City of Billings

Public Water System

PWSID # MT0000153

City of Laurel

Public Water System

PWSID # MT 0000270

Lockwood Water and Sewer District

Public Water System

PWSID # MT 0000156

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SOURCE WATER DELINEATION AND ASSESSMENT REPORT

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EXECUTIVE SUMMARY

The report is required by the 1996 amendments to the Federal Safe Drinking Water Act. Montana's Department of Environmental Quality (DEQ) is completing reports like this one for all public water systems in the state. The purpose is to provide information so that the public water systems, consumers, and communities can begin developing strategies to protect their source of drinking water. This information focuses on areas that are most critical to maintaining safe drinking water. The report includes maps of source water protection areas, an inventory of potential contaminant sources within these areas, and an assessment of the relative threat potential contaminant sources pose to the water system.

INTRODUCTION:

Laurel, Billings, and Lockwood are located in Yellowstone County near the Yellowstone River and have a combined population of over 100,000. The drinking water (source water) for the Laurel, Billings and the Lockwood Water and Sewer District is supplied by three individual surface water intakes. These three public water supplies teamed with the Montana Department of Environmental Quality to complete this Source Water Delineation and Assessment Report (SWDAR) for the Yellowstone River watershed upstream of the intakes. There are more than 50 other public water supplies in the vicinity of Billings, Laurel, and Lockwood. Most of these public water supplies use ground water as their source water while others purchase water from other larger public water supplies. The Montana Bureau of Mines and Geology is completing reports for these public water supplies under contract with the DEQ.

WATER QUALITY:

The three public water supplies are classified as community systems and are required to conduct routine monitoring of the drinking water for contaminants in accordance with the Federal Safe Drinking Water Act. According to DEQ records all contaminants are below the Maximum Contaminant Level (MCL) and there have been no detections of coliform bacteria in the drinking water of any of the three public water supplies within the past five years. Within the past five years the concentration of nitrate detected in the drinking water of each of the three public water supplies has ranged from 0.12 mg/L to 0.34 mg/L, well below the MCL of 10 mg/L.

SOURCE WATER PROTECTION AREAS:

Management areas are delineated for the public water supplies and include a 1) Spill Response Region, 2) an Inventory Region generally north of the Yellowstone River and south of the Rims, and 3) a Watershed Region. Normally, the inventory of potential contaminant sources is restricted to just the Spill Response Region. However, due to the extensive network of irrigation canals and drainage ditches throughout the Yellowstone Valley between Laurel and Lockwood, an Inventory Region is added. The canals and drainage ditches have the potential to transport contaminants from outside the Spill Response Region and discharge them directly into the Yellowstone River. In addition, studies of ground-water flow patterns in the valley indicate that ground water in some areas could also transport contaminants to the Yellowstone River in the vicinity of the drinking water intakes. These studies also estimate the volume of ground water discharged to the Yellowstone River is small compared to the year-round flow of the Yellowstone. As a result, dilution plays a significant role in reducing the threat posed by many of the potential contaminant sources in the valley. However, given the network of canals and drains, and the general ground water flow patterns, it is prudent to include an Inventory Region for this report.

The goal of management in the Spill Response Region and the Inventory Region is to avoid introducing contaminants directly into the river upstream of the public water supply intakes. The goal of management in the Watershed Region is to maintain and improve water quality over long periods of time.

INVENTORY RESULTS:
The largest concentration of significant potential contaminant sources is in the Billings / Lockwood area and a smaller number of these contaminant sources are located near Laurel. There are multiple petroleum pipelines, highway and railroad bridges that cross the Yellowstone River, its tributaries, and many of the canals and ditches are within the Spill Response Region. Some of these crossings are of particular concern because they are relatively close to the public water supply intakes. Leaks or spills of fuels or other hazardous materials at these crossings may impact the drinking water supply. There are multiple underground fuel storage tanks, wastewater discharge sites, and municipal sewer lines present within the Billings area. Because of the irrigation canal and drainage ditch network, and the prevailing ground-water flow direction toward the Yellowstone River; potential contaminant sources in and west of the city may pose a threat to the public water supplies.

Laurel and Billings operate wastewater treatment plants that are permitted to discharge treated wastewater directly into the Yellowstone River. Laurels discharge point is approximately 16 miles upstream from the City of Billings. The Billings wastewater treatment discharge site is located just down-stream from the Lockwood public water supply intake.

Agricultural land is considered to be a significant potential contaminant source when it is located within the source water protection regions. Over-application of fertilizers and/or pesticides can result in those agricultural chemicals infiltrating into ground water and running off in to surface water bodies. It should also be noted that these same issues likely exist on a somewhat smaller scale in urban and suburban areas. Over application of fertilizers and other garden and lawn-care products could have a negative impact the surface and ground water resources. A U.S. Geological Survey study of the Yellowstone River documented low levels of agricultural chemicals are present. Additional studies will be needed to determine whether concentrations are increasing in the long-term or seasonally.

Multiple high to moderate septic density areas are located west of Billings and in the Lockwood area. There are also multiple high and moderate septic density areas near Laurel, and between Laurel and Billings. The concern is the septic effluent could increase nitrate and the total dissolved solid load in Canyon Creek, Hogans Slough, and Blue Creek. Household hazardous wastes are also a concern with septic systems in these areas. Under some conditions, the high to moderate septic density areas could be the source of pathogens entering the surface water bodies.

The inventory within the Watershed Region identifies large facilities and landuses that could pose a threat to the source water, however, it is assumed that distance and dilution will reduce the hazard or threat these potential contaminant sources pose to the source water and the public water supplies.

Inventory Limitations
The inventory was developed from readily available public sources of information, some of which are not updated routinely and in some cases may not be current. The inventory of potential contaminant sources in this report should be viewed as a starting point that the communities can expand on to continue their effort to protect their source water.

SUSCEPTIBILITY RESULTS:
Susceptibility of the source water is determined by two factors: the potential of a contaminant reaching the intake and the resulting health hazard. Barriers that would slow or prevent contaminants from impacting the source water are also identified and used to adjust the final susceptibility ratings for individual potential contaminant sources. Some potential contaminant sources are considered significant based upon the following factors: the volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or ground water, and the proximity of the

potential contaminant sources to the public water supply intakes. It is important to understand that the some of the pipeline and transportation crossings and canal outflows that are relatively close to the surface water intakes could pose a threat to the public water supplies. In this report, barriers such as dilution, emergency response and automated leak detection have been used to reduce the final susceptibility rating in accordance with the Montana Source Water Protection Guideline Document. There is concern however that some of these barriers may not be effective if a major release or spill occurred close to the intake locations. For some sites like bridges and petroleum pipelines that are close to the intakes, the effectiveness of the barriers listed is in question and the susceptibility rating could be set higher than shown in Table 8 of the main report. It is advisable for the three communities to sponsor or support more detailed studies of the pipeline and transportation crossings and canal outflows near the intakes to better understand and define the hazard they may represent to the public water supplies and the source water. Susceptibility results are summarized below and a more detailed listing is presented in Table 8 of the main report:

- **Lockwood's Public Water Supply** has high to very high susceptibility to:
    - Multiple highway and rail bridge crossings.
    - Multiple pipeline crossings.

Other potential contaminant sources in the Lockwood Spill Response Region are assigned moderate susceptibility ratings. These include:

- Petroleum pipeline crossings.
- Conoco Refinery.
- Wastewater discharge sites.
- One underground storage tank site.
- One superfund site.
- Two hazardous spill sites.
- One regulated toxic release site.
- Multiple canal and storm water ditches.

Note: Susceptibility ratings for some of these sites may be higher due to their proximity to the intake. All other potential contaminant sources are assigned low susceptibility ratings.

- **City of Billings Public Water Supply** has high to very high susceptibility to:
    - No sites were assigned high to very high susceptibility.

Other potential contaminant sources in the Billings Spill Response Region are assigned moderate susceptibility ratings. These include:

- Multiple petroleum pipeline crossings.
- Multiple highway and rail bridge crossings.
- One hazardous spill site.
- One wastewater discharge site.
- One underground storage tank site.
- One superfund site.
- One regulated toxic release site.
- Multiple canal and storm water ditches.

Note: Susceptibility ratings for some of these sites may be higher due to their proximity to the intake. All other potential contaminant sources are assigned low susceptibility ratings.

- **City of Laurel Public Water Supply** has high to very high susceptibility to:
    - Multiple highway and rail bridge crossings.
    - Multiple pipeline crossings.
    - One hazardous spill site.

Other potential contaminant sources in the Laurel Spill Response Region are assigned moderate susceptibility ratings. These include:

- Two wastewater discharge sites.
- One hazardous spill site.

Note: Susceptibility ratings for some of these sites may be higher due to their proximity to the intake. All other potential contaminant sources are assigned low susceptibility ratings.

Sites within the Blue Creek, Canyon Creek or Hogans Slough Spill Response Regions are assigned high to very high susceptibility that relate to the Billings Public Water Supply intake susceptibility:

- Agricultural land within Hogans Slough Spill Response Region covers 70% of the region.

Other potential contaminant sources in the Blue Creek, Canyon Creek or Hogans Slough Spill Response Regions are assigned moderate susceptibility ratings. These include:

- Multiple petroleum pipeline crossings.
- Multiple highway and rail bridge crossings.
- Multiple underground storage tank sites.
- Two superfund sites.
- One regulated toxic release site.

All other potential contaminant sources in the Spill Response Regions are assigned low susceptibility.

Susceptibility Analysis Limitations

Due to uncertainties related to the ground-water and surface water interactions, the general hydrologic setting, and limited, dated, or inaccurate information, some of the potential contaminant sources assigned low susceptibility ratings, or not identified in the inventory, could pose a threat to the public water supplies and the source water.

MANAGEMENT RECOMMENDATIONS:

Management options are noteworthy because if they are implemented, they can act as additional barriers that reduce the susceptibility of a public water supply to specific sources of contamination. It is important to recognize that implementation of the management recommendations is beyond the scope of any single community or public water supply within the project area. It will also be important for the three communities and the other 50 or so public water supplies to work together to identify key management actions and to decide how those actions can be effectively implemented. Public Water Supplies could benefit from participating in watershed-level action groups such as the Yellowstone River Conservation Council to help address activities beyond the project area.

It is also important to understand that management efforts must not be restricted just to land areas within the Spill Response Region. Due to the presence of the network of irrigation canals and ditches, and the prevailing ground-water flow direction, potential contaminant sources beyond the Spill Response Region and within the Inventory Region could impact the source water. Management and source water protection planning efforts need to consider land areas and potential contaminant sources outside of the Spill Response Region to be effective. Management recommendations fall into the following categories:

- **Emergency Response Planning –** Emergency response planning with an emphasis on the pipeline and transportation crossings will provide a tangible benefit for protecting the source water. An existing effort to develop an inventory of hazardous materials for the City of Billings could be expanded to include other communities and land areas within the project area.

- **Growth and development planning –** It would be advisable to encourage growth and development in areas outside of the Spill Response Region and away from tributaries, canals and ditches. Ground-water flow direction in these areas should also be taken into account.

- **Sewer maintenance and leak detection –** Upgrading old sewer lines and maintaining a program to

routinely inspect lines for leaks will help reduce the susceptibility of the public water supplies to contamination from industrial and household wastes. This is especially important for the City of Billings and Lockwood because ground water flows from sewered areas within the City and discharges to the Yellowstone River.

- **Sewer extension –** Areas around Laurel and Billings, particularly west of both cities, have grown substantially in the last 10 years. Extending city services, especially sewer, to these areas would help reduce the volume of household hazardous wastes, nitrate, and pathogens released into the shallow ground water that is hydraulically connected to surface water bodies.

- **Agricultural Best Management Practices (BMPs) -** BMPs addressing application and mixing of fertilizers and pesticides are a viable alternative to prohibition of their use. BMPs for use of garden and lawn-care products in suburbs and urban areas would also be beneficial.

- **Storm water Management –** EPA Phase II Storm Water Rules will soon be implemented in the Billings area and will include identification of outfalls to the canals and ditches, and water quality samples from at least some of outfalls. It is may be advisable to expand the inventory of storm water discharge points to the Yellowstone Valley between Laurel and Billings.

- **Education -** Educational workshops could be provided to the general public to increase awareness and promote safe handling and proper storage, transport, use, and disposal of hazardous materials. In several larger cities in Montana education efforts and voluntary hazardous waste collection days have helped raise public awareness of source water protection issues. These efforts have also helped reduced the volume of potential contaminants stored and improperly disposed within the community.

- **Long-term Infrastructural Planning –** A component of a 10 or 20 year plan for the Billings Public Water Supply could be to construct a new surface water intake some distance upstream of the City of Laurel. This would move the intake upstream and away from a large number of potential contaminant sources associated with urban, suburban, and industrialized areas near the present intake location.

INTRODUCTION

Boris A. Krizek, Environmental Engineer, with the City of Billings Public Works Department, in cooperation with Larry McCann, Public Works Director, with the City of Laurel (406-628-4796 ext.3), and Rick Russell, Manager, Lockwood Water and Sewer District (406-259-4120), completed this Delineation and Assessment Report. This report only addresses the delineation and susceptibility assessments and potential impacts on three surface water systems on the Yellowstone River. The Bureau of Mines in conjunction with the Montana State University of Billings have been contracted by the DEQ to perform the delineation and susceptibility assessment reports for all the ground water public systems in the valley. Jim Stimson with the DEQ Source Water Protection Program provided review, editing, and mapping support to complete this report.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the City of Billings (COB), City of Laurel (COL), and Lockwood Water and Sewer District (LWSD) 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 the 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 assists the City of Billings, City of Laurel, and the Lockwood Water and Sewer District, to protect and respond to potential contaminants released in the drinking water source and intake facilities.

It is important to note that from a source water protection standpoint, this project area is complicated. The three communities included in this report have relatively high growth rates and the Yellowstone Valley in the project area is becoming increasingly urbanized. In addition, the Valley hosts significant transportation infrastructure and a variety of businesses and industries. Numerous irrigation canals and storm water ditches drain or pass through agricultural land, industrial areas, suburbs, and urban areas before discharging into the Yellowstone River. The canals and ditches have the potential of transporting contaminants from areas that are not immediately adjacent to the river. Studies of the ground water flow patterns in the project areas indicate ground water could potentially have the same impact. Given this complicated setting, Source Water Protection and proactive management of potential contaminant sources will be more effective if they carried out as a joint effort among the three communities on a project area of this scale.

Limitations

This report was prepared to assess threats to the water supply for the City of Billings, City of Laurel, and the Lockwood Water and Sewer District, to be addressed as PWSs (Public Water Systems). The terms "drinking water supply" or "drinking water source" refer specifically to the source for the PWSs and not any other public or private water supply system. Also, not every potential or existing source of ground water or surface water contamination in the area of the PWSs has been identified.

The terms "contaminant" is used in this report to refer to constituents for maximum concentration levels (MCLs) that 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 Communities

The three public water supplies included in this report are located in southeast Montana with Billings the county seat of Yellowstone County (Figure 1). According to the Census Bureau the population of Yellowstone County in 2002 was 129,400 with a City of Billings population at 92,008 making it the largest city in Montana. The population for the City of Laurel is at 6,268 and the population served by the Lockwood Water and Sewer District is approximately 5,775. The Yellowstone River Valley is the largest population center in a 500-mile radius. Urbanization is rapidly spreading in the Yellowstone River Valley between Laurel and Lockwood converting irrigated cropland to residential and commercial development. This development is outpacing the municipal water and sewer services resulting in the use of wells and septic drain fields in many areas.

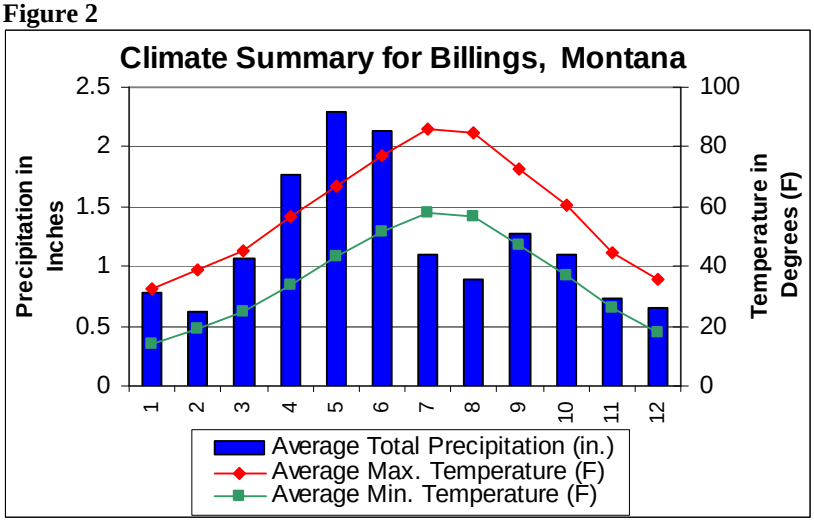
The valley's economy is primarily a serviced–based economy that includes specialized manufacturing, and professional services to support the regions rural agricultural and energy economies. The sugar beet industry continues to have a strong economic impact in the valley. Three oil refineries, Cenex Refinery in Laurel, Conoco Inc. Refinery in Billings, and the Exxon Refinery and Terminal east of Lockwood are all located on the banks of the Yellowstone River and provide a significant economic impact. The City of Billings has two major medical facilities, Deaconess Hospital and St. Vincent Healthcare. The medical centers support a four state region. The area also has a thriving higher education system, retail and distribution sector, and tourism industry. The schools that provide higher education are the Rocky Mountain College and the Montana State University of Billings.

A noticeable feature throughout the valley is the network of irrigation canals. These open waterways (approximately 15 miles in total length) wind through the valley crossing streets and municipal water and sewer lines (facilities). The head-gates are typically opened from mid-April through October and not only supply water to agricultural land, but also for urban irrigation and aquifer recharge in the valley. The largest of the ditches is the Billings Bench Water Association that has flows of 630 cubic feet per second. Drainage ditches or drains also course through many parts of the valley but they intercept ground-water discharge.

At this point it is important to recognize a distinction between irrigation canals and drainage ditches or drains. The distinction is important from a source water protection standpoint. The irrigation canals divert Yellowstone River water at their head-gates and transport it to agricultural areas in the valley before they discharge back into the river. These canals typically lose water through their channel-beds and provided recharge to aquifers in the valley (Olson and Reiten, 2002). A few of the irrigation canals apparently collect some volume of storm water but their primary purpose is to transport irrigation water (see page 17, paragraph 2). The drainage ditches on the other hand, intercept ground water to help lower the water table below the root zone for crops and to "dewater" certain tracts of land. Water intercepted by the ditches is ultimately discharged into the Yellowstone River. The drainage ditches are usually considered to be potential sources of contamination. Irrigation canals on the other hand are generally considered to pose less of a threat to the source water because they transport Yellowstone River water that typically is of higher quality than the ground water discharged to the drains. It is important to understand that there can be exceptions to this general principal in some parts of the Yellowstone Valley and in other areas. Irrigation canals and drainage ditches are discussed in more detail later in this report.

The major transportation routes into the valley are U.S. Interstate 90, U.S. Interstate 94, U.S. Highway 87, and U.S. Highway 72. Burlington Northern Santa Fe Railroad provides railway service to the area.

Figure 2



Geographic Setting

The Yellowstone River Valley is located in southeastern Montana in the Yellowstone Plateau section of the Great Plains physiographic province. The climate in this area is considered semi-arid. Average daily maximum and minimum temperatures in the valley are 86.3° F and 13.9° F (Figure 2). Annual average precipitation is 14.41 inches with the wettest months typically in May and June (Western Regional Climate Center, Monthly Climate Summary 7/1/1948 to 12/31/2001).

BILLINGS WSO, MONTANA (240807)
Period of Record Monthly Climate Summary
Period of Record : 7/ 1/1948 to 3/31/2003

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	32.4	38.8	45.5	56.6	67.1	76.8	86.3	85	72.6	60.4	44.8	35.8	58.5
Average Min. Temperature (F)	13.9	19.4	24.6	33.8	43.4	51.7	58	56.7	46.9	37.2	25.9	18	35.8
Average Total Precipitation (in.)	0.78	0.62	1.06	1.77	2.29	2.13	1.1	0.89	1.28	1.1	0.73	0.66	14.41

Table 1 - Climate Summary for the Billings Area

General description of the Source Water and Hydrogeologic Conditions

The Yellowstone River is a perennial stream, stretching over 670 miles and is the longest free flowing river in the lower 48 states. The headwaters of the Yellowstone River originate from the Continental Divide in Yellowstone National Park, Wyoming. The hydrologic unit code (HUC) for this watershed is 10070007. This watershed drains approximately 70,000 square miles of land from Yellowstone Park to the Missouri River. The stream flow data in this report is from the U.S.G.S. gauging station 06214500, located downstream of the Lockwood intake and upstream of the City of Billings wastewater treatment plant outfall. Based on stream gauging data collected from 1929 through 2000, the mean monthly discharge at this station varied from 2,491 cubic feet per second (cfs) in January to 25,369 cfs in June (U.S.G.S). The average annual streamflow recorded at this station is 8,444 cfs. The highest recorded monthly average flow of 53,910 cfs occurred in June of 1997. It is important to note that the Yellowstone is a large river in this region and its discharge, even during low flow periods, provides substantial dilution potential and therefore, represents a significant barrier to potential sources of contamination identified in the report. For example, a flow of 8,444 cfs means that 63,172 gallons of water pass by the gaging station in one second. In one hour about 23 million gallons of water pass by the gaging station. This volume of flow should provide sufficient dilution to reduce the hazard posed by the majority of potential contaminant sources located along the river, with the possible exception of sources that are located in close proximity to the public water supply intakes.

The Yellowstone River Basin is a study unit within the U.S. Department of Interior's National Water-Quality Assessment Program (NAWQA). The NAWQA on the Yellowstone Basin studies began in 1997. The initial phase addresses the planning, study design, and analysis of existing data. A subsequent phase

examines ground-water, surface-water, and biological data incorporating several years of water quality monitoring at selected sites. The study will provide descriptions of land use and land cover, soil, geology, physiography, climate, and drainage characteristics that may influence the water quality on the Yellowstone River study unit. The segment of the river were the three public water supply intakes are located is within the transition segment between the cold and warm water fisheries.

The Public Water Supplies

Figure 3 shows the public water supplies in the project area. The figure shows that the Billings area has a mixture of community and non-community transient public water supplies. Some of the public water supplies purchase water from the city of Billings, or from some other source. Other public water supplies utilize ground water as their source of water. Source Water Delineation and Assessment Reports (SWDARs) are being completed for all of the public water supplies in the project area. Reports for public water supplies using ground water are being completed under contract with the Montana Bureau of Mines and Geology (MBMG), Billings Office. City of Billings staff have written this report for the community public water supplies of Laurel, Billings, and Lockwood. Numbers next to the public water supplies in Figure 3 are also included in the table identifying the public water supplies in Appendix C.

The City of Billings is classified as a community public water system (PWS #MT000153) serving a resident population of approximately 92,008. The Yellowstone River supplies 100% of the raw water needs for the Billings Water Treatment Plant through two intakes adjacent to the plant site. The primary intake (Intake No.1) is located along the shoreline of a control levee and draws water through an open channel. Flow from the open channel to the sedimentation basin is through six 48-inch diameter conduits with each having a 36-inch manually operated control gate. The Screen House or Intake No.2 is the plant's secondary feed located in the center of the river channel. This intake has not been used for several years. The plant treatment consists of coagulation, settling, disinfection, and filtration through ten dual media filters. The plant can also operate under direct filtration bypassing the primary settling basin. The nominal plant capacity is approximately 50 million gallons per day (MGD).

The Billings distribution system is comprised of approximately 374 miles of transmission and distribution mains with pipe diameters ranging from 4-inches to 42-inches. Intersections or crossings of the distribution system by sewer and storm water lines, or other facilities, are numerous and therefore would be too difficult to individually identify all crossings. The report will attempt to identify crossings that have a significant potential for contamination. The sewer collection system comprises of approximately 363 miles of pipe. Typically the sewer lines are located below the water main crossings and have a minimal horizontal separation of ten feet. Also, the City has a storm drain collection system comprises of 121 miles of pipe. These facility crossings are typically located above the water mains.

The City of Laurel (PWSID # MT0000270) draws its' water supply entirely from the Yellowstone River through two submerged screened intakes. Approximately 6,268 citizens are served by the city's public water supply. The intakes are located immediately downstream of highway 212 and the Montana Raillink bridge crossings. The newer of the two intakes is designed with two parallel 24-inch diameter lines rated at 25 mgd. The raw water is pumped from the intake lines to the water treatment plant. The plant is a direct filtration multi-media treatment system with a design capacity of 10 mgd. The distribution system has approximately 53 miles of water lines ranging in diameter from 2 to 24-inches. These water lines cross other lines or facilities including sewer lines, storm drains, gas and oil pipelines, railroad spurs, and irrigation ditches. The following irrigation/drainage ditches that course through the city are; Canyon Creek Ditch, Clarks Fork Ditch, Italian Ditch, Big Ditch, Nutting Drain, and Laurel Drain. The distribution lines cross through previous oil and fuel spill sites, in these areas the pipe material is coated ductile iron with VOC resistant gaskets.

The Yellowstone River supplies 100% of the Lockwood Water & Sewer District (PWSID #MT00156-005) needs which serves a population of approximately 5,775 residents. The conventional water treatment plant has a nominal capacity of 3.0 MGD. The raw water intake is a passive intake Johnson screen system with air purge and water scour system to clear debris and sediment. The plant utilizes ferric chloride or alum and polymers for flocculation and coagulation in the sedimentation process. The intake is located directly below the Burlington Northern Railroad crossing and also ¼ mile downstream of Interstate 90 bridge crossing.

The public distribution system comprises of approximately 45 miles of water mains. There are approximately 38 irrigation ditch crossings. The ditches are owned by the Lockwood Irrigation District and the Coulson Ditch Company. Also, gas and oil transmission lines cross distribution mains at five locations. The gas and oil pipelines are owned and maintained by the following companies; Cenex, Exxon, Conoco, and Montana Sulphur and Chemical.

Sanitary Sewer Systems

City of Billings is served by a municipal sanitary sewer system. The wastewater treatment plant is located down stream of the City's water treatment plant and Lockwood's intake on the north bank of the Yellowstone River. The plant is an activated sludge type secondary treatment facility designed for an average daily flow of 26 (MGD). The original primary treatment plant was upgraded in the 1970's increasing the capacity of the primary treatment and providing an activated sludge secondary treatment system. The treated wastewater effluent discharges to the Yellowstone River and must meet national secondary treatment standards. The City's MPDES permit number is 0022586-003. The collection system includes five lift stations and approximately 363 miles of sewer lines ranging from 6-inch to 60 inches in diameter. Private residential and commercial septic systems are predominately used outside the city limits. Through annexation and extension of the city's utilities, private septic systems are being replaced primarily in the area west of the city.

City of Laurel has a municipal sanitary system. The wastewater treatment plant is located on the north bank downstream of the water treatment plant. Design capacity is 0.9 mgd with an average daily influent flow of 0.65 MGD. The plant has a MPDES permit to discharge directly into the river following secondary treatment with rotating biological contactors. The collection system comprises approximately 46 miles of pipe. The Sections of the collection system cross through previous oil and fuel spill sites, in these areas the pipe material is a coated ductile iron with VOC resistant gaskets.

Lockwood does not have a municipal collection system. The Lockwood Water and Sewer District (LWSD) wastewater is treated by private and commercial septic tanks and leach fields. The septic systems and drainfields contribute to elevated nitrate concentrations in the shallow ground water in the Lockwood area.

Storm Water and Irrigation Systems

The City of Billings and Yellowstone County are designated as MS4s that are required to obtain coverage under an MPDES storm Water Discharge Permit. The City adopted a Storm Water Management Manual in 1986 to address detention and retention of storm water runoff from commercial properties and new subdivisions. The manual establishes the criteria and defines the storm water characteristics within the City limits based on historical records. The City operates and maintains approximately 130 miles of main line storm drainage piping discharging at nine major outfall points into the Yellowstone River. The major outfalls are Canyon Creek, Cove Creek, Danford Drain, Hogan's Slough, Blue Creek, City-County Drain, Yegen Drain, Alkali Creek, Hilltop Road Outfall, and Five Mile Creek. The Billings storm drainage collection system receives excess irrigation water and drainage carried into the MS4 permit area from

private irrigation ditches. The ditches and drains that collect storm water and those that intercept ground water discharge ultimately empty into the Yellowstone River. Hogan's Slough, City-County Drain, and Yegen Ditch account for approximately 70% of the storm drain collection for the City. Other drainage ditches that course through the valley include the following; Arnold Drain, Kratz Drain, Sacajawea Park Drain, and the North 15th street Outlet.

Figure 4 shows the general drainage areas that contribute storm water runoff and irrigation return flows for Canyon Creek, Hogan's Slough, City-County Drain, and Yegen Ditch. Comparing Figure 4 with the Landuse / Landcover maps in Figure 12 shows that the areas that contribute water to Canyon Creek and Hogan's Slough are dominated by rural and agricultural landuse. The City-County Drain and Yegen Ditch on the other hand receive storm water and runoff from developed and urban areas, and their outflows to the Yellowstone River are relatively close to the intakes for the City of Billings and for Lockwood.

It is important to note that significant development and subdivision is taking place in the west Billings area that is changing the area to a more urban setting. Many of the developments are using individual septic systems for waste disposal and community-level water systems that rely upon one or more relatively shallow supply wells. Ground-water studies in the area have identified leakage from some of the irrigation canals and ditches, as well as water loss from septic drainfields as sources of recharge to the shallow ground water system in the west Billings area (Olson and Reiten, 2002). For more detail from the cited study see the Hydrologic Conditions – Ground Water section below in Chapter 2.

Hogan's Slough is the storm water outfall for the western section of the City with the outfall located along the South 20th Street West alignment. The general limit of this storm water collection area is; west of 37th Street West and 24th Street West, north of King Avenue, and south of Grand Avenue. The ditch is a combination of open channel and box culverts which courses through commercial and residential developments.

City-County Drain is the storm water outfall for the central section of the City with an outfall located along Washington Street. The general limits of this storm water collection area are; west of 11th Street, east of 24th Street West, north of King Avenue, and south of Rimrock Road. The ditch is a combination of open channel and box culverts which courses through commercial and residential developments.

City-County Drain culvert under U.S. 90

City-County Drain with irrigation crossing

The Yegen Ditch outfall is located along the eastern edge of a Conoco above ground tank site and discharges upstream of the LWSD intake. This ditch provides storm water drainage for the area generally north of King Avenue East, west to North 32nd Street and south of 12 Avenue North. The ditch is a combination of open channel and box culverts which course through industrial, commercial, and residential developments. Petroleum product pipelines cross the ditch both above and below the ditch channel.

Yegen Ditch next to Conoco Tank Farm

Yegen Outfall into Yellowstone River

Several irrigation ditches course through the valley totaling approximately 14 miles of open canals provide both irrigation and storm water discharge. Each year the ditches are filled in April/May and dewatered by November. The largest of the ditches is the seven mile long Billings Bench Water Association Canal which flows 650 cfs. Other ditches are the Hi-line, Grey Eagle, The Big Ditch, Cove, Hogan Slough, Arnold Drain, and the Kratz Drain. Both the storm drains and irrigation ditches have numerous waterline crossings through out the City. The irrigation canals that convey irrigation water and storm water ultimately discharge into the Yellowstone River.

In Laurel the two primary ditches that serve a combined function of irrigation/storm water drainage are the Laurel Drain that outfalls into the Yellowstone River between the Laurel water and waste water treatment plants. The other main drainage is the Nutting Drain which outfalls downstream of the Laurel waste water treatment plant.

Water Quality

The three systems are classified as community PWSs and are 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.

The City of Billings has been monitoring the Yellowstone River water quality at the WTP intake for approximately 50 years. The intake is upstream of the United States Geological Survey (USGS) gauging station no.06214500. Table 2 shows the raw water parameters that have been monitored for the year 2002. Table 3 shows the finish/treated water parameters monitored during 2002.

Table 2 - Water Quality Data of Raw Water

LABORATORY SUMMARY				
YELLOWSTONE RIVER				
January 1 THRU December 31 2002				
PARAMETER	MCL/SMCL(a)	AVERAGE	MAXIMUM	MINIMUM
Physical Properties				
pH (s.u.)	6.9 - 9.0(a)	8.39	8.80	8.05
Sp. Conductance (umhos)		352	481	131
Temperature (F)		47	72	32
Turbidity (NTU)	0.5	21	383	2
Total Hardness as mg CaCO3/l		140	189	57
Calcium as mg Ca/l		37	51	16
Solids (mg/l)				
Total Dissolved Solids	500(a)	209	298	72
Metals (ug/l)				
Arsenic	50	13.4	18.5	4.9
Magnesium (mg/l)		11.4	14.8	4.4
Manganese	50(a)	21	51	*<10
Iron	300(a)	367	2050	62
Lead	15	*<5	*<5	*<5
Sodium (mg/l)	20(a)	20.8	26.3	6.2
Copper	1300	*<10	*<10	*<10
Inorganic Non-metals (mg/l)				
Chloride		6.2	10.0	1.7
Fluoride	4	0.45	0.62	0.18
Nitrate+Nitrite as N	10.0	0.19	0.44	<0.02
Sulfate	250(a)	54.8	84.1	13.3
Alkalinity as CaCO3		110.8	158.0	42.5
Bacteria				
Total Coliform(col/100 ml)		199	1067	1
Fecal Coliform(col/100 ml)	Absent	71	575	<1
Heterotrophic Plate Count (cfu/ml)	<500	1015	4900	11
Total Organic Carbon (mg/l)		2.50	8.28	1.42

Table 3 shows the finish water quality for the year 2002 for the City of Billings Water Treatment Plant. Finish water quality records date back more than fifty years.

Table 3 - Water Quality of Finished Water

LABORATORY SUMMARY				
FINISHED WATER QUALITY				
January 1 THRU December 31 2002				
PARAMETER	MCL/SMCL(a)	AVERAGE	MAXIMUM	MINIMUM
Physical Properties				
pH (s.u.)	6.9 - 9.0(a)	7.93	8.24	7.28
Sp. Conductance (umhos)		372	509	124
Temperature (F)		49	75	32
Turbidity (NTU)	0.5	0.03	0.07	0.023
Total Hardness as mg CaCO3/l		144	191	45
Calcium as mg Ca/l		38	52	13
Solids (mg/l)				
Total Dissolved Solids	500(a)	203	290	64
Metals (ug/l)				
Arsenic	50	6.1	12.3	*<2
Magnesium (mg/l)		11.9	15.7	2.8
Manganese	50(a)	*<10	22	*<10
Iron	300(a)	*<50	*<50	*<50
Lead	15	*<5	*<5	*<5
Sodium (mg/l)	20(a)	21.7	28.1	5.2
Copper	1300	*<10	*<10	*<10
Inorganic Non-metals (mg/l)				
Chloride		10.5	15.2	5.3
Fluoride	4	0.45	0.63	0.16
Nitrate+Nitrite as N	10.0	0.21	0.43	<0.02
Sulfate	250(a)	58.3	88.2	11.6
Alkalinity as CaCO3		110.6	160.0	36.5
Free Chlorine		1.04	1.23	0.83
Bacteria				
Total Coliform(Present/Absent)	Absent	ABSENT	ABSENT	ABSENT
Heterotrophic Plate Count (cfu/ml)	<500	<1	<1	<1
Trihalomethane (ug/l)	100	21.1	31.9	11.2
Total Organic Carbon (mg/l)		1.73	2.71	1.14
Organic Chemicals				
Pesticides/PCB's		Less	Than	MCL
(19 Compounds)	Varies			
Volatile Organic Chemicals		Less	Than	MCL
(18 Compounds)	Varies			
Source: Public Utilities Department, City of Billings				
MCL Maximum Contaminant Level				
SMCL(a) Secondary Drinking Water Standards set by the Environmental Protection Agency				
*< Indicates that the value is less than the detection limit of the test.				

According to the DEQ PWS Database there have been no detections of coliform bacteria in the drinking water of any of the three public water supplies within the past five years. Within the past five years the concentration of nitrate detected in the drinking water of each of the three public water supplies 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 Yellowstone River that the PWSs withdraw from 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 fish and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

Although this segment of the Yellowstone 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 uses. This segment of the river is partially supporting aquatic life and cold-water trout fishery.

CHAPTER 2 - DELINEATION

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

Two management areas are identified within the source water protection area defined as the Spill Response Region and the Watershed Region. The Spill Response Region represents the area of surface water upstream of each of the three public water supply intakes where a potential for contamination can occur in a relatively short period of time. The watershed region represents the area of the Upper Yellowstone and Clarks Fork Watershed that is upstream of and contributes water to the valley.

The three public water supply systems have surface water intakes located on the Yellowstone River (Figure 1). According to the Montana Source Water Protection Program guidelines, a Spill Response Region for a surface water system extends ½ mile down-stream of the system's surface water intake and 10 miles up-stream from the intake. A Spill Response Region also extends ½ mile from each riverbank. Figure 1 shows the general areas where the three intakes are located and the Spill Response Region delineated for the project area. In this case, the delineation limits of the study ranges from ten miles upstream of the Laurel WTP intake and about ½ mile below the Lockwood WTP intake on the main stem of the Yellowstone River. The delineated Spill Response Region extends ½ mile from the banks of the Yellowstone River proper, Blue Creek, Hogans Slough, Canyon Creek, and the Clarks Fork of the Yellowstone. The Spill Response Region also includes a section of the Yellowstone River between Laurel and Billings, primarily because portions of this area are being developed and the interstate, railroad, and petroleum pipelines are relatively close to the river in this corridor. Other tributaries of the Yellowstone River in this area include Duck Creek, Pryor Creek, and Alkali Creek. These tributaries are not included in the Spill Response Region because they drain largely undeveloped areas that are not experiencing rapid growth.

Because the PWS's obtain their drinking water from the Yellowstone 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 4).

Table 4 - 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)

The Spill Response Region is divided into multiple segments, three for each of the municipal intakes, three

others for the Blue Creek, Canyon Creek, and Hogan's Slough, and one for the area extending between the end of the Billings Spill Response Region and the beginning of the Laurel Spill Response Region. Blue Creek, Canyon Creek and Hogan's Slough are included because they collect water drained from areas where significant development is taking place. Separate sections are presented in the susceptibility table listing significant potential contaminants for each of the intakes, Blue Creek, Canyon Creek, and Hogan's Slough (Table 8).

The City of Billings WTP intake and Lockwood Water and Sewer District (LWSD) intake have overlapping spill response zones. Appendix A contains a list of all identified potential contaminant sources within the defined Yellowstone Valley area. Hydrologic conditions for surface and ground water are discussed below.

Hydrogeologic Conditions – Surface Water

The headwaters of the Yellowstone River and its tributaries originate in the mountain ranges to the west and southwest of the Laurel-Billings-Lockwood (LBL) Project Area and include: the Bridger Range, Crazy Mountains, Absaroka-Beartooth Range, upland areas in Yellowstone National Park, the Prior Mountains, and Bighorn Mountains. Significant tributaries to the Yellowstone draining these land areas include the Shields River, Boulder River, Stillwater River, Clarks Fork of the Yellowstone, and the Bighorn River.

Annual precipitation for the Billings area is about 14 inches, however, precipitation is much higher in the mountainous headwaters. Annual precipitation can range between 40 and 60 inches in the higher mountain ranges. A significant portion of that precipitation occurs as snow during the winter months and as spring rain, both of which contribute to high streamflow events. Peak flows for the Yellowstone River commonly occur in spring and early summer, and low flows are more common in late summer through the winter months.

Certain land uses and businesses located along the Yellowstone River and its tributaries upstream from the Laurel-Billings-Lockwood Project Area represent potential contaminant sources for the public water supplies. Spills and leaks of contaminants are considered to represent a high hazard to a public water supply if they are located so that they result in direct discharge into Yellowstone River or into one of the its tributaries upstream in the vicinity of one of the public water supply intakes. The concern is that spills or leaks occurring in closer proximity to one of the Laurel-Billings-Lockwood intakes could reach the intake before plant operators can close or isolate the intake. Other contaminant sources may discharge to the river and its tributaries in a less direct manner. These contaminant sources are within the watershed but are farther from the river and contaminants can be flushed into the streams during spring snowmelt or storm events. Indirect discharge to streams can also come from contaminants that infiltrate into aquifers adjacent the river that then discharge to streams via hydraulic connections. Because these contaminants are not discharged directly into the river, they tend to pose a less immediate threat to the public water supply and are usually assigned a lower hazard rating.

Seasonal timing of direct contaminant discharges into rivers and streams can complicate the potential threat to the Laurel-Billings-Lockwood public water supplies. Spills occurring during high water periods will tend to travel toward the surface water intake faster than during low water conditions. However, dilution during high flows in the spring and early summer would help reduce the hazard posed to the public water supplies. Direct discharges during low flow conditions would not be diluted as much as during high flow conditions but they would also travel slower and take longer to reach the intakes. In other words, there would be more time to respond to the contaminant incident. Also as mentioned previously, the Yellowstone is a relatively large river and even during low flow periods its discharge provides substantial dilution potential. Dilution will play a major role in reducing the hazard of potential releases or spills of contaminants into the river, and

it is considered to be a significant barrier to potential sources of contamination identified in the report.

Hydrogeologic Conditions – Ground Water

The Yellowstone River valley lies between the sandstone cliffs to the north and rolling hills underlain by a thick sequence of shale to the south. The cliffs are locally known as the "Rims" and are composed of the Eagle Sandstone and the Telegraph Creek Formation, both are Cretaceous in age (Olson and Reiten, 2002; Lopez, 2000). The sandstone formations dip gently to the north and are not present in the valley beneath the river. Within the Yellowstone River valley in the Project Area, the Yellowstone River has cut down into a thick sequence of Cretaceous aged shale. The shale sequence is on the order of 2,000 feet thick and is widely exposed in the hills south of Billings (Lopez, 2000).

Within the valley, the Yellowstone River has deposited five distinct terraces with varying thicknesses of gravel. Some of the terraces are more extensive than others and several are important aquifers in the western part of the Project Area between Laurel and Billings (Olson and Reiten, 2002). The terraces are distinguished by their elevation above the modern Yellowstone River flood plain and are described in detail by Olson and Reiten, 2002. Figure 5 and Figure 6 show the ground-water flow direction and general aquifer boundaries for the near the City of Billings Intake and for the area between Laurel and Billings, respectively. Mapping in Figure 5 comes from Hutchinson (1983) and mapping in Figure 6 comes from Olson and Reiten (2002). Some highlights from the Olson and Reiten study, and from an earlier study by Hutchinson, 1983 are summarized below.

- Ground water occurs in gravel deposits ranging from 0 to 30 feet thick and lying beneath terraces 1, 2, 3, and 4. Modern alluvium adjacent the Yellowstone River is mapped as part of Terrace 1 in Olson and Reiten, 2002). Terraces 2 and 3 are aerially extensive in the valley occurring in sub-parallel bands adjacent the Yellowstone River flood plain (Figure 6). Saturated thickness beneath the terraces is approximately 15 feet and the individual terraces do not appear to be hydraulically connected. There is up to 100 feet of silty clay or clayey sand above the saturated gravel units that acts as a confining layer in some areas, mainly in the northwest part of the project area. Ground-water flow direction is generally from the west-northwest to the east-southeast. Flow rate within the gravel units is in the range of 1 to 3 feet per day. Isotopic analysis of Tritium-Helium on water from 9 wells in the area indicate that ground water in the valley is between 0.9 and 32.0 years old.

- Water balance isotopic analysis of deuterium and oxygen-18 suggest that between 66 and 84 percent of the water recharging the terrace gravel aquifers originates irrigation return flow and or water lost from canal and stream channels. Smaller contributions to recharge come from infiltration of precipitation, septic effluent, and lawn irrigation. The importance of irrigation return flow for recharge is underscored by the observation that water levels in wells located near flood irrigated fields and irrigation canals rise rapidly after the irrigation season begins in April, peaks in August to September, and decline after the growing season ends. Water levels in wells in non-irrigated areas show a very different pattern; they fall during the irrigation season reaching a minimum in mid- to late summer. Water levels begin to rise again in fall when irrigation and crop production comes to an end.

- Ground water discharges to multiple streams and drains in the Project Area providing base flow during the winter for major streams and increased flow as the streams flow across the terrace deposits. Maps included in the Olson and Reiten (2002) and Hutchinson (1983) studies show the general flow paths are toward the major tributaries like Canyon Creek and Hogan's slough, and toward the Yellowstone River (Figure 5 and Figure 6). The streams and drains essentially collect

ground-water discharge and transport it to the Yellowstone River. Ground-water contributions to the streams, drains, and the Yellowstone River are estimated to be on the order of 1% of the Yellowstone River's discharge. In other words, ground-water discharge to the Yellowstone River does not represent a large portion of the rivers flow (See Table 7, page 27 of Olsen and Reiten, 2002).

Another observation that can be made from the maps included in the Olson and Reiten (2002) and Hutchinson (1983) studies is that the terrace deposits and modern alluvium are truncated just east of Billings where the river flows north for a short distance and the valley becomes narrower. This causes the ground water to flow directly toward the river in the vicinity of the City of Billings intake (Figure 5 and Figure 6). This is important because any contaminant originating in the east side of the city could be entrained by the ground water and carried toward the river near the intake. However, as noted above, the volume of ground- water discharge is small compared to average discharge of the Yellowstone River. Dilution will play a major role in reducing the concentration of potential contaminants delivered to the Yellowstone River via ground water or by streams and drains in the area.

Conceptual Model and Assumptions

The three public water supply intakes are located on the Yellowstone River near the cities of Laurel, Billings and Lockwood. There are multiple potential contaminant sources that cross the river or located adjacent the river. Contaminants, if spilled directly into the Yellowstone River upstream or are in the immediate vicinity of the three surface water intakes, could potentially reach the intakes before the water operators could isolate the system or shut down intake pumping facilities. Severity of a contaminant impact would depend on the type of contaminant, the location of the spill point relative to the intakes, and the river flow conditions at the time of the spill. River flow is highly variable during the year. Over a longer time frame, contaminants that accumulate throughout the watershed could be flushed into the Yellowstone River during periods of spring run-off. Contaminants in ground water can also enter the Yellowstone River in areas where it is hydraulically connected to sub-surface sediments.

The Spill Response Region segments for the City of Billings and the Lockwood intakes overlap based on the ½ mile down stream and 10 miles upstream criteria for each intake. This segment includes two major storm ditch outfalls, the City County Drain and the Yegen Drain. Also, Blue Creek, Canyon Creek and Hogan's Slough outfalls are within this segment upstream of the City of Billings intake. The Spill Response Region for the Laurel intake is about six miles upstream of the end of the Billings Spill Response Region. As mentioned previously, this study includes the inventory and susceptibility for this section between Laurel and Billings.

Ground-water discharge provides base flow for the Yellowstone River and its tributaries in the area, and for the streams and some drainage ditches. Overall, ground-water base flow contributions to the Yellowstone River are small. Rough estimates place the ground water recharge on the order of 1 percent of the Yellowstone River discharge. Ground water flows generally from upland areas north and south of the Yellowstone River. In the area west of the City of Billings and Lockwood intakes, ground water is flowing due east toward the River (Figure 5). In the vicinity of the City of Laurel intake ground water is flowing from the north – northwest to the south – southeast (Figure 6).

Limiting Factors

The delineation for the spill response 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. Ground-water 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 each of the public water supplies 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 the Yellowstone valley focuses on facilities that generate, use, store, transport, or dispose of potential contaminants, and on certain land types on which potential contaminants are generated, used, stored, transported or disposed. Additionally, the inventory process identifies potential sources of 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 valley spill response region include nitrate, pathogens, fuels, solvents, herbicides, pesticides, and metals. The inventory for the public water supplies 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.

The inventory of potential contaminants in this project area is complicated and challenging for several reasons. 1) There are a relatively large number of significant potential contaminant sources in the areas surrounding the three public water supplies and portions of the project area are experiencing relatively rapid development and population growth. 2) A relatively large number of significant potential contaminant sources are located outside the Spill Response Region and normally would not be included in the inventory and susceptibility analysis. However, some of these potential contaminant sources are located close to irrigation canals and storm water ditches that discharge directly, or indirectly, to the Yellowstone River. In addition, the location of the storm water discharge points to canals and to other ditches are not well documented and add an uncertainty to the susceptibility analysis that is difficult to quantify. 3) Ground water is recharged outside of the Spill Response Region and travels beneath agricultural, suburban, industrial, and urban areas toward the Yellowstone River where it discharges and provides baseflow. Ground water could transport contaminant from outside the Spill Response Region and discharge them in the vicinity of the public water supply intakes. 4) Interstate 94, the railroad, and multiple petroleum pipelines are located adjacent the Yellowstone River and cross the river and its tributaries at multiple locations. The interstate, railroad, and pipelines also cross irrigation canals and storm water ditches at multiple locations, some of which are relatively close and up-stream from the public water supply intakes. 5) Many of the sources of information used for the inventory are not current. This is especially true for communities like Laurel, Billings, and Lockwood that are experiencing rapid development and population growth. For these reasons, the Source Water Delineation and Assessment effort needs to consider the hazard posed by potential contaminant sources outside of the Spill Response Region. To address these challenges, a fairly conservative approach was used to develop the inventory and limitations are discussed in several sections of the report. This report should be viewed as a one part of the effort to initiate management of potential contaminant sources in the project area to provide protection to the source water.

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 from the NRIS database.

Step 2: The Yellowstone valley geology data was collected from the Montana Bureau of Mines and Geology database and various reports.

Step 3: 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 4: Major road and rail transportation routes were identified.

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
- Petroleum product pipelines
- 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

The potential contaminant source inventory within the Spill Response Region is intended to help identify sites where release of contaminants could result in a direct discharge in to the Yellowstone River or a tributary. The inventory also helps identify potential sources that could contaminate shallow ground water adjacent the river and that is considered to be hydraulically connected to the river. Significant potential contaminant sources that could release contaminants directly into the Yellowstone River, or one of its tributaries or canals that discharge directly into the river are assigned a high hazard rating. A hazard rating of moderate is assigned to potential contaminant sources that could release contamination to shallow ground water that is flowing toward the river. Usually potential contaminant sources outside of the Spill Response Region would be assigned a low hazard rating however; in the Billings area there are multiple canals that collect storm water runoff and discharge into the Yellowstone River up-stream from the Billings and Lockwood intakes. As a result, a significant potential contaminant source located outside of the Spill Response Region but close to a canal or tributary is assigned a hazard rating of moderate. Significant potential contaminant sources outside of the Spill Response Region and not in close proximity to a canal or stream are assigned a low hazard rating.

Figure 7 shows all of the potential contaminant sources identified in the project area, both significant and non-significant sites. While the map shows that there are a relatively large number of potential contaminant sources in the region, it also shows that the number of sites within the Spill Response Region is relatively small, on the order of 100. Most of the sites within the Spill Response Region occur east of Billings and just southwest of the Lockwood area. A second concentration of potential contaminant sources is located in the Laurel area, just south of town. There are multiple potential contaminant sources located within the Blue Creek, Canyon Creek and Hogan's Slough Spill Response Regions (Figure 7) but for the most part they are isolated sites that are not clustered or concentrated at one location.

In examining the maps presented in Figure 7 and subsequent figures, it is important to keep in mind that ground water near Billing is flowing generally toward the Yellowstone River and its local tributaries (Figure 5). Ground water in the vicinity of Laurel also flows toward the Yellowstone and the tributaries (Figure 6). The ground water is discharging into these surface water bodies and contributes to base flow during the winter months. Studies in the Project Area estimate the volume of ground-water discharge is small compared to the average flow in the Yellowstone River. Ground-water discharge probably represents only about 1% or so of the average flow volume in the river (See Table 7, page 27 of Olsen and Reiten, 2002). Despite this fact, the ground-water flow paths in the Project Area raise the possibility that contaminants could be delivered to the Yellowstone River in the vicinity of the public water supply intakes. While dilution would significantly reduce the hazard posed by such releases, it is still important to stress that source water protection efforts should address managing potential contaminant sources outside the Spill Response Regions (Figure 5, Figure 6, Figure 7, Figure 8, and Figure 9). In short, it is important to understand that the ground-water and surface-water systems in the Project Area are interconnected. Additional studies of ground-water and surface-water interactions may be warranted to more clearly understand and define the threat posed by potential contaminant sources in areas that are relatively close to the public water supply intakes.

It should also be noted from Figure 7 that highways, railroads, and petroleum pipelines are located relatively close to the Yellowstone River and cross the river, tributaries, canals and ditches at multiple locations up-stream from all of the intakes. Accidents, spills, and leaks along the transportation and pipeline routes are of concern, especially if they occur at crossings that are located a relatively short distance upstream from the intakes. This is especially true of the railroads and petroleum pipelines because they carry large volumes of product and accidents or spills could result in a significant release to the Yellowstone. Figure 7 and other figures show some of the locations where transportation and pipeline routes cross the Yellowstone River, tributaries, canals and ditches. Some of the crossings are located close to where the canals join the Yellowstone. For example, pipelines cross the City-County Canal and the Yegen Ditch near their outfalls that are a short distance upstream from the Billings and Lockwood intakes. Both canals have the potential to transport contaminants rapidly to the river. As mentioned previously, the Yellowstone is a relatively large river, and it is thought that dilution will act as an effective barrier to prevent contaminant spills and releases from posing a serious threat to the public water supplies and the source water. Emergency response is also considered a barrier that would help reduce the hazard from accidents and spills. However, it would be prudent for the communities to undertake or sponsor additional studies of the transportation and pipeline crossings that are close to the intakes to more clearly understand and define the hazard they may pose to the public water supplies and to the source water. In some cases it is conceivable that dilution would not represent a sufficient barrier to protect the public water supplies, especially for spills or releases that are close to the surface water intakes.

Municipal sewer lines and utility corridors in Billings and Laurel within the Spill Response Region pose a hazard to the source water. Municipal sewer lines and utility corridors may constitute preferred contaminant migration pathways that allow contaminants to enter area ground water that eventually may be transported to and discharged into the river. Figure 5 and Figure 6 mentioned previously show the general direction of ground-water flow in the vicinity of the Billings – Lockwood intakes and the Laurel intake. The maps can be used to identify areas that collect ground water recharge that is eventually discharged into the Yellowstone River. Leaks and spills from the municipal sewer lines, and from other potential contaminant sources in these areas, will have the tendency to move with the ground water toward the river.

Figure 8 and Figure 9 shows enlarged maps with significant potential contaminant sources in the Billings – Lockwood area and near the confluence of Canyon Creek and Hogan's Slough, respectively. Figure 10 shows the significant potential sources in the Canyon Creek and Hogan's Slough area and Figure 11 shows the vicinity of Laurel. The numbers associated with each site on the maps also appear in Table 8.

It is important to note from Figure 8, Figure 9, Figure 10, and Figure 11, that some significant potential contaminant sources are located just outside the boundary of the Spill Response Region. For example, Figure 8 and Figure 9 show a confined animal feeding operation (CAFO) located about 1 mile south of the West Billings Interstate Exit. There are also multiple underground storage tanks (USTs) located outside the Spill Response Region boundaries as well. While the hazard and susceptibility ratings for these potential contaminant sources are assigned lower that those sites within the Spill Response Region, the community should include such sites in planning and management efforts focused at reducing the source water's susceptibility to contamination. In the event that these sites are located relatively close to tributaries, canals, or ditches, they could pose a significant threat to source water quality.

Land cover within the entire Spill Response Region is agricultural land (45%), grassland (20%), forest land (11%), wetlands (9%), open water, (8%) and urban including residential, commercial, industrial, and transportation land comprises only about 4 to 6% (Figure 12). Table 8 lists cultivated crop landuse by percent for each of the Spill Response Regions and the percent of agricultural land for the Watershed Region is listed below under the Watershed Inventory Results section. Figure 12 shows that the agricultural land is concentrated in the stream valleys and is located within the Spill Response Regions.

The agricultural land is located largely north-northwest of the Yellowstone River in upland areas that contribute runoff and irrigation return flow (Figure 12). Significant but aerially less extensive areas of agricultural land are located south of the Yellowstone River. Agricultural land is considered to be a significant potential contaminant source when it is located within the Spill Response Region or the Watershed Region. Over application of fertilizers and/or pesticides can result in those agricultural chemicals infiltrating into ground water and running off in to surface water bodies that may have hydraulic connection with aquifers that supply water. Based on the Source Water Protection Program criteria, the agricultural land poses a moderate hazard to the three PWSs through non-point discharges to the Yellowstone River both by surface and ground water (Tables 6 and 7). Nitrates and pathogens and additional agricultural chemicals used on the land could enter the Yellowstone River via surface water runoff, irrigation return flow, and the Clarks Fork of the Yellowstone River. The confluence of the Clarks Fork is located downstream of the Laurel water treatment plant intake. The headwaters of the Clarks Fork River are in the Wyoming Shoshone National Forest and primary flows through agricultural land use areas. Potential contaminants could also leach into area ground water and then enter the river.

Studies of the Yellowstone River Basin water quality by the U.S. Geological Survey have verified the presences of low concentrations of pesticides and herbicides in the Yellowstone River. The study included water samples from the Billings area out to the gaging station near Sidney. There are plans to expand this study and continue base level monitoring. While concentrations of the ag-chemicals are low, the study does indicate that the use of pesticides and herbicides in the watershed does have the potential to impact the public water supplies using Yellowstone River as their source water. Details on the Yellowstone River Basin Study can be obtained from the USGS web site at: http://wyoming.usgs.gov/YELL/htms/description.htm.

As mentioned previously, the valley has three major refineries along the banks of the Yellowstone River. The Cenex Refinery in Laurel is located immediately upstream of the Laurel WTP intake. The Conoco Inc. Refinery in Billings is located between the Billings Water Treatment Plant and Lockwood Water and Sewer District intakes. East of Lockwood and downstream of the Lockwood Water and Sewer District Water Treatment Plant intake is the Exxon Refinery and Terminal. In the past there have been product releases from the Conoco and Cenex refineries that reached the Yellowstone River. These releases are either remediated or in final stages of remediation and do not pose a threat to the public water supplies.

There are several interconnecting crude and product pipelines between the refineries that are within the Spill

Response Region on the west bank of the river. Also, there are crude oil and product intra- and inter-state transmission pipelines with some that have river crossings. The pipelines range in diameter from 4-inches to 20-inches. Construction and maintenance of the pipelines follows (DOT –CFR 195). There are a number of safety measures and practices to ensure the integrity of the pipelines. Pipelines are constructed with cathodic protection, which includes scheduled station checks. Ultrasonic tests are conducted to measure metal thickness. Pressure tests using water are conducted on 18-year intervals. Sensors for leak detection and pressure are used and linked to satellite control. Also, auto block valves are used to isolate pipeline sections that are activated by sensors. A pipeline failure, depending on the location, could discharge oil product into the Yellowstone River. The volume of the discharge would depend on the pressure, pipeline diameter, length of pipe between valves, and the response time of the safety devices and emergency response personnel. Automated leak detection and emergency response are counted as barriers to reduce the susceptibility of the public water supplies to potential of contamination from the refineries. As mentioned above, additional studies may be advisable where the refineries and pipelines are located relatively close to the River or to tributaries, canals, and ditches that discharge to the River a short distance from the intakes.

While the hazard for contamination is categorized as high for the refineries, the susceptibility is considered moderate due to the safeguards and programs mentioned above that are in place. The three refineries each have Spill Response Plans and also have mutual aid agreements. The CENEX refinery located within 1,500 feet upstream of the Laurel intake has the potential to leach VOC's and hydrocarbons into the Yellowstone River. The plant has a MPDES permit to discharge process water to the river located downstream of the Laurel water treatment plant intake. Off-site storm water runoff is prevented from entering the site by a perimeter berm. The above ground storage tank farm has perimeter containment berms around each tank designed to contain spills. The Conoco refinery is the next downstream facility located below the City of Billing's intake. Above and below ground petroleum product tanks are located throughout the site. The above ground tanks each have perimeter containment berms.

The Exxon refinery is located downstream of the Lockwood Water and Sewer District Water Treatment Plant intake and falls outside the spill response region. As a result the tank farm does not pose a threat to any of the three public water supplies. However, there are interconnecting petroleum product pipelines between the three refineries that are within the Spill Response Region.

The City of Billings owns a railroad spur off the Burlington Northern Railroad line that is used to deliver bulk chemicals to water treatment plant site. A spill during transfer of chemicals to the bulk chemical building storage tanks could flow into the Yellowstone River or could leach into area ground water and then seep into the surface water. The railroad line poses a high hazard to the City of Billings intake.

Underground storage tanks (USTs) and leaking underground storage tanks (LUSTs) are located within the Spill Response Region and may release VOCs to the Yellowstone River. The USTs/LUSTs pose a high hazard to the public water supply intake.

Septic system use continues in portions of the Yellowstone Valley, particularly in the areas west of Billings and on the outskirts of Laurel (Figure 13). Most of the project area has a low septic density with large areas being served by the Billings and Laurel municipal sewer systems. There are areas of moderate and high septic density shown on the maps just east of Billings, near the confluence of Blue Creek with the Yellowstone, in the Canyon Creek Spill Response Region, and near Laurel (Figure 13). High and moderate septic density areas west and southwest of Billings occur in areas that are drained by Canyon Creek, as well as several ditches and canals that discharge into the Yellowstone River. Future management of this potential contaminant source could include the extension of city sewer west of its current limit. Overall, septic system densities within the valley pose a moderate hazard.

Inventory Results/Watershed Region

The inventory within the Watershed Region is used to identify large facilities and general sources of pathogens and nitrate. Hazard and susceptibility ratings are not assigned to each significant potential contaminant source within the Watershed Region because it is assumed that dilution and distance reduce the hazard posed by these sites to the source water. Figure 14 shows the inventory results within the Watershed Region. The figure shows that the majority of the potential contaminant sources are located near the major cities in the region and that most of the Watershed Region is quite rural and undeveloped. Oil and gas test wells and producing wells are present within the region, particularly south and east of Laurel (Figure 14). Petroleum pipelines and transportation corridors are present throughout the region and are of concern primarily because they are often located near the Yellowstone River and its tributaries. Pipelines, roads, and railroads cross the Yellowstone and its tributaries at multiple locations throughout the region and represent a potentially serious threat to the source water used by the public water supplies in the Watershed Region.

Confined animal feeding operations (CAFOs) are also present within the Watershed Region, and some are relatively close to waterways that discharge into the Yellowstone River. However, Figure 14 shows that CAFOs located upstream from the public water supply intakes are in the more distal portions of the region.

Land use within the Watershed Region consists mainly of grasslands at 52%, agricultural land at 36%, 5% commercial and low density residential, and 5% forest (Figure 15). Table 5 lists the significant potential contaminant sources located within the Watershed Region and Figure # shows the location of the sites identified in the inventory. Large-scale planning and management efforts like the Montana DEQ Total Maximum Daily Load (TMDL) program and other watershed-level groups and organizations can play a major role in helping to manage and reduce the susceptibility of the source water to potential contaminants located throughout the watershed. Multiple groups are active in the Yellowstone watershed and public water supply operators and community leaders can work with the groups to supplement on-going efforts to maintain and improve source water quality.

Table 5 – Significant potential contaminant sources in the Project Watershed Region.

Potential Contaminant Sources	Map ID	Contaminants	Hazard
Agricultural Land	Figure 14 & 15	SOCs, Nitrate and pathogens	Enter river via surface water runoff or irrigation return flows
Landfills	Figure 14 & 15	VOCs, nitrates, pathogens, metals	Contaminated ground water discharging to surface water
Gravel Pits/ Mines	Figure 14 & 15	VOCs, nitrates, metals	Interaction of contaminated ground water with surface water
Ground-water Remediation Site	Figure 14 & 15	VOCs, nitrates	Contaminated ground water discharging to surface water
Highways and Railroads	Figure 14 & 15	VOCs, SOCs, Nitrates and pathogens	Accidents, leaks, and spills directly into surface water bodies or infiltration into ground water hydraulically connected to surface water
Oil and Gas Test and Production Wells	Figure 14 & 15	VOCs, petroleum product, saline formation wastewater	Release via improperly abandoned wells, faulty constructions, failing packers, and improper disposal of waste formation water
Petroleum Pipelines and Refineries	Figure 14 & 15	VOCs, petroleum product	Leaks, and spills directly into surface water bodies or infiltration into ground water hydraulically connected to surface water
Regulated Toxic Release Sites	Figure 14 & 15	Variety of materials	Releases to air adjacent surface water bodies or from disposal ponds.
Septic Systems	Figure 14 & 15	Nitrates and pathogens	Effluent discharging directly to river or via contaminated ground water
Superfund Sites	Figure 14 & 15	VOCs, SOCs, metals, TDS	Seepage of VOCs directly into river or via interaction of contaminated ground water with surface water
UST/LUSTs	Figure 14 & 15	VOCs, petroleum product,	Seepage of VOCs directly into river or via interaction of contaminated ground water with surface water
Wastewater Discharges	Figure 14 & 15	VOCs, nitrates, pathogens metals	Effluent discharging directly to river
Storm Water Outfalls	Figure 14 & 15	VOCs, nitrates, pathogens metals	Effluent discharging directly to river

Inventory Update

To make this SWDAR a useful document in the years to come, the certified water system operator(s) for the public water supply should update the inventory for their records every 3 to 5 years. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ at least every 5 years to ensure that this report/plan stays current in the public record. It is very important for the Public Water Supplies operators, community leaders, and citizens work to improve and update the inventory in this report. The communities are in the best position to address the limitations of the present inventory that are mentioned below.

Inventory Limitations

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data readily available through state documents, published reports, and other public sources. Documentation is not readily available on some potential sources. The status of remediation efforts at some of the sites is also not readily available. As a result, all potential contaminant sources may not have been identified and in some cases, assumptions are made as to the status of remediation efforts and the

effectiveness of some barriers. In some instances, inadequate location information precluded the inclusion of potential sources in the inventory.

CHAPTER 4 - SUSCEPTIBILITY ASSESSMENT

Susceptibility of the source water is determined by two factors: the potential of a contaminant reaching the intake and the resulting health hazard. Susceptibility is assessed in order to prioritize potential pollutant sources in the spill response region in order to guide management actions undertaken by local entities, in this case the public water supplies of Laurel, Billings, and Lockwood.

The goal of source water management is to protect the source water, manage significant potential contaminant sources in the spill response region, and ensure that land use activities in the watershed region pose minimal threats to the source water. Management priorities in the spill response region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the three community public water supply operators and community governments to reduce susceptibility are also included in this section of the report.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will reach the public water supply intake (Table 6). The hazard presented by point sources of contaminants in spill response regions depends on whether contaminants can discharge directly to the Yellowstone River, a tributary, or a tributary canal or storm water ditch. Point source hazard is also dependent on the health affects associated with potential contaminants (Table 7). Hazard ratings for nonpoint sources are assigned based on criteria listed in Table 7 for septic systems, sanitary sewers, and cropped agricultural land. Barriers can be anything that decreases the likelihood that contaminated water will reach a public water supply intake. Examples of barriers include: a vegetated riparian area, protective forest management practices, and dilution.

Table 6 - 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

Table 7 - 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 are presented individually for each significant potential contaminant source (Table 8). Figure 6, Figure 7, Figure 8, and Figure 9 show the inventory results for each of the Spill Response Regions and the Watershed Region. Numbers appearing next to a potential contaminant site correspond to the Map Identification Number listed in Table 8.

Table 8 - Susceptibility Assessment Significant Potential Contaminant Sources in the Spill Response Regions

Spill Response Region Name **Table Page Number**

Table 8 displays the susceptibility assessment results for each Spill Response Region delineated for Billings Lockwood, Hogan's Slough, Canyon Creek, and Laurel. The intakes are susceptible to a number of different contaminants including sediments, nitrates, pathogens, agricultural chemicals, petroleum products, solvents, and total dissolved solids. Of all of the significant potential contaminant sources listed in Table 8, only a few are discussed below due to the concern that these potential sources under certain conditions could pose a serious threat to the source water and the public water supplies. Blue Creek's Spill Response Region is not included in the discussion below or included in Table 8 because the only potential contaminant sources present there are several limited areas of high and moderate septic density.

Petroleum pipelines – As mentioned previously the pipelines are considered to represent a serious potential threat to the source water in the project area because substantial lengths of pipeline are located adjacent the Yellowstone River and cross the River, tributaries, canals and ditches at multiple locations. In addition, the pipelines carry large volumes of product and could result in large releases in the event that an accident or leak is not stopped in a short time frame. Hazard is ranked high because spills could occur directly into surface water. Susceptibility is set at moderate with multiple barriers identified for many of the pipelines. Barriers include city and county emergency response, industry emergency response, dilution related to the Yellowstone Rivers relatively large year-round discharge, and pipeline inspections and leak detection technology used on the pipelines. It is noted in this report that where the pipelines and crossings are located relatively close to the intakes, the possibility exists that the barriers mentioned may not be as effective and at some of these locations it is reasonable to assign a high susceptibility rating. It would be prudent for the communities to undertake or sponsor additional studies of the pipeline crossings that are close to the intakes to more clearly understand and define the hazard they may pose to the public water supplies and to the source water. The same is true of the railroad and highway crossings mentioned below.

Active Railroads – Railroads are also considered to pose a serious potential threat to the source water and public water supplies in the project area due to the fact that trains can carry relatively large volumes of hazardous materials and because the lines are located adjacent the Yellowstone River and cross the River, tributaries, canals and ditches at multiple locations. Hazard is ranked high because spills could occur directly into surface water. The susceptibility is ranked from moderate to high depending on the location of the rail line and crossings relative to the intakes.

Transportation Routes- Although the volumes of hazardous material hauled by truck-trailer and semi-trucks are smaller than those transported by trains or the petroleum pipelines, the transportation routes a considered to be a serious potential threat to the source water and public water supplies. Hazard is ranked high because hazardous material spill could enter directly into the river at bridge crossings. The susceptibility is moderate to high depending on the location of the crossings relative to the intakes.

Irrigation canals and storm water collection ditches – There are a number of stream, canals and ditches that flow through the area and discharge indirectly or directly into the Yellowstone River. The fact that some of the irrigation canals apparently collect storm water runoff raises the possibility that they could transport contaminants to the Yellowstone River up-stream from the intakes. It is also common that streams, canals and ditches lose water through their channel base and sides in some reaches thus providing recharge to the shallow ground water system. This raises the possibility that storm water could have a negative impact on ground water quality. Drainage ditches and drains intercept ground water in many areas of the valley and ultimately discharge the ground water into the river. The intercepted ground water can have higher nitrate and total dissolved solids than the Yellowstone River water. However, the volume of ground water discharged directly into the Yellowstone River or intercepted by the drains is estimated to be small compared to the average flow in the river. The impact to the river appears to be minimal. As mentioned above, petroleum pipelines, railroads, and highways cross some of the canals close to where they discharge into the Yellowstone. Hazard ratings for these canals ranges from low for the Laurel to moderate

for Billings and Lockwood. Susceptibility is rated from low for Laurel to moderate for Billings and Lockwood. It would be prudent for the communities to undertake or sponsor additional studies of the storm water – canal interconnections to more clearly understand and define the hazard they may pose to the public water supplies and to the source water.

Agricultural land – Based on the amount of ag-land within the Spill Response Regions, hazard is ranked low for Lockwood, moderate for Billings, and moderate to high for Laurel. Dilution and distance from the intakes is applied as a barrier resulting in a moderate to high susceptibility rating. The low concentrations of herbicides have been documented in the Yellowstone River by the USGS study mentioned previously. The study's results could indicate several possibilities including: 1) the agricultural chemicals are being used and applied appropriately so as to minimize the impact to the river, 2) the agricultural chemicals are beginning to impact the river water quality and may increase in concentration over time or seasonally, or 3) the relatively large year-round discharge of the Yellowstone River is capable of diluting the concentration of the agricultural chemicals. Other interpretations are possible but additional studies will be needed to help determine where the chemicals are coming from, how they get into the river, and if there are seasonal or long-term trends in concentration. While the term "agricultural chemicals" is being used in this report, it is important on understand that use of these chemicals is not restricted to agricultural land. Urban and suburban areas within the watershed or in the study area could also be contributing these chemicals to the river. It is advisable for the communities to be aware of additional studies of Yellowstone River water quality and to participate in watershed-level groups actively engaged in monitoring and promoting studies on the Yellowstone River.

USTs/LUSTs – Hazard for individual sites ranges from low to moderate based on the location within the Spill Response Region, proximity to a canal, ditch or tributary to the Yellowstone, and the leak history. Susceptibility ranges from low to moderate for most tank sites with a leak history and low for many of the other locations.

State Superfund sites – There are multiple state superfund sites in the project area. For some of these sites it is difficult to determine if remediation efforts are complete and it is important for the communities within the project area to verify remediation completion or to press for efforts to continue clean up and monitoring. Hazard is ranked moderate and susceptibility is rated as moderate to high depending on whether remediation is ongoing or incomplete.

Hazardous Spill sites / Ground-water Remediation Program sites– Like the superfund sites, there are multiple hazardous spill sites in the project area. Verifying the completion of remediation is difficult and the communities should verify the status of these sites. Hazard ranges from low to high and susceptibility ranges from moderate to high. It is unclear whether releases at some of these sites were restricted to ground water or whether releases were to surface water bodies.

Municipal Wastewater Treatment Plants – Laurel and Billings have wastewater treatment facilities that discharge to the Yellowstone. The Laurel facility is located near the State Highway 212 bridge (Figure 11). The Billings facility is located about downstream from the Lockwood Intake. Both facilities are regulated and appear to be operating within the requirements of their permits. Hazard is assigned as low and susceptibility is also low with the downstream location counting as a barrier for the Billings plant and distance and dilution counted as a barrier of the Laurel plant.

Class V Injection Wells – Hazard has not been ranked because the location and quantity of Class V Injection Wells in project area is unknown. They have been identified in this report because they have the potential to either discharge directly into the river or via ground-water and surface water interaction. The susceptibility is also unknown at this time. Communities can request the U.S. EPA to conduct an inventory

of Class V Injection Wells and this would help determine the hazard they may pose to the source water.

Management Recommendations

Management recommendations are included in the Table 8. If these management or additional recommendations are implemented, they may be considered additional barriers that will reduce the susceptibility of three public water supplies to specific sources and contaminants.

Management recommendations fall into the following categories:

Emergency Response Plan. Existing plans should be periodically revised and with the review of this report, could be revised to add or increase the emphasis on source water protection. 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.

Growth and development planning. Several areas within the project area are experiencing rapid growth and development. It would be advisable to encourage growth and development in areas that would not pose a threat to source water, that is, in areas that are outside of the Spill Response Region and away from tributaries, canals and ditches. Ground-water flow direction in these areas should also be taken into account.

Sewer maintenance and leak detection. Early leak detection and scheduled replacement of older sewer lines will reduce the susceptibility of the intakes 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.

Long-term Infrastructural Planning – A component of a 10 or 20-year plan for the Billings Public Water Supply could be to construct a new surface water intake some distance upstream of the City of Laurel. This would move the intake upstream and away from a large number of potential contaminant sources associated with urban, suburban, and industrialized areas near the present intake location.

CHAPTER 5 - MONITORING WAIVERS

Waiver Recommendation

Based on the general inventory of the project area, the Source Water Protection Program does not recommend water quality waivers for any these public water supplies. The substantial number and diversity of potential contaminant sources within and outside of the Spill Response Regions indicates that monitoring waivers are not advisable. It is important to recognize that based on past monitoring results it appears that the water treatment measures used by all of the Public Water Supplies are effective and result in the ability to deliver high quality water for customers. However, continued monitoring will provide the Public Water Supplies with a first line of defense in identifying and responding to changes in source water quality.

In short, the susceptibility assessment of the intakes suggests that the Public Water Supplies may not be eligible for monitoring waivers, however, to be sure that eligibility for all available waivers is considered, the operators are encouraged to carefully review the following section on Monitoring Waiver Requirements. If after reviewing this section it is determined that an additional waivers are feasible, the operators should submit a letter with the proper documentation to DEQ requesting 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 ground-water 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 ground water and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include well logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; Time-of-Travel or attenuation studies; vulnerability mapping; and the use of computerized ground-water 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.

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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.

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

LWSD. Lockwood Water and Sewer District

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. ground water 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.

WTP. Water treatment Plant

WWTP. Wastewater Treatment Plant

* 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*)

FIGURES

APPENDICES

APPENDIX A - Potential Contaminant Sources Based On Sic Data

NAME	Standard Industrial Code 1	Standard Industrial Code 2
13th Street Warehouse	Warehouses-Merchandise & Self Storage	#N/A
17th Street Conoco	Service Stations-Gasoline & Oil	Automobile Repairing & Service
2 M Co	Pumps (Wholesale)	Pumps-Manufacturers
3 G's	Convenience Stores	#N/A
3 W's Automotive Repair	Automobile Repairing & Service	#N/A
3-G's Convenience	Convenience Stores	#N/A
3-G's Convenience Ctr	Grocers-Retail	Convenience Stores
3-G's Convenience Ctr	Convenience Stores	#N/A
4 Wheeler Dealer	Auto & Home Supply Stores	#N/A
5 Corners Kwik Stop	Convenience Stores	#N/A
7 K Fabrication & Welding	Welding	#N/A
A & E Architects	Architects	Interior Decorators Design & Consultants
A & E Mini Storage	Storage-Household & Commercial	Business Records & Documents-Storage
A & H Turf & Specialties Inc	Hardware-Retail	Mobile Home Dealers
A & I Distributors	Oils-Lubricating-Wholesale	Mobile Home Dealers
A 1 Yellowstone Sewer	Septic Tanks/Systems-Cleaning/Repairing	Sewer Contractors
A A Small Engine Repair	Lawn Mowers-Sharpening & Repairing	#N/A
A B Dick Co	Printing Equipment (Wholesale)	#N/A
A B Seed & Co	Seeds & Bulbs-Wholesale	#N/A
A Bar B	Business Brokers	#N/A
A C Appraisal Consultants	Real Estate Appraisers	Appraisers
A J Gravel & Trucking	Sand & Gravel (Wholesale)	General Contractors
A No 1 Accredited Batteries	Batteries-Storage-Retail	#N/A
A Plus Electric Motor Repair	Electric Motors-Dlrs/Repairing (Whol)	Bearings-Manufacturers
A Plus Rv & Mini Storage	Storage-Household & Commercial	Warehouses-Merchandise & Self Storage
A To Z Tire	Tire-Dealers-Retail	Tire-Distributors
A-1 Drilling	Automobile Repairing & Service	Special Trade Contractors Nec
A-1 Glenn's Welding/Mach	Welding	Air Conditioning Equipment-Repair
A-1 Mobile Home Svc	Mobile Homes-Repairing & Service	Windows
A-1 Mobile Wash	Truck-Washing & Cleaning	#N/A
A-1 Mobile Wash	Truck-Washing & Cleaning	#N/A
A-1 Pest Control	Pest Control	Bee Removal
A-1 Plus 1 Carpet Care	Carpet & Rug Cleaners	Cleaners-Upholstery
A-1 Vern's Plumbing & Heating	Plumbing Contractors	Heating Contractors
Aaa Antiques Oxford Hotel	Antiques-Dealers	Estates
Aaa Auto Rental	Automobile Renting & Leasing	Auto & Home Supply Stores
Aaa Biegel's Svc	Plumbing Contractors	Heating Contractors
Aaa Mini Storage	Storage-Household & Commercial	Warehouses-Merchandise & Self Storage
Aaa Transmissions	Transmissions-Automobile	Automobile Repairing & Service
A-All Purpose Storage	Storage-Household & Commercial	Warehouses-Merchandise & Self Storage
Aaron's Transport Svc	Trucking	#N/A
Abc Liquidations	Liquidators	Estates
Abco Supply Inc	Heating Equipment & Systems (Wholesale)	Controls Control Systs/Regulators (Whol)
Abell Hobby & Mfg	Hobby & Model Constr Supplies-Mfrs	Hobby & Model Constr Supplies-Wholesale
Abf Freight System Inc	Trucking-Motor Freight	Trucking
Accu-Count Inventory Svc	Inventory Service	#N/A
Accurate Dental Laboratory Inc	Laboratories-Dental	#N/A
Ace Lowe Rent-A-Car	Automobile Renting & Leasing	#N/A
Ace Storage Ctr	Storage-Household & Commercial	Recreational Vehicles-Storage
Aces All Color Embroidery	Embroidery	Monograms
Acme Towing Svc	Wrecker Service	#N/A
Acorn Plumbing & Heating	Heating Contractors	Plumbing Contractors
Action Medical Corp	Metals Service Centers & Offices	Metals Service Centers & Offices
Active Auto	Auto & Home Supply Stores	Auto & Home Supply Stores
Ad Smith Petroleum Meters	Meters (Wholesale)	#N/A
Ade Real Estate Appraisers Inc	Real Estate Appraisers	Appraisers
Adriane's Portrait Designs	Photographers-Portrait	Wedding Supplies & Services
Adt Security Svc Inc	Security Control Equip & Systems-Whol	Burglar Alarm Systems (Wholesale)
Adt/Pro Pump & Equipment	Special Trade Contractors Nec	Pumps (Wholesale)
Advanced Hearing Aid Ctr	Hearing Aids	#N/A
Advanced Hydraulic Cylinder R	Contractors-Equipment & Supls-Repair	Cylinders-Air & Hydraulic (Wholesale)
Advanced Radon Systems	Radon Testing & Correction	#N/A
Advanced Sprinkler Designs	Mobile Home Dealers	#N/A
Advantage Line	Telemarketing Services	#N/A
Advantage Machine & Tool	Machine Tools (Wholesale)	#N/A
Adventure Scuba	Diving Instruction	#N/A
Affordable Heating & Air Cond	Air Conditioning Contractors & Systems	Mobile Homes-Repairing & Service
Ag Express	Trucking	#N/A
Agri Systems	Fabricated Structural Metal (Mfrs)	Feed Mill Equipment & Supplies (Mfrs)
Aikido Of Billings	Martial Arts Instruction	#N/A
Air Products & Chemicals Inc	Chemicals (Wholesale)	#N/A
Airliquide America Inc	Gas-Indstrl/Med-Cylinder & Bulk (Whol)	Welding Equipment & Supplies (Wholesale)
Airpage	Telephone Answering Service	Radio Paging/Signaling Eqpt Systs (Whol)

NAME	Standard Industrial Code 1	Standard Industrial Code 2
Culligan Water Conditioning	Water Softening Equipment Svc & Supls	Salt
Culligan Water Conditioning	Water Companies-Bottled	Hot Tubs & Spas
Cummins Rocky Mountain Inc	Truck-Repairing & Service	Engines-Diesel (Wholesale)
Custom Auto Repair	Automobile Repairing & Service	Automobile Air Conditioning Equipment
Custom Auto Sales	Auto & Home Supply Stores	#N/A
Custom Commercial Svc	Restaurant Equipment-Repairing & Svc	Air Conditioning Contractors & Systems
Custom Sprinkler Svc	Mobile Home Dealers	Landscape Contractors
Cutting Edge Sharpening Svc	Sharpening Service	Saws-Sharpening & Repairing
Cyclery	Bicycles-Repairing	#N/A
Cy-Corp Trailer	Optical Instruments & Lenses	Trailer Hitches
D & D Automotive	Auto & Home Supply Stores	#N/A
D & D Transport Refrigeration	Truck Refrigeration Equipment (Whol)	Trailers-Repairing & Service
D & H Spring Machine & Welding	Machine Shops	Springs-Coil
D & L Construction	General Contractors	#N/A
D & L Lock & Key Svc	Locks & Locksmiths	Keys
D & M Svc	Process Servers	#N/A
D & P Enterprises	Motion Picture & Tape Distribution	#N/A
D & R Fire & Safety Equipment	Fire Department Equipment & Supls (Whol)	Fire Extinguishers (Wholesale)
Dae Myung Tendokan Judo	Martial Arts Instruction	Karate Judo Jiu-Jitsu & Kung Fu Instr
Dahl Funeral Chapels	Funeral Directors	Funeral Plans (Pre-Arranged)
Dale & Jax Door & Glass Inc	Door & Gate Operating Devices	Glass-Auto Plate & Window & Etc
Dana Motors Saab Volkswagen	Auto & Home Supply Stores	Automobile Renting & Leasing
Dana Saab	Auto & Home Supply Stores	#N/A
Dance Factory	Dancing Instruction	Gymnastic Instruction
Dancing Oven Bakery	Wedding Supplies & Services	#N/A
Danette's Pet Grooming	Pet Washing & Grooming	Pet Services
Dan's Body Shop	Automobile Body-Repairing & Painting	#N/A
Dan's Detail	Automobile Detail & Clean-Up Service	#N/A
Darby's Professional Pest	Pest Control	#N/A
Darcova Inc	Gaskets-Manufacturers	Gaskets (Wholesale)
Data Designs	Designers	#N/A
Data Imaging Systems	Scanning Service	Microfilming Service Equipment & Supls
Dave's Garage	Automobile Repairing & Service	#N/A
Dave's Machine	Machine Shops	#N/A
David Cunningham Construction	General Contractors	#N/A
Davidson Home Furnishings Ltd	Furniture-Dealers-Retail	Interior Decorators Design & Consultants
De Mint Motor Co	Auto & Home Supply Stores	#N/A
Deaconess Billings Clinic	Hospitals	Physical Therapists
Deaconess Billings Clinic	Clinics	Optometrists Od
Deaconess Billings Clinic	Hospitals	Physicians & Surgeons
Deaconess Billings Clinic	Hospitals	Physicians & Surgeons
Deaconess Billings Clinic Home	Metals Service Centers & Offices	Metals Service Centers & Offices
Deaconess-Health Ctr	Clinics	Hospitals
Deck The Walls	Picture Frames-Dealers	Art Galleries & Dealers
Decker Music Svc	Musical Instruments-Repairing	Musical Instruments-Dealers
Denmar	Computer Software	Microfilming Service Equipment & Supls
Denny Menholt Frontier	Auto & Home Supply Stores	Auto & Home Supply Stores
Denny Menholt Frontier Chev	Auto & Home Supply Stores	Automobile Parts & Supplies-Retail-New
Dent Works	Automobile Body-Repairing & Painting	#N/A
Deutz Diesel Engines	Engines-Diesel (Wholesale)	#N/A
Dew Drop Sprinkler Systems	Mobile Home Dealers	#N/A
Diamond Parking Svc	Parking Stations & Garages	#N/A
Diamond Truck Detailing	Truck-Washing & Cleaning	#N/A
Dick's 24th St Conoco	Service Stations-Gasoline & Oil	Automobile Repairing & Service
Dick's Project Meat Svc	Sausage & Other Prepared Meat Products	Butchering
Dietz Auto & Truck Salvage Inc	Automobile Parts-Used & Rebuilt (Whol)	Truck Equipment & Parts-Used & Rebuilt
Dignity Orthotics Plus	Hearing Aids	#N/A
Dillon Sprinkler Svc	Mobile Home Dealers	#N/A
Discovery Publishing	Books-Publishing & Printing	#N/A
Dismas Pumps	Pumps & Pumping Equipment (Mfrs)	Paints Varnishes Lacquers & Enamels
Ditch Witch Of Montana	Contractors-Equip/Supls-Dlrs/Svc (Whol)	Mobile Home Dealers
Diversified Transfer & Storage	Trucking-Motor Freight	General Warehousing & Storage
Dixon Brothers Inc	Trucking-Liquid & Dry Bulk	#N/A
Doc's Speed & Custom	Motorcycles & Motor Scooters-Rpr & Svc	#N/A
Dollar Rent A Car	Automobile Renting & Leasing	#N/A
Don Charleson Realty	Business Brokers	Real Estate Investments
Don Wicker's Body Shop	Automobile Body-Repairing & Painting	#N/A
Don's Car Wash	Car Washing & Polishing	Service Stations-Gasoline & Oil
Don's Car Wash	Car Washing & Polishing	Service Stations-Gasoline & Oil
Don's Car Wash	Car Washing & Polishing	Service Stations-Gasoline & Oil
Don's Xpress Lube	Automobile Lubrication Service	#N/A
Donut Hole	Doughnuts	Wedding Supplies & Services
Dove's Transportation Inc	Trucking-Contract Hauling	#N/A

NAME	Standard Industrial Code 1	Standard Industrial Code 2
Lockwood Primary School	Schools	#N/A
Lockwood Schools Admn Office	Schools	#N/A
Locomotive Inn	Motels & Hotels Reservations	#N/A
Lohrenz Enterprises Inc	Auctioneers	#N/A
Lomco Inc	Trucking-Liquid & Dry Bulk	Road Oiling
Lone Wolf Certified Home Build	Home Builders	Real Estate Inspection
Lone Wolf Photo Express	Business Services Nec	Business Services Nec
Longhorn Auction Co	Auctioneers	Estates
Lon's Lawn Svc	Lawn & Grounds Maintenance	#N/A
Los Guys Lawn Svc	Lawn & Grounds Maintenance	#N/A
Louie's & Dean's Montana Truck	Automobile Parts-Used & Rebuilt (Whol)	Truck Equipment & Parts-Used & Rebuilt
Lube Center	Automobile Lubrication Service	#N/A
Lynch Motorcycle Salvage	Motorcycles & Motor Scooters-Rpr & Svc	Motorcycles & Motor Scooters-Supplies
Lynn Scheeler Photography	Photographers-Portrait	Photographers-Commercial
Lystad's Janitorial Products	Janitors Supplies (Wholesale)	Janitors Equipment & Supplies-Mfrs
M & M Firewood	Florists	#N/A
M & M Mufflers	Automotive Glass Replacement Shops	Automobile Racing Car Equipment
M P & E Rental & Supply	Rental Service-Stores & Yards	Contractors-Equip/Supls-Dlrs/Svc (Whol)
M W Mc Coy Cattle Co	Livestock Buyers	#N/A
Maaco Auto Painting & Bodywork	Automobile Body-Repairing & Painting	Automobile Repairing & Service
Mackay Appraisal Svc	Real Estate Appraisers	Appraisers
Maclean Trucking Inc	Trucking	Trucking-Liquid & Dry Bulk
Mad Mac's Auto Inc	Auto & Home Supply Stores	#N/A
Madsen Door Svc Inc	Doors-Garage	Doors-Repairing
Magic Carpet Recreational Ctr	Recreational Vehicles	Trailers-Camping & Travel
Magic City Glass	Glass-Auto Plate & Window & Etc	Notaries-Public
Magic City Lawn & Landscape	Mobile Home Dealers	Landscape Contractors
Magic City Periodicals	Telemarketing Services	#N/A
Magic City Plumbing & Heating	Plumbing Contractors	Water Heaters-Dealers
Magic City Repair Refinishing	Automobile Body-Repairing & Painting	Glass-Auto Plate & Window & Etc
Magic City Welding	Welding	Aluminum Fabricators
Magtrac Bolus	Livestock Equipment & Supplies (Whol)	#N/A
Mail Boxes Etc	Packaging Service	Photocopying & Duplicating Services
Mail Drop	Photocopying & Duplicating Services	Notaries-Public
Mail Room	Photocopying & Duplicating Services	Refuse Systems
Main Street Efx Photography	Photographers-Portrait	Photographers-Commercial
Main Street Printers	Printers	Wedding Announcements & Invitations
Main Street Storage	Storage-Household & Commercial	#N/A
Market Basket	Convenience Stores	#N/A
Marketing Specialties	Service Station Equipment (Wholesale)	Pumps (Wholesale)
Martial Arts Academy-Billings	Martial Arts Instruction	#N/A
Mary Kay Cosmetics	Cosmetics & Perfumes-Retail	#N/A
Mary Kay Cosmetics	Cosmetics & Perfumes-Retail	Skin Treatments
Mary Kay Cosmetics	Cosmetics & Perfumes-Retail	#N/A
Mary Kay Cosmetics	Cosmetics & Perfumes-Retail	Cosmetics-Wholesale
Mary Sue Gunnufson Design	Interior Decorators Design & Consultants	#N/A
Master Lube	Automobile Lubrication Service	#N/A
Master Lube	Automobile Lubrication Service	#N/A
Master Lube	Automobile Lubrication Service	#N/A
Master Lube	Automobile Lubrication Service	#N/A
Master Movers Inc	Mobile Homes-Transporting	#N/A
Masterlube	Automobile Lubrication Service	#N/A
Mat & Frame Shop	Picture Frames-Dealers	#N/A
Maxim Technologies Inc	Engineers-Consulting	Laboratories-Testing
Maximum Security Storage	Storage-Household & Commercial	Recreational Vehicles-Storage
Mayes Drilling Inc	Special Trade Contractors Nec	Automobile Repairing & Service
Mayfair Auction	Schools	Auctioneers
Mayflower Transit Co	Movers	Storage-Household & Commercial
Mc Call Aquatech Pool & Patio	Swimming Pool Contrs Dealers & Designers	Furniture-Outdoor
Mc Clelland & Assoc	Attorneys	Arbitration Services
Mc Donald North American	Junior Colleges & Technical Institutes	Movers
Mc Dowall Agency	Lighting Fixtures-Wholesale	#N/A
Mc Junkin Corp	Valves-Wholesale	Pipe (Wholesale)
Mc Kell Brothers Hauling	Movers	#N/A
Mc Kinley Elementary School	Schools	#N/A
Mc Tech Dental Lab	Laboratories-Dental	#N/A
Meadow Green Lawn Svc	Lawn & Grounds Maintenance	Weed Control Service
Meadow Lark Agency	Trucking-Motor Freight	Trucking-Transportation Brokers
Meadowlark Elementary	Schools	#N/A
Meadowlark Gallery & Frame	Art Galleries & Dealers	#N/A
Mechanical Technology Inc	Controls Control Systs/Regulators (Whol)	Boilers-Repairing & Cleaning
Mega Mini Storage	Storage-Household & Commercial	Recreational Vehicles-Storage
Memorable Occasions	Bakers-Retail	Wedding Supplies & Services

NAME	Standard Industrial Code 1	Standard Industrial Code 2
Signs Now	Signs (Manufacturers)	Banners
Silent Knight Custom Exhuast	Automobile Repairing & Service	Automotive Glass Replacement Shops
Silver Eagle Shuttle Svc	Buses-Charter & Rental	#N/A
Silver Hill	Florists-Retail	Antiques-Dealers
Silver Tip Taxidermy	Taxidermists	#N/A
Sims Stoves	Stoves-Wood Coal Etc-Manufacturers	Camping Equipment
Six Robblees' Inc	Trailers-Equipment & Parts	Wheels & Wheel Covers
Skate City	Skating Rinks	#N/A
Skate World	Skating Rinks	Membership Sports & Recreation Clubs
Skate World West	Skating Rinks	Skating Equipment & Supplies
Ski Station	Skiing Equipment-Rental	Snowboards-Retail
Skyview High School	Schools	#N/A
Smith Funeral Chapel	Funeral Directors	Funeral Plans (Pre-Arranged)
Smith Funeral Chapel-Laurel	Funeral Directors	Funeral Plans (Pre-Arranged)
Smith Funeral Chapels	Funeral Directors	Crematories
Smiths Food & Drug	Grocers-Retail	#N/A
Smith's Food & Drug Ctr	Grocers-Retail	#N/A
Soco Marketing	Petroleum Products (Wholesale)	#N/A
Soelter Auto Sales	Auto & Home Supply Stores	#N/A
Soft Touch Automatic Car Wash	Car Washing & Polishing	#N/A
Sorlie Trucking Inc	Trucking	Trucking-Liquid & Dry Bulk
Sos	Automotive Glass Replacement Shops	#N/A
Sott Homes	General Contractors	#N/A
South Elementary K-5 School	Schools	#N/A
South Elementary School	Schools	#N/A
Southgate Mini Storage	Storage-Household & Commercial	#N/A
Spanish Interpreting Svc	Translators & Interpreters	#N/A
Specialized Construction	General Contractors-Residential Bldgs	#N/A
Specialized Construction	Home Builders	#N/A
Specially For You	Photographers-Portrait	#N/A
Specialty Piping	Sprinklers-Automatic-Fire (Wholesale)	#N/A
Speedometer & Auto Electric	Automobile Repairing & Service	Automobile Air Conditioning Equipment
Spf Stores	Convenience Stores	#N/A
Spoke Shop	Bicycles-Dealers	Bicycles-Repairing
Sports Dome	General Merchandise-Retail	Baseball Sports Cards & Memorabilia
Sprocket's Machine & Welding	Machine Shops	Welding
St Francis Intermediate	Schools	#N/A
St Francis Primary School	Schools	Schools-Nursery & Kindergarten Academic
St Francis Upper School	Schools	#N/A
St Francis West Day Care	Child Care Service	Schools
St Vincent Healthcare	Hospitals	#N/A
St Vincent Healthcare-Lab Med	Laboratories-Medical	#N/A
St Vincent Hospital	Hospitals	Nursing & Convalescent Homes
St Vincents Hospital	Hospitals	#N/A
Stagecoach Ranch Rv & Mini	Storage-Household & Commercial	Recreational Vehicles-Storage
Stainless Steel Specialties Co	Stainless Steel (Manufacturers)	Sheet Metal Fabricators
Staley's Tire & Automotive Inc	Automobile Repairing & Service	Tire-Dealers-Retail
Staley's Tire & Automotive Inc	Tire-Dealers-Retail	Automobile Repairing & Service
Staley's Used Tire Store	Tire-Dealers-Retail	#N/A
Standard Porcelain Refinishing	Bathtubs & Sinks-Repairing & Refinishing	Porcelain Enamel-Repairing/Refinishing
Starlite Roller Rink	Skating Rinks	#N/A
Starter Alternator Specialists	Starters-Engine	Automobile Electric Service
State Avenue Iga	Grocers-Retail	Bakers-Retail
Staudinger's Inc	Wire Springs	Springs-Coil
Ste Von's Landscape	Landscape Contractors	Mobile Home Dealers
Stebbins Trucking Inc	Trucking	#N/A
Steel Etc	Hardware-Retail	Automobile Parts & Supplies-Retail-New
Steffes Auction & Appraisal	Auctioneers	Appraisers
Steffes Auto Sales	Auto & Home Supply Stores	#N/A
Steiner Transport & Leasing	Refuse Systems	#N/A
Steorts Garage Doors	Doors-Repairing	#N/A
Step'n Out	Formal Wear-Rental	Wedding Supplies & Services
Steve Nelson Trucking Inc	Trucking-Heavy Hauling	Livestock Hauling
Stevens Door & Specialty Co	Door & Gate Operating Devices	Doors-Garage
Stevens Fire Protection Svc	Fire Protection Equipment & Supls (Whol)	#N/A
Steve's Auto Sales	Auto & Home Supply Stores	Auto & Home Supply Stores
Stillwater West	Interior Decorators Design & Consultants	#N/A
Stix Billiards	Billiard Parlors	#N/A
Stocker Paralegal Svc	Paralegals	#N/A
Stockton Oil Co	Oils-Lubricating-Wholesale	Automobile Parts & Supplies-Wholesale
Storage Place	Storage-Household & Commercial	Warehouses-Merchandise & Self Storage
Stor-It Mini Warehouses	Storage-Household & Commercial	Warehouses-Merchandise & Self Storage
Stratus Consulting Inc	Business Brokers	#N/A

APPENDIX B – DEQ Water Quality Monitoring Data

Note: The Billings Water Quality Monitoring Report is over 200 pages in length and is not included in this report. Copies of the report can be made available upon request to the DEQ.

APPENDIX C - List of PWSs in the Project Area

List of PWSs in the Project Area

PWS ID	Name	Class	SOURCE NAME	ACTIVITY	SOURCE TYPE	Map ID NUMBER
MT0003408	Albertsons #2021	N	Billings, City of	A	Purchased	1
MT0003931	Albertsons #2026	N	Billings, City of	A	Purchased	2
MT0003380	Albertsons #2027	N	Billings, City of	A	Purchased	3
MT0003409	Albertsons #2030	N	Billings, City of	A	Purchased	4
MT0003650	Albertsons Grand Ave #2041	N	Billings, City of	A	Purchased	5
MT0003552	Aldinger Acres Subdivision	C	NW Well #2	A	Groundwater	6
MT0003552	Aldinger Acres Subdivision	C	NE Well #1	A	Groundwater	
MT0000155	Billings Heights Co Water District	C	Billings, City of	A	Purchased	8
MT0000464	Blains Mobile Home Court	C	Most E Well #1	A	Groundwater	10
MT0000464	Blains Mobile Home Court	C	2nd Most E Well #2	A	Groundwater	
MT0000464	Blains Mobile Home Court	C	2nd Least E Well #3	A	Groundwater	
MT0000464	Blains Mobile Home Court	C	Least E Well #4	A	Groundwater	
MT0001712	Blue Creek School District #3	P	Billings, City of / Fisher Water Service	A	Purchased	14
MT0004093	Blue Grass Water Users Association	C	West Well #1	A	Groundwater	15
MT0004093	Blue Grass Water Users Association	C	East Well #2	A	Groundwater	
MT0001724	Canyon Creek School District #4	P	Boiler Rm Well #1	A	Groundwater	17
MT0000625	Cedar Park Subdivision	C	Yellowstone River	A	Surface Water	18
MT0003654	Cornerstone Community Church	P	Well #1	I	Groundwater	19
MT0004096	County Market #206	N	Billings, City of	A	Purchased	20
MT0004097	County Market #207	N	Billings, City of	A	Purchased	21
MT0004100	County Market #208	N	Billings, City of	A	Purchased	22
MT0003986	Crystal Springs Water System	C	S Well #1	A	Groundwater	23
MT0003986	Crystal Springs Water System	C	N Well #2	A	Groundwater	
MT0003688	Culligan of Billings	C	Billings, City of - Distilled	A	Purchased	25
MT0003688	Culligan of Billings	C	Billings, City of - Purified (Ro)	A	Purchased	
MT0004068	Culligan, Billings Heights	N	Billings, City of - Distilled	A	Purchased	27
MT0004068	Culligan, Billings Heights	N	Billings, City of - Purified (Ro)	A	Purchased	
MT0001786	Duck Creek Mobile Home Park	C	Center Well #2	A	Groundwater	29
MT0001786	Duck Creek Mobile Home Park	C	South Well #3	A	Groundwater	29
MT0001786	Duck Creek Mobile Home Park	C	North Well #1	A	Groundwater	
MT0004089	Elder Grove Elementary School	P	Billings, City of	A	Purchased	32
MT0004089	Elder Grove Elementary School	P	Elementary School Cistern #3	A	Purchased	
MT0003620	Elder Grove School, New Bldg	P	Billings, City of / Fisher Water Service	A	Purchased	32
MT0003620	Elder Grove School, New Bldg	P	New Building Cistern 2	A	Purchased	
MT0001725	Elder Grove School, Old Bldg	P	Billings, City of / Fisher Water Service	A	Purchased	32
MT0001725	Elder Grove School, Old Bldg	P	Old Building Cistern 1	A	Purchased	
MT0001723	Elysian School District #23	P	Well #1	I	Groundwater	38
MT0004017	Emmanuel Baptist Church	N	Well #1	A	Groundwater	39
MT0004140	Evergreen IGA - Sparkling Pure	N	Billings, City of	A	Purchased	40
MT0003107	First Student	N	Well	A	Groundwater	41
MT0001848	Fisher Water Service	C	Billings, City of	A	Purchased	42
MT0002895	Fox Water Service	C	Laurel, City of	A	Purchased	75
MT0002840	Golden Eagle Water Users Association	C	Secondary Well #1	A	Groundwater	43
MT0002840	Golden Eagle Water Users Association	C	Primary Well #3	A	Groundwater	43
MT0004054	Holiday Store #280	N	Billings, City of	A	Purchased	45
MT0003726	Hope Evangelical Church	N	Well #1	A	Groundwater	46
MT0004151	IGA - Sparkling Pure	N	Lockwood W&SD	A	Purchased	47
MT0001754	Laurel Golf Club	N	Well #1	I	Groundwater	76
MT0003955	Little Tykes Academy	P	E Well #1	A	Groundwater	48
MT0004152	Mary's Health Store - Sparkling Pure	N	Billings, City of	A	Purchased	50
MT0004032	Mountain Mudd	N	Billings, City of	A	Purchased	51
MT0004175	Mountain Mudd Water Truck	C	Billings, City of	A	Purchased	52
MT0003164	New Life Assembly Church	N	Well #1	A	Groundwater	53
MT0003697	Pelican Motel	N	Well #1	A	Groundwater	78
MT0003322	Pelican RV Campground	N	Well	A	Groundwater	54
MT0002831	Pelican Truck Plaza	N	Well	A	Groundwater	55
MT0003748	Peter Yegen Jr Golf Club	N	Well #1	A	Groundwater	56
MT0001735	Pioneer School District #41	P	Well #1	A	Groundwater	79
MT0003467	Reliable Water Service	C	Billings, City of	A	Purchased	57
MT0000123	River Grove Estates Trailer Court	C	E Well #1	A	Groundwater	58
MT0000123	River Grove Estates Trailer Court	C	W Well #2	A	Groundwater	
MT0001756	RIVERS EDGE	N	Well No 1	A	Groundwater	80

APPENDIX D – Sanitary Survey

APPENDIX E - Concurrence Letter & Other Correspondence