

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

11/99

New Miami Colony
Public Water System

PWSID # MT0001914

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Jacob Wipf,
Certified Operator

Route 3, P.O. Box 448
Conrad, Montana 59425

phone: (406) 472-3310

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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>)

INTRODUCTION

This Delineation and Assessment Report was completed by James Swierc of the Source Water Protection Program at the Department of Environmental Quality with the assistance of Jacob Wipf of New Miami Colony. This Source Water Delineation and Assessment Report was prepared for the New Miami Hutterite Colony Public Water Supply, PWS ID# 01778, located in Teton County.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the New Miami 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 New Miami Colony PWS complete a source water protection plan to protect its drinking water source.

Limitations

This report was prepared to assess threats to the New Miami Colony public water supply, and is based on published information and information obtained from local residents familiar with the community. Information sources such as the most recent sanitary survey referenced in this report are based on data available at the time of preparation of the report. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the New Miami 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 New Miami 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 significant health threats.

CHAPTER 1

BACKGROUND

The Community

The New Miami Hutterite Colony is located in Pondera County, in north-central Montana, as shown in [Figure 1](#). The colony is located approximately 10 miles east of Dupuyer, and 8 miles south of Valier. The nearest town with commercial services is Conrad (population 2903), located approximately 16 miles southeast of the colony. There are currently 108 residents at the colony. The economy of the colony relies on the production of a variety of agricultural products.

The Colony complex comprises four 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. Human waste and animal processing wastes are treated in wastewater treatment lagoons located on the northern part of the colony, away from the buildings.

Geographic setting

New Miami 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 to an altitude of over 4,000 feet above the plains. The colony is located on the eastern bank of the Dry Fork of the Marias River, which is an ephemeral stream in this area.

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 New Miami Hutterite Colony has two systems that serve their water needs. Wells located around the colony grounds provide water for the systems. The soft water system represents the PWS for the colony, obtaining water from a single well. The hard water system provides water for livestock and other water needs of the colony from several wells. The wells are located as shown in [Figure 1](#). Both systems are piped into the colony, with soft water used for drinking and domestic tasks, and the hard water is used throughout the barns.

Shallow ground water in the area that supplies the wells occurs in sandstones of the Two Medicine Formation, and potentially the upper part of the underlying Virgelle Sandstone. The soft water well is approximately 75 feet deep. The source aquifer is considered unconfined in the area of the colony. Infiltration of precipitation and surface water recharges the source aquifer in the area surrounding the colony. Shallow ground water flow in the area of the colony is considered likely to flow in a general northward direction, following topography and the gradient of the Dry Fork of the Marias River, toward New Miami Colony. The area is located within the Marias River watershed (USGS Hydrologic Unit Code 10030203), located within the Upper Missouri River Watershed Management Region of Montana.

The Public Water Supply

The configuration of the public water supply for New Miami Colony is outlined in the most recent sanitary inspection report completed by McNenny Environmental Engineering and Consulting on October 28, 1994. A copy of this report is included in Appendix A. The following discussion summarizes information obtained from

this report.

The water system for New Miami Colony serves a resident population of 108 people through 20 active service connections located in the colony residential and other buildings. The general layout of the colony buildings is depicted in Appendix A. Water for the soft water system is obtained from the supply well (Source 002), stored in a glass lined 10000 gallon storage tank, pumped from the tank to a captive air pressure tank and then piped to the service connections. An additional source well in the DEQ PWS database, Source 003, is listed as inactive and used for livestock. The well lithology and construction logs for the main well and several wells for the hard water system are included in Appendix B.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring parameters typically include coliforms (as an indicator of pathogenic organisms), nitrates, metals and multiple chemicals. The monitoring schedule depends on many factors such as the size of the system, the water source for the PWS, the number of sources (e.g. wells), and land use in the vicinity. A specific monitoring program is designed for each PWS that follows the general protocols for operation of a PWS defined by DEQ following the guidelines originally established in the federal Safe Drinking Water Act.

A review of the DEQ PWS database indicates that monitoring results for the New Miami Colony PWS show several problems with coliform bacteria in 1995. The system was disinfected, and coliforms have not been detected in regular sample since. The source of the coliforms to the system was not determined. The only regulated chemical consistently detected is nitrate, which can occur naturally or from human and animal waste. The drinking water standard, or MCL, for nitrate is 10 mg/L. The monitoring results for the potable water supply indicate varying nitrate concentrations, ranging from none detected up to a maximum of 3.07 mg/L detected on December 27, 1994. The two most recent sample results, from November 19, 1998 and November 9, 1999 indicate 0.95 mg/L and 0.64 mg/L, respectively.

A monitoring sample for VOCs from December 9, 1998 detected a trace concentration of 2.55 µg/L of Chloroform. Since there are no identifiable sources for the compound at New Miami Colony, the result is interpreted to result from laboratory contamination, and is not considered representative of any threat to the water supply. Verification sampling for this compound, based on this result, was not required.

CHAPTER 2 DELINEATION

The source water protection area, the land area that contributes water to New Miami Colony is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the control zone, inventory region, and recharge region. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region represents the zone of contribution of the well, which approximates a three-year groundwater time-of-travel. The recharge region represents the entire portion of the aquifer that contributes water to the New Miami Colony water system.

Hydrogeologic Conditions

There are no published reports on the hydrogeology of the area around New Miami Colony. The following discussion of the hydrogeologic setting of the area is based on application of basic principles of hydrogeology to the local geologic setting. The interpretation is based on the geologic map of the area (Ross et. al., 1955), as depicted in [Figure 2](#). Well logs for the area from the Ground Water Information Center at the Montana Bureau of Mines and Geology provided additional information on local geology. This information is included in Appendix B. The area around New Miami Colony has only six wells in the database, and the colony owns all of these wells.

The New Miami Colony is located adjacent to the valley of the Dry Fork of the Marias River, which has incised into the bedrock surface. The aquifer is present in sandstones of the Two Medicine Creek Formation. Fracture flow may represent the primary porosity for the aquifer, especially in more fine-grained layers. The primary aquifer for the New Miami Colony is considered unconfined in the area as a shallow fractured bedrock system. Based on this criteria, the aquifer is classified as having a high source water sensitivity to contamination.

Ground water flow in the vicinity of New Miami Colony is considered to be generally northeastward, following topography and the general gradient of the Dry Fork of the Marias River. However, the ground water flow direction is estimated here with a degree of uncertainty due to several factors. Flow through the colony may be west reflecting a westward flowing tributary stream present immediately south of the colony. The flow direction could also be north following the gradient of the Dry Fork of the Marias River located west of the colony. The actual flow direction is considered likely to reflect input from both the tributary stream and the Dry Fork of the Marias River, resulting in a flow direction that is generally to the northwest through the colony. However, the actual flow direction may change seasonally in response to changes in flow conditions in the surface streams in the area. The yield from the source well is generally low, suggesting that ground water flow in the aquifer does not have a high volume and is relatively slow. The aquifer is recharged by infiltration of surface water and precipitation into the subsurface in the area from the surrounding the colony. Ground water flow in the aquifer occurs in the primary porosity of the sandstone, and in fractures in the bedrock which provide secondary porosity.

Conceptual Model and Assumptions

Ground water is recharged from infiltration of surface water and precipitation into the subsurface in the area southwest to southeast of New Miami Colony. Ground water flow generally follows the topographic gradient to the north and northeast through the colony.

Well Information

The PWS well was installed in 1985, replacing the original colony well installed in 1948. The well is

approximately 109 feet deep, with a steel casing to 70 feet grouted with neat cement to that depth. The well materials inside the casing are constructed of PVC, with a screened interval present from 81 to 96 feet. The well is drilled into sandstone of the Two Medicine Formation. The well yields approximately 40 gpm. The well location is depicted in [Figure 1](#) with the estimated location of other New Miami Colony hard water wells. Available well logs are included in Appendix B.

Table 1. PWS Source well information.

Information	Well #1 “Soft Water Well”
PWS Source Code	002
Well Location	28N05W08CCB
MBMG #	81464
Water Right #	58184
Date Well was Completed	October 22, 1985
Total Depth	109 feet
Perforated Interval	81’ – 96’
Static Water Level	<i>Not Listed</i>
Pumping Water Level	<i>Not Listed</i>
Drawdown	<i>Not Listed</i>
Test Pumping Rate	40 gpm
Specific Capacity	<i>Not Listed</i>

Methods and Criteria

The lack of any specific data on hydrologic characteristics of the area limits the ability to accurately estimate hydrologic flow rates. As a result, there is not sufficient data to estimate a three-year time of travel distance for the aquifer as required under the DEQ Source Water Protection program criteria for unconfined aquifers (DEQ, 1999). In order to establish an inventory zone that is protective of the water system at the New Miami Colony, the inventory zone is delineated based on a one-mile radius around the colony, biased towards the area hydrologically upgradient from the colony wells. The recharge area is delineated at the watershed of the Dry Fork of the Marias River upstream from the colony.

Delineation Results

The delineated management zones for the wells are depicted in [Figure 3](#). The control zones comprise an area of a 100-foot radius around the wellheads. The inventory zone reflects an area with a one-mile radius around the wellheads, biased to the west, south and east of the colony. The recharge area reflects the watershed of the Dry Fork of the Marias River upgradient from the colony; however, the area that recharges the colony PWS well is likely to be within several miles of the colony.

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 sources at New Miami Colony. The inventory zone of a one-mile radius provides a conservative approach that helps to minimize the potential effects from the lack of hydrologic data for the area.

CHAPTER 3 INVENTORY

An inventory of potential sources of contamination was conducted for the New Miami Colony PWS within the control and inventory regions. Potential sources of all primary drinking water contaminants and pathogens such as *Cryptosporidium* were identified. From these potential sources, those meeting the criteria as significant potential contaminant sources as outlined in the Montana Source Water Protection Program (DEQ, 1999) were selected for detailed inventory. The significant potential contaminants in the New Miami Colony PWS inventory region are nitrates and pathogens from the colony wastewater treatment systems and agricultural activities; and herbicides and pesticides from cropped agricultural land.

The inventory for the New Miami 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 New Miami 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. Specific locations of relevant facilities were identified on a sketch map of the layout of the colony systems.

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 regulated facilities were identified using Envirofacts, which queries facilities 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.

- The only facilities located within a five-mile radius of New Miami Colony are three coal mines located approximately 1 ¼, 2 ¼, and 2 ½ miles southeast of the colony, as shown in [Figure 5](#).

Inventory Results/Control Zone

The PWS well is located on the east side of the colony, adjacent to the main area of the colony. The control zones for the wells are not located where any Colony agricultural activities occur; however, the machine shop for the colony is located approximately 100 feet southwest of the wellhead ([Figure 5](#)). The control zones for the well is not fenced or otherwise controlled. Chemical use in the control zones is limited to spot application of herbicides for weed control.

Inventory Results/Inventory Region

The inventory region for the PWS wells includes all of the colony and farm facilities. No other potential contaminant sources were identified outside of the Colony. Table 2 lists the potential contaminant sources, and they are identified in [Figure 5](#). These include the domestic and animal waste systems, the animal barns, other colony barns, garages, petroleum storage areas, dryland farming areas outside of the colony, and the garden.

Potential contaminant sources to the PWS wells, as identified in the inventory zone, include human and animal wastes, petroleum hydrocarbons, pesticides and herbicides. The primary hazards are nitrates and pathogens from human or animal wastes, chemical or fuel spills, excess application of herbicides/pesticides, runoff from the animal facilities into the ground water system, and leakage from sewer mains and lagoons.

Inventory Results/Recharge Region

The recharge region for the PWS wells is primarily used for dryland agriculture and cattle grazing. Use of weed control herbicides and fuels for farm machinery are the contaminants of concern in the recharge region. Several coal mines are also located away from the colony in the recharge area. The status of these mines is not available; however, the distance of the mines away from the colony minimizes the potential hazards to water quality that may occur. These hazards would reflect acid-rock drainage and the localized effects to the ground water system in the vicinity of the mines.

Table 2. Significant potential contaminant sources in the inventory region.

Source	Hazard
Housing	Leaking Sewer Lines
Barns (Chicken, Duck and Hogs)	Leaking Sewer Lines or Collection System
Slaughterhouse/Butcher Shop	Leaching from Animal Wastes
Garden	Land Application of Animal Waste Spills and Excess Application of Herbicides
Machine Shop	Spills of chemicals used
Truck, Tractor and Other Shops	Spills of chemicals used
Fuel Storage areas	Leakage of Tanks
Sewer Mains/Lagoons	Leaking and infiltration to ground water
Herbicide/Pesticide Storage	Leaking of stored chemical
Colonywide	Waste Chemical Spills
Access Road (County Road)	Spills of Transported Chemical
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 New Miami 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 the identified contaminant sources represent the major threats to the source water for New Miami 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 New Miami 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 are recommended as methods New Miami Colony can implement to reduce susceptibility of the PWS to contamination.

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 New Miami Colony PWS wells (Table 3). Hazard is rated by the proximity of the potential contaminant sources to the wells. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 4). The susceptibility of each well to each potential contaminant source is assessed separately.

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

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

For point sources, the relative hazard of the significant potential contaminant sources listed in Table 4 reflects the location of the sites relative to the PWS wells, and how long ground water would take to travel from that site to the wells. Sites located within a time of travel distance of less than one year are assigned a hazard ranking of high. Sites within a time of travel distance of one to three years are assigned a hazard ranking of moderate. The remaining sites located in the recharge region are assigned a hazard ranking of low.

For non-point sources, hazard levels are assigned based the following table:

Source Type	High Hazard	Moderate Hazard	Low Hazard
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

For the New Miami Colony PWS, the majority of sites are assigned a relative hazard of high or moderate, with none of the identified sites located within the recharge region. All point sources for the colony are considered to be within a one-year time of travel distance. Since there is not sufficient data available to assess ground water flow rates, the assignment of relative hazards as high is to provide a conservative method of classifying the potential contaminant sources meeting DEQ program criteria. The primary barrier for all of these is clay-rich soils that can inhibit migration of any released potential contaminants into the subsurface.

The results of the susceptibility assessment indicate that the colony buildings and activities all represent potential threats to the source water for the New Miami Colony PWS.

Table 4. Susceptibility assessment for significant potential contaminant sources.

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Housing and Domestic Sewers	Pathogens and Nitrate	Leaks	High	Low Permeability Soils	High	Leak Monitoring and Prompt Repair
Machine Shop	Various Chemicals	Leaks or Spills	High	Low Permeability Soils	High	Manage and dispose of chemicals used
Animal Barns	Pathogens and Nitrate	Leaks	High	Low Permeability Soils	High	Manage animal waste, Leak Monitoring and Prompt Repair
Slaughterhouse/ Butcher Shop	Pathogens and Nitrate	Runoff	High	Low Permeability Soils	High	Dispose Wastes Outside Inventory Region
Garden	Pesticides/ Herbicides; Nitrate	Runoff	High	Low Permeability Soils	High	Use BMPs for chemical use
Truck, Tractor and other Shops	Various Chemicals	Spills	High	Low Permeability Soils	High	Use BMPs for chemical use, storage and disposal
Fuel Storage	VOCs	Spills	High	Low Permeability Soils	High	Build Containment Around Storage Tanks
Chemical Storage	VOCs	Spills	High	Low Permeability Soils	High	Limit Volumes Stored, Provide Containment for Large Volumes
Sewer Lagoons	Pathogens and Nitrate	Leaking	High	Low Permeability Soils	High	Leak Monitoring and Prompt Repair
Animal Waste Collection System	Pathogens and Nitrate	Leaks	High	Low Permeability Soils	High	Leak Monitoring and Prompt Repair
Dairy Stockyards	Pathogens and Nitrate	Leaching	High	Low Permeability Soils	High	Follow Waste Management Plan
Waste Chemical Handling	VOCs, SOCs	Spills	High	Low Permeability Soils	High	Recycle/Dispose of Waste Chemicals
Mixing Herbicides and Pesticides	SOCs	Spills	High	Low Permeability Soils	High	Apply Absorbent Material to Spills
Land Application of Human/Animal Wastewater	Pathogens and Nitrate	Leaching	High	Low Permeability Soils	High	Prohibit Within Inventory Region
Chemical Application (Agricultural Land)	SOCs	Leaching	High	Low Permeability Soils	High	Apply According to Label Instructions
Access Road	Various Chemicals	Spills	High	Low Permeability Soils	High	Develop emergency response protocol

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