Town of Rexford
Public Water Supply

PWS ID #MT0000315

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Date of Report: 23 December 2004

Report Prepared For:
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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (called a SWDAR) was prepared under the Federal Safe Drinking Water Act and the Montana Source Water Assessment Plan. The Department of Environmental Quality (DEQ) is ensuring that assessments are completed for all public water systems in Montana. The purpose of these reports is to provide information so that the public water system operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water (i.e., the Inventory Region), an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential contaminant sources pose to the water system. Jeffrey Frank Herrick and Erin Carlson with DEQ's Source Water Protection Program completed this report.

The drinking water for the Town of Rexford public water supply is produced from 3 wells (Grob Lake Well #1, USFS Well #2, and the in-town Town of Rexford Well) located north and east of town, and within Town (see Figure 2, Figure 3, Figure 4, Figure 6, Figure 7, and Figure 8). Based on sanitary surveys, well logs, and the depth of the well, it appears that a confined aquifer is located beneath the Grob Lake Well #1, an unconfined shallow alluvial aquifer probably underlies the USFS Well #2, and a deep unconfined bedrock aquifer underlies the Town of Rexford and its in-town well. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifers (source waters) are considered to have both a low sensitivity (for the Grob Lake and in-town wells) and high sensitivity (for the USFS well) to potential contaminant sources. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Three types of source water protection management regions for the Town of Rexford public water system were mapped as part of this assessment. They are the Control Zones, Inventory Regions, and the Recharge Region. Potential sources of contamination were identified within each of these three region types and the results are as follows:

- The Control Zones were delineated as a 100-foot radius circle around each of the wells and all sources of potential contaminants should be excluded in this region. The goal of management in the Control Zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. No significant potential contaminant sources were noted as being within the Control Zones.
- Since the source water along the Tobacco River probably should be considered unconfined, the Inventory Region for the USFS Well #2 consists of the aquifer around the wellhead and was delineated as a 1-mile radius circle around the wellhead (see Figure 6). The Grob Lake Well #1 appears to be drawing water from a confined aquifer, so the Inventory Region is a 1,000-foot radius circle around the wellhead (also seen on Figure 6). The Inventory Region for the Town of Rexford Well (in-town) was the entire town and the peninsula on which the town was built (Figure 7). The Inventory Regions should all be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. Significant potential contaminant sources that were identified within the Inventory Regions include Highway 37, large capacity septic systems, some agricultural land, the municipal sewer mains located in town, and the towns wastewater lagoons. These potential contaminant sources are listed on Table 6.
- The Recharge Region (the watershed above the Community Center) was mapped and is seen on Figure 8. Most of the potential contaminant sources for the area are all located within or adjacent to the nearby Town of Eureka which is upgradient of Wells #1 and #2 along the Tobacco River.

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried contaminant sources at concentrations that would pose concern. Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the public water supply well intakes. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource. The Town of Rexford supply wells appear to have a high

susceptibility to contamination from spills that may occur along the highway. The town's in-town well has a moderate susceptibility to the municipal wastewater lagoons located west of town. Although the assessment indicated that the PWS wells have a susceptibility to several other potential contaminant sources in the area, the well's susceptibility to these sources was moderate to very low. A discussion of the susceptibility assessment results is presented on Table 10.

The costs associated with contaminated drinking water are high. Developing an approach to protect that drinking water resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issues as they pertain to the quality of your drinking water sources. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Regions) and have identified potential sources of contamination within those areas. In addition, we provide you with recommendations (i.e., Best Management Practices) regarding the proper use and practices associated with some common potential contamination sources. We believe public awareness is a powerful tool for protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality. Refer to the figures within the document to better understand the spatial relationship of the area. The susceptibility of the PWS to the significant potential contaminant sources is discussed on Table 10 and in the Susceptibility Assessment chapter of this report. Overall, there appear to be only a few threats to the production wells.

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INTRODUCTION

This Delineation and Assessment Report was completed by Erin M. Carlson, an intern with Montana Department of Environmental Quality (DEQ) Source Water Protection Program (SWPP) and by Jeffrey Frank Herrick, a hydrogeologist also with DEQ SWPP. This report was prepared for:

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Purpose

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

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

Limitations

This report was prepared to assess threats to the Town of Rexford PWS public water supply, and is based on published information and information obtained from persons familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Town of Rexford public water supply and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of the PWS are identified. Only potential sources of contamination in areas estimated to contribute water to its drinking water source are considered.

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

CHAPTER 1
BACKGROUND

The Community

Rexford is located in northwestern Montana's Lincoln County (Figure 1, Figure 2, Figure 3, and Figure 4). The nearest town is Eureka, which is approximately six miles to the east. The Canadian border is about seven miles north of Rexford. Interestingly, the town has only been in its present location for about thirty years, as the formation of nearby Lake Koocanusa by the flooding of Libby Dam in the 1970s necessitated moving the town from the area now covered by the waters of the lake. According to 2000 United States Census data, Rexford is home to 151 people, and Lincoln County has 18,835 people. According to U.S. Census data, major industries in Lincoln County include educational, health, and social services, retail trade, and manufacturing. Median household income for the county is $26,754.

Geographic Setting

Rexford is found in extreme northwestern Montana's Tobacco Valley, approximately seven miles south of the Canadian border. The town is found on the eastern shore of Lake Koocanusa, a 95-mile long body of water on the Kootenai River that drains the Tobacco River, Pinkham Creek, Big Creek, and many other streams. The area surrounding Rexford is marked by evidence of past glacial activity, as layers of glacial till and many drumlin hills and shallow kettle lakes are found. Evergreen forest covers most of the area, as is common in western Montana. The Purcell Mountains are found to the west of Rexford and Lake Koocanusa, while the steep western face of the Whitefish Range borders the valley to the east. The Salish Mountains bound the valley's southwestern extent.

The major transportation route near Rexford is Montana Highway 37, which runs in an east-direction through the town. Highway 37 joins north-south trending US 93 approximately six miles east of Rexford. A railroad line is found in the area, though recent information suggests that this line is now inactive.

The climate in the Rexford area is typical of many other low-elevation intermontane basins of the northern Rocky Mountains west of the continental divide. Winters are cold, though summers are relatively mild. Average high temperatures in January and July are 29.8° and 76.1° F, respectively, and average low temperatures for the same months are 15.5° and 49.6° F. An average of 14.39 inches of precipitation fall yearly, and snowfall totals 45.9 inches annually.

Table 1. Table of Climatic Data
Eureka Ranger Station, Montana (242827), 6/1/1960 to 3/31/2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	29.8	38.4	48.3	58.8	68.6	76.1	84.7	84.4	72.7	57.3	40.2	30.5	57.5
Average Min. Temperature (F)	15.5	20.6	26.2	32.7	40.1	46.4	49.6	48.4	40.6	32.4	25.8	18.1	33.0
Average Total Precipitation (in.)	1.18	0.77	0.81	0.94	1.78	2.12	1.30	1.07	1.11	0.94	1.19	1.19	14.39
Average Total Snow Fall (in.)	12.7	6.3	5.5	1.2	0.1	0.0	0.0	0.0	0.0	0.4	6.1	13.5	45.9
Average Snow Depth (in.)	4	2	1	0	0	0	0	0	0	0	1	2	1

Source: wrcc@dri.edu

General Description of the Source Water

Glacial features dominate the topography of the Tobacco Basin, which includes the town of Rexford, as well as the town of Eureka and a portion of southern Canada. Hummocky topography is common, except on the Tobacco Plains east of Lake Koocanusa, which are nearly level except for isolated drumlin hills and kettle lakes. One of these kettle lakes, Grob Lake, marks the location of the first well for the town of Rexford (Grob Lake Well #1). This well is relatively deep and likely withdraws water from a fractured bedrock aquifer or from one of many types of sediments put down as the valley filled with debris from the surrounding mountains. The second well is located near the Tobacco River (USFS Well #2). In this area, groundwater generally flows parallel to the river and relatively impermeable glacial tills and/or bedrock bound the alluvial aquifer to the area within the immediate vicinity of the Tobacco River. A third well for the Town of Rexford is located in town (Town of Rexford Well). It is thought that this 3rd well is installed into similar materials as the Grob Lake well.

Some water quality data have been collected in the area by the DEQ TMDL program to determine classification of local major streams and the need for inclusion in the listing of impaired waterways. It appears that most waters in the Kootenai River drainage have received B-1 classification under the Administrative Rules of Montana (17.30.623). According to B-1 classification standards, these waters are suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

It appears that a municipal sewer system services the town of Rexford. Large capacity septic systems likely serve other public water supplies (businesses, housing developments, etc.) in the area. Private septic systems are found in increased density scattered throughout the region. These septic systems will be discussed in greater detail in the hazard and susceptibility section of this report.

The Public Water Supply

The Town of Rexford public water supply serves a resident population of 159 people daily throughout the year. There are 64 active residential service connections. According to the sanitary survey completed in 1998, two wells supply water to the system, though a third well will soon be included in the system, to supplement or replace one or both of the current wells. Currently, the first well, known as Well 1 Grob Lake N (to be called Well #1 or Grob Lake Well in this report), is located 2.5 miles northeast of the town of Rexford. It was completed on July 15, 1970 and extends to 358 feet below ground surface (bgs). Well #1 is screened from 285-294 feet below ground surface (bgs), and also from 304-311 feet bgs. Ten-inch diameter casing that extends to 281 feet bgs; 12-inch diameter casing is

found from 281 feet bgs to the bottom of the well. This well appears to be grouted, though some discrepancy exists as to the depth of grouting. It looks as if the well is grouted to at least 38.9 feet bgs and possibly deeper. The static water level is 110 feet bgs and the pumping water level is 252 feet bgs. Well yield was reported as 82 gallons per minute (gpm).

The second well in the system is known as Well 2 USFS E (to be called Well #2 or USFS Well in this report). It is located two miles east of Rexford and was drilled in 1981. No well log is available for this well, though it is believed to be 95 feet deep. No other information regarding this well is available at this time. A common header, located at the water storage tank near the town's storage reservoir, joins the two wells.

The third well in the system has not yet been assigned a designation for common usage, but showed up on the Montana Bureau of Mines and Geology, Ground Water Information Center site as the Town of Rexford Well. It appears to be located on the north side of the city limits of Rexford and was drilled in 2003. The well log for this well suggests that is 346 feet deep. It appears that the hole has a casing that extends to 322 feet bgs and was grouted to a depth of about 98 feet bgs. No other information regarding this well is available at this time. At the time of writing this SWDAR (December 2004) the well is not on-line and no details concerning how it is to be tied to the distribution system are available. Any information that is provided to DEQ about this new well and updates to the water supply will be added to this report.

Well #1 has a 15-hp submersible pump in the well. This pump has a rated capacity of 100 gpm. Well #2 is also equipped with a submersible pump, and this pump's rated capacity is 30 gpm. The PWS is able to store 150,000 gallons of raw water, equivalent to one day's supply, in a tank 1000 feet south of town on a ridge. An altitude valve located in a vault near the storage reservoir controls this tank's level. The distribution system for the PWS consists mostly of 6-inch A/C pipes, and no treatment measures are employed, though Well #2 appears to be outfitted for chlorination measures.

Table 2. PWS Facilities and Well Information

Town of Rexford PWS (#MT0000315)

Contact Information	**Town of Rexford** **Richard Payton** **P.O. Box 100** **Rexford, MT 59930** **(406) 297-2770**		
PWS Class	Community		
Well/Intake Source Code	WL002 with EP502	WL003 with EP502	Not yet designated
Well/Intake Name	Well 1 Grob Lake N	Well 2 USFS E	Town of Rexford Well (in-town)
Status	Active	Active	Not yet active
Treatment System	None		
Pressure Control Assembly	None		
Distribution System	DS001 Distribution System Active		
Storage Tanks	ST001 Storage Facility 1 Active		

Note: A common header, CH001, joins wells 1 and 2.

Water Quality

Coliform bacteria has been detected in routine and repeat samplings several times during the past five years. No *E. coli* has been detected, though, and only one health advisory has been issued since 1999. Nitrate levels in the past five years have fallen within the range of 0.26-0.46 mg/L, well below the federal maximum regulatory limit. Elevated sulfate levels have been noted, ranging from 21-37 mg/L, but increased levels of other analyses have not been noted. A summary of the information on this system was found in the most recent Sanitary Survey (19xx), which is found in Appendix xxxxxxx and is also found summarized in a printout of the DEQ PWS Database found in Appendix xxxxxxx. Water quality data is also included in the database printout found in Appendix xxxxxxx.

CHAPTER 2
DELINEATION

Delineation Process

The source water protection regions are identified in this chapter. They are the delineated land areas that contribute water to the sources at the Town of Rexford PWS. Three management or source water protection regions are usually identified. These three regions are the Control Zone, Inventory Region, and Recharge Region. The Control Zone, also known as the exclusion zone, is an area at least 100-foot radius around the PWS wellhead, spring collection box, or surface water intake. Human activity in this area can have an immediate impact on water quality by introducing contaminants into the area directly above a well screen or other intake structure. As such, management of this Control Zone is critical to protect a PWS. For groundwater sources, the Inventory Region usually represents the zone of contribution of the well, which can approximate a three-year groundwater time-of-travel distance or a 1-mile radius around a wellhead. The Inventory Region comprising a 1-mile radius circle around a well is often a conservative value that is used either for convenience or when insufficient geologic or hydrogeologic information is available about an area or details are lacking on the construction of a production well. In certain circumstances where a PWS well taps into an aquifer that has been characterized as being confined, the Inventory Region can be limited to an approximate 1,000-foot radius around the wellhead, and the inventory of potential contaminant sources is only completed for those sources within 1,000-feet of the wellhead. Activities or contaminant releases within the Inventory Region have the potential to reach a PWS well in a period approximating less than 3 years. The Recharge Region represents the entire portion of the aquifer or an area that contributes water to the local aquifer and over time supplies water to a well. This extended region of groundwater recharge is often, but not always, inclusive of the limits of a watershed. At times, an entire watershed is too large to be realistically manageable by a PWS or community, so a subsection of that watershed is delineated as the Recharge Region. Long-term water quality at a PWS can be affected by contaminant releases or certain land use activities in the Recharge Region. Table 3 summarizes how these source water protection regions are determined.

Table 3. Methods and Criteria for Delineating Source Water Protection Regions

If Your Source of Water Is	Delineate These Water Protection Regions	Method For Each Region	Minimum Distance Values & Type of Inventory Required
Ground Water that is:			
• **Unconfined or Semi-confined***	Control Zone Inventory Region Recharge Region	Fixed radius Fixed radius Topography	Distance - 100 feet Distance - 1 mile or 3 year groundwater TOT Limits of the watershed
• **Confined**	Control Zone Inventory Region Recharge Region	Fixed radius Fixed radius Topography	Distance - 100 feet Distance - 1000 feet Limits of the watershed
*Ground Water that is hydraulically Connected to Surface Water also needs the following ---------->>	Surface Water Buffer Zone	Fixed Distance	In addition to the Inventory Region, a one-half mile surface water buffer will extend upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. The buffer will not exceed the extent of the watershed. Inventory is limited to pathogens and nitrate sources.
• **Surface water***	Spill Response Region Watershed Region	Fixed Distance Topography	One-half mile buffer extending upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. Buffer will not exceed the extent of the watershed. Inventory is for all regulated contaminants for that PWS. Limits of the watershed

****Note: Highlighted choices are those pertaining to the wells at Town of Rexford PWS.**

Hydrogeologic Conditions

Geology

According to Kendy and Tresch (1996), the Tobacco Valley basin occupies the southern extension of the thousand-mile-long Rocky Mountain Trench, a zone of closely spaced normal faults. Late Paleocene to Eocene extension along these faults caused crustal blocks to drop down at least 4,000 feet relative to the surrounding terrane, resulting in a series of subparallel basins, including the Tobacco Valley.

Middle Proterozoic metasedimentary bedrock of the Belt Supergroup surrounds the Tobacco Valley south of the international border. Here, the argillite, quartzite, sandstone, and dolomite rocks are extensively folded and faulted. Due to recent filling of the basin by debris from the surrounding mountains, tertiary sediments are not exposed at the surface but probably overlie bedrock almost everywhere in the basin. These sediments may be as thick as 3,000 feet. If the lithology of the Tertiary basin fill in the Tobacco Valley is analogous to that of other basins in the Rocky Mountain Trench, then it likely consists of Oligocene conglomerate, sandstone, siltstone, marlstone, oil shale and coal, and Miocene lacustrine deposits. Later, during the Pleistocene time, a heterogeneous mixture of interfingering glacial till, glacial lakebed deposits, glacial outwash, and deltaic deposits were put down unconformably on top of the Tertiary basin fill. The maximum thickness of the Pleistocene deposits is unknown. Glacial till is usually chaotic and composed of boulders to fine grained particles, often within

a clay or silt matrix. If the till has been reworked by water, it can be somewhat more sorted and stratified.

Hydrogeology

According to Kendy and Tresch (1996) hydrogeology of the basin fill is complex, due to the interfingering of discontinuous alluvial, deltaic, glacial-outwash, glacial lakebed, and glacial till deposits. Flowing wells are common, as are wells completed in perched aquifers. Well depths in the basin range from less than 30 feet bgs to more than 500 feet bgs. Many of the shallowest wells are completed into flood-plain alluvium, and this is likely the case for the USFS Well (Well #2) of the Rexford system. The sand and gravel that composes the alluvium is permeable, and has an estimated transmissivity as large as 67,000 ft^2/d. These wells usually yield 5 to 25 gpm with very little drawdown. The USFS Well #2 appears to be installed in shallow river alluvial materials. Groundwater flow direction in this area is unknown. The author estimates that groundwater may flow generally subparallel to the Tobacco River, from east to west.

The Grob Lake Well (Well #1) is completed either into one of the many types of Quaternary deposits or into the deeper bedrock. Wells completed in glacial outwash are known to produce relatively large yields in the area. Wells completed in bedrock sometimes also sustain relatively large yields. It seems likely that the Grob Lake Well is completed into one of these two deposits, though because of the disordered nature of the sediments, it is difficult to draw a final conclusion. For purposes of this report though, the well will be considered to be completed into an area that behaves under confined conditions. Groundwater flow direction in this area is unknown. The author estimates that groundwater may flow generally from north to south and possibly from northeast to southwest.

The Town of Rexford Well (completed in 2003) does have a lithologic log associated with it. Although the log provides limited information, this log suggests that the well is drilled through 49 feet (to 49 feet bgs) of fine silty-clay matrix, then through gravel to 71 feet bgs, where bedrock was encountered. The type of bedrock can't be determined from the log. The borehole was then extended to a depth of 346 feet bgs. No static or pumping water levels were recorded on the log, so it can't be determined if the well produced much water or if the aquifer was behaving as if it were under confined conditions. At minimum, this is clearly a deep bedrock well. Groundwater flow direction in this area is unknown. The author estimates that groundwater may flow generally from south to north and generally toward the lake.

Based upon the hydrogeologic setting, the wells for this system are classified as having high source water sensitivity (for Well #2 and the Town of Rexford Well (in-town)) and low source water sensitivity (for Well #1) to contamination, as shown by highlighting below. A map of the surficial geology of the area is included in Figure 5.

Table 4. Source Water (Aquifer) Sensitivity

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

Note: The 3 wells for the Town of Rexford appear to represent 3 different types of source water as seen in this table. The USFS Well #2 is drawing water from unconfined alluvium, the Grob Lake Well #1 is probably pulling water from a confined aquifer, and the Town of Rexford Well (in-town) appears to be a deep fractured bedrock aquifer.

Public Water Supply Source/Well Information

Included in Appendix B are the well logs for many of the wells found in proximity to the PWS wells. Information regarding the sources at Rexford is summarized in Table 5 below.

Table 5. PWS Source/Well Information

Angel Island Subdivision PWS (#MT000582)

Source Name	**Well 1 Grob Lake N**	**Well 2 USFS E**	**Well 3 (??) Town of Rexford Well, located in-town**
Source Code	WL002	WL003	
Status	Active	Active	Not yet active
MBMG GWIC #	90542	None	207052
Water Right #	W002288-00	None	None
Date completed	15 July 1970	~1981	08 September 2003
Total Depth (feet bgs)	358	95	346
Perforated Interval (ft bgs)	285-294, 304-311	Unknown	Open bottom
Static Water Level (ft bgs)	110	Unknown	Not recorded
Pumping Water Level (ft bgs)	252	Unknown	Not recorded
Draw Down (ft)	Unknown	Unknown	Not recorded
Test Pumping Rate (gpm)	Unknown	Unknown	Not recorded
Yield (gpm)	82	Unknown	Not recorded

Delineation Results

Control Zones

In all instances, a 100-foot radius Control Zone is delineated around the wellhead. This is done in order to ensure that the area immediately surrounding the wells remains free of contamination. Thus 100-foot radius Control Zones have been delineated and inventoried around the wells at Rexford.

Inventory Regions

A 1000-ft. fixed radius Inventory Region was delineated for Well #1, the Grob Lake Well, as it is believed to withdraw water from an aquifer behaving under confined conditions. Conversely, a 1-mile fixed radius Inventory Region was delineated for the USFS Well, Well #2. was the most conservative and protective option for this well, as no well log is available. Well #1 and #2 Inventory Regions are presented on Figure 6. The new Town of Rexford Well was difficult to delineate as little or no hydrogeologic information is available and the final location of the well is very approximate. Fractured bedrock aquifers have very little primary porosity and water moves mostly through fractures or dissolution channels (in the case of carbonates). Water that moves through fractures can travel relatively quickly, which suggests that the Inventory Region should be large to encompass all land uses and potential contaminant sources that may have an impact on water quality in the well. Thus the peninsula /

terrace on which the Town of Rexford is situated is enclosed within the Inventory Region. This Inventory Region for the Town of Rexford Well is shown in Figure 7.

Recharge Region

The Recharge Region for Wells #1 and #2 is shown in Figure 8. It encompasses a portion of the Tobacco River upstream of Well #2 as well as Grob Lake, US Highway 93, and the town of Eureka. The Recharge Region for the Town of Rexford Well is the watershed above the town, which is essentially the area that the author enclosed in the Inventory Region seen on Figure 7. As such, no separate Recharge Region was delineated for that well.

Limiting Factors

Groundwater behavior in general terms is reasonably well understood in the Tobacco Valley, but is not easily predictable beneath specific locations and especially around a certain well that is drawing water from a specific depth. Groundwater flow direction fluctuates seasonally and from year to year. Here, several conservative assumptions were made in the delineation of the source water protection areas and the development of this report. Also, reliance on some basic hydrogeologic principals to define the aquifer boundaries and groundwater movement was employed. The SWDAR, however, can and should be revised if more data becomes available that alters the assumed groundwater flow direction(s).

Chapter 3
INVENTORY

Inventory Method

An inventory of potential sources of contamination was conducted for the Town of Rexford PWS within the Control Zone, Inventory Regions, and Recharge Region. Potential sources of all primary drinking water contaminants and *Cryptosporidium* were also identified and noted, however, only significant potential contaminant sources were selected for detailed inventory and the susceptibility evaluation that occurs in Chapter 4 of this SWDAR. It should be noted that the inventory emphasizes potential contaminant sources. Inclusion of a facility or business in the inventory does not indicate that it is an actual polluter, with the exceptions of known hazardous waste sites where past releases have occurred, areas with known onsite contamination, locations with leaking underground storage tanks (LUSTs), or wastewater dischargers.

The inventory for the Town of Rexford PWS focuses on all activities in the Control Zone around the well, certain types of municipal and private facilities in the Inventory Regions, and general land uses and large facilities in the Recharge Region. The following databases have been searched in an effort to identify generators, storage facilities, and land uses that could be potential generators of contamination in the Inventory Region.

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). More recently, county records of agricultural land appraisal have been examined to determine the predominant agricultural land uses. These data are useful because they are much more current and display the land uses that can have the greatest impact on a drinking water supply (irrigated cropland and pasture). Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities. Septic density (the density of private onsite septic systems) was determined based on the 2000 US Census and obtained from the Montana State Library's Natural Resource Information System (NRIS) Thematic Mapper (http://nris.state.mt.us/mapper/) and (http://nris.state.mt.us/wis/swap/swapquery.asp).

Step 2: As appropriate, EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts (http://www.epa.gov/enviro/) to identify Concentrated Animal Feeding Operations with MPDES permits. The PWS system operator and/or system managers are familiar with the area included in the Inventory Region will have identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the Inventory Region: Underground Storage Tanks (UST) (http://webdev.deq.state.mt.us/UST/), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills (http://nris.state.mt.us/gis/datalist.html), abandoned mines (http://nris.state.mt.us/gis/datalist.html) and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: Major road and rail transportation routes were identified throughout the Inventory Region (http://nris.state.mt.us/gis/datalist.html).

Step 6: All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the Recharge Region and identified on the base map.

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

1. Large quantity hazardous waste generators.
2. Landfills.
3. Underground storage tanks.
4. Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
5. Underground injection wells.
6. Major roads or rail transportation routes.
7. Cultivated cropland greater than 20 % of the Inventory Region.
8. Animal feeding operations.
9. Wastewater treatment facilities, sludge handling sites, or land application areas.
10. Septic systems.
11. Sewer mains.
12. Storm sewer outflows.
13. Abandoned or active mines.

Inventory Results

Results of inventory for each of the three protection regions are presented below. Tabular summaries are presented in Tables 6 and 7, found at the ends of the inventory and recharge sections.

Inventory Results/Control Zones

During examination of a number of documents associated with the Town of Rexford public water supply, no potential contaminant sources were identified within the Control Zones.

Inventory Results/Inventory Regions

Grob Lake Well (Well #1)

No significant potential point sources of contamination were noted within the Inventory Region for the Grob Lake Well, as presented on Figure 6. Some grazing was indicated for the area surrounding the well, but this is not considered significant. Analysis of predominant land covers in the Inventory Region for this well revealed that the area is primarily grassland (66%). Other land covers include forest (20%)

and open water (13%). None of these land uses are typically thought to pose any threat to public water supply wells.

USFS Well (Well #2)

Potential contaminant sources in the Inventory Region for the USFS Well include Montana Highway 37, which runs in an east-west manner through the Inventory Region. Spills or accidents along this route, though rare, could prove catastrophic to the PWS well. Along the same lines, any historic spills of chemicals that happened along the now abandoned railroad tracks could potentially be a future threat to water quality at that well. No recorded spill sites are noted for the area, so this is probably not a significant potential contaminant source for the well. Both of the above transportation routes are depicted on Figure 2 and Figure 6.

A small area of high density of private septic systems is found within the Inventory Region, southwest of the PWS well (Figure 8). This area of high septic density has the potential to contaminate the PWS well, as wastewater discharged to drain fields may contain improperly disposed chemicals or nitrate and pathogens that may not have been completely eliminated from the effluent. Similarly, any large capacity septic systems within the Inventory Region pose related risks. Large capacity septic systems are defined as those serving more than 20 people daily, and unfortunately, no public records exist as to their exact locations. They are assumed, however, to be present at many businesses, residential developments, and similar facilities and may be found within the Inventory Region.

Analysis of the predominant land covers in the Inventory Region for Well #2 showed that the area is primarily grassland (51%). Other land covers in the area include forest (34%), agricultural land (10%), and other uses (5%). Agricultural use is typically thought to be the only land use that may pose a threat to a public water supply well, especially if agricultural land is irrigated. A closer look at the agricultural land in the Inventory Region for this well shows that only a small portion of the land is irrigated, and that most is grassland used for grazing or it is timber (Figure 6).

Town of Rexford Well (in-town)

Potential contaminant sources in the Inventory Region (on Figure 7) for the Town of Rexford Well include Montana Highway 37, which runs in a east-west manner along the southern boundary of the town's Inventory Region. Spills or accidents along this route, though rare, could prove catastrophic to the PWS well. The Town of Rexford is serviced by a municipal sewer collection and disposal system. Sewer mains that collect and transport septic waste can leak and become very significant sources of impacts to groundwater before the releases are detected. Additionally, wastewater lagoons are an area where large volumes of septic waste are concentrated. Although these lagoons are relatively new, there is always the potential of leakage to groundwater. No discharge permits were found during the development of this SWDAR, so it is assumed that the lagoons do not discharge to surface water or to groundwater, but are probably set up to dispose treated waste via evaporation and/or land application. It appears that the town also has a backup septic drainfield, but this system has not been used. A mine prospect showed up west of town, but this does not appear to have been a developed site. The Mariner's Haven Campground and Store appear to have a couple of wells (seen on Figure 7). These locations were derived from the MBMG GWIC database and are only rough approximations. What their presence brings attention to is the developed campground that must be serviced by some type of septic system, possibly a large capacity septic system. Alternately, the campground may have non-draining septic vaults that are pumped on a routine basis. The UST that services the Mariner's Haven Store is probably

located roughly as plotted, which places it outside of the Inventory Region and lateral to groundwater flow to the well. No agricultural land use was identified inside the Town of Rexford Inventory Region.

Table 6. Noteworthy Potential Contaminant Sources in the Inventory Regions (IRs)
Town of Rexford PWS for Grob Lake Well #1, USFS Well #2, and Town of Rexford Well (in-town)

Source	Contaminants	Description
Septic Systems, localized areas of high septic density or large capacity septic systems (within Well #2 IR).	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater discharged to drain fields may contain improperly disposed chemicals or may not completely eliminate nitrate and pathogens from the effluent.
MT Highway 37 (Well #2 and Town of Rexford Well IR)	Hazardous materials (VOCs, SOCs, metals, other)	Large scale spills of hazardous or other materials could occur.
Agricultural Land (10% of IR for Well #2), including irrigated agricultural land and pasture land	SOCs, nitrates, pathogens	Over-application and spills of pesticides and/or fertilizers are possible. Concentrations of animals in some pastures may cause the accumulation and runoff of animal wastes.
Municipal Sewer Mains (for the Town of Rexford IR)	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater leakage to groundwater that may happen because of a large-scale breakage or small chronic leak.
Municipal Wastewater Lagoons (for the Town of Rexford IR)	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater leakage to groundwater that may happen because of a large-scale release or small chronic leak from the lagoon.

Inventory Results/Recharge Region

As is seen in Figure 8, the two eastern wells serving the Town of Rexford public water supply share the same Recharge Region. This Recharge Region encompasses a number of potential contaminant sources.

There are several areas of increased density of private septic systems located north of Tetrault Lake and around the northern portion of the Town of Eureka. The town of Eureka's southern half is serviced by municipal sewer with a facultative sewage lagoon found west of town. Also, many other public water supplies are found scattered within the Recharge Region, and it is assumed that some or all of these facilities have large capacity septic systems. As was discussed above in the Inventory Region section, the exact locations of these systems is not known, but it is likely that many businesses, residential developments, and other facilities are serviced by these systems. Areas of increased septic density, municipal sewers, and large capacity septic systems all pose similar threats to the public water supply wells serving Rexford, as wastewater discharged to their drain fields may contain improperly disposed chemicals or these systems may not completely eliminate nitrate and pathogens from the effluent.

A number of transportation routes are found in the Recharge Region, including Montana Highway 37, US Route 93, and an older now abandoned railroad line. Accidents and spills along these routes (historic spills in the case of the railroad), though infrequent, could prove disastrous for the public water supply wells serving Rexford.

There are three wastewater dischargers found in the Recharge Region for the Town of Rexford PWS. These include the Owens and Hurst Lumber Co. Stormwater Discharge, found in the northeastern part of the Recharge Region near US 93; the Peltier Oil Co. Stormwater Discharge, found in the southern part of the Recharge Region near Eureka; and the Town of Eureka Facultative Sewage Lagoon, located northwest of Eureka along the Tobacco River. All of these dischargers pose similar threats to the PWS, as they could convey nitrate and/or pathogen contaminants toward the wells.

A large number of USTs (underground fuel storage tanks) are seen within the Recharge Region, including some with known leaks. Most of these potential contaminant sources are found near Eureka or north of town along US 93. Accidental spills or releases of petroleum products that reach groundwater are possible from these sources, especially from those tanks that are known to be leaking.

As is seen in Figure 8, areas of irrigated agricultural land are found scattered throughout the Recharge Region. Though percentages of general agricultural land or irrigated agricultural land in particular have not been calculated, these areas pose some threat to the PWS wells as potential sources of contamination by pesticides or fertilizers. Irrigated agricultural land or pastureland (where large numbers of animals are concentrated) are of greatest concern.

The Recharge Region encloses the town of Eureka surrounding commercial and industrial developments, so any and all businesses within this area that use, store, or dispose hazardous materials can be considered potential contaminant sources.

Table 7. Noteworthy Potential Contaminant Sources in the Recharge Region (RR)
Town of Rexford PWS

Source	Contaminants	Description
Septic Systems (localized areas of high and moderate density of private systems, areas of municipal sewer, and large capacity septic systems)	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater discharged to drain fields may contain improperly disposed chemicals or may not completely eliminate nitrate and pathogens from the effluent.
US 93, MT 37, old Railroad Line	Hazardous materials (VOCs, SOCs, metals, other)	Large scale spills of hazardous or other materials could occur.
Wastewater Dischargers • Owens & Hurst Lumber Co. Stormwater Discharge • Peltier Oil Co. Stormwater Discharge • Town of Eureka Facultative Sewage Lagoon	SOCs, metals, nitrate, and pathogens	Chronic or catastrophic failures to treat effluent and fully remove contaminants, allowing release to the river and transport to vicinity of the well are possible.
USTs/LUSTs	VOCs, petroleum hydrocarbons	Accidental spills or releases of petroleum to groundwater are possible.
Agricultural Land, incl. Irrigated Ag Land and Pastures.	SOCs, nitrates	Over-application and spills of pesticides and/or fertilizers are possible Over-application and spills of pesticides and/or fertilizers are possible. Concentrations of animals in some pastures may cause the accumulation and runoff of animal wastes.
Auto Shops, Photography Shops, Dry Cleaners, and many other businesses in the region that have not specifically been identified	Various hazardous materials	Many businesses under SIC code listings may handle toxic chemicals so accidental spill or improper management and disposal of these agents could severely impact groundwater.

Table 7. Noteworthy Potential Contaminant Sources in the Recharge Region (RR)
Town of Rexford PWS

Source	Contaminants	Description
in the inventory		

Inventory Update

To make this SWDAR a useful document in the years to come, the owners, manager, or the water system operators for the Town of Rexford public water supply should update the inventory for their records every year. Changes in land uses or the presence of new potential contaminant sources should be noted and additions made as needed. This updated inventory should be submitted to DEQ at least every 5 years to ensure that this report/plan stays current in the public record.

Inventory Limitations

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data that is readily available through state documents, published maps and reports, GIS data, and discussions with people that are familiar with the area. Also, documentation may not be readily available on some potential sources. This is the case with large capacity septic systems that are present in the Inventory Regions and Recharge Region. As a result, all potential contaminant sources may not have been identified or recognized as being significant potential contaminant sources. The author of this SWDAR is depending on local PWS owners and/or operators for site-specific knowledge. Their initial review of this document was sought and their comments were incorporated.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

General Discussion

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case Town of Rexford PWS owners and operator(s). The goal of Source Water Management is to protect the source water by 1) controlling activities in the Control Zones, 2) managing significant potential contaminant sources in the Inventory Regions, and 3) ensuring that major land use activities or other significant activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the PWS owners and the operator to reduce susceptibility are recommended in this chapter.

Hazard Determination

The Susceptibility of the Town of Rexford PWS production wells to various types of contamination is assessed in the following paragraphs. The proximity of a potential contaminant source to a spring or well intake, potential contaminant migration pathways, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as hazard (Tables 8a and 8b). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 9. Tables 8a and 8b below describe the criteria to determine hazard within the Inventory Regions as they were delineated in this SWDAR. Note that these tables are specific to PWSs that draw their water from confined and unconfined aquifers, respectively. Table 8a applies to the Grob Lake Well (Well #1), while Table 8b applies to the USFS Well (Well #2) and the Town of Rexford Well (in-town). Hazard determination differs significantly between the two types of wells, and hazards to the USFS Well are rated much more conservatively than hazards for the Grob Lake Well, as unconfined aquifers are considered much more sensitive to contamination than are confined aquifers.

Table 8a. Hazard Determination for Wells Drawing from Confined Aquifers

Town of Rexford PWS—Grob Lake Well (Well #1)

Potential Contaminate Sources within the Inventory Region	The PWS well is not sealed through the confining layer	Other wells in the Inventory Region are not sealed through the confining layer	All wells in the Inventory Region are sealed through the confining layer
Point Sources	High	Moderate	Low
Septic System Density (# per square mile)	High: > 300 Moderate: 50 to 300 Low: < 50	Moderate: > 300 Low: < 300	Low
Municipal or Community Sanitary Sewer (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low
Cropland (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low

Highlighted choices above are those most likely relating to the Town of Rexford PWS Grob Lake Well (Well #1). It is important to note that no potential contaminant sources for this well have been identified at this time; Table 8a is simply included for the sake of completeness and to indicate the difference in hazard determination for the two different types of wells.

- Key to the highlighted choices is the interpretation of the lithologic log for this well and others in the area.
- The first column is selected as most appropriate to the well, as the well is thought to be grouted to a depth of 38.9 ft. bgs. Some confusion exists regarding this point though, and if the well is, in fact, grouted to a deeper level, a different column of the chart may be appropriate for use.

Table 8b. Hazard Determination for Wells Drawing from Unconfined Aquifers

Town of Rexford PWS—USFS Well (Well #2) and the Town of Rexford Well (in-town)

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Within 1 year TOT	Between 1 to 3 years TOT	Over 3 years TOT
Density of Private Septic Systems (# per square mile)	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

- Highlighted areas are those probably relevant to the USFS Well (Well #2) and the Town of Rexford Well (in-town).
- Key to the highlighted choices above is the absence of a well log for one well, making the assumption that both wells draw water from unconfined aquifers appropriate.

Susceptibility Determination

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the PWS well intake. First, hazard is rated by the proximity of a potential contaminant source to the well(s) or based on the percentage of the Inventory Region occupied by a certain type of source (from Table 8a or 8b). Then the presence of barriers is used to come up with susceptibility. Susceptibility ratings are determined individually for each significant potential contaminant source and/or contaminant based on Table 9.

These susceptibility ratings are the evaluation of the vulnerability of wells to the more significant potential contaminant sources and are presented on Table 10.

Table 9. Susceptibility, Based on Hazard and Barriers

Presence Of Barriers	Hazard		
	High	Moderate	Low
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

Discussion of Susceptibility

A summary of the susceptibility assessment for the Town of Rexford PWS wells is located in Table 10. Following is a brief discussion of the susceptibility assessment for the significant potential contaminant sources for Rexford's USFS Well (Well #2) and for the Town of Rexford Well (in-town). No potential contaminant sources were found for the other source, the Grob Lake Well (Well #1). Other sources of contamination may also exist and may pose threats to the public water supply wells serving Rexford. It is prudent to make further attempts to identify these sources, especially if they are up-gradient from the wells, and to understand the treats they pose.

Transportation Route

Montana Highway 37 is rated as a high hazard to Well #2 and the Town of Rexford Well (in-town). Since emergency response measures are in place, one barrier exists and the wells have a high susceptibility to contamination from this source. No known contamination is associated with the historic railroad line that ran through the Tobacco River valley.

Septic Systems

A small area of high septic density is located southwest of Well #2, but this is thought to be relatively insignificant of itself. Any large capacity septic systems that may be present within the Inventory Region for Well #2 or in town are rated as moderate hazards to the wells. A couple of barriers to contamination appear to be present, so the wells have a moderate to low susceptibility to contamination from these potential contaminant sources.

Municipal Wastewater Lagoons

The facultative wastewater lagoons are located west of town and lateral to the inferred groundwater gradient. Because of their presence in the region, they have a high hazard of contamination. There appear to be multiple barriers in place between the municipal in-town well and the lagoon. Thus the well has a moderate susceptibility to contamination from the lagoons.

Table 10. Susceptibility Assessment

Assessment of Hazards in Inventory Region (IR) only for USFS Well (Well #2) and the Town of Rexford Well (in-town)

Source	Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Montana Highway 37 (for both IRs)	Hazardous materials (VOCs, SOCs, metals, other)	Large scale spills of hazardous or other materials could occur	**High Hazard**	• Local and regional emergency response measures including training of responders and resources for spill cleanup in the area	**High Susceptibility**	Emergency planning, training of local emergency response personnel, and allocation of resources/funding for emergency response and/or cleanups of spills
Municipal Wastewater Lagoons (for the Town of Rexford IR)	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater leakage to groundwater that may happen because of a large-scale release or small chronic leak from the lagoon.	**High**	• Clay rich sediments beneath sewer mains and lagoons and above the water table • Lagoons are located lateral to inferred groundwater gradient • Lagoons are located west of a draw and the crest of the ridge from the PWS well • Lagoons are lined and allegedly don't recharge groundwater •	**Moderate Susceptibility**	Use BMPs for lagoon management; use rapid response for repair (as the results can be catastrophic)
Small Area of High Septic Density (for Well #2), Large Capacity Septic Systems along the highway (for both IRs)	Pathogens, nitrates, other organic and inorganic chemicals	Waste water discharged to drain fields that may contain chemicals, nitrates, and pathogens	**Moderate Hazard**	• Clay rich sediments beneath the area and above the water table • Depth to static water level bgs (>50') (for the in-town well)	**Moderate to Low Susceptibility**	Promote the design and installation of advanced septic systems in the area, education (including posters and placards) to reduce improper disposal of chemicals, and possible incorporation into any future community sewer coverage. Involvement of PWS managers/operators in this process is critical.
Agricultural Land (10% of Well #2's IR)	SOCs, nitrates	Over-application and spills of pesticides and/or fertilizers	**Low Hazard**	• Very little of the area is irrigated agricultural land • Tobacco River is between the land and the well • Old railroad line is between the land and the well	**Very Low Susceptibility**	Promotion of Best Management Practices and good cropping practices, coordination with owners of agricultural land to ensure awareness and cooperation with PWS operators to protect groundwater
Municipal Sewer Mains (for the Town of Rexford IR)	Pathogens, nitrates, other organic and inorganic chemicals	Wastewater leakage to groundwater that may happen because of a large-scale breakage or small chronic leak.	**Low (less than 20% of the region)**	• Clay rich sediments beneath sewer mains and above the water table • Depth to static water level bgs (>50') • Thickness of water table above the	**Very Low Susceptibility**	Use BMPs for sewer management; use rapid response for sewer main repair (as the results can be catastrophic)

Table 10. Susceptibility Assessment

Assessment of Hazards in Inventory Region (IR) only for USFS Well (Well #2) and the Town of Rexford Well (in-town)

Source	Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management
				intake (>100’) • Sewer mains drain lateral to groundwater gradient toward the WWTP west of town		

Agricultural Land
Agricultural land in the Inventory Region is considered a low hazard to the USFS Well. No agricultural land is present within the Inventory Region in-town. Since this land only appears to be irrigated in one small area northeast of the well and several barriers appear to be in place, the well is considered to have a very low susceptibility to contamination from agricultural land.

Municipal Sewer Mains
The municipal sewer mains are located in town and upgradient from the probable location of the PWS well. The area served by the sewer mains is estimated at less than 20% of the Inventory Region, thus they have a low hazard. There are thought to be several barriers in place between the sewer mains and the well, which results in the well having a very low susceptibility to contamination from this potential contaminant source.

Summary of Susceptibility Assessment
At this time, no potential contaminant sources could be identified within the Inventory Region for Rexford's Grob Lake Well #1. Some of the region is occupied by grazing land, but this not believed to be significant. Therefore, the susceptibility of the well to this (or other non-inventoried potential contaminant sources) was considered to be low very low.

USFS Well #2
The USFS Well #2 has high susceptibility to Montana Highway 37 and, if present, the USFS Well #2 has a moderate to low susceptibility to large capacity septic systems located along the highway. This well also has a very low susceptibility to contamination that may originate with the irrigated agricultural land located to the northeast.

The Town of Rexford Well (in-town)
The Town of Rexford Well (in-town) has high susceptibility to Montana Highway 37 and, if present, the in-town well has a moderate to low susceptibility to large capacity septic systems located along the highway. No agricultural land is present within the Inventory Region for the in-town well, so it is not susceptible to contamination from this source. The well has a moderate susceptibility to the facultative wastewater lagoons located west of town and a very low susceptibility to the municipal sewer mains located within the town limits.

CHAPTER 5
WAIVER RECOMMENDATION

General Discussion
This section addresses the Town of Rexford Public Water Supply that DEQ classified a community non-transient system. Recommendations are based on the susceptibility assessment above.

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

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

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

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include will logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; Time-of-Travel or attenuation studies; vulnerability mapping; and the use of computerized

groundwater flow and transport models. Review of an organic chemical monitoring waiver application will be conducted by DEQ's PWS Section and DEQ's Source Water Protection Program. Other state agencies may be asked for assistance.

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

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

The objective of the Susceptibility Waiver application is to assess the potential of organic chemical migration from the surface to the unconfined aquifer. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the source, monitoring history of the source, geologic characteristics of the vadose zones, and mobility and persistence characteristics of the organic chemicals. The zone of contribution of the unconfined groundwater source must be defined and plotted. Groundwater flow directions, gradients, and a 3-year time-of-travel should be described. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and nearby wells should also be provided.

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

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

The Susceptibility Waiver has the objective of assessing the potential of contaminants reaching the groundwater used by the PWS. A groundwater source that appears to be confined from surface infiltration in the immediate area of the wellhead may eventually be affected by contaminated

groundwater flow from elsewhere in the recharge area. Contaminants could also enter the confined aquifer through improper well construction or abandonment creating a hydraulic connection from the surface to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. Regional conditions that define the confinement of a groundwater source must be demonstrated by the PWS in order to be considered for a confined aquifer Susceptibility Waiver. Confinement of an aquifer can be demonstrated by pump test data (storage coefficient), geologic mapping, and well logs. Site specific information is required to sufficiently represent the recharge area of the aquifer and the zone of contribution to the PWS well. The following information should be provided:

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

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration of contaminants into water that is used as a source. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the water source development, monitoring history of the source, geologic/hydrologic characteristics of the source water, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The area of contribution to the aquifer into which the PWS intake is installed must be defined and plotted. This should describe the subsurface stratigraphy, groundwater and aquifer characteristics, well construction, groundwater flow direction(s), and a listing (and a map) of other wells in the area that draw from the same formations. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well(s) should also be provided as part of the susceptibility waiver application.

Waiver Recommendations

This recommendation is based on the monitoring history for the well, the results of the inventory, the susceptibility assessment of this SWDAR, the geology of the area, and the nature of the aquifer from which the well draws water. According to DEQ records, the Town of Rexford does not appear to have any monitoring waivers at this time. The Town of Rexford's Grob Lake Well #1, the USFS Well #2, and the Town of Rexford Well (in-town) (when it comes on-line) may all be eligible for some SOC, VOC, and IOC monitoring waivers. For monitoring waiver consideration, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. If requested by DEQ, the PWS may also need to provide some additional information.

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GLOSSARY

Acute Health Effect. An adverse health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Best Management Practices (BMPs). Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Coliform Bacteria. Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

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 that inhibits the flow of water.

Delineation. A process of mapping source water management areas.

Effective Porosity. The percent of soil, sediment, or rock through which fluids, such as air or water, can pass. Effective porosity is always less than total porosity because fluids cannot pass through all openings.

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

Hazard. A measure of the potential of a contaminant leaked from a facility to reach a public water supply source. Proximity or density of significant potential contaminant sources determines hazard.

Hydraulic Conductivity. A coefficient of proportionality describing the rate at which water can move through an aquifer.

Inventory Region. A source water management area that encompasses an area expected to contribute water to a public water supply well within a fixed distance or a specified groundwater time-of-travel distance.

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.

Nitrate. An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are 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.

Pathogens. A bacterial organism or virus typically found in the intestinal tracts of mammals, capable of producing disease.

Point-Source. A stationary location or fixed facility from which pollutants are discharged.

Porosity. The percent of soil, sediment, or rock filled by air, water, or other fluid.

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

SIC Code. The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy.

Source Water Protection Area. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply.

Susceptibility (of a PWS). The 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. 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, non-point, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

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

Transmissivity. The ability of an aquifer to transmit water.

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

Volatile Organic Compounds (VOC). Any organic compound that evaporates readily to the atmosphere (e.g. fuels and solvents).

Recharge Region / 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.

**Definitions taken from EPA's Glossary of Selected Terms and Abbreviations and other sources.

APPENDICES

Appendix A

DEQ PWS's Database Output
Water Quality Data

Appendix B

Sanitary Survey
Well Log Information
Other Relevant Well Information
Lithologic and Construction Logs (GWIC Well Information) for Other Area Wells

Appendix C

Concurrence Letter