

# *Source Water Delineation and Assessment Report*

11/99

Kingsbury Colony  
Public Water System

**PWSID # MT0002031**

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## INTRODUCTION

This Delineation and Assessment Report was completed by James Swierc with the Source Water Protection Program at the Department of Environmental Quality with the assistance of Mike and David Kleinsasser with Kingsbury Colony. This Source Water Delineation and Assessment Report was prepared for the Kingsbury Hutterite Colony Public Water Supply, PWS ID# 2031, located in Pondera County.

### **Purpose**

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

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

### **Limitations**

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

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

# CHAPTER 1

## BACKGROUND

### **The Community**

The Kingsbury Hutterite Colony is located in Pondera County, in north-central Montana, as shown in [Figure 1](#). The nearest town with commercial services is Valier (population 519), located approximately 10 miles east of the colony. The Blackfeet Indian Reservation is located approximately 3 miles north of the colony. There are approximately 98 residents at the colony. The economy of the colony relies on the production of a variety of agricultural products.

The Colony complex comprises several residential buildings, a kitchen building, and several other facilities that support the agricultural activities at the colony. A map showing the layout of the colony is included with Appendix A. There is one well for the PWS. The well is located north of the main colony complex, near the intersection of the access road from Montana Highway 44.

Domestic wastewater is treated in a two-cell lagoon treatment system located east of the main colony buildings. Liquid animal waste from the barns is collected and stored into a two-cell stock lagoon located adjacent to the domestic wastewater lagoons. Solid animal waste is disposed with the liquid waste by land application as fertilizer to cropland.

### **Geographic setting**

Kingsbury Colony is located in the foothills to the east of the central part of the Rocky Mountain Front Range (see [Figure 1](#)). The mountains in this area represent a significant feature with peaks that rise over 4,000 feet above the plains. The colony is located adjacent to the southern edge of the Birch Creek Flats, a thin terrace of unconsolidated alluvium associated with Birch Creek which flows to the east on the northern edge of the terrace at this location. Miller Coulee is the primary drainage along the southern part of the terrace. Ryan Lauffer Ditch is an irrigation ditch that flows to the east in the central part of the Birch Creek Flats. The colony is located on the edge of a bedrock bench that bounds the Birch Creek Flats. The colony is located in the unglaciated region between the recent continental glaciers to the east, and mountain glaciers to the west.

The climate is typical of northern Montana, with a limited amount of precipitation averaging 12.02 inches a year as measured at the weather station at the Conrad Airport. The wettest months are May and June averaging 1.88 and 2.69 inches monthly, respectively. The driest months are October through March, with monthly averages ranging from 0.32 to 0.61 inches per month. The temperature ranges from an average high of 82.5 °F in July (minimum July average of 49.6 °F) to an average of 30.9 °F in January (minimum January average of 5.8 °F).

### **General description of the Source Water**

The Kingsbury Colony water system uses one well for their PWS. The well is located approximately one-half mile north of the central part of the colony ([Figure 1](#)). Water is obtained from a shallow aquifer located in the terrace gravels of the Birch Creek Flats. The area is located within the Two Medicine River watershed (USGS Hydrologic Unit Code 10030201), located within the Lower Missouri River Watershed Management Region for Montana.

There are no published reports on ground water hydrology in the vicinity of Kingsbury Colony. The PWS well is approximately 40 feet deep. Kingsbury Colony also has three wells used for stock water; which draw water from both the gravels and from sandstones in the upper part of the Two Medicine Formation. The well lithologies are listed on the well logs in Appendix B. The PWS source aquifer is unconsolidated terrace gravels,

which represent an unconfined aquifer. The static water level reported at approximately 8 feet below the ground surface. Ground water flow in the PWS source aquifer near the colony is considered likely to flow generally northeast following the general topography of the Birch Creek Flats.

### **The Public Water Supply**

The PWS supply well (Source 002) is located approximately one-half mile north of the main colony complex. Information on the PWS for Kingsbury Colony is reviewed in a sanitary survey completed for the colony in October 1994. The information reported on the PWS is obtained from this report, DEQ records, and from information gathered during a site visit by the author. A copy of the recent sanitary survey is included in Appendix A.

The water system for Kingsbury Colony serves the resident population of 98 people through 12 active service connections located in the colony residential and other buildings. An estimated 6 additional service connections at the colony are considered inactive at this time. The general layout of the colony buildings and distribution system is depicted in Appendix A. The configuration of the public water supply for Kingsbury Colony includes a storage tank located on the hill to the south of the colony. Water is pumped from the supply well through the distribution system, with excess water flowing into the storage tank which helps maintain pressure through the system. There is currently no treatment or disinfection for the water.

The well lithology and construction logs for the well is included in Appendix B. The system operator estimates water usage averages approximately 20,000 gallons per day, or about 14 gallons per minute. The pump in the well provides water at approximately 45 gallons per minute.

### **Water Quality**

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliforms and other signs of pathogenic organism, nitrates, metals and for multiple chemicals. The monitoring schedule depends on many factors such as the size and source water for a PWS, the number of sources (e.g. wells), and the population served. Each PWS has a specific monitoring program tailored to their system that follows the general protocols for operation of a PWS defined by DEQ. A review of the DEQ PWS database indicates that monitoring results for the Kingsbury Colony PWS show no violations or exceedences of any drinking water quality standards. The only detected compound that is regulated is nitrate, which can occur naturally or from agricultural, human and animal waste. The health standard for nitrates, the MCL, is 10 mg/L. The monitoring results for the potable water supply indicate nitrate levels ranging from 5.41 mg/L to 8.89 mg/L over the last five years.

While the detected concentrations of nitrates are below regulatory limits, the levels are higher than the state average for nitrates in ground water. While the detected levels may be from natural sources, the nitrates may also result from runoff from agriculture on the Birch Creek Flats to the west, upgradient from the PWS source. The levels of nitrates in the water source should represent a concern for Kingsbury Colony, especially if they are from agricultural sources upgradient from the colony. If the nitrate source is from agricultural activities, the source aquifer may also be threatened by trace levels of pesticides and/or herbicides that may be used in the same agricultural activities. Monitoring of water quality from the well should be scrutinized to ensure that there are no health threats associated with use of the water by the population of Kingsbury Colony.

## CHAPTER 2 DELINEATION

The source water protection area, the land area that contributes water to Kingsbury Colony is identified in this chapter. Three management areas are identified within the source water protection area. These three regions, the control zone, inventory region, and recharge region, are delineated for the well. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region for the unconfined aquifer is defined as the area upgradient from the well which represents a three-year time of travel distance for water within the aquifer that may be pumped by the well. The recharge region represents the area where the source aquifer for the Kingsbury Colony water system wells is replenished.

### Hydrogeologic Conditions

There are no published reports on the hydrogeology of the immediate area around Kingsbury Colony. The following discussion of the hydrogeologic setting of the area is based on available information on the area, and assumptions based on basic principles of hydrogeology. The assumptions are discussed in the following. A generalized geologic map of the area around Kingsbury Colony, adapted from Ross et. al. (1955), is depicted in [Figure 2](#). Additional geologic information was obtained from well logs for the area from the Ground Water Information Center at the Montana Bureau of Mines (Appendix B).

The Kingsbury Colony PWS source is located on a thin gravel terrace related to Birch Creek which flows to the east on the north side of the terrace. The thin terrace gravels are located on the bedrock surface which is exposed in the hills immediately south of Kingsbury Colony. The aquifer is present in terrace gravels of Birch Creek Flats, which overlies the sandstones of the Two Medicine Creek Formation (see well logs in Appendix B). The primary aquifer for the Kingsbury Colony is considered unconfined in unconsolidated alluvium. Based on this criteria, the aquifer is classified as having a *high* source water sensitivity to contamination.

Ground water flow in the vicinity of Kingsbury Colony is considered to be generally east to northeast, following the topography of the Birch Creek Flats. The source well has a high continuous yield, suggesting that ground water flow in the aquifer is relatively quick. The aquifer is recharged by infiltration of surface water and precipitation into the subsurface on the Birch Creek Flats to the west of the well. Recharge may also occur from stream loss in Birch Creek, Miller Coulee and Ryan Lauffler Ditch when flowing. Shales and other fine-grained rock units within the Two Medicine Formation may keep the local aquifer system perched above any deeper regional systems that may be present in the area.

### Conceptual Model and Assumptions

Ground water is recharged from stream loss and infiltration of surface water and precipitation into the subsurface in the area west of the Kingsbury Colony PWS well. Ground water flow in the area generally follows the topographic gradient of the Birch Creek Flats, to the east.

### Well(s) Information

The well log for the source well for the Kingsbury PWS is included in Appendix B. The well is 40 feet deep. Important information on the well is summarized in Table 1. According to the well log, the yield of the well is 50 gpm.

**Table 1.** Source well information.

Information	Well 1
PWS Source Code	002
Well Location	T30N, R7W, Sec 35 ccb
MBMG #	85072
Water Right #	<i>Not listed</i>
Date Well was Completed	August 7, 1979
Total Depth	40 feet
Perforated Interval	25 to 40 feet
Static Water Level	8 feet bgs
Pumping Water Level	10 feet bgs
Drawdown	2 feet
Test Pumping Rate	50 gpm
Specific Capacity	25 gpm/foot drawdown

### Methods and Criteria

The source water protection areas were delineated using the uniform flow equation, following the criteria defined for unconfined aquifers in the Montana Source Water Protection Program (DEQ, 1999). The lack of any specific data on hydrologic characteristics of the area limits the accuracy of the calculated estimates of hydrologic flow rates. The use of the uniform flow equation assumes that flow within the unconsolidated gravels is uniform through primary porosity. To address the uncertainties in the flow system, all estimated property values reflect conservative assumptions to ensure that proper management zones reflect all potential contaminant sources that may impact the Kingsbury Colony water supply.

### Model Input

The hydrologic parameter values used for the flow rate calculations are summarized in Table 3 and described in the following, with the criteria for selection of each value:

- **Transmissivity:** The transmissivity value is calculated from the specific yield of the PWS well using the method described in Driscoll (1980) for unconfined aquifers, where:

$$Q/s = T/1500; \text{ or } T = 1500 Q/s$$

$$Q = \text{pumping rate, gpm} - 50 \text{ gpm}$$

$$s = \text{drawdown, in feet} - 2 \text{ feet} \quad \text{note: } Q/s = \text{specific capacity}$$

$$T = \text{Transmissivity, in gpd/ft}$$

The estimated value for Transmissivity is 37,500 gpd/ft, which equals 5,025 ft<sup>2</sup>/day.

- **Thickness:** The thickness of the aquifer for the water source was estimated as 20 feet, based on a distance of 1.5 times the thickness of the screened interval across the lower part of the aquifer for the PWS well.
- **Hydraulic Conductivity:** A value for hydraulic conductivity is estimated using the basic relationship

$$T = Kb, \text{ where } T = \text{transmissivity} - 5025 \text{ ft}^2/\text{day}$$

$$b = \text{aquifer thickness} - 20 \text{ feet}$$

The estimated value for the hydraulic conductivity (K) is 251.25 ft/day. A rounded value of 250 ft/day is used as a conservative estimate for this assessment.

- **Hydraulic Gradient:** The hydraulic gradient was estimated at 33 feet/mile, or 0.006 feet/feet.
- **Porosity:** The value for effective porosity is estimated from Heath (1989) at 25%.

- **Pumping Rate:** The pumping rate was estimated at 14 gpm, based on actual estimated withdrawal from the well.

### **Delineation Results**

Ground water flow in the PWS aquifer, based on the above assumptions, travels an estimated distance of 2,260 feet (0.43 miles) in a one-year period. The three year time of travel distance is estimated at 6,660 feet (1.26 miles). The inventory zone is delineated as the area on the Birch Creek Flats west of the PWS well, following the trend of the Ryan Lauffer Ditch. The inventory zone is broadened to the edge of the Birch Creek Flats to the south as an aquifer boundary, and to the north to account for uncertainties in estimates of the ground water flow direction, and natural dispersion within the aquifer.

The delineated management zones for the wells are depicted in [Figure 3](#). The control zone comprises an area of a 100-foot radius around each wellhead. The inventory zone reflects the area describe in the preceding paragraph. The recharge area reflects the area to the east of the colony PWS well on the Birch Creek Flats.

### **Limiting Factors**

The lack of site and regional hydrogeologic data represent the greatest potential source of error to accurate delineations of the management zones for the water source at Kingsbury Colony. The inventory zone is expanded to account for uncertainties in the flow direction.

## CHAPTER 3 INVENTORY

An inventory of potential sources of contamination was conducted for the Kingsbury Colony PWS within the control and inventory regions. Potential sources of all primary drinking water contaminants and *Cryptosporidium* were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Kingsbury Colony PWS inventory region are nitrates, pathogens and herbicides/pesticides and fertilizer from cropped agricultural land; and from spills along Montana Highway 44 located near the wellhead for the PWS well.

The inventory for Kingsbury Colony PWS focuses on all activities in the control zone, certain sites or land use activities in the inventory region, and general land uses and large facilities in the recharge region.

### **Inventory Method**

The inventory for Kingsbury Colony was obtained by visiting the colony, and discussing colony activities with representatives from the colony. Information on the PWS, land use, agricultural chemical storage and application, and waste disposal practices were identified at this time.

Urban and agricultural land uses were identified from the University of Montana GAP landuse analysis project (Redmond et. al., 1998). Major transportation routes through the area, including railroad lines, were also identified. This information is depicted in [Figure 4](#).

As part of the standard inventory process, the information in available databases on environmental sites was reviewed. EPA's Envirofacts System 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), Permit Compliance System (PCS) and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). DEQ Databases were queried to identify the following in the inventory region: Underground Storage Tanks (UST), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills, abandoned mines, and active mines including gravel pits. Any information on past releases and present compliance status was noted.

No facilities were identified with this search.

### **Inventory Results/Control Zone**

The control zone for the PWS well is located north of the main colony complex within the area near Montana Highway 44, and the location of a former gravel pit. The control zone is not fenced or otherwise identified around the wellhead. The primary potential contaminant sources result from agricultural activities and from an accident on the highway.

### **Inventory Results/Inventory Region**

The inventory region for the main PWS well includes the agricultural areas to the west of the well. Potential contaminant sources to the PWS wells are shown in Figure 5 and summarized in Table 2. The potential contaminant sources in the inventory zone include spilled fuels and other farm chemicals, and crop fertilizers and herbicides. The primary hazards are spills of fuels or other chemicals on the highway, spills of animal wastes during transportation to the field for land application, excess application of herbicides and runoff from the cropped areas, and from the actual land application of animal wastes.

## Inventory Results/Recharge Region

The recharge region for the main PWS well is comprised primarily of agricultural cropland, with some areas used for open range cattle grazing. Use of fertilizers, and weed control herbicides and fuels for farm machinery are the contaminants of concern in the recharge region. The location of potential contaminant sources are depicted in Figure 5

**Table 2.** Significant potential contaminant sources.

Source	Hazard
<i>Control and Inventory Zones</i>	
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Montana Highway 44	Spill or Accident from Transported Chemicals or Fuels
<i>Recharge Area</i>	
County Roads and Highways	Spill or Accident from Transported Chemicals or Fuels
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides

## Inventory Update

The certified operator should update the inventory every year for his records. Changes in land uses or potential contaminant sources should 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 for Kingsbury Colony are taken from data and reports that are readily available. Consequently, unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data, however, should help assure that contaminant sources that are identified represent the major threats to the source water for Kingsbury Colony.

## CHAPTER 4 SUSCEPTIBILITY ASSESSMENT

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 the Kingsbury Colony PWS.

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 land use 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 Kingsbury Colony PWS to reduce susceptibility are recommended.

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 Kingsbury Colony PWS wells (Table 3). Hazard is rated by the proximity of a potential contaminant source to the well(s). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 4).

**Table 3.** Relative susceptibility to specific contaminant sources based on hazard and barriers.

Presence Of Barriers	Hazard		
	High	Moderate	Low
<b>No Barriers</b>	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
<b>One Barrier</b>	High Susceptibility	Moderate Susceptibility	Low Susceptibility
<b>Multiple Barriers</b>	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

For unconfined aquifers, hazards for point sources are assigned based on the location of the potential contaminant source within inventory zone. Sources located within a one-year time of travel distance are assigned a relative hazard of high. Potential sources located within the inventory zone within a time of travel distance of one to three years are assigned a relative hazard of moderate. Additional point sources within the recharge area are assigned a relative hazard of low.

When the location of septic systems are known, they are treated as point sources, with hazards assigned based on the above criteria. For non-point sources, the relative hazard is assigned based on the relative concentration of the sources within the inventory zone, based on the following table:

<i>Source Type</i>	<i>High Hazard</i>	<i>Moderate Hazard</i>	<i>Low Hazard</i>
Septic Systems	> 300 per sq. mi.	50 – 300 per sq. mi.	< 50 per sq. mi.
Municipal Sanitary Sewer (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region
Cropped Agricultural Land(% Land Use)	> 50% of region	20% – 50% of region	< 20% of region

The only potential point source of contamination within the inventory zone is a spill along the highway. The proximity of the PWS well to Highway 44 results in a relative hazard of high for the highway. The classification of landuse in the inventory zone as primarily agricultural results in a relative hazard rating of high for this non-point source to the Kingsbury Colony PWS well.

There are no natural barriers for the PWS well, as the well log indicates predominantly gravel at the surface, overlying sandstone bedrock material. Based on this criteria, there are no barriers identified that may mitigate the impacts of the potential contaminant sources to water quality in the PWS well.

The results of the susceptibility assessment are summarized in Table 4, with recommended management actions. The results indicate that both Highway 44 and cropped agricultural land and related activities represent the greatest relative hazard for contamination to the PWS well. The location of the PWS well away from the central part of the colony provides a measure of protection to potential impacts to water quality in the wells from colony activities.

**Table 4.** Susceptibility assessment of significant potential contaminant sources.

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
<i>Control and Inventory Zone – Main PWS Well (Source 002)</i>						
County and Colony Access Roads	VOCs, Pathogens and Nitrate	Spills	High	None	Very High	Develop emergency response plan
Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	High	None	Very High	Communicate with upgradient landowner, apply chemicals according to label instructions
<i>Recharge Area (Main PWS Well (Source 002)</i>						
County and Colony Access Roads	VOCs, Pathogens and Nitrate	Spills	Moderate	None	High	Develop emergency response plan
Cropped Agricultural Land	SOCs, Nitrates	Infiltration and Runoff	Moderate	None	High	Communicate with upgradient landowner, apply chemicals according to label instructions

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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-foot 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 effect ground water flow systems.

**Inventory Region.** A source water management area for ground water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year ground water travel time.

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

**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>)

## ***Kingsbury Colony Public Water Supply Summary of Time of Travel Calculations***

<b>Property</b>		<b>Units</b>	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	250
Hyd Grad	I	ft/ft	0.006
Pumping Rate	Q	gpm	14
		ft <sup>3</sup> /day	2695
Aquifer Thickness	b	feet	20
 <b>Distance Upgradient to Null Point</b>			
Null Distance	Xl	feet	14
		miles	0.00
 <b>Lateral limits of Zone of Contribution</b>			
Boundary Limits	Y	feet	45
		miles	0.01

## ***Time of Travel Calculations***

<b>Distance Traveled</b>		<b>Time of Travel</b>	
feet	miles	days	years
1000	0.19	156.51	0.43
100	0.02	11.71	0.03
500	0.09	74.80	0.20
1000	0.19	156.51	0.43
2500	0.47	404.35	1.11
5000	0.95	819.37	2.24
5280	1.00	865.91	2.37
7500	1.42	1235.07	3.38
10000	1.89	1651.05	4.52
10560	2.00	1744.26	4.78
15000	2.84	2483.42	6.80
15840	3.00	2623.29	7.18
21120	4.00	3502.61	9.59
31680	6.00	5261.64	14.41
2260	0.43	364.59	1.00
6660	1.26	1095.35	3.00
11050	2.09	1825.82	5.00