Source Water Delineation and Assessment Report

Town of Broadus

PWSID MT00166

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INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was completed by Jim Stimson, Hydrogeologist with Montana Department of Environmental Quality (DEQ).

Purpose

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

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment." Delineation is a process of mapping areas that contribute water used for drinking. Assessment involves identifying locations in the delineated areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps the town of Broadus protect their drinking water source. Some of the information on the well and the public water supply comes from a sanitary survey completed in May 2000 by Denver Frasier of the Montana Department of Environmental Quality (DEQ) (available from DEQ upon request).

Limitations

This report was prepared to assess threats to the Broadus 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 Broadus public water system and not any other public or private water system. Also, not all potential or existing sources of groundwater or surface water contamination in the Broadus area are identified. Only potential sources of contamination in areas that contribute water to Broadus public water system wells are considered.

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

CHAPTER 1 - BACKGROUND

The Community

Approximately 572 people reside in Broadus, which is located along state highway 212 about 150 miles southeast of Billings, Montana and about 80 miles south of Miles City (Figure 1). The population of Powder River County was estimated at 1,918 in 2000. Broadus is the largest town in the county.

Broadus is located about 50 miles east of the Northern Cheyenne Indian Reservation near the confluence of the Little Powder River with the Powder River. The current economy relies on farming, ranching and related services. Coal mining and coal-fired electric power generation are major industries in the northern Powder River Basin.

Broadus's public water system serves residents in and around the town (Figure 1). A municipal sewer serves the towns residence but one residential area one-quarter mile west of town is unsewered with a septic density of moderate to high. The largest quantities of chemicals in the community are found at three retail gasoline outlets.

Geographic setting

Broadus is located on the eastern edge of the Powder River Basin at 45.4439-north latitude and -105.4075-east longitude. This location is about 3,029 feet above sea level and is within the Middle Powder River Watershed (HUC 10090207). The Powder River Basin is a geologic or structural basin located between the Bighorn Mountains to the west and the Black Hills to the east. The Basin extends into Northern Wyoming. The Miles City Arch separates the Powder River Basin from the Williston Basin. This area is dominantly rolling hills and badlands topography with local relief between 100 and 500 feet. Land elevations range from 4,800 feet in the Wolf - Little Wolf Mountains to the southwest to 2,200 feet at the Powder River's confluence with the Yellowstone River. Within the Upper Powder River Watershed within Montana, elevations of the uplands reach about 4,300 feet near the state line.

The average daily high and low temperatures at Broadus are 86.8°F and 55.5°F in July and 31.4°F and 5.5°F in January. Precipitation averaging 13.53 inches annually is heaviest in May and June. Average annual snowfall is 1.0 inches.

General Aquifer Setting

The Broadus public water supply obtains water from 3 wells located in town (Figure 1). The wells are deep, completed at 965, 892, and 1,100 feet below ground surface (bgs). The wells are completed within a deeper regional aquifer within the Fox Hills-Hell Creek Formation. This Formation can be up to 1,300 ft thick and consists of beds of shale, mudstone, sandstone, and coal. Multiple thick layers of shale and mudstone encountered in wells acts as confining layers. Yields reported by drillers for wells in the Broadus area range from 85 to 300 gpm for the Broadus wells.

Water Quality

Water quality for the deeper regional aquifer is summarized in Table 1. The information comes from a report by Slagle and others (1983). In general, the water is dominant in sodium and sulfate with smaller amounts of magnesium, calcium, and bicarbonate. Dissolved solids are generally between 400 to 6,000 milligrams per liter (mg/L) and average about 2,000 mg/L. Coal aquifers tend to be dominated by sodium and bicarbonate water.

Table 1. Chemical analyses of water from wells in the deeper hydrologic unit (Slagle ann others, 1983).

Number of Samples	Ca mg/L	Mg mg/L	Na mg/L	K Mg/L	HCO_3 mg/L	Cl mg/L	SO_4 Mg/L	Dissolved Solids
Maximum	350	330	1,100	14	2,000	770	3,300	5,720
Average	32	27	450	4	850	36	390	1,400
Minimum	1.0	0.1	13	1	230	3.0	0.1	390

Monitoring and Enforcement Actions

The Broadus wells are 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 depending on system classification and population served. In August of 1997, bacteria were detected in a water sample from the system that triggered the collection of additional samples. No bacteria were detected in the follow-up samples and no water quality violation was registered against the system. There were no detects of other regulated contaminants in the Broadus wells during the past five years with the exception of nitrate. Nitrate can come from human or animal wastes but also occurs naturally. The highest nitrate level detected in the school's water during the past five years was 4.02 mg/l, considerably below the maximum Contaminant level of 10 mg/l set by the U.S. Environmental Protection Agency (EPA).

CHAPTER 2 - DELINEATION

The source water protection areas for the Broadus public water system are delineated in this chapter. The purpose of delineation is to map the source of the water supply's drinking water and to define areas within which to prioritize source water protection efforts. Three types of management regions are mapped; they are the control zone, inventory region, and recharge 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 inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

Hydrogeologic Conditions

This section provides an overview of the geology and ground-water hydrology of the Powder River Basin. This is an important section because it identifies and describes the geologic formations or groups of formations that are used as aquifers in this region. It also helps in understanding why some of the aquifers are more sensitive to potential contamination from the land surface and why others are less sensitive. Descriptions of hydrogeologic conditions in the Powder River Basin come from reports by Cannon (1985), Lee, Slagle, and Stimson (1977), Rankl and Lowry (1985), Slagle et al. (1983), Slagle, Lewis, and Lee (1985), and Smith et al. (2000).

Quaternary alluvial deposits and terrace deposits are present within most stream valleys and tributaries (Figure 2). These deposits consist of lenses and beds of gravel, sand, silt and clay ranging in thickness between 0 to 100 feet. Bedrock is also exposed at the land surface in the region and is almost exclusively the Fort Union Formation of Paleocene age (Figure 2). The Wasatch Formation (Eocene age) crops out in several areas in the southern portion of the Powder River Basin within Montana. The Fort Union Formation consists of beds of fine-grained sandstone, siltsone, shale, and coal. Clinker beds are also present where outcrops of coal have burned and fused rock material together. The Fort Union can be up to1,600 feet thick and can be divided into three members in descending order: the Tullock, Lebo Shale, and Tongue River. The Hell Creek Formation (Upper Cretaceous) is below the Fort Union, ranges between 200 and 900 feet thick, and contains beds of silty shale, mudstone, sandstone, and coal. Generally, the Hell Creek is more fine grained and contains less coal than the overlying Fort Union. Sandstone beds are more abundant in the lower part of the Hell Creek Formation. The Fox Hills Formation (Upper Cretaceous) lies below the Hell Creek and is marked by a light-colored sandstone bed ranging in thickness from 30 to 150 feet. The sandstone is known as the Colgate Member and is present over large areas in this region. The lower part of the Fox Hills is made up of sandstone, sandy shale, silty shale, and carbonaceous shale. Thickness of the entire Fox Hills ranges between 60 and 400 feet in this region and further east. The Pierre Shale (Upper Cretaceous), also known as the Bearpaw Shale in other parts of Montana, occurs below the Fox Hills and is between 1,300 and 3,000 feet thick. Geologic formations below the Pierre Shale are generally not considered as potential aquifers due to either limited yield or poor water quality.

Published reports on ground-water resources in the Powder River Basin identify four primary aquifers that include: 1) the alluvial and terrace deposits within stream valleys, 2) the upper 200 feet of the Fort Union Formation, 3) sandstone beds within the lower Fort Union Formation, and 4) the lower Hell Creek - upper Fox Hills Formation (Colgate Member). Water from formations below the Pierre Shale tend to have high total dissolved solids and are too saline for domestic and stock water use.

Several studies in this region divide the aquifers into a shallow group, referred to as a shallow hydrologic unit, that represents aquifers within 200 feet of the land surface (Slagle et al. 1983, Smith et al. 2000). In most places this correlates to the upper part of the Fort Union Formation. Ground-water flow within this shallow hydrologic unit is generally from upland areas toward stream tributaries and major streams. A deeper group of aquifers or a deeper hydrologic unit, is present below the pervasive claystone and shale beds in the upper Hell Creek Formation represents. This hydrologic unit is generally below 200 feet. Ground-water flow within the deeper hydrologic unit is generally from upland areas toward major streams. Below the deeper unit, the lower Hell Creek - upper Fox Hills can be treated as a distinct hydrologic unit. Ground-water flow in the lower Hell Creek - upper Fox Hills is generally north toward the Yellowstone River valley and represents a deeper regional flow system. Studies also indicate the regional flow system contributes water to segments of the Tongue River and Powder River.

Although identifying and mapping the multiple groups of aquifers or hydrologic units can seem confusing and maybe unnecessary, it is actually a very important concept. In many places in eastern Montana, potable water is very hard to come by. Many shallow wells either encounter no water or water of poor quality. Knowing that the lower Hell Creek - upper Fox Hills hydrologic unit is present over large areas in eastern Montana provides drillers with an alternative target for a source of potable water. The down-side to having to use the deeper hydrologic unit is that drilling costs are increased, in some cases substantially.

The Montana Ground Water Information Center (GWIC) records about 632 wells in the Middle Powder River Watershed where Broadus is located. Of these, about 30% are less than 75 feet deep and 57% of the wells are less than 200 feet deep. The deepest well is 1,350 feet deep and the average drilling depth for wells in this watershed is 262 feet. This information indicates that a good number of wells in this watershed are completed in the deeper hydrologic unit.

All of the Broadus wells tap sandstone beds that are between 650 to 1000 feet below land surface. These beds are within the deeper hydrologic unit of the Fox Hills - Hell Creek Formation and can be considered a confined aquifer. Ground-water flow is generally from the south toward the Yellowstone River Valley, although studies indicate there is some leakage from the deeper hydrologic unit to the shallow hydrologic unit and some of this water discharges to larger rivers in the region i.e. the Tongue and Powder (Rankl and Lowry, 1985). Aquifers within deep consolidated sandstone bedrock are assigned a low aquifer sensitivity rating, according to the Montana Source Water Protection Document (Montana DEQ, 1999).

Conceptual Model

The aquifers in this region receive water from infiltration of precipitation, loss of water from streams and irrigation canals, and, in some locations, from leakage from adjacent aquifers. Water enters (recharges) the deeper hydrologic unit of the Fort Union Formation from upland areas some distance from Broadus in the southern part of the Middle Powder River Watershed. Multiple claystone and shale beds above the sandstone beds utilized by the Broadus wells act as confining beds and impede flow from potential contaminants present at the land surface in the vicinity of Broadus. Water from the deeper hydrologic unit mixes with water from the shallow hydrologic unit at discharge areas along larger stream drainages like the Tongue River and Powder River (Figure 3).

Source Well

The wells that serve Broadus are located within town (Figure 1 and Figure 4) and the water is treated with chlorine at each well house. There are two storage reservoirs in the system located above town to the northwest, a 100,000-gallon buried storage reservoir and a 286,000-gallon above ground level tank. Water is delivered to residence through a network of concrete pipes and 327 active connections.

Table 2. Information from drillers logs from wells near the Broadus.

MBMG # DNRC WR#	102267 (Main Well) D002008	7633 (Clinic Well) NA	(Hill Well)
Location	04S 51E 34 ACAC	04S 51E 34 ABAD	04S 51E 34 ABC
Date Completed	Oct 13, 1969	May 29, 1963	January 01, 1961
Depth (ft bgs*)	1,110	965	892
Screened Interval (ft**)	775 - 1,000	646 - 684 840 - 960	-
SWL Depth (ft bgs*)	4	-	40
PWL Depth (ft bgs*)	300	-	-
Drawdown (ft**)	296	-	-
Test Pumping Rate (gpm***)	72	300	300
Specific Capacity (gpm/ft****)	0.27	-	-

*ft bgs = feet below ground surface, **ft = feet, ***gpm = gallons per minute, ****gpm/ft = gallons per minute per foot of drawdown.

Delineation

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). For wells completed in a confined aquifer, inventory regions can be delineated as 1000-foot fixed radius regions, and when multiple inventory regions overlap they can be combined into a single region. Source water protection regions for the Broadus public water supply wells include individual control zones for each well and a common inventory region (Figure 4). A recharge region is also delineated (Figure 5). Each source water protection region is described below.

Control Zones - A 100-foot radius control zones are delineated for all of the wells; all sources of potential contaminants should be excluded in this region.

Inventory Region – The inventory region is a 1000-foot fixed radius circle measured from the wellhead. Because the inventory regions of each well overlap, they are combined. All potential sources of contamination are inventoried within this region.

Recharge Region - Topographic divides that represent the 8-digit watershed HUC 10090207, are used as the recharge region for the Broadus wells. Aquifers within the Fox Hills - Hell Creek formation receive recharge from the infiltration of precipitation, loss of water from streams and irrigation canals, and from leakage from adjacent and overlying aquifers. The goal of management in the recharge region is to maintain and improve the long-term quality of groundwater in the bedrock and alluvial aquifers.

CHAPTER 3 - INVENTORY

An inventory of potential contaminant sources was conducted to assess the susceptibility of Broadus' wells to contamination and to provide a basis for source water protection planning. The inventory for the wells focuses on facilities that generate, use, or store potential contaminants and certain land uses in the inventory region delineated in the previous section. Sources of all primary drinking water contaminants and cryptosporidium are identified, although only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory. The contaminants of greatest concern to Broadus are nitrate, microbial contaminants, fuels, solvents, and pesticides.

Inventory Method

Databases were searched to identify businesses and land uses that are potential sources of regulated contaminants. The following steps were followed:

Step 1: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (USGS, 2000). Land cover types in this dataset were mapped from satellite imagery at 30-meter resolution using a variety of supporting information.

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

Step 3: DEQ databases were queried to identify underground storage tanks (UST), hazardous waste contaminated sites, landfills, and abandoned mines.

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

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

Step 6: All significant potential contaminant sources were identified in the inventory region, sources of nitrate and microbial contaminants were identified in the surface water buffer, and land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region.

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 lagoons or spray irrigation
9) Septic systems
10) Sewered residential areas
11) Storm runoff
12) Floor drains, sumps, or dry well

Inventory Results/Control Zones

Control zones for the three wells include residential and business lots within Broadus. Spills from traffic accidents on city streets, leaks from sewer lines, spills of small quantities of chemicals by residents, and Class V injection wells represent potential contaminant sources in the control zones.

Inventory Results/Inventory Regions

Land use in the inventory region is 74 percent low intensity residential and 16 percent grassland or shrubland. These land uses are not considered to be potential contaminant sources. However, nitrate and pathogens are potential contaminants from municipal sewer lines that are present beneath the residential areas within the city limits. Use of fertilizers and pesticides on yards, school grounds, and parks are potential contaminant sources in the inventory region but probably do not involve sufficient quantities to be considered significant. A short section of Highway 212 is located within the southern portion of the inventory region. Accidental spills of hazardous material are considered significant threats to the water supply. Eleven businesses located within the inventory region include: auto repair shops, the fire department, a funeral home, and a taxidermy shop (Figure 4). If these businesses store and use petroleum products and other hazardous chemicals, they are considered potential sources of contamination. In addition, some of these businesses may have Class V injection wells, also known as floor drains, that are not connected to the municipal sewer system. Class V injection wells represent significant potential sources of contamination.

According to information on file at the DEQ, between 1989 and 1998, there were 29 reports of leaking underground storage tanks in the vicinity of Broadus. Currently, all of the leaking tanks are listed as being permanently out of service. Of these sites, twenty-four UST are still in operation but are shown to be in compliance with state and federal regulations. Three of the sites are located within the inventory region (Figure 4). UST sites are considered significant potential source of contamination. The most likely contaminants in the inventory region are petroleum products (fuels), nitrate, and microbial contaminants.

Table 3. Significant potential contaminant sources in the inventory region of Broadus.

Source	Contaminants of Concern
3 UST sites - gas stations	VOCs (petroleum and fuel products)
Municipal Sewer Lines	Pathogens / Nitrate
Class V Injection Wells	A variety of hazardous materials
Highway 212	Accidental spills of hazardous materials

Inventory Result/Recharge Region and Surface Water Buffer Region

Land use in the recharge region is 76 percent grassland or shrubland, 12 percent forest, and 8 percent agricultural land (Figure 5). Grassland, shrubland, and forest are not considered to be potential contaminant sources. Pesticides and nitrate use within the watershed is not a threat to the water supply because the percent of agricultural land within the watershed is small.

Inventory Update

The Montana Source Water Protection Program recommends that the certified water system operator update their inventory records every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years.

Inventory Limitations

The potential sources of contaminants described above are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information, however, should ensure that the major threats to the source water for Broadus have been identified.

CHAPTER 4 - SUSCEPTIBILITY ASSESSMENT

The susceptibility of the Broadus wells to contamination is assessed in this chapter. The proximity of a potential contaminant source to a well or the density of non-point potential contaminant sources determines the threat of contamination, referred to here as hazard (Table 5A and 5B). Hazard and the existence of barriers to contamination determine susceptibility (Table 6).

Barriers can be anything that decreases the likelihood that contaminants will reach a well. 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 clay-rich soils, a deep water table or a thick saturated zone above the well intake can be natural barriers.

Table 4. Hazard of potential contaminant sources for the Broadus public water system bedrock wells.

Potential Contaminate Sources	The PWS well is not sealed through the confining layer	Other wells in the inventory region are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
Point Sources	High	Moderate	Low
Septic Systems (# per square mile)	High: > 300 Moderate: 50 to 300 Low: < 50	Moderate: > 300 Low: < 300	Low
Sanitary Sewer (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low
Cropland (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low

Table 5. Susceptibility to potential contaminant sources based on 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

Susceptibility Discussion

The Broadus water supply wells are completed in a deep confined bedrock aquifer. There are only two other deep wells (approximately 600 feet deep) within the inventory region and neither appears to penetrate the confining unit or shale beds that are immediately above the aquifer used by the public water supply wells. Based on information from drillers logs and the most recent sanitary survey, the Broadus wells appear to be properly completed and maintained. As a result, the hazard assigned to all significant potential contaminant sources within the inventory region is low (see third column of Table 4). Susceptibility ratings are presented individually for each significant potential contaminant source in the inventory region (Table 7).

Underground Storage Tanks (UST) – Hazard from the UST sites is rated low for the reasons stated in the paragraph above. Susceptibility is rated low because the UST sites are in compliance with current state and federal regulation to provide leak detection and monitoring which is considered a barrier.

Municipal Sewer Lines – Hazard is rated low because about 43% of the inventory region is underlain by the sewer district. Susceptibility is rated moderate because no barriers are identified.

Class V injection wells – The presence of Class V wells has not been verified in the Broadus area and will not be done until EPA completes a nation-wide inventory of the Class V wells. However, Class V wells are listed as potential contaminant sources because they have been widely used in many communities throughout the nation in the past. Hazard of the Class V wells within the inventory region would be low and susceptibility would be rated moderate.

Highway 212 – Hazard is rated low for the reasons stated in the paragraph above. Susceptibility is rated moderate because there is no documentation that Broadus has an emergency response plan to guide the mobilization of emergency personnel in the event of an accidental spill. Documenting and implementing an emergency plan would count as a barrier and would lower the susceptibility rating from moderate to low.

Table 6. Susceptibility assessment for the Broadus wells.

Source	Contaminant	Hazard Rating	Barriers	Susceptibility	Management
UST Sites	Petroleum Products Fuels	Low	Compliance with state and federal regulations	Low	Continue inspections, leak detection and monitoring
Municipal Sewer Lines	Pathogens / Nitrate	Low	None	Moderate	Maintenance and inspection (when practical) to detect leaks.
Class V Injection Wells (including floor drains)	Hazardous Materials	Low	None	Moderate	Inventory and permitting or closure of Class V injection wells.
Highway 212	Accidental spills Hazardous Materials	Low	None	Moderate	Implement an emergency response plan

Management Recommendations

Management recommendations are listed along with the susceptibility analysis in Table 7. These recommendations are suggested to entities such as Broadus City Government and Powder River County that have the authority or ability to implement them. These recommendations can be considered additional barriers that if implemented will reduce the susceptibility of the Broadus wells to specific sources and contaminants.

Management recommendations fall into five categories:

- Inspection and monitoring of USTs
- Sewer extension
- Inventory and closure or permitting of Class V injection wells

Inspection and monitoring of USTs – The majority of USTs in operation today have been upgraded as of December 1999. The upgrading requires tanks to have leak detection and operators to maintain records designed to identify leak events. Operators should comply with state and federal regulations and maintain record keeping to help early detection of leaks and early response.

Sewer Extension – Some unsewered areas exist in the Broadus area. Installation of advanced septic treatment systems such as sand filter septic tanks can limit contamination from new rural residential development, however, annexation and extension of sewers is the only way to eliminate contamination from existing unsewered developments.

Inventory and permitting or closure of Class V injection wells – The U.S. EPA is implementing a program to identify and permit or close sumps, floor drains, dry wells, or commercial septic systems that are potential contaminant sources. This program is being implemented gradually with EPA planning to complete an assessment for Broadus within the next year. EPA's first step is to mail shallow well inventory request forms to businesses that often have Class V injection wells (they concentrate on automotive service businesses). EPA makes decisions on permitting and closure based on responses they receive and subsequent inspections. Permit recipients are required to sample their shallow injection wells quarterly and ensure that the fluid being injected meets drinking water standards.

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Figures

Figure 1 - General Location Map

Figure 2 - Geology Map

Figure 3 - Conceptual Ground-Water Flow Model

Figure 4 - Inventory Map

Figure 5 - Landcover and Surface Water Buffer Region

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 system 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 system 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 system. 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 sources that are diffuse and do not have a single point of origin.

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 system. 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 system.

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