Region
Cultivated Cropland – Hazard is rated moderate because greater than 20 percent of the spill response region is cultivated cropland. Susceptibility is rated moderate instead of high because dilution in Fresno Reservoir should reduce concentrations.

Septic Systems – Hazard is rated low because unsewered development in the spill response region is limited to a small number of recreational cabins. Susceptibility is rated low for nitrate because dilution in Fresno Reservoir is a barrier. Susceptibility is rated moderate for microbial contaminants because dilution is not considered a barrier.

Inventory Region
Cultivated Cropland – Hazard is rated low because less than 20 percent of the inventory region is cultivated cropland. Susceptibility is rated low because clay soils should act as a barrier to contaminants.

Surface Water Buffer
Cultivated Cropland – Hazard is rated moderate because 35 percent of the surface water buffer is cultivated cropland. Susceptibility is rated moderate because clay soils should act as a barrier to contaminants.

Watershed Region
Express Crude Oil Pipeline – Hazard is rated high because large quantities of crude oil could be released to the Milk River during a pipeline accident. Susceptibility is rated moderate because there are multiple barriers in place. Existing leak detection equipment and emergency response procedures should limit the quantity of oil released and expedite collection of spilled oil. Also, the time it would take a spill to reach the district's intake should provide sufficient time to stop pumping.

Table 7. Susceptibility assessment for significant potential contaminant sources.

Region	Source	Contaminant	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Watershed	Express Pipeline	Crude Oil	High	Emergency planning, Residence time	Moderate	Emergency Planning
Spill Response	Cultivated Cropland	Pesticides and Nitrate	Moderate	Dilution	Moderate	Best management practices
Spill Response	Septic Systems	Microbial Contaminants	Low	None	Moderate	Growth Management
Surface Water Buffer	Cultivated Cropland	Nitrate	Moderate	Clay soils	Moderate	Best management practices
Inventory	Cultivated Cropland	Pesticides and Nitrate	Low	Clay soils	Low	Best Management Practices
Spill Response	Septic Systems	Nitrate	Low	Dilution	Low	Growth management

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GLOSSARY*

Acute Health Effect. A negative health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source

Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing non-point source pollution.

Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.

Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.

Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters. The receiving unit for an injection well typically represents the aquifer, or water-bearing interval.

Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.

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 groundwater in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

Delineation. The process of determining and mapping source water protection areas.

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 groundwater flow systems.

Inventory Region. A source water management area for groundwater systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year groundwater travel time.

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

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

Leaking Underground Storage Tank (LUST). A release from 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 – Groundwater 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 groundwaters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Phase II (and IIb) Rules. EPA updated or created legal limits on 38 contaminants. The rules became effective July 30, 1992 and January 1, 1993. Some of these contaminants are frequently-applied agricultural chemicals such as nitrate and others are industrial solvents.

Phase V Rule. EPA set standards for 23 contaminants in addition to those addressed by the Phase II Rules. The Phase V Rule became effective January 17, 1994. Some of these contaminants include inorganic chemicals such as cyanide and other Phase V contaminants are pesticides that enter water supplies through run-off from fields where farmers have applied them or by leaching through the soil into groundwater. Six are probable cancer-causing agents. Others can cause liver and kidney damage, or problems of the nervous system and brain.

Point Source. A stationary location or a fixed facility from which pollutants are discharged. This includes any single identifiable source of pollution, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fracture, container, rolling stock (tanker truck), or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource (e.g. groundwater used for drinking water).

Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.

Public Water System (PWS). A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

Resource Conservation and Recovery Information System (RCRIS). Is a database that provides information about specific sites through the EPA Envirofacts website.

Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.

Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.

Source Water. Any surface water, spring, or groundwater source that provides water to a public water supply.

Source Water Delineation and Assessment Report (SWDAR). A report for a public water supply that delineates source water protection areas, provides an inventory of potential contaminant sources within the delineated areas, and evaluates the relative susceptibility of the source water to contamination from the potential contaminant sources under "worst-case" conditions.

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For groundwater sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

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

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Total Maximum Daily Load (TMDL). The total pollutant load to a surface water body from point, nonpoint, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

Toxicity. The quality or degree of being poisonous or harmful to plants, animals, or humans.

Toxicity Characteristic Leachate Procedure. A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals that evaporate readily to the atmosphere.

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

* With the exception of the definitions for Lacustrine, Phase II and Phase V Rules, and Standard Industrial Classification Code, definitions were adapted from EPA's Term References System (formerly known as Glossary of Selected Terms and Abbreviations) which can be found at: http://www.epa.gov/trs/index.htm . The definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

The definitions for Phase II and Phase V Rules were adapted from:
http://www.epa.gov/OGWDW/source/therule.html#PhaseII
http://www.epa.gov/OGWDW/source/therule.html#PhaseV

The definition for Standard Industrial Classification Code was adapted from:
EPA/Office of Enforcement and Compliance Assurance: Guide to Environmental Issues: Glossary of Terms & Acronyms *Term Detail*