Four Corners Business Park
Public Water System
(PWS # MT 0002903)

Source Water Assessment

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is conducting these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Inventory Region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

As part of this assessment, three types of source water protection management areas were identified for the Four Corners Business Park public water system. They are: the control zone, the inventory region, and the recharge region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- No apparent significant potential contaminant sources were located in the control zone. The control zone is delineated as a 100-foot radius around the wells and all sources of significant potential contaminants should be excluded in this region.
- Significant potential contaminant sources identified within the inventory region include: domestic septic systems, large capacity septic systems, and underground storage tanks (USTs). The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region was delineated based on a one mile radius around the wellheads.
- Potential contaminant sources identified within the recharge region include: Agricultural land and wastewater discharges. The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

The Four Corners Business Park public water supply has a very high susceptibility to the following potential contaminant sources: large capacity septic systems serving the business park, and domestic septic systems located nearby and upgradient. Lower risk potential sources and potential sources located outside the Inventory Region, but within the Recharge Region such as the Utility Solutions-Elk Grove Subdivision wastewater systems may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for Four Corners Business Park. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this report will help increase public awareness about the relationship between land use activities and drinking water quality.

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was prepared for the Four Corners Business Park Public Water Supply (PWS) located in Gallatin County. It was completed by Joe Meek of the Source Water Protection Program at the Department of Environmental Quality (DEQ) and intern Bethany Haines.

PURPOSE

The primary purpose of this source water delineation and assessment report is to provide information that helps the Four Corners Business Park protect its drinking water sources. A major component of the Montana Source Water Protection Program is '*delineation and assessment*'. Delineation is the process of identifying areas that contribute water to aquifers or surface water bodies used as drinking water supplies. The delineated areas are referred to as source water protection areas. Assessment involves identifying and inventorying potential sources of contamination within the source water protection areas, and then determining the potential for contamination of drinking water by these sources. This report is intended to meet the technical requirements for the completion of a source water delineation and assessment report for the Four Corners Business Park public water system, as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 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.

LIMITATIONS

This report was prepared to assess threats to Four Corners Business Park's public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms '*drinking water supply'* or '*drinking water source'* refer specifically to the source of the Four Corners Business Park public water supply, and not to any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the vicinity of the Four Corners Business Park public water supply are identified. Potential sources of contamination are considered only in areas that contribute water to the source of the public water supply.

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 potentially represent health threats.

CHAPTER 1
BACKGROUND

THE COMMUNITY

Four Corners Business Park is located northeast of Four Corners, Montana in a rural setting on the east of the Gallatin River. The Four Corners Business Park public water supply provides water for 31 service connections that supply commercial buildings that serve 200 persons per day. According to the Census Bureau, the population of Gallatin County in 2000 was 67,831 with the population of Bozeman at 30,723. Four Corners is rapidly expanding with residential, retail, service, and industrial areas. Water and sewer utilities are typically provided by on-site systems but this is changing as the area moves from rural to suburban. Wastewater from Four Corners Business Park is handled by several drainfields and septic systems.

GEOGRAPHIC SETTING

Four Corners Business Park is located in the Gallatin River Valley of southwestern Montana, t east of the Gallatin River near the junction of US Highways 191 and 84 (Figure 1). The Gallatin River originates in Yellowstone National Park and flows northward about 80 miles through a bedrock canyon before entering the Gallatin Valley near Gallatin Gateway. This area is bounded by the Horseshoe Hills on the north, Bridger Range on the east, Gallatin and Madison Ranges on the south, and the western Three Forks Valley on the west (Kendy and Tresch, 1996). The elevation of the Gallatin Gateway area is approximately 4,100 to 4,500 feet above mean sea level.

CLIMATE

The climate of the Bozeman area is typical of mid-elevation intermontane basins of the Northern Rocky Mountains east of the Continental Divide. Based on Western Regional Climatic Center data for the period of record, annual precipitation in Bozeman averages 18.31 inches. Monthly average precipitation ranges from 0.86 inches in December to 2.88 inches in May. Summer thunderstorms and winter snows provide a majority of the precipitation in the area. The annual mean snowfall in the Bozeman area is 85.4 inches. Periodic drought cycles (as defined by moving annual precipitation averages less than 10 inches) do not occur in this area. A summary of the available climatic data for the Bozeman area is presented in Table 1.

Table 1. Period of Record Monthly Climate Summary
Bozeman 6 W Climate Station (241047) 11/01/1966 to 09/30/2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.4	38.2	45.8	55.5	64.9	73.1	81.9	81.7	71.1	58.3	42.3	34.0	56.7
Average Min. Temperature (F)	12.1	16.2	22.3	29.8	37.7	44.1	48.9	47.6	39.8	31.2	20.7	12.8	30.3
Average Total Precipitation (in.)	0.58	0.53	1.07	1.61	2.71	2.77	1.43	1.26	1.50	1.39	0.86	0.61	16.32
Average Total Snow Fall (in.)	8.9	6.4	10.6	7.8	1.4	0.1	0.0	0.1	0.4	3.7	8.2	8.6	56.2
Average Snow Depth (in.)	4	3	2	0	0	0	0	0	0	0	1	2	1

Taken from Western Regional Climate Center, wrcc@dri.edu

Geologic and Hydrogeologic Setting

The Gallatin Valley extends over roughly 520 square miles of southwestern Montana. The valley is bounded by the Horseshoe Hills to the north, the Gallatin and Madison ranges to the south, the Bridge range to the east, and the Western Three Forks Valley to the west (Kendy and Tresch, 1996). The valley is drained by the Gallatin River and its tributaries.

Quaternary flood-plain alluvium generally is the most permeable material in the basin, and the most reliable source of ground water. Transmissivity values range from 5,100 to 90,00 ft^2/day, and average 27,000 ft^2/day for alluvium of the Gallatin River. Quaternary and Tertiary alluvial-fan deposits have a wide range of hydraulic characteristics, indicating that they can provide sufficient supplies for many water uses including domestic, livestock, and irrigation. Until the 1960's, it was not known that Tertiary sediments beneath the Gallatin Valley could produce large enough yields for irrigation. East of the Madison Plateau, wells completed in these sediments typically have low production capabilities. Wells drilled deep into the Madison Plateau tap a permeable zone capable of yielding sufficient amounts of water The bedrock has a low permeability and therefore does not transmit ground water readily.for irrigation purposes. Basin-fill aquifers are unconfined throughout the Gallatin Valley. Bedrock is not an important aquifer in the basin.

The valley is an east-tilted graben (a downdropped fault block). Precambrian rocks probably floor the valley, but the majority of the basin is filled with Tertiary sedimentary rocks, over which Quaternary alluvium was deposited. Near Bozeman Hot Springs, the alluvial cover is estimated to be approximately 70 feet thick (Kendy and Tresch, 1996). The mountains surrounding the basin are composed of metamorphic, sedimentary and igneous bedrock. The bedrock is generally less permeable than the unconsolidated basin sediments, although fractures or carbonate dissolution features create significant local flow conduits.

According to the Source Water Protection Program (DEQ, 1999) the source water aquifer for the wells is considered to have **high sensitivity** to potential contamination, since the source aquifer is shallow unconsolidated alluvium.

GENERAL DESCRIPTION OF THE SOURCE WATER

This section provides an overview of the geology in the vicinity of the Four Corners Business Park. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers to potential contamination sources.

The following is primarily drawn from Kendy and Tresch (1996). The Four Corners Business Park is located in the Gallatin Basin. A series of steep normal faults along the fronts of the Bridger and Gallatin Ranges bound it on the east and there are no obvious faults bounding it on the north, south, or west. Precambrian bedrock forms most of the basin and Tertiary sediments of the Bozeman Group fill the entire basin. Where these sediments are not exposed, they are covered by Quaternary and/or Tertiary aged alluvium. In general, the Tertiary sediments are composed of finer-grained, tuffaceous siltstone and sandstone. Four Corners Business Park pumps its water from a wells drilled into the overlying Quaternary alluvium (Figure 2). Quaternary deposits cover more than half of the basin. These deposits consist of a heterogeneous mixture of coarse and fine-grained sediments. Quaternary flood-plain alluvium underlies the Gallatin River and extends across the large plain between the Gallatin and East Gallatin rivers. Moderately sorted cobbles, pebbles, and gravel compose a majority of the alluvium, but sand, silt, and clay are also present in places. Estimates of the thickness of the alluvium range from 70 feet near Bozeman Hot Springs to more than 800 feet near Belgrade.

PUBLIC WATER SUPPLY

The Four Corners Business Park water system serves 31 service connections that serve 200 people per day. The facility is a development currently including 31 commercial buildings that operates year round. The Four Corners Business Park is classified as a non-transient non-community system under the Federal Safe Drinking Water Act, because the system is not a community water system, but does regularly serve at least 25 of the same persons over six months per year. Water demand is approximately 3,000 gallons per day assuming 15 gallons per day per patron (EPA, 1991). Water use may fluctuate considerably from this estimate depending on the type of businesses (tenants) served by the PWS. Well #1 is located in a wood-frame well building in the northeastern area of the property. Well #2 is located in a wood-frame well building in the southern are of the subdivision near the intersection of Shedhorn Drive and Huffine Lane. In 2002, well #2 was inactive and was to be abandoned but now is online and to be used as a back up well. This system does not use treatment.

There are no well logs available for either Well #1 or Well #2. The 1994 sanitary survey indicated Well #1 was drill to approximately 100 feet deep and screened at 55 feet below ground surface (bgs). Well #1 has an approximate static water level of 12 feet bgs. The well was estimated to be drilled in 1980. The 1994 sanitary indicated Well #2 was drilled to approximately 72 feet deep and is screened at 56 feet bgs. The static water level was approximately 10.5 feet bgs. This well is also estimated to be drilled in 1980.

WATER QUALITY

Every PWS is required to perform regular sampling of their water supply to detect any contamination. The analytical parameters include: coliform bacteria and other pathogenic organisms, nitrates, metals, petroleum hydrocarbons, and other organic chemicals. The monitoring schedule depends on factors such as the size and source water of a PWS, the number of supplies (e.g. wells), and the population served. Each PWS has a specific monitoring program tailored to their system that follows the general protocols defined by DEQ for operation of a PWS. PWS monitoring schedules are available at: <http://nris.state.mt.us/wis/swap/swapquery.asp>.

Four Corners Business Park has had no coliform detections in the past five years. Health based violations are issued when the amount of contaminant in the treated drinking water exceeds the safety standard (maximum contaminant level or MCL), or water was not treated properly.

Other compounds detected during Four Corners Business Park water sampling over the past five years include nitrite + nitrate (1.29 to 1.83 mg/L (milligrams per liter)) and copper, reported at 1.11 to 1.16 mg/L. The compounds detected are all below established EPA primary maximum contaminant levels (MCLs). National secondary drinking water standards (SMCLs) are non-enforceable guidelines that may affect the aesthetic quality of water (i.e. odor, color, etc.) and are not health standards.

CHAPTER 2
DELINEATION

This report delineates three source water management areas. The goal of source water management is protecting the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the inventory region, and 3) ensuring that major land use activities or other significant activities in the recharge region pose minimal threat to the source water.

CONCEPTUAL MODEL AND ASSUMPTIONS

Four Corners Business Park's production wells are located in the Upper Missouri watershed, which is located within Montana's Upper Missouri watershed (Heath, 1984). Quaternary alluvium is the source of groundwater for the Four Corners Business Park's wells. Recharge to the alluvial aquifer is most likely from direct precipitation, irrigation return flow, losses from area streams, and from some upward gradient flow from the bedrock.

DELINEATION

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). The delineated management zones for the well are shown on Figure 3. These zones were delineated based on a modified one mile fixed radius approach which probably under estimates the zone in the north-south direction and may over estimate the zone in an east-west direction. This method was used due to the uncertainly of estimating actual flow direction where the substrate is composed of buried braided alluvial deposits.

Control Zone – A 100-foot radius control zone is delineated for Four Corners Business Park's wells. All sources of potential significant contaminants should be excluded in this region.

Inventory Region – The method was modified from DEQ's Source Water Protection Program criteria for community water systems PWS (DEQ, 1999); the inventory zone was delineated based on a one-mile radius circle around the wells. This method was used due to the uncertain nature of ground water flow in the unconfined aquifer and the relatively rural nature of the setting. All sources of potential contaminants are inventoried in this region.

Recharge Region –The recharge region for the Four Corners Business Park wells includes the Gallatin River and its tribunes and Hyalite Creek. The goal of management in the recharge region is to maintain and improve the long-term quality of groundwater in the aquifer.

LIMITING FACTORS

Delineation of the source water protection areas for the Four Corners Business Park PWS wells is based on a simplified approach. The delineation was completed using conservative assumptions to help ensure that the inventory zone reflects the actual area where contamination to the system may occur.

CHAPTER 3
INVENTORY

INVENTORY METHOD

Significant potential contaminant sources in the source water management areas were inventoried to assess the susceptibility of Four Corners Business Park's proposed well to contamination, and to provide a foundation for source water protection planning. The inventory for Four Corners Business Park focuses on facilities or features that generate, use, store, or transport potential contaminants, as well as certain land uses in the inventory and recharge regions. It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of drinking water sources is less likely when potential contaminants are properly used and managed.

The inventory focus is slightly different in each of the delineated management areas. The inventory for Four Corners Business Park focuses on all activities in the control zones for the wells; certain types of facilities and land uses in the inventory region; potential sources of nitrates and pathogens in the surface water buffer; and general land uses and large facilities in the Recharge Region. Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases, described below. The process for completing the inventory included several steps, which are summarized as follows:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's (USGS) Geographic Information Retrieval and Analysis System <http://nris.state.mt.us/gis/datalist.html>. Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

Step 2: The US Environmental Protection Agency's (EPA) Envirofacts System <http://www.epa.gov/enviro/> was queried to identify EPA-regulated facilities located in the management areas. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: Montana DEQ databases were queried to identify any of the following in the management areas:

- Underground storage tanks (USTs) <http://www.deq.state.mt.us/UST/USTDownloads.asp>
- Hazardous waste contaminated sites, above ground storage tanks (ASTs), landfills, and abandoned and active mines, including gravel pits <http://nris.state.mt.us/gis/bundler/>

Any information on past releases and present compliance status was noted.

Step 4: Major road and rail transportation routes were identified throughout the inventory region: <http://nris.state.mt.us/gis/gisdatalib/gisDataList.aspx>.

Potential contaminant sources are designated to be significant if they fall into one or more of the following categories:

1. Large quantity hazardous waste generators.
2. Landfills.
3. Underground storage tanks.
4. Known groundwater contamination (including open or closed hazardous waste sites, state or federal Superfund sites, and leaking UST sites).
5. Underground injection well.
6. Major roads or rail transportation routes.
7. Cultivated cropland exceeding 20% of the inventory region.
8. Animal feeding operations.
9. Wastewater treatment facilities, sludge handling sites, or land application areas.
10. Septic systems.
11. Sewer mains.
12. Storm sewer outflows.
13. Abandoned or active mines

CONTROL ZONE INVENTORY RESULTS

The control zone for Well #1 has the well house itself. The drainfields are 200 feet or greater in distance from Well #1. Well #2 control zone has Shedhorn Drive, and the bank building in the control zone. It is unknown if a drainfield or septic tank is in Well #2's control zone. The PWS should be vigilant to ensure that potential sources of contamination are excluded from the control zone and that positive drainage away from the well casing is maintained.

INVENTORY REGION RESULTS

The inventory results for Four Corners Business Park's source water are summarized in Table 2 and are shown on Figure 4. The businesses in the inventory region may have large capacity septic systems. Large capacity septic systems are on-site septic system serving 20 or more persons. Nitrates and pathogens could leach into area groundwater from the septic tanks, associated piping, and the drain field through routine discharge or if malfunctions occur.

Septic density is in the inventory region is 15% High, 60% Medium and 25% Low. These regions are a significant hazard to the aquifer, as the medium and high-density areas are up-gradient of the well. Nitrates and pathogens could leach into area groundwater.

There are several USTs in inventory region. Spills of hazardous materials could cause contaminants to leach into area groundwater.

Land uses within the inventory region include primarily undeveloped forest and grassland. There is a small percentage of irrigated agricultural land in the inventory region; however, this is not a significant percentage and is not considered a risk at this time. Additional point sources of potential pollutants (such as businesses or facilities listed on regulatory databases) were not identified in the inventory region.

There is no formal stormwater collection system in Four Corners. There are likely French drains or other similar structures used to discharge stormwater from parking lots to the subsurface.

Table 2. Summary of Potential Contaminant Sources in the Inventory Region

	Source Type	***Potential Contaminants***	***Description/Concern***

Land Use Cover (Step 1)		
Onsite Septic Systems	Ongoing or catastrophic leakage of sewage into groundwater	If not properly designed, installed, and maintained, septic lines can be a point source of residential and commercial effluent in groundwater.
Large Capacity Septic Systems	Ongoing or catastrophic leakage of sewage into groundwater	If not properly designed, installed, and maintained, septic lines can be a point source of residential and commercial effluent in groundwater.
Septic Density Moderate (60%) and High (15%)	Ongoing or catastrophic leakage of sewage into groundwater	If not properly designed, installed, and maintained, septic lines can be a point source of residential and commercial effluent in groundwater.
EPA Envirofacts Sites (Step 2)		
None Identified		
DEQ Databases (Step 3)		
UST	Contaminants leaching into groundwater	Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, and BMPs.
Miscellaneous Others, including Step 4 and 5		
None		

Notes: Individual sites identified are evaluated in Chapter 4.

INVENTORY RESULTS/SURFACE WATER BUFFER

Land cover within the surface water buffer consists primarily of pasture land at 40% and grassland at 26%. 73% of the surface water buffer region has a low septic density, but there are areas of moderate and high septic density near the well (Figure 3). Potential Contaminant Sources within the surface water buffer are the same as those found in the inventory region with the addition of several USTs as well as several irrigation ditches including Farmer's Canal, and Middle Creek Ditch. (Figure 5)

RECHARGE REGION INVENTORY RESULTS

According to the 1992 National Land Cover dataset, the primary land uses in the recharge region are forest, grassland, residential, and agricultural. The percentage of agricultural land is considered a low risk to the drinking water supply. Grasslands or forests are not considered potential sources of contamination unless there are significant grazing operations in the area. Elk Grove's lagoons, and other septic systems all are considered potential sources of contamination if an accident were to occur. Additional sources of potential pollutions (such as businesses or facilities listed on regulatory databases) were not identified in the recharge region.

INVENTORY UPDATE

To make this SWDAR a useful document for the years to come, the certified water system operator should review the inventory every year. Changes in land uses or potential contaminant sources should be noted and additions made as appropriate. The complete inventory should be submitted to DEQ every five years to ensure the source water delineation and assessment remains current.

INVENTORY LIMITATIONS

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 [U.S. Code Title 42, Chapter 6A, Subchapter XII, Part E, § 300j-13-(a) Source Water Assessment]. The following limitations should be noted:

- Not every source of contamination to the PWS well has been identified. Consideration was limited to potential sources of contamination within the inventory region. Additionally, sources of contaminants that are not regulated for were not inventoried or assessed.
- No site inspection was performed, and the inventory was developed from available sources of information, including DEQ files and NRIS.
- The potential contaminant sources described in the inventory are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The inventory is not exhaustive.
- Some management recommendations are fairly site-specific and can be implemented by the public water supply. However, other management options can only be implemented by federal, state, county or local governmental entities. When the latter options are mentioned, it is not implied or suggested that this public water supply should lead or spearhead the effort to implement the management option. It is assumed that representatives from this public water supply would participate in the public process sponsored by various governmental entities to develop and implement any of these management options.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

HAZARD DETERMINATION

The threat of contamination is referred to as *hazard*. The degree of hazard is determined either by the proximity of a potential contaminant source to a spring or well intake, potential contaminant migration pathways, or by the density of potential non-point contaminant sources.

DISCUSSION OF SUSCEPTIBILITY

Susceptibility is the degree of likelihood for a public water supply to be impacted by inventoried contaminant sources, at concentrations that would pose a concern. Susceptibility is assessed to prioritize potential pollutant sources for local management, in this case the Four Corners Business Park PWS managers and operators. Alternative management approaches that could be used by the PWS managers and operators to reduce susceptibility are recommended in this chapter.

Susceptibility is determined by considering the hazard rating for each potential contaminant source relative to any contaminant barriers. Barriers to contamination are anything that decreases the likelihood that contaminants will reach a spring or well. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers include spill catchment structures and leak detection for underground storage tanks. Emergency planning and best management practices (BMPs) are considered management barriers. Thick clay-rich soils, a deep water table or a thick unsaturated zone above the well intake are examples of natural barriers. No barriers were identified for Four Corners Business Park. If a well log or additional accurate well completion information becomes available in the future, it may be necessary to amend the sensitivity rating and susceptibility ratings in Table 3.

A summary of the susceptibility assessment for Four Corners Business Park production well is provided in Table 4. This table only includes the potential contaminant sources (identified in Chapter 3) that were determined to present a <u>significant</u> potential risk to the drinking water supply. Therefore, this list is not exhaustive, and it is highly recommended that the PWS operator and community members familiar with the nature of businesses and land use in the area enhance the inventory through further research and local input.

MANAGEMENT RECOMMENDATIONS

It should be noted that even small releases of some chemicals in close proximity to a public water supply well can have significant negative impact on water quality, and therefore are a significant threat to the public water supply. Steps can be taken to reduce the likelihood of releases in the source water for the PWS or in the vicinity of the sources. Management recommendations for protecting the Four Corners Business Park drinking water supply are detailed in the susceptibility table (Table 3). If these, and other, management recommendations are implemented; they may be considered additional barriers that will reduce the susceptibility of the intake to specific sources and contaminants.

Table 3. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Inventory Region.						
Four Corners Business Park's Septic System (large capacity septic systems)	Nitrates, Pathogens	Ongoing or catastrophic leakage of sewage into groundwater	***High***	None	***Very High***	Properly operate and maintain the on-site septic system and distribution lines. (For large capacity septic systems, see attached Fact Sheet – Appendix A).
Area Septic systems Moderate (60%) High (15%)	Nitrates, Pathogens	Ongoing or catastrophic leakage of sewage into groundwater	***High***	None	***Very High***	Encourage and support city and county efforts to extend city sewer or to promote maintenance of septic tanks and distribution lines.
UST	VOCs, petroleum hydrocarbons	Contaminants leaching into groundwater	***Moderate***	Groundwater monitoring	***Moderate***	Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, and BMPs.
Recharge Region/Surface water Buffer						
Other septic systems Elk Grove wastewater system	Pathogens, nitrates	Ongoing discharge or catastrophic leakage of sewage	***Moderate***	Distance from Well	***Low***	Ensure proper operation and maintenance of onsite wells especially sampling schedule.

Notes: VOCs - Volatile organic compounds (i.e. solvents, fuel components)
UST - Underground Storage Tank
BMPs - Best Management Practices
RR – Recharge Region
SOCs - Synthetic Organic Compounds (i.e. pesticides, herbicides, plasticizers)
LUST - Leaking Underground Storage Tank
DEQ- Montana Department of Environmental Quality

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Western Regional Climate Center Montana Climate Summaries. wrcc@dri.edu

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 non-point source 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 (e.g. dry well). 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.

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.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). A database that provides information about specific sites through the EPA Envirofacts website.

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 inhibits the flow of water and maintains the pressure of the groundwater in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

Delineation. The process of determining and mapping source water protection areas.

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

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 groundwater flow systems.

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

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

Large Capacity Septic System. Defined by Underground Injection Control regulations as an on-site septic system serving 20 or more persons.

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 – Groundwater Information Center (MBMG/GWIC). The database of information on all well drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national permitting system that utilizes a database to track entities that discharge wastewater into waters of the United States.

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. Examples of nonpoint- source pollution include agriculture, forestry, and run-off from city streets. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of these chemicals into surface and/or groundwaters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Phase II (and IIb) Rules. EPA updated or created legal limits on 38 contaminants. The rules became effective July 30, 1992 and January 1, 1993. Some of these contaminants are frequently-applied agricultural chemicals such as nitrate and others are industrial solvents.

Phase V Rule. EPA set standards for 23 contaminants in addition to those addressed by the Phase II Rules. The Phase V Rule became effective January 17, 1994. Some of these contaminants include inorganic chemicals such as cyanide and other Phase V contaminants are pesticides that enter water supplies through run-off from fields where farmers have applied them or by leaching through the soil into groundwater. Six

are probable cancer-causing agents. Others can cause liver and kidney damage, or problems of the nervous system and brain.

Point Source. A stationary location or a fixed facility from which pollutants are discharged. This includes any single identifiable source of pollution, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fracture, container, rolling stock (tanker truck), or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource (e.g. groundwater used for drinking water).

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 (PWS). 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. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes 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.

Resource Conservation and Recovery Information System (RCRIS). Is a database that 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 groundwater source that provides water to a public water supply.

Source Water Delineation and Assessment Report (SWDAR). A report for a public water supply that delineates source water protection areas, provides 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 groundwater 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.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

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.

Total Maximum Daily Load (TMDL). The total pollutant load to a surface water body from point, nonpoint, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

Toxicity. The quality or degree of being poisonous or harmful to plants, animals, or humans.

Toxicity Characteristic Leachate Procedure. A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

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.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter.

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 that evaporate readily to the atmosphere.

Watershed. The region drained by, or contributing water to, a stream, lake, or other water body of water.

* With the exception of the definitions for Lacustrine, Phase II and Phase V Rules, and Standard Industrial Classification Code, definitions were adapted from EPA's Term References System (formerly known as Glossary of Selected Terms and Abbreviations) which can be found at: http://www.epa.gov/trs/index.htm . The definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

The definitions for Phase II and Phase V Rules were adapted from:
http://www.epa.gov/OGWDW/source/therule.html#PhaseII
http://www.epa.gov/OGWDW/source/therule.html#PhaseV

The definition for Standard Industrial Classification Code was adapted from:
EPA/Office of Enforcement and Compliance Assurance: Guide to Environmental Issues: Glossary of Terms & Acronyms *Term Detail*

Appendix A
Fact Sheets

Appendix B
Fact Sheet

Appendix C
Sanitary Survey

Appendix D
Monitoring Data

Appendix E
Concurrence Letter