SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Black Eagle Cascade County Water
PWSID# MT0000157
is purchased from:
Great Falls
Public Water System

PWSID # MT0000525

Date of Report: 11/20/02

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Final Report

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INTRODUCTION

Carolyn DeMartino, a Water Quality Specialist with the Montana Department of Environmental Quality, completed this Delineation and Assessment Report. Special thanks goes to Michael W. Jacobsen, Plant Manager, for his assistance to make this a complete and accurate report.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for Great Falls as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

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

Limitations

This report was prepared to assess threats to the Great Falls public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Great Falls public water supply and not any other public or private water supply. Also, not every potential or existing source of groundwater or surface water contamination in the area of the Great Falls has been identified. Only potential sources 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 concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to be significant health threats.

CHAPTER 1: BACKGROUND

The Community

The City of Great Falls is located in west central Montana and is the county seat of Cascade County (Figure 1). Both the city and county are named for the nearby waterfalls in the Missouri River. According to the Census Bureau the population of Cascade County in 2000 was 80,357 with the population of Great Falls at 56,690 making it the third largest city in Montana. In 1882, Paris Gibson developed the plans for Great Falls and James Hill an influential railroad man provided the finances. Today, the economy of Great Falls is based mainly on industrial and retail services. Malmstrom Air Force Base and the Great Falls International Airport located immediately southwest of Great Falls and Montana Refining Company located in Great Falls also contribute to the local economy. Great Falls is also the headquarters for the reserve units of the U.S. Army, Navy, and Airforce. There is also a thriving medical community and there are several educational facilities in Great Falls.

Major water users in the community include Malmstrom Air Force Base, the community of Black Eagle, educational facilities, and area hospitals. Malmstrom Air Force Base, and Montana Refining Company are considered major waste generators. The major transportation routes in the Great Falls area are U.S. Interstate 15, U.S. Highway 87, U.S. Highway 89, and Montana State Highway 200. The Burlington Northern Railroad provides daily railway service.

Great Falls is served by a municipal sanitary sewer system. The wastewater treatment plant is located in northeast Great Falls on the north bank of the Missouri River. The plant is an activated sludge type secondary treatment facility designed for an average daily flow of 21 million gallons per day (MGD) and a peak hourly flow of 60 MGD (DHES and Process Applications, May 1993). The original plant was upgraded and the new activated sludge type secondary treatment system put on line in 1974. The treated wastewater effluent discharges to the Missouri River and must meet national secondary treatment standards. Septic system use continues in portions of Great Falls.

Geographic Setting

Great Falls is located in the Missouri Plateau section of the Great Plains physiographic province. The climate in this area is considered semi-arid. Average daily maximum and minimum temperatures in Great Falls are 84.4° F and 54.5° F in July and 33.8° F and 13.7° F in January. Annual average precipitation is 14.67 inches with the wettest months being May and June. An annual average of 43.6 inches of snow is received in the Great Falls area mainly November to April (Western Regional Climate Center, 1/1/1893 to 12/31/1956).

The Missouri Plateau section contains both glaciated and unglaciated features, with plateaus and terraces being the predominant physical features. Great Falls is flanked to the west by the Rocky Mountains; to the south by the Little Belt Mountains, and to the east by the Highwood Mountains. Generally, the land is underlain by relatively flat-lying sandstone, siltstone, and shale that have been dissected by major drainages, mainly the Missouri River and Sun River (Figure 2). Interstream areas are broad, relatively flat benches rising 200 to 500 feet above the river bottoms. Numerous springs and seeps flow from water-yielding rocks around the edges of the benches such as the Sun River Bench. However, Giant Springs located downstream from Black Eagle Dam near Great Falls, is different from springs that flow out of the bench area as it is much larger and flows from vents at the edge and in the channel of the Missouri River (Wilke, 1983).

The headwaters of the Missouri River are located near Three Forks where the Jefferson, Madison, and Gallatin rivers meet. The Missouri River enters the Great Falls vicinity from the southwest, and flows to the

northeast.

General description of the Source Water

The City of Great Falls obtains its water from a surface water intake located in the Missouri River (Figure 3). The segment of the Missouri River from Sheep Creek to the Sun River that flows through Great Falls is located in the Upper Missouri-Dearborn Watershed. The hydrologic unit code (HUC) for this watershed is 10030102. The land area covered by the Upper Missouri-Dearborn Watershed is 2,662.74 square miles.

The Missouri River is a perennial stream. Stream flow data was obtained from U.S.G.S. gaging station 06078200, located on the Missouri River, upstream of the Great Falls PWS intake. Based on stream gaging data collected from 1957 through 2001, the mean monthly discharge at this station varied from 4,678 cubic feet per second (cfs) in September to 11,070 cfs in June (U.S.G.S). The average annual streamflow recorded at this station from 1958 through 2000 varied from a low of 3,690 cfs in 1988 to a high of 10,030 cfs in 1975.

The Public Water Supply

The Great Falls PWS is classified as a community PWS because it serves a resident population of 62,100 and a transient population of 4,350 through 19,414 active connections (DEQ SDWIS Database). The PWS obtains water from an intake located along the Missouri River (Source 002).

The City of Great Falls PWS is a rapid sand filtration plant that utilizes coagulants to settle out particulates and chlorine and ammonia to disinfect the water. Site layout maps have not been included in this report. Additional information about this water system is available upon request from the City of Great Falls or DEQ.

Water Quality

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

Background Missouri River water quality data was obtained from United States Geological Survey (USGS) gaging station 06078200 near Ulm, Montana. The parameters that were sampled at this gaging station include water temperature and specific conductance. No other water chemistry data was collected at this gaging station. Missouri River water quality data obtained at gaging station 06078200, near Ulm is presented in Table 1.

Table 1. Water quality data for the Missouri River at USGS Gaging Station 06078200 near Ulm (U.S. Geological Survey, NWIS, 2002).

Parameter	Sampling Dates (years)	Parameter Range	MCL	MCGL	Secondary Standard
Water Temperature	1982-2001	32.9 – 78.8 °F	NA	NA	NA
Specific Conductance	1982-2001	197 – 424 µS/cm	NA	NA	NA

According to the DEQ PWS Database there have been no detections of coliform bacteria in the drinking water within the past five years. Within the past five years the concentration of nitrate detected in the drinking water has ranged from 0.12 mg/L to 0.34 mg/L, well below the MCL of 10 mg/L (SDWIS).

The segment of the Missouri River from Sheep Creek to Sun flowing from which the City of Great Falls withdraws drinking water is classified by the State of Montana as B-1 water meaning, that the water is 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 supply.

Although this segment of the Missouri River is on the proposed 2002 303(d) list of impaired streams (DEQ, TMDL Section), the stream segment is fully supporting of agricultural, drinking water supply, industrial, and recreational beneficial uses. This segment of the Missouri River is partially supporting aquatic life and cold-water trout fishery. The probable cause for this ranking is siltation due to agricultural activities.

CHAPTER 2: DELINEATION

The source water protection area, the area of surface water and land that contributes water to the Great Falls PWS, is delineated in this chapter. The purpose of delineation is to map the source of Great Falls' drinking water and to define areas within which to prioritize source water protection efforts.

Two management areas are identified within the source water protection area. They are the spill response region and the watershed region. The spill response region represents the area of surface water upstream of the Great Falls PWS in which contaminants can be drawn into the intake in a relatively short period of time. The watershed region represents the entire area of the Upper Missouri-Dearborn Watershed that is upstream of and contributes water to the Great Falls PWS.

Hydrogeologic Conditions

The headwaters of the Missouri River are located near Three Forks where the Jefferson, Madison, and Gallatin Rivers meet. River flow is controlled by the numerous irrigation diversions and hydroelectric dams along the river. The Missouri River flows in to Great Falls from southwestern Montana and flows northeast through town. Great Falls is located in the Upper Missouri-Dearborn Watershed (HUC 10030102). Snowmelt, direct precipitation, surface runoff, and lateral inflow from alluvial and bedrock aquifers contribute to flow in the Missouri River. The Missouri River loses water via infiltration to the adjacent alluvium, evapotranspiration, and irrigation water withdrawals.

Flow measurements were obtained from USGS gaging station 06078200. The mean monthly flow measured between 1957 – 2001 ranged from a low of 4,678 cfs in September to a high of 11,070 cfs in June.

Much of the following information was obtained from *Appraisal of Water in Bedrock Aquifers, Northern Cascade County, Montana* by Kurt Wilke, 1983. The course of the Missouri River shifted during the Pleistocene ice age glacial events. Glaciers moving southwest from Canada blocked all drainage to the north, forcing the Missouri River and its southern tributaries to flow east around the ice front. This glacial period also resulted in the deposition of clay, silt, sand, and gravel that underlie much of the area. Subsurface geology in the Great Falls vicinity consists of Quaternary alluvium and glacial lake deposits underlain by limestone and sandstone (Figure 2). Upstream from Great Falls the river transverses an area that coincides with its preglacial course, where the bedrock is covered by as much as 300 feet of glacial lake and alluvial deposits. As the glacier front melted, retreating to the north, the lake began to drain to the east. The course of the river was re-established across the area covered by Glacial Lake Great Falls and the continental glacier.

Because Great Falls obtains its drinking water from the Missouri River, a surface water supply, the source water sensitivity is classified as highly sensitive to contamination, in accordance with Montana Source Water Protection Program aquifer sensitivity criteria (Table 2).

Table 2. Source 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

Contaminants, if spilled directly into the Missouri River upstream or in the immediate vicinity of the Great Falls intake, could potentially reach the intake before the water operators could close it. Over a longer time frame, contaminants that accumulate throughout the watershed can be flushed into the Missouri River during periods of spring high flow run-off. Contaminants in groundwater can also enter the Missouri River in areas where it is hydraulically connected to sub-surface sediments.

Methods and Criteria

DEQ's Source Water Protection Program specifies the methods and criteria used to delineate subregions of the source water protection area for Great Falls PWS intake. Because this is considered a surface water system, a spill response region and a watershed region have been delineated.

Delineation Results

The Upper Missouri-Dearborn Watershed lies in the Upper Missouri River Watershed Region. According to the EPA the watershed covers approximately 2,662.74 square miles. The spill response region for the Great Falls intake extends ½-mile downstream and ten miles upstream from the intake, and includes ½-mile wide buffers adjacent to all shorelines (Figure 3). The watershed region encompasses the entire area of the Upper Missouri-Dearborn Watershed that is upstream of and contributes water to the Great Falls PWS (Figure 4).

Limiting Factors

The delineation for the Great Falls PWS spill response region and watershed region is based on fixed-distance and watershed mapping. The spill response region represents an approximation of the distance required for contaminants upstream to reach the surface water intake in a short period of time. Numerous assumptions are associated with the Source Water Protection Program criteria for spill response region delineations. Contaminant transport rates and concentrations will vary depending on the physical and chemical characteristics of both the river and the contaminants. Groundwater flow within adjacent riparian areas will also play a role in contaminant transport. 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 contaminant sources was conducted to assess the susceptibility of the Great Falls PWS to contamination, and to identify priorities for source water protection planning. These inventories were conducted within the spill response and watershed regions. The inventory for Great Falls focuses on facilities that generate, use, store, transport, or dispose potential contaminants, and on certain land types on which potential contaminants are generated, used, stored, transported or disposed. Additionally, the in inventory process identifies potential sources of all regulated primary drinking water contaminants and pathogens. Only those potential contaminant sources that pose the most significant threat to human health were selected for detailed inventory. The most significant potential contaminants in the Great Falls spill response region include nitrate, pathogens, fuels, solvents, herbicides, pesticides, and metals. The inventory for the Great Falls PWS 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: Urban and agricultural land uses were identified from landcover data collected by the USGS.

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

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

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

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

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

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

- Large quantity hazardous waste generators
- Landfills
- Hazardous waste contaminated sites
- Underground storage tanks
- Major roads or rail transportation route

- Cultivated cropland
- Animal feeding operations
- Wastewater lagoons or spray irrigation
- Septic systems
- Sewered residential areas
- Storm sewer outflows
- Floor drains, sumps, or dry wells
- Abandoned or active mines

Inventory Results/Spill Response Region

Land cover within the Great Falls Spill Response Region includes mainly agricultural land (34%) and grassland (36%). Residential land comprises only 10% of land cover within the spill response region (Figure 5).

Significant potential contaminant sources in the spill response region are identified in Table 3 and indicated on Figure 5, Figure 6, and Figure 7. Table 3a in Appendix A contains a list of all identified potential contaminant sources within the Great Falls area.

Table 3. Significant potential contaminant sources in the Great Falls PWS Spill Response Region.

Significant Potential Contaminant Sources	Figure / Map ID#	Contaminants	Hazard
Agricultural land	Figure 5	Nitrates, pathogens, SOCs	Enter river via surface water runoff or irrigation return flows
Transportation Routes State Hwy 87/ 89	Figure 6 18	VOCs, SOCs, nitrates, pathogens	Spills on bridges entering directly into the river
Railroad Burlington Northern	Figure 6 3	VOCs, SOCs, nitrates	Spills at the water treatment plant that may enter directly into surface water or leach into groundwater and then into surface water
USTs/LUSTs: Town Pump 9170664 Pro Lube #1 Meadowlark Country Club Country Club Express Gas Station Hall Transit Company Lower River Rd Lift Station Ayrshire Dairy Farm	Figure 6 4 5 7 8 10 11 13	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water
Above Ground Storage Tank: White Bear Island Marina	Figure 6 9	VOCs	Spills directly into the river.

Table 3. Significant potential contaminant sources in the Great Falls PWS Spill Response Region.

Significant Potential Contaminant Sources	Figure / Map ID#	Contaminants	Hazard
Septic Systems	Figure 7	Nitrates and pathogens	Effluent discharging directly to river or via contaminated groundwater
Sanitary Sewer Main	Figure 7	Nitrates and pathogens	Failure of older clay sewer lines contaminated water discharging directly to the river or via contaminated groundwater
State Superfund Sites: 3rd Street Groundwater BN Fueling Facility	Figure 6 1 2	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water
Groundwater Spill Sites: Trailer Terrace Trailer Park Lower River Rd-130	Figure 6 12 15	Nitrates and, pathogens	Sewage lagoon effluent discharging directly to river or via contaminated groundwater upstream of surface water intake
Wastewater Discharge Great Falls Water Treatment Plant	Figure 6 6	Suspended solids, chlorine	Spent backwash water discharged to the river
Petroleum Pipeline:	Figure 6 17	VOCs	Spill could occur directly into Sand Coulee Creek a tributary to Missouri River
Class V Injection Wells	Locations currently unknown	VOCs, SOCs, metals	Discharges into the river via contaminated groundwater
Gravel pits/ Mines	Figure 6 14, 16	VOCs, nitrates, metals	Contaminants discharging to surface water via groundwater

Agricultural Land poses a moderate hazard to the Great Falls PWS intake. Nitrates and pathogens and additional agricultural chemicals used on the land could enter the Missouri River via surface water runoff or through irrigation return flow. These potential contaminants could also leach into area groundwater and then enter the river via interaction of groundwater with the surface water.

Spills of fertilizers, pesticides, volatile organic compounds (VOCs), and synthetic organic compounds (SOCs) on transportation routes, especially at bridge crossings could enter directly into the river. This potential contaminant source poses a high hazard to the PWS intake.

Burlington Northern Railroad has an active line that runs through the Great Falls Water Treatment Plant site. A spur off the main line is used for chemical delivery to the plant. Spills in the vicinity of the plant could flow directly into the Missouri River or could leach into area groundwater and then seep into the surface water. The railroad line poses a high hazard to the PWS intake.

Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) are located within the spill response region and may release VOCs to the Missouri River. The USTs/LUSTs pose a high hazard to the PWS intake. One above ground fuel storage tank (AGST) is indicated for the White Bear Island Marina that is located upstream from the PWS intake.

Septic system use continues in portions of Great Falls (Figure 7). Overall, septic system densities within the Great Falls Spill Response region pose a moderate hazard.

Municipal sewer lines and utility corridors within the spill response region pose a high hazard to the PWS. Municipal sewer lines and utility corridors may constitute preferred contaminant migration pathways that

allow contaminants to enter area groundwater that eventually may leach into the river.

Two State Superfund sites are located in the spill response region. These sites pose a low hazard to the intake, as they are located downstream of the intake.

Wastewater discharges from the Great Falls Water Treatment in the form of spent backwash water may introduce low concentrations of suspended solids and chlorine to the Missouri River. The discharge is located downstream of the surface water intake and poses a low hazard to the intake.

A petroleum pipeline was identified in the spill response region and poses a high hazard to the Great Falls PWS intake.

Class V Injection wells may be located within the spill response region; however, their locations are unknown at this time.

Inventory Results/Watershed Region

Land use within the Watershed Region consists mainly of grasslands at 54%, forests at 21%, and agricultural land at 20% (Figure 8). In addition to the significant potential contaminant sources identified in the spill response region, additional potential contaminant sources located in the watershed region are listed in Table 4. Center pivot irrigation is used on portions of the agricultural land. Irrigation ditches may be utilized in other areas of the watershed region. Some irrigation ditches may have return flows that discharge to the Missouri River. The towns of Sand Coulee, Ulm, and Cascade are also located in the Great Falls PWS Watershed Region; however, potential contaminant sources have been or will be addressed in the SWDARs for these towns.

Table 4. Potential contaminant sources in the Great Falls PWS Watershed Region.

Potential Contaminant Sources	Map ID	Contaminants	Hazard
Agricultural Land	Figure 8	Nitrate and pathogens	Enter river via surface water runoff or irrigation return flows
UST/LUSTs	Figure 9	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water
Septic Systems	Figure 7	Nitrates and pathogens	Effluent discharging directly to river or via contaminated groundwater
Superfund Sites	Figure 9	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water
Groundwater Remediation Site	Figure 9	VOCs, nitrates	Sewage lagoon effluent discharging directly to river or via contaminated groundwater
Wastewater Discharges	Figure 9	VOCs, nitrates, pathogens metals	Effluent discharging directly to river
Gravel Pits/ Mines	Figure 9	VOCs, nitrates, metals	Interaction of contaminated groundwater with surface water
Closed Landfills	Figure 9	VOCs, nitrates, pathogens, metals	Contaminated groundwater discharging to surface water

Inventory Update

The certified operators of the Great Falls 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 sent to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The potential contaminant sources described in this section have been identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. In some cases, inadequate location information precluded the inclusion of potential contaminant sources in the inventory. The use of multiple sources of information, however, should ensure that the major threats to the source water for the Great Falls PWS have been identified.

CHAPTER 4: SUSCEPTIBILITY ASSESSMENT

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

The goal of source water management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources within the Spill Response Region and 3) ensuring that land use activities in the Watershed Region pose minimal threat 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 Great Falls to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers (Table 5). Barriers can be anything that decrease the likelihood that contaminated water will flow into the Great Falls PWS intake.

Table 5. 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 hazard presented by point sources of contaminants in the Great Falls spill response region depends on whether contaminants can discharge directly to segments of the Missouri River and Sand Coulee Creek located in the spill response region. Point source hazard is also dependent on the health affects associated with potential contaminants (Table 6).

Table 6. Hazard of potential contaminant sources for surface water intakes.

Potential Contaminant Source	**High Hazard**	**Moderate Hazard**	**Low Hazard**
Point Sources	Potential for direct discharge to Source Water	Potential for discharge to GW that is hydraulically connected to SW	Potential contaminant sources present 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 (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Hazard ratings for non-point sources are assigned based on criteria listed in Table 6 for septic systems, sanitary sewers, and cropped agricultural land. Hazard ratings are presented individually for each significant

potential contaminant source and each associated contaminant (Table 7).

Table 7. Hazard of significant potential contaminant sources for the Great Falls PWS Spill Response Region and Watershed Region

Significant Potential Contaminant Sources	Figure / Map ID#	Contaminants	Hazard	Hazard Rating
Transportation Routes	Figure 6 18	VOCs, SOCs, nitrates, pathogens	Spills on bridges entering directly into the river	High
Burlington Northern Railroad	Figure 6 3	VOCs, SOCs, nitrates	Spills could directly enter the river or enter via groundwater that seeps into the river	High
USTs/LUSTs	Figure 6 4,5,7,8,10, 11,13	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water	High
Above ground fuel storage tanks	Figure 6 9	VOCs	Spills directly into the river.	High
Groundwater Spill Sites	Figure 6 12, 15	Nitrates and, pathogens	Sewage lagoon effluent discharging directly to river or via contaminated groundwater	High
Petroleum Pipeline	Figure 6 17	VOCs	Spill could occur directly into Sand Coulee Creek a tributary to Missouri River	High
Class V Injection Wells	Locations currently unknown	VOCs, SOCs, metals	Discharges into the river via contaminated groundwater	High
Agricultural land	Figure 5	Nitrates and pathogens	Enter river via surface water runoff or irrigation return flows	Moderate
Septic Systems	Figure 7	Nitrates and pathogens	Effluent discharging directly to river or via contaminated groundwater	Low
Sanitary Sewer Main	Figure 7	Nitrates and pathogens	Failure of older clay sewer lines contaminated water discharging directly to the river or via contaminated groundwater	Low
State Superfund Sites	Figure 6 1,2	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water	Low
Wastewater Discharges	Figure 6 6	Suspended solids, chlorine	Spent backwash water discharged into the river	Low
Inactive gravel pits	Figure 6 14, 16	VOCs, nitrates, metals	Contaminants discharging to surface water via groundwater	Low

Table 8 displays the susceptibility assessment results for the Great Falls PWS surface water intake. The intakes are susceptible to a number of different contaminants including nitrates, pathogens, agricultural chemicals, petroleum products, solvents, and total dissolved solids. Tables 3,4,5, 6,7, and 8 list all the significant potential contaminant sources identified in the spill response region and watershed regions for the Great Falls PWS.

Table 8. Susceptibility assessment for significant potential contaminant sources in the Great Falls Spill Response Region and Watershed Region.

Contaminant Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Agricultural land	Nitrates and pathogens	Contaminants in surface water runoff or irrigation return flows	Moderate	Dilution	Moderate	Use BMPs
Transportation Routes State Hwy 87/ 89	VOCs, SOCs, nitrates, pathogens	Spills on bridges entering directly into the river	High	Dilution	High	Implement emergency response plan
Burlington Northern RR	VOCs, SOCs, nitrates	Spill directly or indirectly to river	High	Dilution	High	Implement emergency response plan
USTs/ LUSTs	VOCs	Seepage of VOCs directly into river or via interaction of contaminated groundwater with surface water	High	Secondary containment, monitoring, spill site remediation	Moderate	Continued monitoring of operation and maintenance
Above ground fuel storage tank	VOCs	Spills directly into the river.	High	Secondary containment, dilution	Moderate	Monitor tank condition and operation
Septic systems	Nitrates and pathogens	Effluent discharging directly to river or via contaminated groundwater	Low	None	Moderate	Monitor to insure proper maintenance Implement zoning
Sanitary Sewer Main	Nitrates and pathogens	Failure of older clay sewer lines contaminated water discharging directly to the river or via contaminated groundwater	Low	None	Moderate	Periodically inspect older sewer mains and implement upgrades where necessary
Groundwater Remediation Sites	Nitrates and, pathogens	Sewage lagoon effluent discharging directly to river or via contaminated groundwater	High	Site remediation ongoing, monitoring, dilution	Moderate	Continue site remediation and monitoring of soil and groundwater
Petroleum pipeline	VOCs	Spill could occur directly into Sand Coulee Creek a tributary to Missouri River	High	Leak detection, dilution	Moderate	Monitor pipeline operation and maintenance, emergency response plan
Inactive gravel pits/mines	VOCs, nitrates, metals	Contaminants discharging to surface water via groundwater	Low	Distance from intake	Low	Monitor to insure proper site management
State Superfund sites	VOCs	Seepage of VOCs directly into river or via interaction of contaminated	Low	Site remediation ongoing, located downstream from intake	Very Low	Continue site remediation and monitoring of soil and groundwater

Table 8. Susceptibility assessment for significant potential contaminant sources in the Great Falls Spill Response Region and Watershed Region.

Contaminant Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
		groundwater with surface water				
Wastewater Discharges	Suspended solids and chlorine	Spent backwash water discharged to the river	Low	Permitted discharges, dilution	Very Low	Monitor effluent to ensure permit requirements are met
Closed Landfills	VOCs, nitrates, metals	Contaminants discharging to surface water via groundwater	Low	Distance from intake, groundwater monitoring	Very Low	Continue to monitor
Toxic Spill Site	VOCs, nitrates, metals	Seepage of contaminants into Sand Coulee Creek via interaction of contaminated groundwater with surface water	Low	Site remediation, monitoring, dilution	Very Low	Continue to monitor site soils and groundwater
Class V Injection Well	VOCs, SOCs, metals	Discharges into the river via contaminated groundwater	Unknown at this time	Not evaluated	Unknown at this time	Work with EPA to identify locations and appropriate response

The susceptibility results for each significant potential contaminant source and their associated contaminants are identified as follows:

Agricultural land – Hazard is ranked moderate because cropped agricultural lands occupy 37% of the Spill Response Region and 52% of the Watershed Region. The susceptibility of the intake to these agricultural sources of nitrate and pathogens is moderate due to dilution.

Transportation Routes- Hazard is ranked high because hazardous material spill could enter directly into the river at bridge crossings. The susceptibility is moderate due to dilution.

Burlington Northern Railroad-Hazard is ranked high due to the proximity of the rail line and spur to the water treatment plant site and intake. The susceptibility of the intake to this potential source of contamination is ranked high has dilution is only barrier.

USTs/LUSTs – Hazard is ranked high because there is the potential for petroleum spills to directly enter the Missouri River or via interaction of groundwater and surface water. Due to secondary containment, leak detection, site remediation, and groundwater monitoring, the overall susceptibility is moderate.

Above ground fuel storage tank – The potential hazard imposed by this type of fuel storage tank at White Bear Island Marina is high. The marina is located upstream of the Great Falls intake and petroleum spilled from the tank could enter directly into the Missouri River and migrate towards the intake. Due to secondary containment and dilution, the overall susceptibility is moderate.

Septic systems – Hazard is ranked low based upon septic system density, however, there are no known

barriers making the overall susceptibility moderate.

Sanitary sewer mains – Hazard is ranked low for potential contamination from sewer main failure, however, the overall susceptibility is moderate because there are no known barriers.

State Superfund sites – Hazard is ranked low because there is ongoing site remediation and the facilities are located downgradient of the intake.

Groundwater Remediation (Hazardous Spill) sites – Hazard is ranked high because there is the potential for sewage lagoon effluent to discharge either directly to the river or via groundwater surface water interaction. The susceptibility is moderate due to on-going remediation and dilution.

Petroleum pipeline - Hazard is ranked high because spills could occur directly into surface water. The susceptibility is moderate due to leak detection and dilution barriers.

Gravel Pits – Hazard is ranked low because contaminants would first have to seep into the groundwater and then be discharged into the surface water and due to the distance between these inactive gravel pits/ mine sites and the surface water intake. The susceptibility is also low based on the amount of distance between these inactive gravel pits/ mine sites and the surface water intake.

Wastewater Discharges – Hazard is ranked low because overall the wastewater discharges are downstream from the surface water intake. The susceptibility is very low due to permitted discharge effluent limits and dilution.

Toxic waste site –Hazard is ranked low because contaminants would first need to seep into the groundwater and then be discharged into Sand Coulee Creek, a tributary of the Missouri River. The susceptibility is very low based on site remediation, monitoring efforts, and dilution.

Closed Landfills – Hazard is ranked low. Contaminants would first have to leach into groundwater and then enter the Missouri River. The susceptibility is very low based on the distance of the closed landfills away from the intake groundwater

Class V Injection Wells – Hazard has not been ranked because the location and quantity of Class V Injection Wells in Great Falls is unknown. They have been identified in this report because they have the potential to either discharge directly into the river or via groundwater surface water interaction. The susceptibility is also unknown at this time.

Management Recommendations

The Great Falls PWS Source Water Delineation and Assessment Report was prepared to assist Great Falls. The report provides information concerning the Missouri River water intake that supplies water to Great Falls, identifies the spill response region and the watershed region, and within each of these protection areas identifies the significant potential contaminants that may impact the source of water to Great Falls. Also provided in the table are recommendations regarding how the potential contaminant could be better managed to prevent impacts in the vicinity of the Great Falls water intake. If these management recommendations are implemented, they may be considered additional barriers that will reduce the susceptibility of Great Falls' intake to specific sources and contaminants.

Management recommendations fall into the following categories:

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

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

Agricultural Best Management Practices. BMPs that address application and mixing of fertilizers and pesticides are a viable alternative to prohibition of their use. BMPs are voluntary but their implementation can be encouraged through education and technical assistance. BMPs may also be utilized to minimize surface runoff and soil erosion on cultivated fields

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

Education. Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel would promote the efficiency and effectiveness of emergency responses to hazardous material spills. Educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. Educational materials covering these topics are available to the public and can be obtained from the US EPA and the State of Montana.

Emergency Response Plan. This is a management recommendation that the City of Great Falls itself could develop and implement. Coordination with county and state emergency response personnel would greatly benefit the plan. The plan should identify the procedures the water operators and other emergency personnel should follow in the event that contaminants enter the Missouri River and there is an imminent threat that the contaminated water would reach the PWS intake. The emergency response plan should be updated annually to reflect changes in emergency contacts, phone numbers, and resources available within the city and county to respond to an emergency situation, such as a hazardous material spill.

Chapter 5: Monitoring Waivers

Monitoring Waiver Requirements

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers. Following are descriptions of the different types of waivers. Monitoring waiver recommendations for the City of Great Falls follows these descriptions.

Use Waivers

A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific organic chemicals were not used, manufactured, or stored in the area of a water source (or source area). If certain organic chemicals have been used, or if the use is unknown, the system would be determined to be vulnerable to organic chemical contamination and ineligible for a Use Waiver for those particular contaminants.

Susceptibility Waivers

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

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

Susceptibility Waiver for Confined Aquifers

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

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

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

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

Susceptibility Waiver for Unconfined Aquifers

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

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

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

Waiver Recommendation

Currently, the City of Great Falls does not have any waivers. Based on past monitoring results and the susceptibility assessment of the Great Falls PWS intake, the Great Falls PWS may be eligible for monitoring waivers. For further monitoring waiver consideration, the Great Falls PWS should submit a letter to DEQ requesting additional monitoring waivers. The PWS also needs to provide additional information to DEQ regarding chemical use within the inventory region.

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GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

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

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

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

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

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

Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). A database that provides information about specific sites through the EPA Envirofacts website.

Confined Animal Feeding Operation (CAFO). Any agricultural operation that feeds animals within specific areas, not on rangeland. Certain CAFOs require permits for operation.

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the

overlying confining unit.

Confining Unit. A geologic formation present above a confined aquifer that inhibits the flow of water and maintains the pressure of the ground water in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

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

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

Geographic Information Systems (GIS). A computerized database management and mapping system that allows for analysis and presentation of geographic data.

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

Hazard. A relative measure of the potential of a contaminant from a facility or associated with a land use to reach the water source for a public water supply. The location, quantity and toxicity of significant potential contaminant sources determine hazard.

Hydraulic Conductivity. A constant number or coefficient of proportionality that describes the rate water can move through an aquifer material.

Hydrology. The study of water and how it flows in the ground and on the surface.

Hydrogeology. The study of geologic formations and how they effect ground water flow systems.

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

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

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

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

Montana Bureau of Mines and Geology – Ground Water Information Center (MBMG/GWIC). The database of information on all wells drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national permitting system that utilizes a database to track entities that discharge wastewater into waters of the United States.

Nitrate. An important plant nutrient and type of inorganic fertilizer that can be a potential contaminant in water at high concentrations. In water the major sources of nitrates are wastewater treatment effluent, septic tanks, feed lots and fertilizers.

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Examples of nonpoint- source pollution include agriculture, forestry, and run-off from city streets. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of these chemicals into surface and/or ground waters at increased levels that may exceed MCLs.

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

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

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

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

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

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

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

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

Recharge Region. A source water management region that is generally the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

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

are managed in an environmentally sound manner.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

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

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

APPENDIX A

POTENTIAL CONTAMINANT SOURCES IN THE GREAT FALLS AREA

Table 3a. Potential Contaminant Sources Within The Great Falls Spill Response and Watershed Regions

NAME	ADDRESS	CITY	STATE	ZIP	SIC1*	SIC2*	SIC3*
A & J Glass	911 4th St S	Great Falls	MT	59405-4017	523110	152122	507206
A All Lot Repairs	3128 Upper River Rd	Great Falls	MT	59405-7241	769999		
Aafedt's Mini Storage Ctr	1306 7th St S	Great Falls	MT	59405-4326	422503	422505	
Ace Hardware	3527 10th Ave S	Great Falls	MT	59405-3453	525104	526109	523107
Advanced Chiropractic Ctr	1114 9th St S	Great Falls	MT	59405-4402	804101	801104	799999
Americlean-Carpet & Upholstery	216 8th Ave S	Great Falls	MT	59405-4010	152114	721704	721701
Animal Clinic On 9th St	1116 9th St S	Great Falls	MT	59405-4402	074201	599929	
Auto Corner	3849 10th Ave S	Great Falls	MT	59405-3645	551103		
Auto Parts Co	1308 9th Ave S	Great Falls	MT	59405-2659	501313	371401	509998
Automotive Service	617 10th Ave S	Great Falls	MT	59405-4094	753801	553106	753919
B & M Machine Co	524 9th Ave S	Great Falls	MT	59405-4038	359903	753802	359998
Bell Building Mechanical Svc	1425 8th Ave S	Great Falls	MT	59405-2603	171105	507420	599905
Benefis Addiction Medicine	500 15th Ave S	Great Falls	MT	59405-4324	839902	839901	806202
Benefis Women's Care	540 17th Ave S	Great Falls	MT	59405-6900	806202	832218	
Benefit Convenience Care Ctr	500 15th Ave S	Great Falls	MT	59405-4324	801104	801101	806202
Big O Tires	1117 7th St S	Great Falls	MT	59405-4350	553123	753914	
Big R Stores	4800 10th Ave S	Great Falls	MT	59405-5697	519102	569907	
Big Sky Fire Protection Inc	1800 21st Ave S	Great Falls	MT	59405-6142	508734		
Big Sky Tire Rama	4501 10th Ave S	Great Falls	MT	59405-5630	553123		
Bio-Tech Laboratories	613 Doris Dr	Great Falls	MT	59405-3714	599933	384298	
Bison Ford	500 10th Ave S	Great Falls	MT	59405-4047	551103	551105	753801
Bob's Mini Storage	2400 14th Ave S	Great Falls	MT	59405	422503		
Carl's Exxon Towing Svc	2300 10th Ave S	Great Falls	MT	59405-2968	753801	554101	553106
Cenex	1501 10th Ave S	Great Falls	MT	59405-2625	541103	769203	754901
Cenex Convenience Store	2525 10th Ave S	Great Falls	MT	59405-3236	541103		
Central Montana Surgery Ctr	1411 9th St S	Great Falls	MT	59405-4503	809308	806202	
Chapel Of Chimes Funeral Home	1219 13th St S	Great Falls	MT	59405-4608	726103	726102	
City Motor Co	3900 10th Ave S	Great Falls	MT	59405-3695	354998	551105	553111
City Toyota	3900 10th Ave S	Great Falls	MT	59405-3648	551102		
Clay Loney Concrete Cnstr	3000 Upper River Rd	Great Falls	MT	59405-7239	152103	177105	171138
Columbia Paint & Coatings	3400 10th Ave S	Great Falls	MT	59405-3473	523107	508508	
Communtiy Home Oxygen Inc	2817 10th Ave S	Great Falls	MT	59405-3267	516920		
Consolidated Electrical Distr	901 River Dr S	Great Falls	MT	59405-4056	506330	506319	
Crescent Electric Supply Co	100 9th Ave S	Great Falls	MT	59405-4064	506330		
D & R Knutson Trucking Inc	1316 3rd West Hill D	Great Falls	MT	59404-3036	421304		
Denture Care Clinic	2509 7th Ave S # D1	Great Falls	MT	59405-3031	807203		
Dick Anderson Construction	4610 Tri Hill Fronta	Great Falls	MT	59404-4935	152103		

Dick Olson Constructors Inc	1124 24th St S	Great Falls	MT	59405-5013	152103	152105	154213	
Dickman Excavating	130 Gibson Flats Rd	Great Falls	MT	59405-8103	503211	179403	152103	
Discover Moving & Storage Inc	812 2nd St S	Great Falls	MT	59405-4002	421401	422503		
Donald P Haman Construction	2100 17th St S	Great Falls	MT	59405-6202	154213	152103		
Eklund Enterprises Constr	70 Dick Rd	Great Falls	MT	59404-6477	152103	152112	154213	
Executive Motors	5601 8th Ave S	Great Falls	MT	59405-5803	551103	552101		
Federated One Estop	1310 9th Ave S	Great Falls	MT	59405-2659	526137			
Firestone Tire & Auto Ctr	1325 10th Ave S	Great Falls	MT	59405-2652	553123	753801	753914	
Flegel Construction	3309 Eagle Ct	Great Falls	MT	59404-3812	152103	162304	179403	
Fred's Auto Sales	4930 10th Ave S	Great Falls	MT	59405-5606	551103			
Front Range Aviation Inc	4500 Ulm North Front	Great Falls	MT	59404	559908	458104		
G & M Auto Parts	1117 7th St S	Great Falls	MT	59405-4350	553111			
Gabe's Auto Sales	3615 10th Ave S	Great Falls	MT	59405-3455	551103			
Gagnons Reprographics	308 9th Ave S	Great Falls	MT	59405-4034	504403	506304	506528	
Gasamat	3200 10th Ave S	Great Falls	MT	59405-3449	541103	554101		
Glasgow Construction	2705 Fern Dr	Great Falls	MT	59404-3637	152103			
Gold Dental Lab	807 13th Ave S # 3	Great Falls	MT	59405-4371	807201			
Good Guys Auto	3635 10th Ave S	Great Falls	MT	59405-3455	551103			
Gore Hill Pop Inn Truck Stop	3100 Tri Hill Fronta	Great Falls	MT	59404-4734	554101			
Great Falls Clinic	2119 10th Ave S	Great Falls	MT	59405-2863	804918	799999		
Great Falls Fire Dept	1800 Fox Farm Rd	Great Falls	MT	59404-3500	922404			
Great Falls Intl Airport	2800 Terminal Dr	Great Falls	MT	59404-5593	458106	962104		
Great Falls Taxidermy	242 Ulm North Fronta	Great Falls	MT	59404-6339	769904	311101		
Gus & Jack's Tire-Big O Tires	1117 7th St S	Great Falls	MT	59405-4350	553123			
Hansen's Nursery & Landscaping	13th St S	Great Falls	MT	59405	526108			
Hcl Equipment Inc	4732 Tri Hill Fronta	Great Falls	MT	59404-4901	501213	504707	351103	
Heartbeat Auto-Rv	4601 10th Ave S	Great Falls	MT	59405-5632	551103	556103		
High Tech Automotive Inc	2324 10th Ave S	Great Falls	MT	59405-2968	753801	553106		
Highland Cemetery	2010 33rd Ave S	Great Falls	MT	59405-8100	726105			
Hillcrest Lawn Memorial Assn	1410 13th St S	Great Falls	MT	59405-4512	599991	726102	655302	
Hole In The Wall	PO Box 7318	Great Falls	MT	59406-7318	152139			
Holiday Motors	3051 10th Ave S	Great Falls	MT	59405-3492	551103			
Holiday Station Store	1601 Fox Farm Rd	Great Falls	MT	59404-3338	541103	554101		
Holman Aviation Co	1940 Airport Ct	Great Falls	MT	59404-5542	458104	559908	735939	
International Total Svc	2800 Terminal Dr	Great Falls	MT	59404-5593	506304			
Jag Construction-Vision Homes	1248 Rosita Dr	Great Falls	MT	59404-3795	152103			
James Mc Donald Construction	405 45th Ave Sw	Great Falls	MT	59404-5411	152103			
Jensen Jewelers	1200 10th Ave S	Great Falls	MT	59405-4413	594409	391101	763101	
Jurasek Construction Inc	78 Comanche Trl	Great Falls	MT	59404-6415	152103			
K Auto Sales	910 6th St S	Great Falls	MT	59405-4022	551103			
K-D Moving Systems	701 River Dr S	Great Falls	MT	59405-1856	421401			
King Motors	3524 10th Ave S	Great Falls	MT	59405-3454	551103			
Larry Beckner Photography	1912 16th Ave S	Great Falls	MT	59405-4829	733501			
Lucke Construction	1920 20th Ave S	Great Falls	MT	59405-6148	177105	152103		
Mc Kay Construction	4790 13th St S	Great Falls	MT	59405-8127	152103	152112		
Mc Menamy's Sunshine Auto	4701 10th Ave S	Great Falls	MT	59405-5601	551103			
Mealey Construction Co	4005 17th Ave S	Great Falls	MT	59405-5581	152103	154213		
Mechanix Unlimited Inc	5001 49th St Sw	Great Falls	MT	59404-4908	753801	553106	753812	
Metro Auto Sales	3510 10th Ave S	Great Falls	MT	59405-3454	551103	552102	556103	
Missouri River Marine	4250 Lower River Rd	Great Falls	MT	59405-8200	555104	555109		
Mobile On Site Storage	1111 14th St S	Great Falls	MT	59405-4656	422503			

Montana Lines Inc	2800 Upper River Rd	Great Falls	MT	59405-7235	152103			
Montana Lines Inc	2802 Upper River Rd	Great Falls	MT	59405-7235	152103			
Montana Motors	4827 10th Ave S	Great Falls	MT	59405-5603	551103			
Mr Screenprinter	823 8th Ave S	Great Falls	MT	59405-2128	275902	569917	594113	
National Laundry & Dry Cleaner	2309 10th Ave S	Great Falls	MT	59405-2967	721201	721101	721602	
Noon's	1300 12th Ave S	Great Falls	MT	59405-4604	541103	554101		
O K Tire Stores	301 10th Ave S	Great Falls	MT	59405-4043	553123	553120	753914	
O'leary Construction Inc	3111 7th Ave S	Great Falls	MT	59405-3403	152103	152112		
Oasis Bp	825 10th Ave S	Great Falls	MT	59405-2153	541103	554101		
Oberg's Orthodontic Lab	2300 12th Ave S # 13	Great Falls	MT	59405-5052	807201			
On Your Way Inc	3601 10th Ave S	Great Falls	MT	59405-3455	541103			
Orkin Exterminating Co	911 5th St S	Great Falls	MT	59405-4019	734201			
Oswood Construction Co	5000 49th St Sw	Great Falls	MT	59404-4907	152103			
Parts Plus	707 10th Ave S	Great Falls	MT	59405-4050	553111	509901		
Pete's Auto Sales	3845 10th Ave S	Great Falls	MT	59405-3645	551103			
Photo Plus	2900 10th Ave S	Great Falls	MT	59405-3243	738401	722101	722102	
Photomax Portrait Studio	1301 11th Ave S	Great Falls	MT	59405-4654	738401	722101	722102	
Physical Therapy Ctr	2517 7th Ave S # A1	Great Falls	MT	59405-3033	804918	833102	799999	
Pierce Honda Lincoln Mercury	4900 10th Ave S	Great Falls	MT	59405-5606	551102			
Pierce Mini Storage	1204 7th St S	Great Falls	MT	59405-4311	422503			
Pierce's Dodge City Superstore	2720 10th Ave S	Great Falls	MT	59405-3240	553111	753801		
Pierce's Jeep-Eagle Superstore	4025 10th Ave S	Great Falls	MT	59405-5617	551102	551105	553111	
Pierce's Super Stores	2720 10th Ave S	Great Falls	MT	59405-3296	551102	753801	551105	
Pop Inn	3100 Tri Hill Fronta	Great Falls	MT	59404-4734	541103	581208		
Precision Woodworks	2412 13th St S	Great Falls	MT	59405-5935	571211	152113	571213	
Preferred Fencing	2100 13th St S	Great Falls	MT	59405-5932	503903	152107	162902	
Pro Photo Slide Svc	1112 24th St S	Great Falls	MT	59405-5013	738402	738401	738404	
Pro-Kleen Floor Coverings Svc	327 10th Ave S	Great Falls	MT	59405-4043	721704	571305	152114	
Ralph Ward & Sons Auto Parts	1020 Franklin Ave	Great Falls	MT	59405-8230	501501	501505	559909	
Rdo Equipment Co	4900 Tri Hill Fronta	Great Falls	MT	59404-4937	508206	735949		
Rocky Mountain Homestead	1115 8th Ave S	Great Falls	MT	59405-2133	152103			
Rounds Relocations	219 9th Ave S	Great Falls	MT	59405-4032	421401			
Rountree Construction	2228 Upper River Rd	Great Falls	MT	59405-7137	152103	154213		
S & C Auto Inc	1925 32nd Ave S	Great Falls	MT	59405-6449	501501	754901	559909	
S & H Aluminum Products Inc	901 6th St S	Great Falls	MT	59405-4021	176111	176103	599961	
S S Construction	112 Sharon Dr	Great Falls	MT	59405-7255	152103			
Sears Auto & Tire Ctr	1200 10th Ave S	Great Falls	MT	59405-4413	753801	553123		
Sears Portrait Studio	1200 10th Ave S	Great Falls	MT	59405-4413	722101	722102		
Sinclair Marketing Inc	1301 10th Ave S	Great Falls	MT	59405-2652	554101			
Steve's Skyway Conoco	700 10th Ave S	Great Falls	MT	59405-4051	554101	541105	541103	
Superior Cabinets & Remodeling	2228 Upper River Rd	Great Falls	MT	59405-7137	571236	152139	571211	
T & E Electrical Svc	PO Box 6794	Great Falls	MT	59406-6794	173101	152105		
Tamietti Construction	4930 9th Ave S # 3A	Great Falls	MT	59405-5748	152103	177106		
Target One Hour Photo	2000 10th Ave S	Great Falls	MT	59405-2753	738401			
Taylor Brothers John Deere	4800 10th Ave S	Great Falls	MT	59405-5697	508310	526109	508304	
Taylor's Auto Max	4100 10th Ave S	Great Falls	MT	59405-5620	551103	552101	753801	
Tee Compost Farm	5490 13th St S	Great Falls	MT	59405-8250	287503	078204	526108	
Tire-Rama	521 10th Ave S	Great Falls	MT	59405-4093	553123			
Tom Skovron Builders	608 Robin Ct	Great Falls	MT	59404-3568	152103			
Total Pest Control	3604 8th Ave S	Great Falls	MT	59405-3432	734201			
Town Pump	1400 10th Ave S	Great Falls	MT	59405-2624	541103	554101		

Town Pump Food Stores	401 10th Ave S	Great Falls	MT	59405-4044	541103	554101	
United Agri Products Co	708 US Highway 87 N	Great Falls	MT	59405	519104		
Valley Motor Supply Co	2305 11th Ave S	Great Falls	MT	59405-5001	553111		
Wallace Marine	3505 10th Ave S	Great Falls	MT	59405-3453	555104	449304	
Way-More Auto	4801 10th Ave S	Great Falls	MT	59405-5603	551103		
Waylon's Wildlife Taxidermy	4700 10th Ave S	Great Falls	MT	59405-5694	769904		
Wright Commercial Properties	1812 10th Ave S	Great Falls	MT	59405-2681	653113	641112	152103
Yaeger Trucking	1518 Meadowlark Dr	Great Falls	MT	59404-3326	421304		

Sand Coulee, Town of
Ulm, Town of
Cascade, Town of

*See following list of SIC Codes