Florence Associates
SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Florence Associates

Public Water System

PWSID # MT0003924

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ACKNOWLEDGMENTS

This Delineation and Assessment Report for the Florence Associates PWS (source #003924) was completed by Michelle Hutchins and Travis Ross, Environmental Health Specialists with the Missoula Valley Water Quality District. The Missoula Valley is located in Missoula County. The system can be contacted through Samantha Kemp (406) 728-3113.

GLOSSARY
AND
LIST OF ACRONYMS*

Acute Health Effect An adverse health effect in which symptoms develop rapidly.

Alkalinity The capacity of water to neutralize acids.

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

AST Aboveground storage tank.

Best Management Practices (BMPs) Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Coliform Bacteria Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

Confined Aquifer A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit A geologic formation that inhibits the flow of water.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Delineation A process of mapping source water management areas.

DEQ Montana Department of Environmental Quality.

EPA United States Environmental Protection Agency.

GWIC Ground-Water Information Center online well database administered by the Montana Bureau of Mines and Geology.

Hardness Characteristic of water caused by presence of various chemical compounds. Hard water may interfere with some industrial processes and prevent soap from lathering.

Hazard A measure of the potential of a contaminant leaked from a facility to reach a public water supply source. Proximity or density of significant potential contaminant sources determines hazard.

HazMat Hazardous Materials Response Team.

Hydraulic Conductivity A coefficient of proportionality describing the rate at which water can move through an aquifer.

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

Maximum Contaminant Level (MCL) Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act.

MGWPCS Montana Ground Water Pollution Control System.

MPDES Montana Pollution Discharge Elimination System.

NOAA National Oceanic and Atmospheric Administration.

Nitrate An important plant nutrient and type of inorganic fertilizer. In water, the major sources of nitrate pollution are septic tanks, sanitary sewers, feed lots and fertilizers.

Nonpoint-Source Pollution Pollution sources such as stormwater runoff that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet.

NPL National Priority List (Superfund).

Pathogens Bacterial organisms typically found in the intestinal tracts of mammals, capable of producing disease.

Point Source A stationary location or fixed facility from which pollutants are discharged.

Public Water System A system that provides piped water for human consumption to at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level Water level elevation in a well when the pump is operating.

Recharge Region Source water management region that is generally the entire area that could contribute water to an aquifer used by a public water system. Includes areas that could contribute water over long time-periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA) Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

SDWA Safe Drinking Water Act.

Source Water Protection Area For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply.

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

Susceptibility (of a PWS) The potential for a public water system to draw water with contamination 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) Manmade organic chemical compounds such as herbicides and pesticides.

Total Dissolved Solids (TDS) The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Transmissivity The ability of an aquifer to transmit water.

Trihalomethanes (THMs) Organic chemicals formed as disinfection byproducts

Unconfined Aquifer An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

UST Underground storage tank.

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

MWQA Montana Water Quality Act.

WQD Missoula Valley Water Quality District.

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

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Florence Associates PWS as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for the Florence Associates PWS.

Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism the Florence Associates PWS can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Florence Associates PWS operator and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1
BACKGROUND

The Community

The city of Missoula is located in the Missoula Basin at the southern end of the Missoula-Ninemile Valley (Figure 1). The population of Missoula County in 2000 was 95,802 with 57,053 people living in the city of Missoula (Census 2000). The Bitterroot River enters Missoula from the south and the Clark Fork River enters from the northeast. US Highway 93 serves Missoula from the south and the north and Interstate 90 passes along the northern edge of Missoula (Figure 2). Major Missoula area employers include the University of Montana, and the two local hospitals, each employing more than 1000 people. Stimson Lumber operates a lumber and plywood mill in the Bonner area, and employs 450 people. Other economic contributors include Smurfit-Stone Container, several transportation companies, as well as tourism, small businesses and outlying agriculture and timber operations. Wastewater from the community is collected in one sanitary sewer system, which, after treatment, discharges into the Clark Fork River near the western edge of Missoula. Surrounding areas rely on onsite sewage disposal systems. Mountain Water Company supplies Missoula residents and businesses with the majority of the city's drinking water; depending on location, some properties are served by individual or small public water supply wells.

Geographic setting

Missoula is located in the southern end of the Missoula-Ninemile Valley as shown in Figure 1. The valley elevation ranges from approximately 3000 to 3200 feet above sea level, with surrounding mountain ranges, including the Sapphire Range to the east, the Bitterroot Range to the south, the Rattlesnake Range to the north, and the Ninemile Divide to the west, rising to elevations of 5000 to 8000 feet. The Clark Fork and Bitterroot Rivers drain the valley; the Clark Fork flows westward through the valley, and the Bitterroot flows across the southwest corner of the valley, and joins the Clark Fork at Kelly Island, approximately 4 miles west of the City of Missoula. Milltown Dam and Milltown Reservoir are located approximately 5 miles upstream from Missoula at the confluence of the Clark Fork and Blackfoot Rivers. Rattlesnake Creek was a main source of drinking water until an outbreak of illness associated with Giardia lamblia in 1983 prompted the local water company to discontinue use of Rattlesnake Creek water and rely exclusively on groundwater from the Missoula Aquifer. The Missoula Aquifer has been designated a "sole-source" aquifer by the United States Environmental Protection Agency.

The climate in Missoula is typical of western Montana. Missoula receives approximately 13.5 inches of rain per annum, and 45 inches of snow. The annual average temperature is 44°F with average maximum temperatures occurring in July (83°F) and average minimum temperatures occurring in January (15°F).

General description of the Source Water

The Florence Associates wells are completed in the Missoula Valley alluvial aquifer. The aquifer primarily consists of unconsolidated alluvial sand, gravel and cobbles and is recharged mainly by leakage from the Clark Fork River, flow from Tertiary sediments and fractures in Precambrian and Cambrian bedrock of the surrounding hills, leakage from irrigation canals, and underflow from the Clark Fork Valley and tributary drainages (Woessner, 1988; Smith, 1992).

The Public Water Supply

The Florence Associates PWS is a non-transient, non-community water system that obtains water from one well located at 111 North Higgins, in Missoula County. Well depth is 116 feet. The Florence Associates PWS currently serves an estimated non-transient population of 300 with 1 active service connection. The location of the well is shown in Figure 2. The wells are linked to a cistern and one pressure control tank, located in the basement, prior to distribution. There is also a backup connection to Mountain Water (PWS 294) for fire and emergency use. A general plan showing the layout of the distribution system is presented in Appendix A, with a copy of the sanitary survey.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. Water is typically monitored for total coliform and fecal coliform, nitrates, metals and chemicals. The monitoring schedule depends on the population served, the number of wells and the source water for the PWS. DEQ defines monitoring programs and protocols that are specific to each PWS. River Road PWS has three reported violations of total coliform bacteria MCLs listed in the EPA database, from September 2004, April 2001, and May 1996. Table 1 lists typical levels of constituents for the Missoula Aquifer in this area.

The Milltown Dam and Reservoir "Superfund" site, approximately 4 miles upstream from Missoula, has been collecting runoff sediment from upstream mine tailings for decades and consequently harbors several million tons of toxic mine sediments that contain high levels of arsenic and copper. There is currently a plume of arsenic-contaminated groundwater, with arsenic levels exceeding Safe Drinking Water Act MCLs, in the Hellgate Valley Aquifer in Milltown, Montana, upgradient from Missoula. This groundwater contamination rendered several wells in Milltown unusable, and required development of a replacement water source for many residents. The plume appears to have been relatively stable during the period of monitoring, 1982 to present, based upon the existing limited distribution of monitoring wells. No immediate threat to wells in the Missoula area is indicated, because of dilution in the highly conductive aquifer.

Portions of the Clark Fork River downstream could be threatened, as sediment from the reservoir is released during periodic events such as floods and ice jams, spreading contamination downstream. Data from a past ice jam event indicate that copper, which is highly toxic to fish but less toxic to humans, rather than arsenic, was the contaminant of concern after this event. Dam failure is also possible, and this would inundate downstream areas with toxic sediments.

The proposed removal of the dam and the most-contaminated sediments from behind the dam would largely eliminate this threat to downstream areas. The removal process may temporarily increase copper and arsenic levels downstream, but these levels are not expected to be hazardous to human health. In the long-term, dam and sediment removal should eliminate the arsenic-contaminated groundwater plume in Milltown, and improve downstream water quality. The Milltown Reservoir issue is further discussed in the *Inventory* section of this report.

Table 1. Sample water quality data for the Missoula Aquifer, Central Missoula Area (WQD, 1996-2004).

Sample date	Well #/ Location	NO_3 Mg/L	$S0_4$ Mg/L	Cl^- Mg/L	Ca Mg/L	As Mg/L	Ba Mg/L	Bicarb. (Mg/L	pH
1994 - 2004 (Ave.)	WQD 8 (C.S. Porter); WQD 20 (Larchmont); WQD 21 (Blaine/Crosby); WQD 33 (Tower).	1.1	18.6	6.4	51	0.0013	0.22	170	7.4

Table 2. Water quality data for Florence Associates (MDEQ, PWS analytical results, 1997-2001).

Sample Date	Well #/ Location	NO_3 (Mg/L)	Fl^- (Mg/L)	Ba (Mg/L)	As (Mg/L)	SO_4 (Mg/L)	Organic Chemicals
1997-2001 (Ave.)	PWS # 3924 – 13N 19W, sect. 22	1.22	0.1	0.2	None Detected	9	None Detected

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Florence Associates PWS, is identified in this chapter. Four management areas are identified within the source water protection area: the control zone, inventory region, surface water buffer zone 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. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The surface water buffer zone is delineated based on standard distance criteria of 10 miles upstream from the ground water inventory zone and encompasses ½ mile width of land area on each side of the drainages. The recharge region represents the entire portion of the aquifer that contributes water to the Florence Associates water system.

Hydrogeologic Conditions

Geologic and hydrogeologic studies of the Missoula area are listed in Table 3, with a summary of maps listed in Table 4. The following description is derived from these reports.

The Missoula Valley is part of a structural basin that began to open about 65 million years ago, during the early Tertiary crustal movement that created the Rocky Mountains. Precambrian metasedimentary rocks of the Belt Supergroup, and a few interspersed Paleozoic sedimentary rocks surround the valley, with peaks of 5000 to 7000 feet elevation. This relatively impermeable and deeply eroded landscape was partially filled with Tertiary and Quaternary alluvium, and Glacial Lake Missoula clays and silts. Portions of the Tertiary sediments were scoured from the valley during the repeated draining of Glacial Lake Missoula approximately 12,000 to 15,000 years ago, during the Wisconsin glacial stage, and were replaced with layers of sand, gravel and cobbles, deposited during these catastrophic events and more recent alluvium deposited along the river channel and flood plain. The sediments generally become finer to the southwest of the valley as a result of dissipating energy after sediment-carrying water flowed out of Hellgate Canyon and across the broader Missoula Valley, depositing coarser sediments first and then gradually allowing deposition of finer sediments.

The Missoula Aquifer is unconfined or semi-confined, depending on location, and composed mainly of unconsolidated Quaternary alluvium. The Quaternary alluvium consists of three main layers: a top sand/silt, gravel, cobble and boulder layer, which is most often above the water table, a middle clay-rich layer, which yields little water, and a bottom layer of sand, gravel and cobbles, which is the main water-bearing unit (Smith, 1992; Woessner, 1988). Layers of clay and silt deposited in Glacial Lake Missoula are interfingered with sand and gravel layers that were deposited between the multiple episodes of draining and refilling the Lake, creating a complex stratigraphy. Tertiary deposits (mostly Renova and Sixmile-Creek Equivalents) flank and underlie the area of Quaternary alluvium, but Renova Equivalent sediments are generally fine-grained and much less productive than the more recent deposits; probable Sixmile Creek Equivalent sediments do yield useable quantities of water in some parts of the valley. Some wells in the outlying areas of the valley are finished in Precambrian bedrock, but these derive water mainly from fractures and are also much less productive than the main water-bearing alluvium. Depth to the water table ranges from approximately 6 to 110 feet below land surface, depending on drought conditions and distance from rivers and tributary streams. The seasonal fluctuation of the groundwater table ranges from approximately 2 to 13 feet (Woessner, 1988) and

depends upon proximity to the recharge source and hydraulic conductivity of the surrounding aquifer sediments. The lateral extent of the Missoula Aquifer varies from about 0.25 miles wide at the mouth of Hellgate Canyon, to 6.25 miles wide between Maclay Flats and the mouth of Grant Creek; the overall length is approximately 20 miles. Groundwater flows generally west southwestward through the Florence Associates area. The aquifer in this area is classified as having moderate source water sensitivity, because it is semi-confined and comprised of unconsolidated alluvium. The Missoula Valley Aquifer has been designated a "Sole Source Aquifer" by the U.S. EPA. A geologic map of the Missoula area is presented in Figure 3. Figure 4 represents a generalized ground water flow map. Geologic cross sections are shown in Figure 5.

Table 3. List of geologic or hydrogeologic investigations for the Missoula area.

Title of Project	Reference	Area Covered	Project Purpose.
Interactions Between the Clark Fork River and Missoula Aquifer, Missoula County, Montana	K.W. Clark, 1986	Missoula Valley	Define hydrogeology of Clark Fork River and Missoula Aquifer.
Hydrogeology and water resources of the Missoula Basin, Montana	A.L. Geldon, 1980	Missoula Basin	To determine the storage potential of the basin.
Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana	Kendy and Tresch, 1996.	Intermontane basins of the northern Rocky Mountains	Summarize the geographic, geologic and hydrologic characteristics of the Rocky Mountain region in western Montana.
Geology and Ground-water Resources of the Missoula Basin, Montana	McMurtrey, et al., 1965	Missoula Basin	Summary of geology and hydrogeology
A Single Layer Transient Flow Model of the Missoula Aquifer	R.D. Miller	Missoula Valley	Computer model to define groundwater flow and hydraulic properties of the Missoula Aquifer.
The Source, Fate and Movement of Herbicides in an Unconfined, Sand and Gravel Aquifer in Missoula, Montana	M.H. Pottinger, 1988	North central Missoula Valley	Hydrologic properties and groundwater flow of aquifer to determine source and fate of herbicide contamination.
The Hydrogeology of the Central and Northwestern Missoula Valley	C.A. Smith, 1992	Portion of Missoula Valley	Geology, hydrologic properties, groundwater flow, interaction with river and water quality of the Missoula Aquifer.
Missoula Valley Aquifer Study: Hydrogeology of the eastern portion of the Missoula Aquifer, Missoula County, Montana	W.W. Woessner, 1988	Eastern portion of the Missoula Aquifer	To assess existing and future anthropogenic effects on the aquifer

Table 4. List of geologic or hydrogeologic maps available for the Missoula area.

Title or Description	Date	Area Covered	Reference
Geologic Map of the Missoula West 30' x 60' Quadrangle	1998	Missoula Valley west of Missoula, and Bitterroot Valley south to Stevensville, MT	Lewis, R.S., 1998. MBMG Open File 373.
Potentiometric Map, March 1993 and June 1993	1994	Hellgate Canyon, Missoula County	Gestring, S.L., 1994. The Interaction of the Clark Fork River and the Hellgate Valley on the Aquifer Near Milltown, MT
Geologic Map and Sections of the Bonner Quadrangle, Montana	1961	Bonner Quadrangle	Nelson and Dobell, 1961
Generalized geologic map of the Butte 1 X 2 degree quadrangle, Montana	1987	Approximately 100 X 70 mi. area of Missoula, Powell, Lewis & Clark and Deer Lodge Counties	Wallace, C.A., USGS Miscellaneous Field Studies Map MF-1925

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. This section describes the conceptual model used for this report.

The ground water in this part of the Missoula Valley is generally semi-confined under discontinuous Glacial Lake Missoula silts and clays, and occurs primarily in unconsolidated Quaternary sand and gravel units, which are laterally and basally bounded by much less permeable tertiary sediments and bedrock. Tertiary sediments and fractured bedrock yield small quantities of water in some areas. Recharge is derived mainly from the Rattlesnake drainage and Tertiary units flanking the valley. The Clark Fork River loses water to the aquifer along some stretches and gains water from the aquifer along other stretches of its path through the Missoula Valley (Smith, 1992; Woessner, 1988). Ground water flows generally west northwestward through this area (Figure 4).

Methods and Criteria

The Montana Department of Environmental Quality specifies the methods and criteria used for source water protection zone delineation for the Florence Associates PWS (DEQ, 1999). Because the Missoula Aquifer communicates with the Clark Fork River and tributary streams in the area, Surface Water Buffer Zones were applied to the Clark Fork River and tributary drainages. Time-of-travel calculations were completed for the ground water system using the uniform flow equation (U.S.E.P.A. 1991). Using published reports, estimates of the aquifer properties were made and are discussed in the following section. The recharge area is defined as the area where the aquifer is present upgradient from the well(s). The surface water buffer zones were delineated based on standard distance criteria of 10 miles upstream from the ground water inventory zone and encompassed ½ mile width of land area on each side of the drainages.

Well(s) Information

The well is located in the NW corner of the basement, at 111 N. Higgins Avenue, in T13N, R19W, section 22, in Missoula County. Table 5 is a summary of the well information and Appendix B contains copies of the well logs (no driller's logs available).

Table 5. Source well information for Florence Associates PWS (limited information was available on log).

Information	Well #1
PWS Source Code	**003924-002**
Well Location (T, R, Sec or lat, long)	**Lat: 46.8688° Long: - 113.9927°**
MBMG#	**706386**
Water Right #	**NA**
Date Well was Completed	**1/1/1940**
Total Depth	**116 ft.**
Perforated Interval	**NA**
Static Water Level	**NA**
Pumping Water Level	**NA**
Drawdown	**NA**
Test Pumping Rate	**NA**
Specific Capacity	**NA**

Model Input

Time-of-travel input values are conservative assumptions made to identify areas that potentially impact source water for the Florence Associates PWS. These values assume that the general characteristics of the aquifer are the same for both wells. The criteria for selection of each value used for this delineation is summarized as follows:

Thickness: The thickness of the aquifer is estimated to be 75 ft, based on published estimates (Woessner, 1988; Morgan, 1986).

Hydraulic Conductivity: A value for hydraulic conductivity is estimated to be 8000 ft/day, based upon a model created for Mountain Water Company by Land & Water Consulting (2003). We have chosen a value that should provide a conservative estimate of time-of-travel distances.

Transmissivity: The estimated value for transmissivity in this area is 600,000 ft^2/day (T = Kb, where K = hydraulic conductivity = 8000 ft/day; b = aquifer thickness = 75 ft).

Hydraulic Gradient: The hydraulic gradient of 0.0028 is derived from Missoula Valley Water Quality District water level data from 1999.

Flow Direction: The flow direction is generally from the northeast approaching the downtown area, with water originating in the Rattlesnake watershed. Flow direction shifts a bit entering the downtown area, due to hydraulic control from the Clark Fork River.
Porosity: Effective porosity is the percent of rock/sediment volume occupied by interconnected voids, and is estimated at 25%. The estimated value is considered representative of unconsolidated sand and gravel, and is between two published estimates of 20% (Clark, 1986) and 40% (McMurtrey et al., 1965).
Pumping Rate: The estimated combined pumping rate of the wells is based on 10 gallons per day, estimated use per person (Salvato, 1992).

Time-of-Travel Calculation
Travel distances for 100 days, one year and three years are calculated based on input parameters summarized below. The one-year time-of-travel distance is used in Chapter 4 to rate the hazards of potential contaminant sources.

Table 6. Estimates of input parameters used to delineate the Florence Associates source water protection area.

Input Parameter	Range of Values	Values Used
PWS Source Code		**003924 –002**
Transmissivity	**400,00 – 800,00**	**600,000 ft^2/day**
Thickness	**50 – 100 ft.**	**75 ft.**
Hydraulic Conductivity	**8000 ft/day**	**8000 ft/day**
Hydraulic Gradient	**0.002 – 0.0028**	**0.0028**
Flow Direction	**213 – 258 deg.**	**236 deg.**
Effective Porosity	**20 – 40%**	**25%**
Pumping Rate	**2.1 gpm**	**2.1 gpm**
100-day TOT	**6400 – 8950 ft**	**8950 ft 1.7 miles**
1-Year TOT*	**23,300 – 32,750 ft**	**32,750 ft 6.2 miles**
3-Year TOT*	**70,100 – 98,250 ft**	**98,250 ft 18.61 miles**

*Time of Travel

Delineation Results
The results of the calculations indicate an estimated average distance of 8950 feet (1.7 miles) for a 100-day time of travel (TOT), an average distance of 32,750 feet (6.2 miles) for a one-year TOT and an average distance of 98,250 feet (18.61 miles) for a three-year TOT. The delineated inventory zones are depicted in Figure 6 for the Florence Associates PWS. The surface water buffer zones for the Clark Fork River are shown in Figure 7. The recharge region for the aquifer comprises the aquifer

upgradient from the supply wells, delineated in the inventory zone. A 45-degree range of groundwater flow directions was used to define the lateral boundaries of the inventory region (Figure 5).

Limiting Factors

This delineation is based on estimated aquifer properties, pumping conditions and groundwater flow conditions, and assumes uniform flow in a homogeneous aquifer. Conclusions based on this interpretation are uncertain because the extent and properties of the aquifer, and the direction and rate of groundwater flow are not known precisely, and the actual transient flow and heterogeneous stratigraphy can only be roughly approximated by the above assumptions. Time-of-travel distances are estimates based on available data. We have chosen input parameter values that will give us conservative but reasonable estimates of capture zones. This should provide a protective margin for inaccuracy inherent in calculations of this nature.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for the Florence Associates PWS within the control and inventory regions. Potential sources of all primary drinking water contaminants and pathogens were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Florence Associates PWS inventory region are nitrate, pathogens, fuels, solvents, herbicides, pesticides, and metals. The inventory for the Florence Associates PWS focuses on all activities in the control zone, municipal and private facilities in the inventory region, and general land uses and large facilities in the recharge region.

Inventory Method

Available databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. A "windshield survey" was conducted to obtain additional information for this assessment. The following steps were followed:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System. Sewered and unsewered residential land use was identified from boundaries of sewer coverage obtained from municipal wastewater utilities. Septic system density outside of the sewered area was evaluated using the Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) database.

Step 2: 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), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the inventory region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the inventory region: Underground Storage Tanks (USTs), hazardous waste contaminated sites (DEQ CECRA and WQA sites), landfills, abandoned mines and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: County records were queried to identify businesses that generate, use, or store chemicals in the inventory region. The facilities include equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers.

Step 6: A "windshield survey" was undertaken to identify additional potential contaminant sources not listed in the databases.

Step 7: Major road and rail transportation routes were identified throughout the inventory region.

Step 8. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region and identified on the base map.

Potential contaminant sources are designated as significant if they fall into one of the following categories:

1) Large quantity hazardous waste generators.
2) Landfills.
3) Underground storage tanks.
4) Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
5) Underground injection wells.
6) Major roads or rail transportation routes.
7) Cultivated cropland greater than 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.

Inventory Results/Control Zone

The area immediately surrounding the well is commercial.

Inventory Results/Inventory Region

Significant potential contaminant sources for the Florence Associates PWS include nearby septic systems; fuel and chemical spills along transportation routes and pipelines; stormwater injection wells and underground storage tanks. The presence of sewered area is also a significant contaminant source; however, the presence of a corresponding number of on-site systems would represent a more likely threat of contamination. There are several underground storage tanks within ½ mile of the Florence PWS, some of which have leaked in the past, and since been removed. Florence Associates is approximately, 600 feet from Highway 12, 2000 feet from the railroad, ½ mile from I-90, and 2 miles from the petroleum pipeline.

The Florence is two blocks from the former site of a photo processing shop, from which processing chemicals – primarily silver – leaked into the soil beneath the shop. Most of the impacted soil has been removed, and monitoring wells are being installed. Given removal of most of the source material, and the low potential for infiltration of additional water that could flush the contamination into groundwater, it is unlikely that this site will impact drinking water at this PWS. The Florence is 2000 feet from the Burlington Northern (BN) CECRA Facility, where diesel fuel and chlorinated solvents have impacted soil and groundwater. This release has not impacted the Florence PWS, however, and future impact is unlikely. Septic system density is approximately 275/mi^2 in the 1-year time-of-travel, and 149/mi^2 in the 3-year time-of-travel region. Major land uses in the inventory region (1-yr.; 3-yr) are forest (42%; 69%), residential (48%; 26%), and commercial (10%; 5%). The significant potential

contaminant sources within the inventory zone are listed in Table 7. The general locations of these sources are shown in Figure 10.

Inventory Results/Surface Water Buffer Zones

Significant potential contaminant sources for the surface water buffer zone are pathogens and nitrates from sewage disposal systems and underground storage tanks. Septic system density for the surface water buffer zone is 107/mi^2, and major land uses are forest (73%), commercial (15%) and residential (12%). No permitted confined animal feeding operations are listed in the EPA database for this area. Florence Associates is approximately 1000 feet from the Clark Fork River.

Inventory Results/Recharge Region

The land use in the recharge region is primarily evergreen forest (94%), residential (3%), commercial (2%), and grass/rangeland (<1%).

Table 7a-f. Significant Potential Contaminant Sources for PWS #3924 Inventory Region

Table 7a UST Sites				
Site Name	Location	Release?	Active?	Removed?
AAA of Montana	275 W Main Street	Yes	No	No
Blue Star Canvas Products Inc	300 W Main	Yes	No	No
Cenex Tire Service	**400 W Front St**	**Yes**	**Yes**	**Yes**
City of Missoula	**Higgins St. Bridge**	**No**	**--**	**No**
Courtesy Sinclair	541 E Broadway	Yes	No	No
Eastgate Conoco	1002 E Broadway	Yes	No	No
Finest Oil Company Eastgate	940 E Broadway	Yes	No	No/Yes
Garden City Market	**624 E. Broadway**	**Yes**	**Yes**	**Yes**
GW Petroleum	**1020 E Broadway**	**Yes**	**Yes**	**Yes**
Hellgate Conoco Service Center	711 E Broadway	Yes	No	No
Holiday Station #265	111 Orange St.	Yes	No	Yes
Noon's #458	**820 E. Broadway**	**Yes**	**No**	**No**
Noon's #457	**540 E Broadway**	**Yes**	**No**	**Yes**
Orange St. Sinclair	**400 W Broadway**	**Yes**	**Yes**	**Yes**
Former Schwink's Gas Station	**525 W. Broadway**	**Yes**	**Yes**	**Yes**
Tabish Bros. Distr.	**955 Beech**	**Yes**	**No**	**No**
Washington Corporations	500 Taylor St.	Yes	No	Yes

Table 7b RCRA Hazardous Waste Generators					
Handler Name	**Handler Id**	**Street**	**City**	**Handler Type**	**P2 Permit**
Missoula Textile Service	MTD035277359	111 E Spruce St	Msla	Small Generator	X

Table 7c Active WQD Pollution Prevention Permitted Facilities			
Facility Name	**Address**	**City**	**Reg Type**
Finest Oil Company Eastgate	980 E Broadway	Missoula	Gasoline, Diesel
Hellgate Conoco	711 E Broadway	Missoula	Gasoline, New Oil, Used Oil
Jiffy Lube	601 E. Broadway	Missoula	New Oil, Used Oil
Noon's #457	540 E Broadway	Missoula	Gasoline
Noon's #458	820 E Broadway	Missoula	Gasoline, Diesel
Qwest Missoula Central Office	201 N Pattee St	Missoula	Sulfuric Acid
Rattlesnake Trading Post	1002 E Broadway	Missoula	Gasoline, Diesel
Tabish Brothers Distributing	955 Beech St	Missoula	Gasoline, Diesel, New Oil, Hydraulic Oil

Table 7d Confirmed Groundwater Contamination			
Source Name	**Type**	**Contaminants**	**Year of**

Table 7e CECRA			
Source Name	Type	Contaminants	Year of Release
Burlington Northern	Fueling/repair	Diesel; solvents	Unknown
West Front Battery Facility	Auto Repair	Lead	Unknown -- inactive

Table 7f Miscellaneous Sources			
Source	Density	Land Use %	Number
Septic Systems	275/mi^2 1-yr TOT; 149/ mi^2 3-yr TOT		
Sewered Area		20% 1-yr; 11% 3-yr	
Stormwater Injection Wells			474

Inventory Update

The certified operator will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The accuracy of the inventory is limited by the accuracy of information provided by state and federal databases. The windshield survey provides a level of quality assurance that the information presented reflects actual conditions. The inventory is also limited by the accuracy of the delineation, which is discussed above.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

The susceptibility of Florence Associates wells to significant potential contaminant sources is assessed in this chapter. Susceptibility is the potential for a well to be contaminated by one of the sources inventoried in the previous chapter. Hazard ratings and the presence of barriers determine susceptibility (Table 8). Hazard ratings are determined by the proximity of a potential point-source contaminant or the density of non-point source potential contaminants to the well. For the Florence Associates PWS, contaminant sources within the one-year TOT were given a high hazard rating and all other sources within the inventory region were given moderate hazard rating. The susceptibility is then determined based upon the hazard and any barriers that mitigate the hazard. Barriers can be engineered structures, management actions and/or natural conditions. Spill catchments for fueling facilities and leak detection for underground storage tanks are examples of engineered barriers. Emergency planning and availability of trained hazardous materials response team, and best management practices are examples of management barriers. Clay soils, deep wells and a thick layer of substrate above an aquifer can be considered natural barriers.

Table 8. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of 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 7 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. For sites located within a time of travel distance of less than one year, the relative hazard is assigned as high. For the remaining sites located in the inventory region, the relative hazard assigned is moderate.

For non-point sources, the relative hazard is assigned based on the following table.

Table 9. Non-point source relative hazard ratings.

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

Table 10. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region.

Map ID#	Facility Name	Contaminant	Hazard	Barriers	Susceptibility	Management
	Stormwater injection wells	Mixed	High	HazMat Team	High	
	Septic density of 275/mi^2 (1-yr. TOT); 149/mi^2 (3-yr. TOT)	Pathogens & nitrate	Moderate		High	Connections to municipal sewer
Labeled	USTs	Fuel	High	WQD Pollution Prevention Permit; HazMat Team	Moderate	Leak prevention and detection
Labeled	I-90; Hwy 10; Montana Rail Link	Fuel/chemicals	Moderate	HazMat Team	Moderate	
Labeled	Yellowstone Pipeline	Petroleum products	Moderate	HazMat team	Moderate	Pipeline inspection and maintenance
Labeled	CECRA—Front St. Battery	Lead	Low	Closed; no groundwater impact.	Low	--
Labeled	Burlington Northern CECRA	Diesel; solvents	Moderate	Ongoing remediation; monitoring; well-defined plumes do not reach PWS area	Low	--
Non-point	Municipal Sewer 20% 1-yr; 11% 3-yr	Pathogens & nitrate	Moderate	New sewer mains; inspection program	Low	Continued monitoring and repair of mains

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APPENDIX A

PWS System Layout and Sanitary Survey

APPENDIX B

Well Log for PWS

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
FLORENCE HOTEL

Location Information

GWIC Id:	706386	Source of Data:	USGS
Location (TRS):	13N 19W 22 CB	Latitude (dd):	46.8688
County (MT):	MISSOULA	Longitude (dd):	-113.9927
DNRC Water Right:		Geomethod:	MAP
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	116.00	How Drilled:	CABLE
Static Water Level (ft):		Driller's Name:	
Pumping Water Level (ft):		Driller License:	
Yield (gpm):		Completion Date (m/d/y):	1/1/1940
Test Type:		Special Conditions:	
Test Duration:		Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	112ALVM
Recovery Time (hrs):		Well/Water Use:	OTHER
Well Notes:			

Hole Diameter Information
No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	116.0	10.0				

Annular Seal Information
No Seal Records currently in GWIC.

Completion Information[1]
No Completion Records currently in GWIC.

Lithology Information
No Lithology Records currently in GWIC.

[1] - All diameters reported are **inside** diameter of the casing.

APPENDIX C

MBMG-GWIC Well Logs for Area

Ground Water Information Center
Wells Report

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by clicking here to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked Gwic Id for that well. Scroll to the right of your screen to view all the data.

Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	219.00	20.00	40	94.20
Pumping Water Level	75.00	17.00	21	47.05
Static Water Level	63.50	9.00	33	37.54
Yield (gpm)	4,100.00	18.00	29	542.86

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
133915		GOLDMAN LUCILLE	13N19W22	NO	WELL	78.00	66.00	63.50	18.00	2/19/1993	DOMESTIC
69064		MONTANA POWER CO.	13N19W22	NO	WELL	219.00		37.00		8/18/1977	
133918		SEITZ MARK	13N19W22	NO	WELL	60.00	45.00	25.00	40.00	1/14/1993	DOMESTIC
133917		TWITE	13N19W22	NO	WELL	60.00	37.00	25.00	30.00	3/6/1985	DOMESTIC
69065		LLOYD/HARDING DON WALTERSKIRCHEN M M	13N19W22	NO	WELL	94.00			50.00	4/9/1937	PUBLIC WATER SUPPLY
69066		MARTELL EARL W.	13N19W22A	YES	WELL	20.00	17.00	9.00	35.00	7/1/1967	IRRIGATION
69067		PARK HOTEL	13N19W22ABCC	NO	WELL	99.00		45.00	30.00	1/15/1937	PUBLIC WATER SUPPLY
69068		CITY OF MISSOULA	13N19W22ACA	NO	WELL	70.00	40.00	30.00	40.00	11/4/1977	PUBLIC WATER SUPPLY
69069		CITY PARKS & RECREATION	13N19W22ACA	NO	WELL	60.00	25.00	11.00	30.00	3/29/1978	PUBLIC WATER SUPPLY
69070		STATE OF MONTANA	13N19W22ADC	NO	WELL	49.00		20.00	75.00	5/8/1989	IRRIGATION
150967		MISSOULA COUNTY WQD WELL U131922A	13N19W22ADCB	YES	WELL	45.00		25.60		12/17/1985	MONITORING
69071	56746	MISSOULA TEXTILES	13N19W22B	NO	WELL	90.00	70.00	60.00	90.00	7/14/1984	OTHER
181479		BURLINGTON NORTHERN*M-48	13N19W22BA	NO	WELL	37.00		32.50		7/26/1999	
706384		WOOLWORTHS	13N19W22BC	NO	WELL	84.00				1/1/1939	UNUSED
151156		MISSOULA PUBLIC LIBRARY	13N19W22BD	NO	WELL	118.20	47.50	46.50	627.00	7/20/1995	PUBLIC WATER SUPPLY
151157		MISSOULA PUBLIC LIBRARY	13N19W22BD	NO	WELL	118.00	49.00	48.00	618.00	7/21/1995	MONITORING
706386		FLORENCE HOTEL	13N19W22CB	NO	WELL	116.00				1/1/1940	OTHER
706387		KGVO RADIO STATION	13N19W22CB	NO	WELL	89.00	47.00	42.00	75.00	1/1/1939	OTHER
182403		MILENNIUM BUILDING NORTH	13N19W22CB	NO	WELL	140.00		46.00	1100.00	3/24/2000	OTHER
182404		MILENNIUM BUILDING SOUTH	13N19W22CB	NO	WELL	140.00		42.00	1100.00	3/27/2000	OTHER
88941		ST. VENTURES	13N19W22CBB	NO	WELL	55.00				2/26/1991	MONITORING
69074		UNIVERSITY OF MONT.	13N19W22CC	NO	WELL	47.00		23.50		12/17/1985	OTHER
69075		CITY OF MISSOULA	13N19W22CCA	NO	WELL	138.00	44.10	40.40	600.00	4/23/1987	IRRIGATION
69073	P005452-00	MOUNTAIN WATER COMPANY - WELL 30	13N19W22CCAB	NO	WELL	135.00	47.00	32.00	4100.00	12/10/1976	PUBLIC WATER SUPPLY
132845	P000706-00	MOUNTAIN WATER COMPANY - WELL 29	13N19W22CCBA	NO	WELL	176.00	41.50	31.30	1200.00	1/25/1974	PUBLIC WATER SUPPLY
69077	P010378-00	MOUNTAIN WATER COMPANY - WELL 32	13N19W22CCBA	NO	WELL	147.00	52.40	51.50	2000.00	8/17/1977	PUBLIC WATER SUPPLY

184642		SHARP DUANE	13N19W22CD	NO	WELL	120.00	66.00	56.00	30.00	8/2/2000	DOMESTIC
69076		UNIVERSITY OF MONTANA	13N19W22CD	NO	WELL	53.00	36.00			12/16/1985	OTHER
151191		MISSOULA COUNTY WQD WELL U131922C	13N19W22CDAB	DYES	WELL	53.00	36.40	25.00		12/16/1985	MONITORING
69078	C005604-00	MOUNTAIN WATER COMPANY * WELL 32	13N19W22CDAC	NO	WELL	139.50	44.30	43.80	1500.00	8/17/1976	PUBLIC WATER SUPPLY
69063		MOUNTAIN WATER COMPANY - WELL 33	13N19W22CDAD	NO	WELL	196.00	41.90	40.80	1400.00	2/10/1978	PUBLIC WATER SUPPLY
69079		OKKEN ORVAL	13N19W22D	NO	WELL	80.00	50.00	40.00		6/29/1988	DOMESTIC
154910		JGL DISTRUBUTING * MW-4	13N19W22DA	NO	WELL	68.00				1/15/1996	MONITORING
69080		STATE OF MONTANA	13N19W22DAA	NO	WELL	68.30	42.70	75.00		5/9/1989	IRRIGATION
706388		MISSOULA COLD STORE	13N19W22DB	NO	WELL	67.00				1/1/1945	INDUSTRIAL
706389		MISSOULA COLD STORE	13N19W22DB	NO	WELL	83.00				1/1/1997	UNUSED
120486		JENNINGS MARK	13N19W22DC	NO	WELL	80.00	43.00	20.00	40.00	8/1/1990	DOMESTIC
69081		CITY OF MISSOULA	13N19W22DCAB	NO	WELL	56.80	50.00	38.00	100.00	12/20/1977	IRRIGATION
69082		UNIVERSITY OF MONTANA	13N19W22DCB	NO	WELL	139.10	39.30	38.30	625.00	6/27/1986	IRRIGATION
132846	75741	MCKAYS ON THE RIVER	13N19W22DDA	NO	WELL	80.00	75.00	50.00	50.00	5/25/1990	DOMESTIC

End of Report.

40 record(s) listed.

This report is restricted to site types of **WELL**, **BOREHOLE**, **SPRING**, **PETWELL**, and **COAL BED METHANE WELL**.

Explanation of Columns:

Td = **T**otal **d**epth of well in feet below ground

Pwl = **P**umping **w**ater **l**evel in feet below ground

Swl = **S**tatic **w**ater **l**evel in feet above/below ground - Negative values are reported for water levels that are above land surface.

Yield = Yield in gallons per minute

Date = Completion date of well/borehole

Use = Reported use of water

Ver? = Was location verified?

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. There may be wells in the area

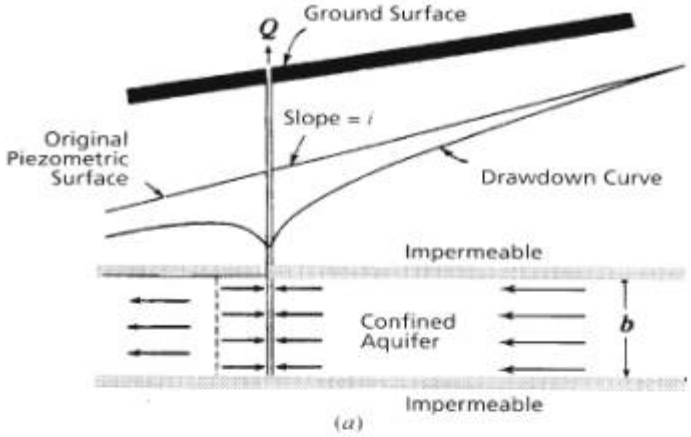
that are not recorded at the Information Center.

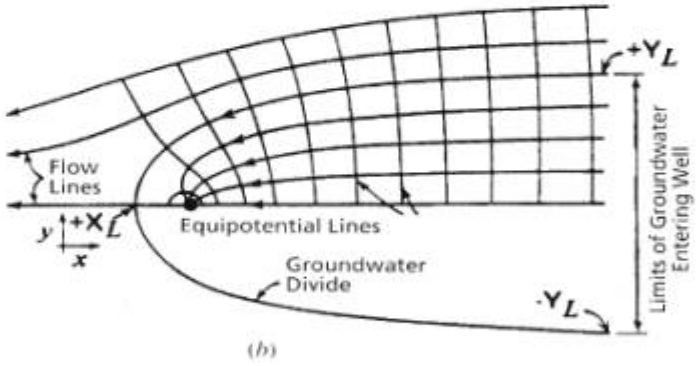
APPENDIX D

Time of Travel Calculations

UNIFORM GROUNDWATER FLOW EQUATION

Flow to a well penetrating a confined aquifer having a sloping plane piezometric surface - vertical section and plan view (Todd, 1980).





$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)$$

Uniform-Flow Equation

$$X_L = -\frac{Q}{2\pi Kbi}$$

Distance to Down-Gradient Null Point

$$Y_L = \pm\frac{Q}{2Kbi}$$

Boundary Limit

Legend:

- Pumping Well

Where:

Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

TIME-OF-TRAVEL CALCULATION METHOD

The time of travel for water to move along a line parallel to the hydraulic gradient, from a point to a pumping well (EPA 1991).

$$T_x = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi}\ln\left(1 + \frac{2\pi Kbi}{Q}X_L\right)\right]$$

T_X	=	travel time from point x to a pumping well
n	=	porosity
X_L	=	distance from pumping well over which groundwater travels in T_X
Q	=	discharge
K	=	hydraulic conductivity
b	=	aquifer thickness
i	=	hydraulic gradient

APPENDIX E

Inventory Sheet

APPENDIX F

Checklist

Department of Environmental Quality
Source Water Protection Program

CERTIFICATION CHECKLIST

Source Water Delineation and Assessment Reports (SWDAR)
For Community and non-community non-transient PWSs

The following items represent the minimum requirements for certification of a completed SWDAR for Community and non-community non-transient PWSs. The SWDAR represents the technical component of the SWPP, and mush be completed per the 1996 amendments to the Federal Safe Drinking Water Act. This checklist should be used in conjunction with the information and general format provided in the template for preparing SWDAR documents. While the format of the template may be modified as needed, all requested information should be included for certification.

For any items that are not applicable or information is not available, note in checklist column and provide and explanation. Attach additional sheets for explanation, if necessary.

Name of System:		**Florence Associates**
PWS #:		**3924**
Date Submitted:		**May 31, 2006**
Operator Name:		**Ken Crisp**
SWPP Contact:	Name:	Samantha Kemp
	Address:	P.O. Box 9169 Missoula, MT 59807
	Phone:	(406) 728-3113
Person Preparing	Name:	Michelle Hutchins, Environmental Health Specialist
Plan Contact:	Address:	Missoula City County Health Department 301 W. Alder Missoula, MT 59802
	Phone:	(406) 258-4890

The following summary checklist is derived from the Source Water Delineation and Assessment Report template document. The completed plan should include summary discussions, when appropriate, for each listed item. Indicate the page and/or section number where this information is, or indicate not applicable (n/a) when appropriate. For items indicated as not applicable, the text should indicate why.

Introduction

	Page
Person who prepared document	iv
Name of system and county located in	iv
PWS Identification Number	iv
PWS contact person, with address and phone number	cover

Chapter 1 – Background

This section provides background information on the community served by the PWS.

	Page
1. The Community:	1
• Population	1
• Economic base	1
• Major water users	1
• Major waste generators	1
• Domestic sewage treatment and disposal	1
2. Geographic Setting	1
• Geographic setting, including surrounding area	1
• Physiographic features	1
• Streams and lakes	1
• Climate information (including annual precipitation and temperatures)	1
• A vicinity map at appropriate scale	Fig. 1

For surface water sources, or ground water systems influenced by surface water

• 8 and 11 digit USGS Hydrologic Units	n/a
• Montana Watershed Management Region	n/a
3. General Description of Source Water	1

Description of PWS system, including:

- Source of water (number of wells, depths, etc.) 2
- Well lithology and construction logs (in appendix) Appx B
- Distribution system 1, Appx A
- Number of connections and users 2
- PWS Treatment System 2

- Copy of latest Sanitary Survey (in appendix) Appx A

- A map indicating the general layout of the PWS. Appx A

4. Water Quality:

- Summarize enforcement actions in the past 5 years 2
- Describe background/regional water quality 2
- Table summarizing background water quality 3

For surface water sources, or ground water systems influenced by surface water

- Use classification n/a
- Threatened or impaired streams in watershed n/a
- TMDL development prioritization and status n/a

Chapter 2 – Delineation

This section provides information on the hydrogeology of the water supply for the PWS. Background information on the hydrogeologic setting should be assembled into a ***Hydrogeologic Conceptual Model*** that summarizes the ground water system in a simplified manner. The background information should support the process to delineate management areas.

		Page
1.	Hydrogeologic Conditions	4
•	Identification of references for hydrogeologic information	4
•	Summary tables of hydrogeologic studies and maps for area	5-6
•	Summary of wells in area from GWIC database	Appx C
•	Geologic map(s) included (if not, valid justification for omission)	Fig. 3
•	Geologic cross section(s) included	Fig. 5

For ground water systems:

• Identify aquifer	4
• Geologic setting of aquifer	4
• Aquifer properties (lithology, boundaries, etc.)	4
• Aquifer type (confined, unconfined, semi-confined)	4
• Connection with surface water	4
• Classify sensitivity of hydrogeologic setting of source water	4

For surface water sources, or ground water systems influenced by surface water

• Hydrogeologic setting of PWS watershed	n/a
• Identification of references for hydrogeologic information	n/a
• Stream flow characteristics	n/a

2.	Conceptual Model and Assumptions	6
•	Seasonal trends in system	4
•	Assumptions made to simplify model	9

For ground water systems:

• Aquifer boundaries	4
• Aquifer recharge areas	6
• Ground water flow direction	6
• Communication with surface water	6

For surface water sources, or ground water systems influenced by surface water

• Relationships of surface water with ground water system	n/a

3. Well (or source) Information

For ground water systems:

- Well depths, construction details 7
- Well locations described 7
- Summary table of source information 7
  [Source information to include: PWS Source Code, Well Location, MBMG (GWID) No., MT Water Right No., Date Well completed, total depth, perorated interval, static water level, pumping water level, drawdown, test pumping rate, and specific capacity]

For surface water sources, or ground water systems influenced by surface water

- Description of source water intake system n/a
- Streamflow data, if available n/a

4. Delineation Methods and Criteria

- Overview of approach used for delineation 6

5. Model Input

For ground water systems:

- Identify analytical method used, with source reference 6
- Values of hydraulic parameters identified, with ranges 9
- Identify hydrogeologic parameter values used, with rationale 7-8
- Summary table of input values for model 9
- Reference and justification for assumed values 7-8
- Time of travel equations or model specifications 7-8

For surface water sources, or ground water systems influenced by surface water

- Time of travel calculations for surface water body n/a
- Summary of ranges for streamflow parameter values n/a
- Identify streamflow parameter values used with rationale n/a
- Summary table of input values for model n/a

6. Delineation Results

- Travel time calculation results, or computer model calibration criteria 9
- Management zones identified on map(s) Figs. 6 & 7
- Delineated areas reflect seasonal variations in hydrologic systems 9

7. Limiting factors

- Identify uncertainties in delineation approach based on assumptions 9
- Identify how uncertainties may effect delineated areas 9

Chapter 3 – Inventory

This section identifies all known and potential contaminant sources which may affect the PWS.

1. Inventory methods identified 10-11
2. Appropriate databases searched, with potential sources identified 10-11

For ground water systems:

- Control zone 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- Inventory Region 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- Surface Water Buffer 12

Description of land uses
Description of potential contaminant sources for pathogens (acute health hazards)

- Recharge Region 15

Description of land uses
Description of large potential contaminant sources
Large potential sources and land use shown on a map

For surface water sources, or ground water systems influenced by surface water

- Spill Response Region n/a

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- ***Watershed Region*** n/a

Description of land uses
Description of large potential contaminant sources
Map of watershed region showing significant potential contaminant sources
(e.g. MPDES permitted discharges, to the extent practical with existing databases)

For all systems

- Inventory update – procedures to update every five years 15
- Inventory limitations identified 15

Chapter 4 – Susceptibility Assessment

This section evaluates the potential for the PWS water supply to be contaminated by the significant potential sources of contamination identified in Chapter 3. This information can be used by local officials to prioritize management actions for the delineation control and inventory zones. Worksheets to be considered when completing each task are listed with each topic.
Attach completed worksheets as Appendices to final document

1. Hazard of potential contaminant sources identified 17-19

2. Barriers for each potential contaminant sources identified and evaluated 17-19

   - Supporting information for identification of features as barriers 17-19

3. Threats from significant potential contaminant sources ranked 17-19

References

All technical references are listed in the appropriate format 25-26

Appendices

All necessary supporting information is included in Appendices yes

List any Deficiencies:

none

APPENDIX G

Letter of Concurrence

Source Water Protection Section
Department of Environmental Quality
POB 200901
Helena, MT 59602-0901

RE: Source Water Delineation & Assessment Report

To Whom It May Concern:

The Florence Associates public water system #3924 has reviewed the source water delineation and assessment report (SWDAR) dated May 2006. We concur that the delineation component appears to describe current conditions at the water system based on reasonably available information and that the susceptibility assessment identifies the origins of regulated contaminants to the extent practical.

We understand that the Florence Associates PWS SWDAR will be made available to the public by DEQ as described in the Montana Source Water Protection Program. Also, we will make a copy of the report available for the public to view during our normal office hours and describe the results in subsequent releases of our consumer confidence report.

Signed,

_____

Signature Title and Date

Figures

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