RAWLINGS HOMEOWNERS ASSOCIATION
PUBLIC WATER SYSTEM
SOURCE WATER DELINEATION AND ASSESSMENT REPORT

PWSID # MT0001785
Kalispell
Flathead County
Montana

AUGUST 18, 2005

PREPARED FOR:

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report 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 operators, consumers, and community citizens can begin developing strategies to protect their source of drinking water. The information that is provided includes the identification of the areas 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 these potential sources pose to the water system. Andrea Mazur an intern with DEQ's Source Water Protection Program completed this report. Eric Sivers, a DEQ hydrogeologist, reviewed the document.

The drinking water for the Rawlings Homeowners Association is supplied by two wells, as shown on Figure 3 and 4. Based on the sanitary survey, well logs, and the depth of the wells, it appears the aquifer providing water to the PWS' wells is confined. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifer (source water) is considered to have a low sensitivity to potential contaminant sources since it is a confined aquifer. 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 were mapped as part of this assessment for the Rawlings Homeowners Association public water system. They are the Control Zone, Inventory Region, and the Recharge Region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- The Control Zone is delineated as a 100-foot radius around 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. The only potential contaminant sources identified in the Control Zone are private onsite septic systems.
- The source water is withdrawn from a confined aquifer. As such, the Inventory Region for the wells consists of a 1,000-foot radius circle around the wellheads. The Inventory Region should be managed to prevent contaminants from reaching the wells. Significant potential contaminant sources that were identified within the Inventory Region include: areas of increased septic system density around the both of the wells, Highway 93, and railroad lines. Potential contaminant sources for the Inventory Region and Recharge Region are summarized in Table 6.
- The goal of management in the Recharge Region is to maintain and protect water quality over long periods or increased usage. The aquifers in the area are probably recharged in the area shown in Figure 2. No additional potential contaminate sources were found in the Recharge Region.

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried potential contaminant sources at concentrations that would pose concern.

Susceptibility is determined by considering the hazard rating for each potential contaminant source located within the inventory region 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 Rawlings Homeowners Association public water supply well has a moderate susceptibility to private onsite septic systems associated with the Rawlings HOA. It also appears that the wells have a low susceptibility to contamination associated with the highway and railroad lines found in the inventory region.

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 other issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Region). We have identified several potential sources of contamination within the areas of interest. 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 and active involvement by the PWS staff are powerful tools for protecting your 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 in Table 9.

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FIGURES:

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was completed by Andrea Mazur, an intern with the Montana Department of Environmental Quality, Source Water Protection Program and was reviewed by Eric Sivers, a DEQ hydrogeologist. Rawlings Homeowners Association Public Water Supply (PWS) # MT0001785 is located five miles south of Kalispell on Highway 93 in Flathead County, Montana. Contacts for the PWS are provided in Table 1 below.

Table 1. Rawlings Homeowners Association PWS Contacts

Name and Title	Telephone	Address
E J Weidner Administrative Contact Financial Contact	406-752-3275	101 Forest Hill Columbia Falls, MT 59912
E J Weidner Operator	406-752-3275	101 Forest Hill Columbia Falls, MT 59912

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report (SWDAR) for Rawlings Homeowners Association PWS as required by the Montana Source Water Protection Program (SWPP) and the federal Safe Drinking Water Act (SDWA). The Montana Source Water Protection Program (SWPP) is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana SWPP is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for Rawlings Homeowners Association PWS. Much of the content for this SWDAR has been borrowed from reports written for other Flathead County PWSs.

Delineation is a process whereby areas that contribute water to aquifers or surface water used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of a source water protection planning, a mechanism Rawlings Homeowners Association PWS can use to protect its drinking water source. Although voluntary, source water protection planning is the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to facilitate Rawlings Homeowners Association PWS and the community to be involved in source water protection planning activities that meet their specific needs.

CHAPTER 1
BACKGROUND

The Community

Rawlings Homeowners Association PWS supplies water to a residential area five miles south of the city of Kalispell on Highway 93. Kalispell is located to the north of Flathead Lake. Kalispell serves as the population and commercial center of Flathead County and portions of four surrounding counties. Kalispell is the Flathead County seat. Major industrial, health care and government facilities are also located in the Kalispell area. The economic base of the Kalispell area and Flathead County is diverse. The county's leading industries are wood products manufacturing, microelectronics manufacturing, metals refining, railroad, agriculture, tourism, and the federal government. The area is also attractive to retirees and the local retirement income represents a substantial and growing portion of the local economy. The area's proximity to Glacier National Park and Big Mountain, a destination ski resort, makes it a year-round center for the tourist trade.

The major transportation corridors include Montana State Highway 93 which is the primary north-south corridor connecting Kalispell with Whitefish to the north and Polson and Missoula to the south. Montana State Highway 2 is the major east west corridor connecting Kalispell to Libby on the west and Columbia Falls to the northeast. The Burlington Northern Santa Fe Railroad, the major east-west rail line in the area also passes through the City of Kalispell.

It appears that this PWS serves an average daily population of 70 year round residents through 44 service connections. The available evidence suggests that sewage from residences is disposed to private onsite septic systems.

Geographic Setting

Rawlings Homeowners Association PWS is located just south of the City of Kalispell in the Flathead Valley. The Flathead Valley is a south to northwest trending intermountain valley on the western side of the continental divide in western Montana. The valley is surrounded by the Flathead and Mission Mountains to the east and the Cabinet and Salish mountains to the west and north. Glacier National Park is north and east of the valley. The northeastern portion of the study area lies between the Flathead and Whitefish Rivers. This area is characterized as a large complex of swales, streams, wetlands, and alluvial terraces comprised of a significant amount of floodplain and hydric soils. The Evergreen alluvial aquifer located generally along the Flathead River floodplain, is a highly permeable sand and gravel aquifer controlled by the flows of the river.

Description of the Source Water

Rawlings Homeowners Association PWS obtains water from two wells that are located as shown in Figure 3 and 4. These locations are approximations based on a map provided in the most recent sanitary survey (2004), but are adequate for the purposes of this SWDAR. Based on the well logs, the wells appear to be drilled into a confined aquifer. The principal confined aquifer in the valley is present within the deeply buried Pleistocene unconsolidated sediments that were deposited by glacial meltwater. These water-bearing units are comprised of extensive

deposits of glacial outwash and coarse fluvial deposits that are topped by glacial till and lacustrine (lakebed) deposits. These fine-grained till and lacustrine derived materials are the confining units for the deep aquifer. Groundwater flow direction is generally to the east-northeast, towards the Flathead River.

Figure 1. Regional Map

Figure 2. Rawlings Homeowners Association PWS Recharge Region

Figure 3 and 4. Rawlings Homeowners Association PWS Location Map

Figure 5. Rawlings Homeowners Association Geology Map

The Public Water Supply

It appears that this PWS serves a population of approximately 70 year-round residents through 44 service connections. The system is supplied by two wells. The approximate location of the Rawlings Homeowners Association PWS wells is shown on Figure 3 and 4.

Table 2. PWS Facilities and Other Information

Rawlings Homeowners Association PWS (#MT0001785)

Contact Information		**E J Weidner** **Administrative Contact** **Financial Contact** **101 Forest Hill** **Columbia Falls, MT 59912** **(406) 752-3275**	**E J Weidner** **Operator** **101 Forest Hill** **Columbia Falls, MT 59912** **(406) 752-3275**
PWS Class	Community PWS		
Well/Intake Source Code		WL002	WL003
Well/Intake Name		Well 1	Well 2
Status		Active	Active
Treatment System	None		
Pressure Control Assembly	PC001 Pressure Control Assembly		
Distribution System	DS001 Distribution System Active		
Storage Tank	None		

Water Quality

The Rawlings Homeowners Association PWS wells pull water from a confined aquifer. The local confined aquifer generally has a low sensitivity to surface contamination because it is capped by thick glacial till. Water quality data for Rawlings Homeowners Association PWS dating back five years was printed out from DEQ's PWS Database and this printout is attached. This data indicates water samples contained nitrate concentrations between 0.14 and 0.88 mg/L; this is below the federal MCL of 10 mg/L. Total coliform results have been negative for the past five years. The operator for the PWS is required to monitor for several contaminants on varying schedules. The data suggests that none of these chemicals were present in elevated concentrations over the past 5 years.

CHAPTER 2
DELINEATION

General Discussion

The source water protection area, the land area that contributes water to Rawlings Homeowners Association PWS, is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the Control Zone, Inventory Region, and Recharge Region. The Control Zone, also known as the exclusion zone, is an area of at least 100-foot radius around the wells. The Inventory Region represents the zone of contribution of the wells, which approximates a three-year groundwater time-of-travel. This is sometimes approximated by a 1-mile radius. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping can often be used to calculate groundwater time-of-travel distance in sedimentary materials. In certain hydrogeologic settings where the aquifer behaves as if it were under confined conditions, the Inventory Region is restricted to the 1,000-foot radius circle around the wellheads. The Recharge Region represents the entire portion of the aquifer that contributes water to Rawlings Homeowners Association PWS water system. This is commonly, but not always, the watershed above a well.

Conceptual Model for the Aquifer

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. The aquifer supplying groundwater for the well at Rawlings Homeowners Association is confined. Groundwater flow in this area is generally to the east-northeast, towards the Flathead River.

Hydrogeologic Conditions

Kalispell is located within the center of the Flathead Valley in northwestern Montana. The Flathead Valley is a northwest trending intermontane basin forming the southern extension of the Rocky Mountain Trench. The valley is bounded on the east by the Swan-Whitefish fault located along the base of the Swan Range and on the west by the Kalispell fault at the base of the Salish Mountains. The mountains to the east rise abruptly 4,500 feet above the valley floor, but are lower to the west. Gravity data indicate the Cenozoic basin-fill in the central part of the valley may be as much as 4,000 feet thick (Noble and others, 1982). Although Tertiary rocks are not exposed, it is believed that Miocene and Oligocene sediments rest unconformably on Precambrian bedrock. Pleistocene continental and mountain glaciation advanced southward through the Rocky Mountain Trench in the vicinity of Kalispell depositing extensive volumes of glacial till, glacial outwash, and glacial lakebed deposits. As the glaciers receded, meltwater lakes pooled in areas where drainage was impeded, leaving either local or valley-wide lakebed deposits. In contrast, fluvial outwash deposits accumulated where discharge flowed unrestricted. It is estimated that 600 to 1,000 feet of Wisconsin-age Pleistocene glacial deposits overlie the Tertiary sediments. Surficial geology of the area is shown on the geologic map.

The two major aquifers recognized in the Kalispell area are the shallow alluvial aquifer and the deep artesian aquifer (Konizeski and others, 1968; MBMG, 2000). Several minor aquifers that are more limited in extent are also recognized. The shallow alluvial aquifer is composed of unconsolidated fluvial sediments (*i.e.*, sand and gravel) deposited along the

floodplains of the Flathead, Whitefish, and Stillwater Rivers. The aquifer thickness ranges from 20 to 100 feet and it is always a water table or unconfined aquifer. Low permeability glacial till and lakebed deposits of various thicknesses separate the shallow aquifer from the deeper confined aquifer. The low permeability deposits are laterally continuous in the area and generally separates surface water and shallow groundwater from the deep artesian aquifer.

The deep confined aquifer (erroneously called an artesian aquifer) consists of a series of interbedded sand and gravel layers with fine-grained interbeds. These deposits probably represent paleo-channels of the Flathead and Stillwater Rivers. Recent work in the central and eastern portions of the valley indicate this package of sediments is hydraulically interconnected and responds as a single aquifer demonstrating anisotropic characteristics (Shapley, 1992; and Noble, 1998). The thickness of the deep confined aquifer is unknown but a well located in Section 18 of Township 29 North, Range 21 West was drilled to a depth of more than 800 feet and did not penetrate the base of the aquifer. This deep confined aquifer appears to rest unconformably on Tertiary age sediments. In the western portion of the Flathead Valley, the confining unit overlying the deep artesian aquifer consists of glacial till composed of clayey and silty gravel. Northwest of Kalispell, the till is overlain by glacial outwash deposits forming the shallow water table aquifer discussed above. The shallow unconfined aquifer is often referred to as the Evergreen Aquifer.

The Rawlings Homeowners Association PWS wells tap two different aquifers. Well 1 is shallower, and is completed into Pleistocene alluvium at 92 feet. This is the regional confined aquifer described above. Well 2 was drilled through the valley sediments, and completed into consolidated Precambrian bedrock at 373 feet. Both aquifers are confined by overlying low permeability sediments. Both wells serving the Rawlings Homeowners Association PWS are classified as having Low Source Water Sensitivity. The SWPP criteria for source water sensitivity are outlined in Table 3.

Table 3. 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 Aquifer

Well Information

The location of the Rawlings Homeowners Association PWS wells is shown on Figure 3 and 4.

Table 4. Well Information

Information	Well # 1	Well # 2
PWS Source Code	WL002	WL003
MBMG # (GWIC)	80924	80925
Water Right #	W034310	65558
Date Well was Completed	10-13-1965	09-08-1986
Total Depth (feet bgs)	92	373
Casing Diameter (inches)	7	8, 6
Casing Depth (feet bgs)	92	110, 373
Grout Depth (feet bgs)		110, cement
Static Water Level (feet bgs)	4	11
Pumping Water Level (feet bgs)	24	41
Yield \ Test Pumping Rate (gpm)	35	80

Methods and Criteria

Source water protection areas are divided into zones or regions according to the amount of time water takes to reach the water supply intake or the hydrogeologic sensitivity of the source water. Source water protection areas for groundwater-based systems, in order of increasing size are the Control Zone, Inventory Region, and Recharge Region. The methods and criteria used to delineate the source water protection zones for Rawlings Homeowners Association PWS are specified in the DEQ's SWPP (DEQ, 1999). Rawlings Homeowners Association PWS appears to be drawing water from a confined aquifer.

Table 5. 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
Unconfined / Semi-confined/Leaky-confined	- Control - Inventory	-Fixed radius -Time-Of-Travel Calculation	-Distance - 100 feet - Distance - Larger of 1,000 feet up-gradient or 3-year TOT or 1-mile radius (plus half-mile buffer around hydraulically connected surface water for 10 miles upstream*)
	- Recharge	-Hydrogeologic Mapping	-Physical and Hydrologic flow boundaries

Table 5. 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
*Ground Water that is hydraulically connected to Surface Water	-Surface Water Buffer Zone	- Fixed radius	-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.
Confined	- Control - Inventory - Recharge	-Fixed Distance - Fixed radius -Hydrogeologic Mapping	-Distance - 100 feet -Distance - Minimum of 1,000 feet - Physical and Hydrologic flow boundaries
Surface water	-Spill Response	-Fixed Distance	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.

For a confined aquifer, the Control Zone is based on a fixed distance of a 100-foot radius around each well; the Inventory Region is based on a 1,000-foot fixed radius circle around the wellheads, and the Recharge Region is based on geologic mapping and locations of hydrologic boundaries. If the aquifer is semi-confined or unconfined, the control and Recharge Regions are the same as for a confined aquifer, but the Inventory Region is typically determined using a calculation of groundwater velocity and an estimated three-year groundwater time-of-travel (TOT) distance. When information is lacking, a fixed 1-mile radius circle around the wellheads can be used as a conservative and protective Inventory Region. Based on the available information, the aquifer supplying Rawlings Homeowners Association PWS is a confined aquifer.

Delineation Results

The Control Zone is based on a fixed 100-foot radius around the wells; the Inventory Region is based on a 1,000-foot radius circle around the wellheads, as depicted on Figure 3. Because the wells are drawing from a confined aquifer, a 1,000-foot fixed radius circle around the wells was used for the Inventory Region and is believed to be an appropriate estimate of the area that could impact water quality of the aquifer beneath the Rawlings Homeowners Association and should be protective of public health. The Recharge Region for Rawlings Homeowners Association captures the area shown in Figure 2.

Limiting Factors

The available information on Rawlings Homeowners Association suggests the wells draw water from the confined aquifer. The assumed groundwater flow direction and gradients in the area are based on regional data, but actual local gradients and flow directions may vary considerably. If more current data or information becomes available that is more specific to the immediate vicinity of Rawlings Homeowners Association, the assumptions of this author about the aquifer characteristics and behavior of groundwater in the area may be revised.

CHAPTER 3
INVENTORY

General Discussion

An inventory of potential sources of contamination was conducted for Rawlings Homeowners Association PWS within the Control Zone, Inventory Region, and Recharge Region. Potential sources of all primary drinking water contaminants were identified, however, only significant potential contaminant sources were selected for the susceptibility assessment provided in the next chapter. The most significant potential contaminant sources within the Rawlings Homeowners Association PWS Inventory Region include: areas of increased septic system density and transportation corridors. Potential contaminant sources for the Inventory Region and Recharge Region are summarized in Table 6. The inventory for Rawlings Homeowners Association PWS focuses on all activities in the Control Zone, certain sites or land use activities in the Inventory Region, and major land uses and large facilities in the Recharge Region.

Inventory Method

The initial inventory of the three zones included a search of available databases to identify potential sources of impacts. 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 the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html) and Flathead County tax records. Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from Flathead County.

Step 2: As appropriate the 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 water system operator or other local official familiar with the area included in the Inventory Region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following within 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, abandoned mines and active mines including gravel pits (http://nris.state.mt.us/gis/datalist.html). 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.

Step 7: All wells located within the Inventory Region were identified and well logs were obtained when available.

Potential contaminant sources are designated as significant (DEQ, 2000) 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 percent 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

Control Zone

The Control Zone is the area immediately surrounding the well and the wells are located approximately as shown on Figure 3. The only potential contaminant sources within the Control Zones are private onsite septic systems near the Rawlings HOA wellheads.

Inventory Region

The Inventory Region contains several significant potential contaminant sources. These are: areas of increased septic system density, Highway 93, and railroad lines. Potential contaminant sources for the Control Zone, Inventory Region, and Recharge Region are summarized in Table 6.

Recharge Region

No additional potential contaminate sources were found in the Recharge Region.

Table 6. Significant Potential Contaminant Sources for Rawlings Homeowners Association PWS

	Potential Contaminant Source	Contaminants
Control Zone	Areas of Increased Septic Density surrounding the wells. Septic lines and drainfields may discharge poorly treated or untreated sewage to the shallow aquifer if these systems fail or are poorly maintained.	Pathogens and Nitrates
Inventory Region	Areas of Increased Septic Density surrounding the wells. Septic lines and drainfields may discharge poorly treated or untreated sewage to the shallow aquifer if these systems fail or are poorly maintained.	Pathogens and Nitrates
	Highway 93 and Railroad Lines. Major spills and routine herbicide applications along the highway and railway may impact local groundwater.	VOCs, SOCs
Recharge Region	Same list as above with no additional potential contaminant sources identified.	

Inventory Update

Rawlings Homeowners Association PWS should update the inventory for their records every year. Changes in land uses or new potential contaminant sources will be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years to ensure that the inventory and this source water delineation and assessment report remains 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. An example of this is the private onsite septic systems present in the Inventory Region. No community or large capacity septic system exists for this community. Every potential contaminant source may not have been identified or recognized as being a significant potential contaminant source. The author of this SWDAR is depending on local knowledge of the PWS owners and/or operator for site-specific knowledge.

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 Rawlings Homeowners Association PWS owners and the operator. The goal of Source Water Management is to protect the source water by: 1) controlling activities in the Control Zone, 2) managing significant potential contaminant sources in the Inventory Region, 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 Rawlings Homeowners Association 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 (Table 7). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 8. Table 7 below describes the criteria to determine hazard within the Inventory Region as it was delineated in this SWDAR. Note that each table is specific to PWSs that draw their water from a confined aquifer. The determination of hazard is somewhat different for each type of water source. Note also that the hazard determination for wells drawing from a confined aquifer is based on the presence of an adequate seal around the casing of the PWS well and of other wells within the Inventory Region. An adequately sealed well will reduce the chance that contamination will migrate down the outside of the well casing and reach the confined aquifer.

Table 7. Hazard of Potential Contaminant Sources

Confined Aquifers

Potential Contaminant Source	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 Hazard	Moderate Hazard	Low Hazard
Septic Systems	High: >300 Moderate: 50 to 300 Low: <50	Moderate: 50 to 300 Low: <50	Low
Sanitary Sewer (% land use)	High: >50 Moderate: 20 to 50 Low: <20	Moderate: >50 Low: <50	Low
Cropped Agricultural Land (% land use)	High: >50 Moderate: 20 to 50 Low: <20	Moderate: >50 Low: <50	Low

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 PWS well (if it is within the Inventory Region); by the presence or absence of a migratory pathway down the outside of the well casing; and then by a percentage of the region that potential contaminant source occupies. Susceptibility ratings are then determined individually for each significant potential contaminant source and/or contaminant based on Table 8. These susceptibility ratings are the evaluation of the vulnerability of well to the potential contaminant sources and are presented on Table 9.

Table 8. 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 Rawlings Homeowners Association PWS wells is located in Table 9. Below is a brief discussion of the susceptibility assessment.

Increased Septic Density

The Rawlings HOA is served by private onsite septic systems. Residential septic systems are considered to be significant potential contaminate sources for the Rawlings Homeowners Association PWS. A large concentration of these systems increases the potential of a failure to treat sewage resulting in a chronic or large-scale release of septic effluent to groundwater. Suggested management tools that can be used to reduce the impacts from septic waste on the aquifer within the Inventory Region include:

- Aggressive local promotion of advanced septic treatment systems. This is applicable to the Rawlings HOA and surrounding areas that are not connected to city sewer.
- Public education concerning the proper handling and disposal of household or landscape maintenance chemicals. This is applicable to Rawlings HOA and surrounding areas.
- Maintenance and repair of the development's septic systems (including plumbing, tanks, and drainfields).
- Promotion of upgrading and maintenance of antiquated private septic systems.
- The potential development of local community sewer and wastewater treatment system (if feasible).

The hazard assigned to the various septic systems within the Inventory Region is low, due to the very thick glacial sediments above the well intakes. Multiple natural barriers are believed to be in place between the potential contaminant sources and the well intakes. The wells are thought to have a moderate susceptibility to contamination from septic systems (nitrates and pathogens).

Highway 93 and Railroad Lines

Accidents can and do happen along all highways and railways. Occasionally these accidents also involve releases of large quantities of hazardous materials. These releases are rare events, but if they occur, they can be catastrophic for local groundwater quality. The highway is assigned a moderate hazard, but is located east and downgradient from the wells. Along with the downgradient location of the highway and railway, it appears that there are multiple barriers in place and the Rawlings HOA wells have a low susceptibility to contamination from releases along the railway and Highway 93.

Table 9. Susceptibility Assessment - Unconfined Aquifers

Rawlings Homeowners Association – Inventory Region

Source	Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Increased Septic Density	Nitrates, pathogens	Ongoing or catastrophic leakage of sewage into ground water. This happens mostly when these systems fail or are poorly maintained.	**Moderate Hazard**	- Vertical upward groundwater gradient (the water is under pressure, thus it rises up in the well casings)	**Moderate Susceptibility**	Encourage and support city efforts to extend city sewer. Promote aggressive maintenance of septic tanks and distribution lines. Promote the installation of advanced septic treatment for all new or replacement systems. Encourage and support city and county efforts to provide educational materials and workshops to the public on proper handling and disposal of industrial and household hazardous wastes and recycling.
Highway 93 and Railroad Lines.	Pesticides, fertilizers, VOCs, SOCs, other	Contaminants leaching into groundwater. This would be due to the spills, routine spraying, and storm water runoff	**Moderate Hazard**	- Emergency response planning - Down Gradient from the well intakes - Vertical upward groundwater gradient (the water is under pressure, thus it rises up in the well casings)	**Low Susceptibility**	Encourage and support emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.

Summary of Susceptibility

The Rawlings Homeowners Association public water supply uses two production wells. The aquifer beneath Rawlings Homeowners Association is a confined aquifer. The groundwater beneath the area of the wells is believed to flow to the east-southeast. For the purposes of this delineation and assessment, the Inventory Region is a 1,000-foot radius circle around the wellheads. The significant potential contaminant sources that were identified in the Inventory Region might affect water quality at the PWS. The potential contaminant sources found within the Inventory Region of greatest significance are:

- The areas of private onsite septic systems associated with Rawlings Homeowners Association and the surrounding area. These systems are assigned a moderate hazard.
- Highway 93 and the railroad lines are assigned a moderate hazard.

Several natural barriers are believed to be in-place to reduce the wells' susceptibility to some of these potential contaminant sources.

The Recharge Region and Inventory Region are depicted on Figure 2 and Figure 3, and the susceptibility of the PWS is discussed on Table 9.

It should be noted that several assumptions were made to develop this delineation and assessment. Because a contaminant source has not been identified in the inventory or susceptibility assessment of this report, it doesn't mean that the potential source is not there or that the potential for contamination does not exist (it is not a threat). So, if potential contaminant sources were present near or upgradient of any PWS, it would be prudent to understand the threat from these sources.

Monitoring Waivers

Introduction and Waiver Requirements

This section addresses the Rawlings Homeowners Association PWS that DEQ has classified as a Community System. The authors' recommendation is based upon the determination of susceptibility as described above. The 1986 Amendments to the Safe Drinking Water Act require that community and non-community non-transient 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.

Types of 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 upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals (or 1,000-foot radius circles around the well in the case of confined aquifers). The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

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

Susceptibility Waiver for Confined Aquifers

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

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

<u>Susceptibility Waiver Application Objective</u>

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.

<u>Waiver Recommendation</u>

Based on past monitoring results and the susceptibility assessment of the Rawlings Homeowners Association PWS, the PWS appears to be eligible for monitoring waivers. DEQ records show that the

PWS currently has no monitoring waivers. Based on the monitoring history for the wells, the results of the inventory, the susceptibility assessment of this SWDAR, the geology of the area, the nature of the aquifer from which the wells draw water, the PWS production wells are probably eligible for inorganic chemical (IOC) waivers. For monitoring waiver consideration, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. This water system is encouraged to contact the Montana DEQ requesting monitoring relief for IOCs. As there is no record of an annular seal for Well 1, organic chemical waivers are probably not appropriate.

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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 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.
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 does not allow the flow of water, maintaining the pressure of the ground water in the aquifer. The physical properties of a confining unit may range from a five-feet thick clay layer to a shale that is hundreds of feet thick.
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. The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) provides information about specific sites through the EPA Envirofacts website.
Delineation. The process of determining and mapping source water protection areas.
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 affect 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.
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). Database system to track entities that discharge wastewater of any type into waters of the State of Montana.
National Pollutant Discharge Elimination System (NPDES). A national database system to track entities that discharge wastewater.
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. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of 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.
Point-Source. A stationary location or fixed facility from which pollutants are discharged.
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. 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. The Resource Conservation and Recovery Information System (RCRIS) 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 Assessment Report. A report for a public water supply that delineates source water protection areas, performs 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.
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.
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.
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 evaporates readily to the atmosphere.

*** Definitions adapted from EPA's Glossary of Selected Terms and Abbreviations (http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html) and other sources.**

APPENDICES

Appendix A
Well Log

Appendix B
Sanitary Survey

Appendix C

DEQ PWS Database

System Summary

Water Quality Data

Appendix D
Concurrence Letter