

Springwater Colony

The attached Source Water Delineation and Assessment Report (SWDAR) for Springwater Colony was completed by Bill O'Connell of Montana Rural Water Systems, Inc. and Lisa O'Connell of Montana Tech as part of a June, 2003 report entitled "Hydrogeologic Assessment of the Principal Aquifers in the Upper Musselshell River Basin, Montana in Support of Source Water Assessment and Delineation Reports for Public Water Systems". Additional regional background information and assessment methodology for the Musselshell Project area from the Hydrogeologic Assessment is available at

[Regional Background Information and Assessment Methodology](#)

The primary intent of a Source Water Delineation and Assessment Report is to provide the background information for the community to use in developing local drinking water protection strategies. The attached report for Springwater Colony incorporates delineation and assessment components and includes a limited management and emergency response plan. ***DEQ has not reviewed the report or plan to confirm that it meets the requirements of Montana's Source Water Protection Program or that it is protective of your drinking water supply.***

It is highly recommended that the water system and community:

- Review the delineation of the inventory region to ensure it is protective of the long-term water quality;
- "Enhance" or refine the identification of the potential contamination sources and susceptibility analysis through further research and local input;
- Ensure that the management plan adequately identifies and reduces the risks of groundwater contamination from all potential contaminant sources (existing and future) that may affect the drinking water supply; and
- Ensure that the emergency plan identifies the potential threats to the drinking water supply and provides the detail necessary to implement a response to contamination or disruption of the public water system.

Technical assistance is available through DEQ for communities that choose to move beyond the assessments and voluntarily develop a Drinking Water Protection Plan. Clean safe drinking water is fundamental to the viability of any community. Protecting the drinking water source is a wise and relatively inexpensive investment in the community's future.

For technical assistance with review of this assessment or in developing plans to protect your public water system contact:

Joe Meek
Supervisor
Source Water Protection Section
Montana Department of Environmental Quality
PO Box 200901
Helena MT 59620-0901
ph. (406) 444-4806
fax: (406) 444-6836
email: jmeek@state.mt.us

SOURCE WATER PROTECTION PLAN

SPRINGWATER COLONY

Public Water System

PWSID # MT0000719

Report Date: November 28, 2001

Contact Person:

Will Wipf

Certified Operator

P. O. Box 782

Harlowton, MT 59036

phone: (406) 632-4783

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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.

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

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.

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.

Delineation. A process of mapping source water management areas.

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 the area expected to contribute water to a public water supply within a fixed distance or a specified groundwater travel time.

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 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.

Public Water System. A system that provides piped water for human consumption to 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.

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 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.

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

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. 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.

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.

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

Volatile Organic Compounds (VOC). Any organic compound which evaporates readily to the atmosphere.

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

INTRODUCTION

This Report was completed by Bill O'Connell, Groundwater Technician with Montana Rural Water Systems inc. (MRWS) and Will Wipf, the licensed operator for the Springwater Colony's Public Water System (PWS). Mary Hendrickson a hydrogeologist with the Montana Bureau of Mines and Geology assisted with the hydrogeologic investigation. Additional information on the "new" well is taken from the Engineering Report completed by Neil Consultants, Inc. Perri Phillips of the DEQ's Source Water Protection Program reviewed the report. Additional information was provided based on the review comments.

Purpose

This report is intended to meet the technical requirements for the completion of the Source Water Protection Plan for Springwater as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996.

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 that contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of the source water protection plan is to protect the drinking water source.

Limitations

This report was prepared to assess threats to Springwater's public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the community's 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 Springwater are identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

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

CHAPTER 1 BACKGROUND

The Community

Springwater is located in central Montana, about 5 miles east of Harlowton. The PWS serves a Hutterite religious community of about 100 residents. The Colony farms and ranches on several sections of land surrounding the well sites. The Colony also has commercial egg, milk, and hog operations. The Colony has a sewage lagoon ¼ mile east of the compound. Some of the animal waste is land applied as fertilizer. The public water system has 15 hook-ups. See the vicinity map in figure 1.

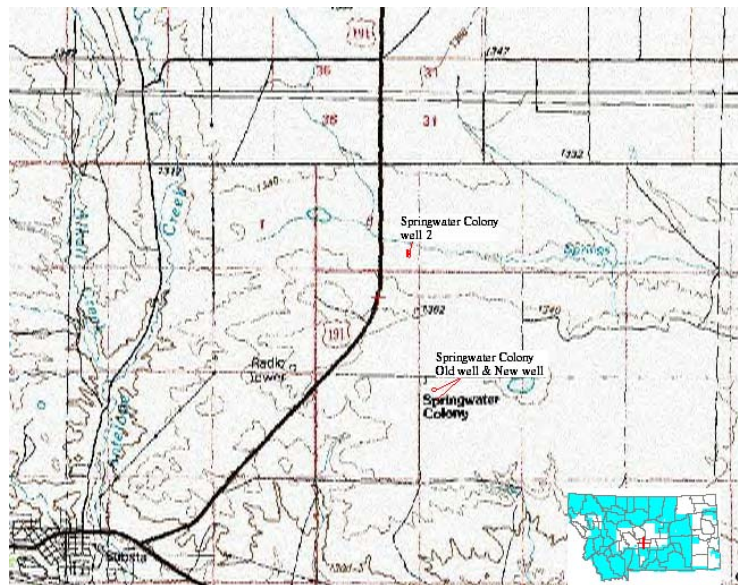


Figure 1. Springwater vicinity map

Geographic setting

Springwater Colony is located in the Unglaciated Missouri Plateau of the Great Plains Physiographic Province. The Colony sits on sedimentary deposits of the Cretaceous aged Montana Group Formations. The Montana Group includes the Bearpaw Shale, the Judith River formations, the Claggett shale and the Eagle sandstone.

The Big Snowy Mountains rise several miles north of the Colony as part of the Big Snowy uplift. Erosion has exposed the Cretaceous formations on a pediment surface that drops down to the Musselshell River, 352 feet below the Colony's well site. The average annual temperature in the Harlowton area is 44.2° F. Average precipitation is 13.79 inches (National Water and Climate Center).

General Description of the Source Water

Springwater Colony currently uses groundwater supplied by two wells to meet its drinking water requirements. The main well (Well 1) is located on the northwest edge of the Colony compound. The well is 1145 feet deep and is slotted from 320 feet to 400 feet and is open hole below 400 feet. The Eagle Sandstone Formation contains the primary aquifer. The aquifer is recharged by precipitation infiltrating through sandstone exposures north and northeast of the well. The first significant water was reported in the Judith River sandstone at a depth of 225 feet and in the Eagle Sandstone below 1000 feet. See the well logs in appendix III.

A second well (Well 2) 580 feet deep is located 1 mile north of the Colony compound. This well has multiple completions from 50 feet to 570 feet. The well is in the Judith River Formation.

A new well has been drilled and is currently being reviewed as a replacement for the existing deep well. The new well is 200 feet south of the existing main well and is drilled to similar depths.

All three wells are artesian.

Table 1. List of geologic or hydrogeologic maps available for the Springwater area.

Title or Description	Scale	Area Covered	Reference
topographical, geologic	1:100,000	Big Snowy Mountains, Montana	MBMG 341
Geological	Various	Montana	Taylor and Ashley

The Public Water Supply

The Springwater Colony's main well is located on the northwest corner of the Colony. A second well that is not used is located 150 feet southeast of the current well. A new well has been drilled 200 feet south of the main well. Well 2 is located 1 mile north of the compound. The wells are connected to the distribution system through pitless adapters and 2 inch PVC pipe that runs to the pumphouse. The pumphouse is about 250 feet east of the main well.

The pumphouse contains two 6000 gallon storage tanks and a 12000 gallon pressure tank. A 2 inch PVC line runs from the pumphouse and loops around the colony's houses and kitchen. A service line branches to the milk barn and slaughterhouse for cleaning equipment. A schematic of the water distribution system is shown in Figure 2.

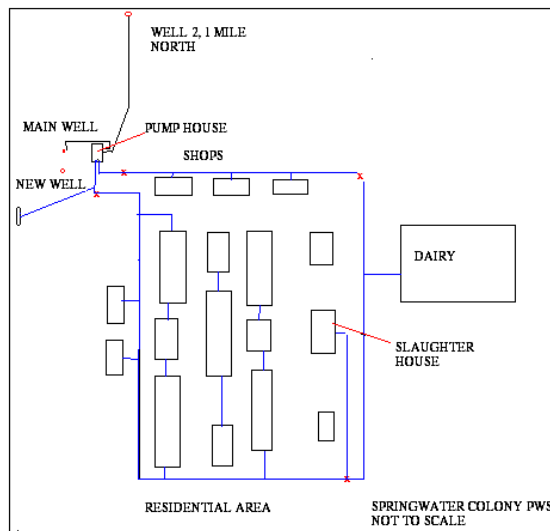


Figure 2. Springwater Colony Public Water System

Water Quality

Springwater is routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs monthly. Compliance with other drinking water standards is based on additional sampling on a variety of schedules. The groundwater quality in this region is marginal. The water is high in total dissolved solids including Fe, Mg and Na. Wells in the Musselshell River basin also have high sulfate and can produce hydrogen sulfide gas.

Influencing Factors

The source water protection plan was completed to ensure the PWS was complying with all DEQ requirements. When the waiver program began the potential for actual savings has made the program more attractive.

Source Water Protection Management

Will Wipf will oversee implementation of the SWPP.

CHAPTER 2

DELINEATION

The portions of the aquifers that can contribute water to Springwater=s wells are identified in this chapter. Three management regions (the control zone, inventory region, and recharge region) are mapped for each well. The goal of management in the control zone is to protect against direct introduction of contaminants into the well or the immediate surrounding area.

Management in the inventory region should focus on pollution prevention activities where water is likely to flow to the wells within a relatively short time period. The goal of management in the recharge region is to maintain and improve the quality of groundwater that could reach the wells over longer times or with increasing water usage.

Geologic Conditions and Aquifer Characteristics

The Colony=s wells sit on 10 feet of Quaternary sand and gravel, which are a remnant of a pediment formation created during desert conditions. Cretaceous sediments of the Montana Group lie beneath the Quaternary sediments. The main well (Well 1) is 280 feet above and just under 3 miles north the Musselshell River. Well 2 is 1.25 miles north of the Colony and more than 4 miles north of the River. The Big Snowy Mountains 10 miles north of the Colony rise several thousand feet above the surrounding area. The Big Snowy up-lift and several anticlines and synclines nearby attest to the area=s complex geology.

The main well is on a relatively flat area with surface drainage due north of the Colony to the east-southeast. The main drainage west of the Colony is in the south flowing Antelope Creek. About 1 mile south of the main well the land surface drops off sharply to the south and west. Several sandstone ridges (Judith River Formation) delineate steep changes in elevation south of the Colony compound. The sandstone dips 2 degrees to the northeast. The dip in these formations is in a different direction than the grade of the land surface above the outcrop.

Well 2 (1.25 miles north of the Colony compound) is in a draw that runs to the southeast. The draw isolates the Colony compound from surface runoff from the north. The elevation at Well 2 is about 60 feet lower than the elevation at the main well.

The static water level in the new well is 47 feet, which is near the elevation of the highest sandstone outcrop. The remaining outcrops are below the static water level and the River is approximately 235 feet below the static water level.

While drilling the new well, the first groundwater was found at a depth from 80 to 100 feet. A series of shale, clay, siltstone and sandstone layers from the 100 to 200 foot depth did not contain water. Between the 200 and 235 foot depth the first significant water was encountered. This water rose up to approximately 47 feet below the surface indicating a confined aquifer with no direct hydrologic connection to the lower sandstone outcrops. Water was found in the Claggett shale Formation at a depth of 600 feet. The Claggett produces poor water and the water

was sealed off. The remaining formations were dry until the Eagle Sandstone was reached near the 1000 foot depth. The Eagle Sandstone is the aquifer supplying the well.

The Judith River Formation is over 500 feet thick in this area and exposed to the west and south of the colony, where the overlying Bearpaw Shale and alluvial Quaternary sediments have been eroded away. The aquifer tapped is confined and the water rises 154 feet up the well under artesian pressure. The two drinking water wells (and the new well) are the only wells in the area that penetrate to this depth. Stock wells are located southeast of the compound and at a lower elevation in the Musselshell River Basin.

Wells

Springwater Colony=s Main Well, is 1145 feet deep and was originally cased to 400 feet with a 60 foot cement grout. According to Will Wipf, the PWS operator, in 1987 the well was reworked by DeBuff Drilling and PVC casing was installed in the open hole. The operator remembers the driller pushing the casing into the lower depths of the well. These depths are far below the working depth for PVC and with the driller forcing the casing down the hole much of the casing is probably busted. The pump is at a depth of 700 feet, so the casing is intact to at least that depth. The only water recorded in the driller=s log is at 213 feet but the well is not completed above 320 feet. According to the previous PWS operator, the well was logged by a geologist which means the log is probably accurate. The busted casing and the misplaced screened interval may be the reason the swl is so much lower than the log reports.

A second 580 foot deep well is over 1 mile north of the colony and produces less than 5 gpm. The well is grouted with bentonite to a depth of 20 feet and is completed from 50 feet to 570 feet. Well 2 has 8 completion intervals from 50 to 570 feet. The well shows good water at the 235 foot depth, about the same depth as for the new well. In the driller=s log for this well, the static water level is 6 feet and the pumping water level is 106 feet at 23 gpm. The well is only used occasionally. Both wells are plumbed into the pumphouse and the water mixed in storage tanks before entering the distribution system.

The other well is a shallow well 120 feet deep (communication with previous operator). The shallow well is 200 feet east of Well 1 and is not used.

A new well was drilled through similar stratigraphy as the Main Well. The new well was drilled down through to the Eagle Formation at a depth of 1160 feet. The Eagle formation did not initially produce sufficient water and as a result the well was completed in the Judith River Formation at a depth of 225 feet to 235 feet below the surface. The static water level in the well is 47 feet below the surface. The sandstone ridges 1.5 miles south of the well site are Judith River and may be recharge sources. The static water level is 47 feet and the well produces 25 gpm. The new well (test well) is 200 feet south of Well 1. See the well logs in appendix III.

Table 2. Source well information for Springwater Colony.

	Main Well	test well (new)	Well 2
MBMG #	123279		20894
Water Right #			
Latitude / Longitude	46.4574/-109.7593		46.4818/-109.7659
Date Completed	May 15, 1982	May 10, 2001	March 28, 1990
Depth	1145 ft	1160 ft	580 ft
Perforated Interval	320 to 400 ft	225 to 235 ft	50 to 570 ft
SWL Depth	135 ft	47 ft	6 ft
PWL Depth	222 ft (below 500 ft)	68 ft	106 ft
Drawdown	87 ft	19 ft	100 ft
Test Pumping Rate	22	38 gpm	23 gpm
Specific Capacity	.25 gpm/ft	2.6 gpm/ft	.23 gpm/ft
Pumping Rate	8 gpm	25 gpm	<7 gpm
Source Type	bedrock confined	Bedrock	Groundwater

Conceptual Model and Assumptions

The only substantial water identified in the drillers' logs for the two deep wells is at depths below 213 feet. The Main well's casing was slotted from 320 feet to 400 feet and the well is cased to at least 700 feet (pump depth).

The new well was completed in May of 2001 and is slotted from 225 feet to 235 feet below the surface. This is completed in part of the Judith River Formation. The well penetrated through the Eagle formation to the Telegraph Creek shale formation. Water chemistry was used to determine that the Eagle formation beneath this site is the principle aquifer supplying the well.

The Eagle Sandstone Formation is exposed throughout the Harlowton area. The Eagle Sandstone exposures are on both sides of the Musselshell River but because the static water level in the aquifer is 235 feet above the River only the formation exposures north and west of the River is considered as a potential recharge area.

The Big Snowy Uplift and the Shawmut Anticline are the structures controlling recharge to Eagle aquifer in this area. The Anticline located south and east of the Colony raised the geologic

formations relative to their pre-anticline positions. The Eagle Sandstone is exposed on the flanks of the anticline. Subsequent faulting along the west flank of the Anticline has down-dropped large sections of the formations throughout the region. The down-dropped western sections of the Eagle Formation are not hydrologically connected to the sections on the Anticline. As a result recharge is from the north-northeast. See the geologic map in appendix I.

Methods and Criteria

DEQ's Source Water Protection Program specifies methods and criteria used to delineate subregions of the source water protection areas for Springwater. One hundred-foot radius control zones were delineated for each well. Hydrogeologic mapping and a time-of-travel equation describing uniform groundwater flow were used to delineate an Inventory Region bounded by a three-year time-of-travel distance for Well 2. An 1100 foot radius circle centered between the deep wells was used to delineate the Inventory Region for the Main well and new well.

The time-of-travel calculation delineates the distance in the aquifer that water or nitrates and chlorides could travel in three years. The stagnation point and boundary limit delineate the down gradient and lateral extent of the capture zone for the wells (see Appendix II for an explanation of the stagnation point and boundary limit). Finally, topographic divides were used to approximate hydrologic boundaries in order to delineate the recharge region.

Time-of-Travel Calculation

The calculations for Well 2 are:

Transmissivity: $T = 2000 Q/s = 2000 (7 \text{ gpm}/100 \text{ ft}) = 140 \text{ gpm}/\text{ft}$

Hydraulic conductivity: $K = T/\text{aquifer thickness} = 140/35 \text{ ft} = 4 \text{ ft}/\text{day}$

Aquifer thickness: $b = 5+5+5+4+4+4+4+4 = 35$

Hydraulic gradient: $i = 20/1000 = .02$

Down gradient: $-X_L = Q/2\pi Ti = ((7 \text{ gpm})(1440 \text{ min}/\text{day})/7.48 \text{ gal per ft}^3)/2(3.14)(140)(.02) = 76.6 \text{ ft}$

Lateral limits: $Y_L = (-X_L)(\pi) = (76.6 \text{ ft})(3.14) = 240.6 \text{ ft}$

Upgradient extent: $X = kit/n = (4)(.02)(1095 \text{ days})/.1 = 876 \text{ ft}$

Due to the Main and new wells' depth (completed below 225 ft) and the overlying geology (shale and clay), a time-of-travel calculation was not used. Instead an 1100 foot radius circle was delineated and inventoried around the wells. This is the default delineation required by the DEQ.

Delineation Results

The delineated areas are the 1100 foot radius around the main well and the new well at the Colony compound. North of the compound is the delineation for well 2. The triangle shape is the area calculated from the analytical equations above. See the delineations on map in figure 3.

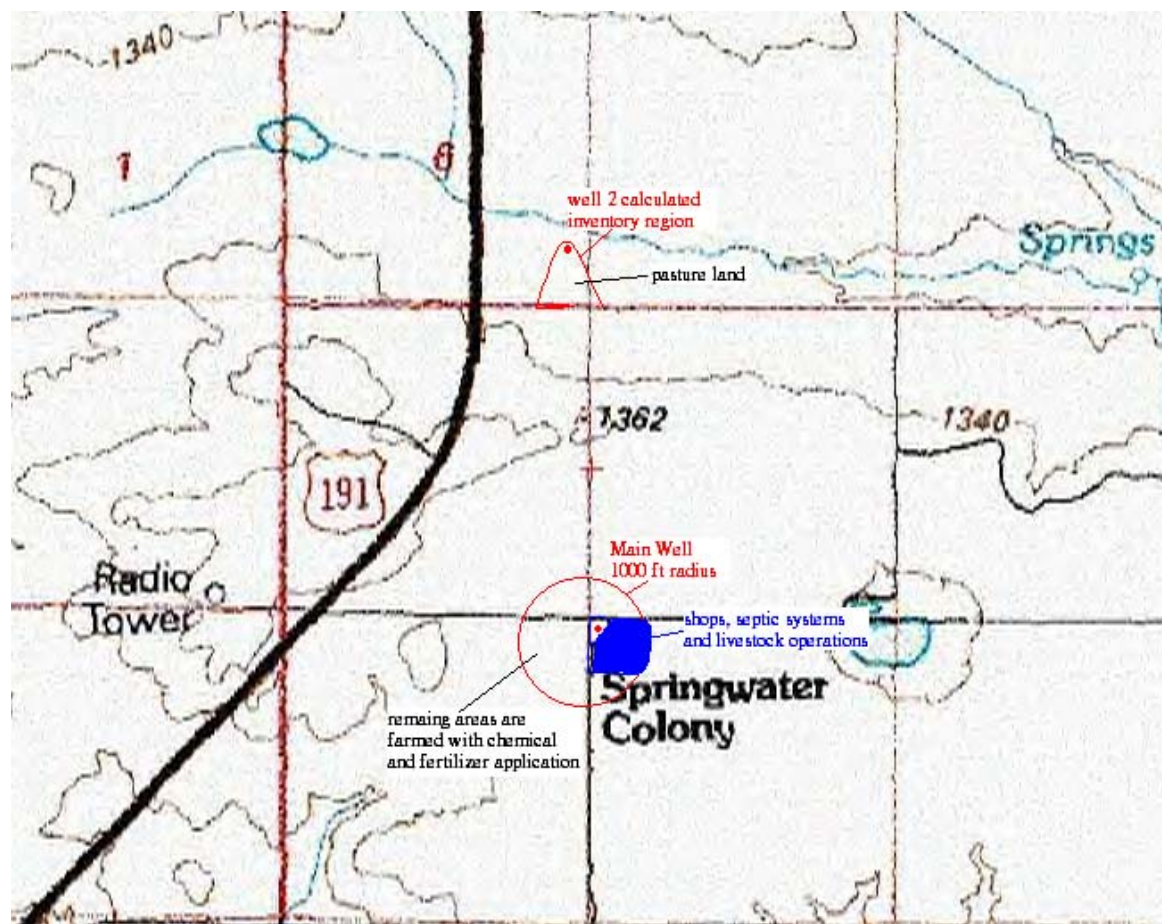


Figure 3. Delineated Inventory Regions

CHAPTER 3

INVENTORY

Potential sources of contamination were inventoried to assess the susceptibility of Springwater=s drinking water sources to contamination. Potential sources of all contaminants with primary drinking water standards and cryptosporidium were identified but a detailed inventory was conducted only for potential sources of contaminants that are the greatest threat to health. The contaminants of greatest concern to Springwater are nitrate and pathogenic organisms.

The inventory for Springwater focuses on all activities in the control zone, major facilities in the inventory region, and general land uses in the recharge region.

Inventory Method

Databases were 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: EPA=s Envirofacts System was queried to identify EPA regulated facilities located in the Inventory Region. This system contains information pertaining to facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), Permit Compliance System (PCS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). 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 2: DEQ databases were queried to identify underground storage tanks (UST)s, hazardous waste contaminated sites (DEQ Hazardous Waste Site Cleanup Bureau), landfills, and abandoned mines in the inventory region. Any information on past releases and present compliance status was noted.

Step 3: Major road and rail transportation routes were identified throughout the inventory region.

Step 4: 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. Hazardous waste contaminated sites | 4) Underground storage tanks |
| 5. Major roads or rail transportation routes | 6). Cultivated cropland |
| 7. Animal feeding operations | 8) Wastewater treatment or spray irrigation |
| 9. Septic systems, Sewered residential areas | 10) Storm sewer outflows |

Inventory Results/Control Zone

The control zone is the 100 foot radius around each well. Within the control zone for the main well and the proposed well, the main potential contaminant is from vehicle traffic near the wellhead. The road to the well site is only for access to the well.

Well 2 sits in a pasture 1.25 miles north of the Colony compound. The only road is a jeep trail used by the operator to reach the well. There is a potential for cattle and other agricultural activities to be within the 100 foot control zone.

Inventory Results/Inventory Region

The Inventory Region for Springwater=s main well includes residential areas, shops and animal handling buildings, some pasture land, and dry land farmland. The Colony does apply animal waste on these crop fields. The Colony has a large septic system located east of the compound. The Colony is a self-sufficient operation and the shops contain what is needed to keep the farm equipment running.

Well 2 is located in a pasture away from the compound. The two potential contaminant sources are an intermittent stream and highway 191, both are outside the delineated area but near enough to be included.

Table 3. Contaminant inventory for Springwater=s main well

map ID	Source	Hazard
	Housing	leaking sewer lines
	Slaughterhouse	leaking sewer lines or waste collection systems
	barns	leaching from animal waste
	shops	chemical leaks
	cropped land and pasture land	Chemicals and animal waste
	Roads and highway 191	Vehicles and cargo

Inventory Results/Recharge Region

The Recharge Region for the well outside the inventory region is primarily used for agriculture.

Inventory Update

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

Inventory Limitations

The potential sources of contaminants for Springwater are determined from readily available data and reports. Unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data should ensure the major threats to the source water for Springwater. The unique isolated nature of the colony allows them to control activities around the wells.

CHAPTER 4

SUSCEPTIBILITY ASSESSMENT

The susceptibility of Springwater=s wells to significant potential contaminant sources is assessed in this chapter and to rank the threats to the drinking water source. The degree of susceptibility is determined by the hazard associated with a source and the existence of barriers to contamination (Table 4). The proximity of point contaminant sources to the town=s wells or the density of non-point sources in the inventory region determines hazard (Table 5). Barriers can be anything that decreases the likelihood that contaminated water will flow to the town=s wells. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers are spill catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices can be considered management barriers. Thick clayey soils, a deep water table, or a thick saturated zone above the well intake can be natural barriers.

Susceptibility ratings are presented individually for each significant potential contaminant source in the inventory region. Springwater is not considered susceptible to individual point sources in the recharge region because dispersion and dilution of contaminants should reduce concentrations of contaminants below levels associated with adverse health affects.

Table 4. Susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

	High Hazard	Moderate Hazard	Low Hazard
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Table 5. Hazard of potential contaminant sources for Springwater.

	High Hazard	Moderate Hazard	Low Hazard
Point Sources of All Contaminants	Within one-year TOT	one to three years TOT	Over three years TOT
Septic Systems	More than 300 per sq. mi.	50 B 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (% land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (% land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

The results of the susceptibility assessment for Springwater are summarized in Table 6. The following are brief descriptions of the susceptibility assessments for each significant potential contaminant source.

Table 6. Susceptibility assessment for the Springwater Inventory region.

Source	Contaminant	Hazard	Rating	Barriers	Susceptibility	Management
housing - domestic sewers	pathogens and nitrates	Leaks	Moderate	well intake below 200 feet well grouted to bedrock distance from well	Low	routine monitoring
slaughter houses	pathogens, nitrates	Leaks	Moderate	distance from well depth to groundwater clay and shale formations	low	proper waste disposal
shops and chemical storage	VOCs SOCs other chemicals	Spills	high	distance from well well intake below 200 feet confined aquifer	very low	routine monitoring
chemical application on farm land and pasture	VOCs, SOC and nitrates	infiltration	high	confined aquifer distance to well depth to groundwater	moderate	routine monitoring
Roads	various chemicals	Spills	Moderate	see above	very low	emergency response plan

CHAPTER 5

MANAGEMENT

The goal of the Source Water Protection Program is to prevent Springwater=s drinking water source from being contaminated. All land uses have been inventoried and the potential for these activities to contaminate the drinking water have been ranked. Management activities can be considered as another barrier developed to reduce the susceptibility of a specific contaminant from entering Springwater=s water.

Control Zone Management

No chemicals will be used, stored or transported within the 100 foot radius of the wells. Due to the remote location of the well(s), this requirement is already in effect.

Inventory Region Management

Management of this region for Springwater=s is based on the wells' locations away from most land use activities. The Colony controls all the land in this region and will use best management practices in their farming and ranching activities.

Recharge Region Management

The recharge region for Springwater Colony farm and pasture land. Most of the land is controlled by the Colony. The PWS operator will monitor any land use changes in the area to ensure they won=t impact the wells.

Management Implementation

The management strategies have been in use since the wells began serving the PWS.

CHAPTER 6

EMERGENCY PLAN

Procedures for responding to emergencies are described and an emergency coordinator is designated in this chapter. The equipment and materials needed to respond to an emergency and the source of a temporary water supply are also described.

Possible Disruption Threats

The main threat to the PWS has been identified as casing failure. A failure of the casing could allow contaminated surface water to enter the well and/or it could prevent groundwater from entering the well.

Emergency Coordinator

The emergency coordinator for Springwater is Will Wipf.

Equipment and Material Resources

A catastrophic loss of water will require the services of an engineer and a well driller. Minor disruptions to the water system will be handled by the Colony.

Procedures to Shut Down the Well

The wells can be isolated from the water distribution system by using the valves at the well sites. The wells can be turned off at the pump house but requires a key for access.

Security

The Main Well is located in the Colony compound and except for the wellhead all facilities are in locked building. The Colony is 1 mile from the highway. Well 2 is in a field north of the colony. The well is in a locked pit.

Table 8. Emergency Contacts

Contact Name	Title	Phone	Responsibility
Will Wipf	operator	(406) 632-4732	All PWS
DES	Wheatland County		Disaster & Emergency Services
24 hour Spill Hotline		(406) 444-5400	All spills
	Dept of Agriculture	(406) 444-5400	Ag chemicals
DEQ Enforcement		(406) 444-0379	

CHAPTER 7

ALTERNATE WATER SOURCES

Springwater is actively looking for a new water source. A new well is being constructed near the existing well and an alternative location 1.5 miles south of the Colony is being considered. The Colony has been working with a local engineering firm.

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6. Porter, Karen W. and Wilde Edith M., 1999, Geologic Map of the Musselshell 30' x 60' Quadrangle, Central Montana
7. Porter, K.W., Wilde, E.M., and Vuke, S.M., 1999, Preliminary Geologic Map of the Big Snowy Mountains 30' x 60' Quadrangle

Appendix I
Geologic Map

Appendix II
Time-of Travel Equations
&
Area Delineations

Appendix III
Well Logs

Appendix IV
Engineering Report

Taken from
Montana Bureau of Mines and Geology
Open File No. 434
Geologic Map of the
Harlowton 30' x 60' Quadrangle
Central Montana
By Edith M. Wilde and Karen W. Porter
2001