# STEVENSVILLE, DARBY, AND HAMILTON MONTANA

# SOURCE WATER PROTECTION PLAN

Prepared for:

**Town of Stevensville - PWSID #MT0000335**

**Town of Darby - PWSID #MT0000195**

**City of Hamilton – PWSID #MT0000234**

May 30, 2002

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## 1. INTRODUCTION

This document is a Source Water Protection Plan (SWPP) for the communities of Darby, Hamilton and Stevensville, Montana. The work completed to prepare this plan was funded by the U. S. Environmental Protection Agency (USEPA), and by in-kind services from each of the communities. The intentions of this project are three-fold:

- Each community will develop a Plan that guides the management and protection of their water sources into the future. This SWPP is the Plan. The communities must implement the Plan to protect water sources.
- By implementation of the Plan, Ravalli County citizens will become *more* aware of their water resources and take the necessary actions for resource protection.
- The approach to teaming in Source Water Protection planning will be evaluated by the state of Montana and used as a demonstration to other communities where joint efforts make sense.

This report is organized into several chapters, following guidelines by the state of Montana for preparing Source Water Protection Plans (MDEQ 1999). In most cases, the community information is presented first for Stevensville, then Hamilton, and finally Darby. This order of presentation follows the north to south location of the communities in the Bitterroot Valley. Various technical data for each water system are also provided in the plan appendices. Appendix A presents general information that applies to the Bitterroot Valley and to each of the water systems. Appendix B presents the information for Stevensville. Appendix C presents the information for Hamilton. And Appendix D presents the information for Darby.

### What is Source Water Protection Planning?

Water supplies serving public water systems come from groundwater and surface water. Groundwater is extracted by pumping wells, springs, and infiltration galleries (shallow perforated pipes). Surface water is extracted by an intake facility built into a stream or lake. Source Water Protection Planning evaluates the potential for contamination of these water supply sources, and determines the management that is necessary to ensure future protection. Implementation of the Source Water Protection Plan is required to actually protect the water sources.

### Why protect water supply sources?

Protection of public health is the primary reason behind source water protection. No one disagrees that drinking a clear, refreshing water free of contaminants is healthy. We also cannot monitor and treat water for all substances that may be harmful to man. Protecting a water supply source makes good sense because it reduces the chance for entry of unknown contaminants into the water system. Protection of water sources will also save you money. Public water systems cost money to operate. If a source is contaminated, there will be additional costs for treatment and/or replacement of the source. If a water source in Darby, Stevensville or Hamilton becomes contaminated, the additional costs to the rate payers will be on the order of $500,000 to $1,000,000. Protecting water sources provides a potentially large cost savings to the water system.

**How can water sources become contaminated?**

There is a large amount of chemical use and waste generation in developed areas. Solvents may be spilled from drums or illegally disposed onto the land surface. Underground fuel tanks can leak gasoline or other chemicals to groundwater. Fertilizers and pesticides are routinely applied in agricultural and residential lands and can be transported into surface- and ground-waters. Sewage wastes are discharged through municipal treatment plants and septic systems. In rural areas, wildlife and livestock may be associated with pathogens, such as giardia and cryptosporidium. All of these contaminants may have potential to migrate to a water supply source, including wells, springs, and surface water intakes.

**What types of management activities may be implemented to protect a water source?**

There are a variety of approaches to manage the protection of water supply sources. The most important approach is to maintain community awareness of water resource vulnerability through educational efforts. In Source Water Protection Planning, anything that can be done to advocate protection of water resources is better than nothing.

The actual approaches to protect water sources are chosen by the community. There are administrative duties that should be implemented in order to have a program. Normally, a city employee becomes responsible for collecting information and tracking implementation. Most management for source water protection is educational, including outreach programs to schools and the community as a whole. Some communities may choose to pass special ordinances to mitigate unacceptable risks to their water sources.

**Is Source Water Protection Planning a regulatory program?**

**No. Source Water Protection Planning is a voluntary community effort**. There are regulatory requirements for Source Water Protection, however, they apply to the state of Montana, and not to the public water system. Public water systems that prepare and implement Source Water Protection Plans will gain from greater awareness of their water source and its vulnerability to contamination. They may also gain in the future by relief from certain regulations because they have an active Source Water Protection Program.

**How is Source Water Protection Planning completed?**

This SWPP was prepared with a consultant and a Source Water Protection Advisory Committee. The consultant performed technical work to provide information to the committee, facilitated meetings, and compiled the SWPP. The committee reviewed the SWPP and determined the specific management activities of the plan. The committee met four times to review the plan and to make decisions about management activities. Each of the communities also provided staff time to collect data for the technical portions of the SWPP. The Source Water Protection Advisory Committee members are listed below.

| | |
|---|---|
| County & State Government | |
| Lea Jordan | Ravalli County |
| James Swierc | State of Montana DEQ |
| Local Watershed Group | |
| Roxa French | Bitter Root Water Forum |
| Local Businesses | |
| Jean Matthews | Chapter One Bookstore, Hamilton* |
| Bob Popham | Popham Ranch* |
| Local Government | |
| Bruce Park | Town of Stevensville |
| George Thomas | Town of Stevensville |
| Dale Huhtanen | City of Hamilton |
| Lorin Lowry | City of Hamilton |
| Dave Szeszycki | City of Hamilton |
| Bill Decker | Town of Darby |
| Bud Hall | Town of Darby |

*Indicates volunteer participation.

**1.1 Communities**

The locations of Stevensville, Hamilton and Darby, within the Bitterroot Valley of western Montana, are shown on Figure 1-1. As the only incorporated communities in Ravalli County, each is a center of activity for the citizens both within and outside the city limits. The county population in 1998 was estimated at 35,000, and presently is experiencing a 5% annual growth rate. The high population estimated for the year 2005 is 52,500. In 1998, Hamilton, the county seat, had a population of 4,275. The 1998 populations in Stevensville and Darby were 1,965 and 851, respectively.

Land use in the Bitterroot Valley is dominated by agriculture, although there is an increasing trend of subdividing agricultural lands for residential development. Timber harvesting is a major industry of the area, and to a lesser degree, mining has also been important to the local economy. Log home manufacturing is a booming industry in the valley, and tourism remains strong, drawing many vacationers from around the US and other countries.

Stevensville, Hamilton and Darby are the principal economic centers in their respective parts of the valley. Although they vary in size, the communities are very similar to one another, and to a degree, typify the smaller mature towns of western Montana. Each community provides centralized water service in accordance with the Safe Drinking Water Act regulations. Each community also provides a sewage collection system and wastewater treatment plant, in accordance with the Clean Water Act regulations. Outside of the water and sewer services areas, residences are supplied water through private wells and utilize on-site sewage systems, typically consisting of a septic tank and drainfield. These private, single-home water and wastewater systems occur in the low-density areas. As development densities increase, the communities will extend water and sewer service to these areas.

## 1.2 Geographic Setting

Stevensville, Hamilton and Darby lie within the Bitterroot Watershed, which drains an area of approximately 2,800 $mi^2$ in western Montana. The communities are located in the Bitterroot Valley portion of the watershed. This valley is a north to south intermontane basin averaging 7-miles in width and extending about 60 miles in length, with an area 430 $mi^2$ (Kendy and Tresch 1996). The valley is bounded by the Bitterroot Range on the west, the Missoula Valley on the north, the Sapphire Mountains on the east, and the Anaconda Range on the southeast. The valley elevation is about 3,900 ft msl at Darby and 3,300 ft msl at Stevensville. The neighboring mountains have summit elevations from approximately 7,000 ft to over 10,000 ft msl.

Climate in the region is generally characterized by cool summers, moderately cold winters, and typically dry conditions throughout the year. July and August are the warmest months, while December and January are the coldest. The wettest months of the year are May and June. Average air temperatures in July and August reach a maximum in the range from 80 to 85 ° F. During December and January the average minimum temperatures range from 15 to 20 ° F. Total annual precipitation measured at Stevensville and Hamilton averages 12.64 and 12.21 inches, respectively. Darby is considerably wetter, with average annual precipitation of 16.10 inches. Three to 5-inches of the total annual precipitation occurs during the months of May and June.

Irrigation canals, drawing from the Bitterroot River and tributaries, are used extensively in the Bitterroot Valley, and some date back to the 1840's. Canal systems occur on both the east and west sides of the valley, and likely total in excess of about 300 miles in length. Canal leakage and the application of irrigation water in excess quantities is a primary source of recharge to the groundwater aquifers of the valley. Upon filling of the canals in spring, groundwater static levels will typically rise 5 to 10 ft, reflecting the onset of recharge. Static levels will remain high through the summer period, declining in the fall and through the winter months.

## 1.3 Public Water Supplies

Stevensville, Hamilton, and Darby operate their water systems in accordance with the rules of the state of Montana for community water systems. Each water system is routinely monitored for chemical constituents and is managed by certified water system operators. The state public water system (PWS) identification numbers and water operator information for each system is provided in Table 1-1.

TABLE 1-1

WATER SYSTEM GENERAL INFORMATION

| PWS Name & Number | Number Connections (Yr 2000) | Operator | Operator Number | Telephone |
|---|---|---|---|---|
| Stevensville No. 335 | 665 | Bruce Park<br>George Thomas | 1988<br>4568 | (406) 777-5271 |
| Hamilton No. 234 | 1709 | Lorin Lowry<br>Dave Szeszycki | 4760<br>4386 | (406) 363-2101 |
| Darby No. 195 | 315 | Bill Decker | 4550 | (406) 821-3753 |

Groundwater obtained from wells is the principle water supply for each of the communities. Figures 1-2, 1-3, and 1-4 show the locations of the water supply sources in each of the communities. Tables 1-2 through 1-4 provide data on well construction. Well logs are provided in the appendices. The groundwater aquifers tapped by the wells are generally shallow and receive recharge from the Bitterroot River, its tributary streams, irrigation canals, and applied irrigation water. In some years, direct infiltration of precipitation and snow melt can be an important recharge process. Each community delivers water through a grid-type water distribution system, equipped with valves, hydrants and elevated storage reservoirs. Detailed Water systems maps for each community are included in the Appendices B, C, and D.

Stevensville obtains water supply from a filtration treatment plant and three production wells. The filter plant treats a groundwater source that is obtained by gravity flow through a large infiltration gallery. This source is intentionally recharged by periodic flooding of the land area above the infiltration gallery. The state has classified the source as groundwater under the direct influence of surface water. This classification means that although the source is drawing water from below ground surface, the source of water is regulated as a surface water. The Stevensville well sources (nos. 1, 2, and 3) are used during the summer months on a continuous basis. Stevensville installed a test well in 1990 to investigate a new well site. This well is not equipped with pumping equipment and is not used in the water system. Stevensville treats water at the filter plant by coagulation, direct filtration and chlorine disinfection with contact time. The well supplies do not presently require treatment.

Hamilton presently utilizes five water supply wells (nos. 1, 2, 4, 5, and 6). Well No. 7 was drilled in 1999 and has not been put into service. With the exception of Well No. 5, the operating wells are treated with chlorine disinfection. Well No. 5 is used mainly as a backup source during the summer peaking period. Darby water production comes from three wells (nos. 1, 2, and 4). There is no water treatment presently needed by the Town for these sources.

TABLE 1-2

STEVENSVILLE WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| Filter Plant | 1979[1] | 7 – 12[2] | NA | 8 | 8,134[3] | 350 |
| 1 | 1956 | 455 | None | 10 | 362 – 370 (P) | 155/500 |
| 2 | 1968 | 56 | None | 8 | 36 – 56 (P) | 225 |
| 3 | 1976 | 75 | None | 8 | 40 – 50 (P) 55 – 75 (P) | 225 |
| Test Well | 1990 | 552 | 20 | 6 | 310 – 332 (P) 391 – 394 (P) | 500 (site) |

[1] Filtration equipment was installed in 1979. Prior to 1979, the source was used unfiltered. [2] The filter plant intake consists of horizontal perforated pipe installed into shallow trenches. [3] The engineer’s drawing for the intake system indicates a total of 8,134 ft of tile "in this field" for the infiltration of groundwater.

TABLE 1-3

HAMILTON WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| 1 | 1934 | 67 | None | 10 | 54 – 64 (P) | 450 |
| 2 | 1934 | 66 | None | 10 | 50 – 65 (P) | 450 |
| 4 | 1946 | 66 | None | 12 | 50 – 65 (P) | 450 |
| 5 | 1975 | 109 | Unknown | 12 | 85 – 90 (S) | 250 |
| 6 | 1986 | 68 | 20 | 12 | 42 – 58 (S) | 700 |
| 7 | 1999 | 58 | 20 | 10 | 32 – 40 (S) | 470 |

TABLE 1-4

DARBY WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| 1 | 1960 | 100 | Unknown | 10 | 87 – 100 (S) | 175/350 |
| 2 | 1973 | 70 | 18 (?) | 8 | 40 – 70 (P) | 350 |
| 4 | 1981 | 80 | 18 | 8 | 61 – 77 (P) | 275 |

## 1.4 Water Quality

This section primarily summarizes information on the groundwater quality in the Bitterroot Valley shallow alluvial aquifer. Sampling data for general water quality indicators provided in published reports (McMurtrey and others 1972) and for the City of Hamilton Well No. 7 are provided in Table 1-5. Other recent water quality data for terrace areas in the Bitterroot Valley is published in Briar and Dutton (2000). As these data show, the groundwater contains a fair amount of dissolved ions, as evidenced by the hardness, alkalinity and total dissolved solids. The water type is calcium-carbonate, which is typical for a shallow groundwater having a relatively short residence time below the land surface (on the order of several years). Essentially all of the hardness is carbonate hardness, and the hardness is considered high by general standards (>150 mg/L as $CaCO_3$). The principal component for carbonate in the groundwater is the bicarbonate ion ($HCO_3$). The pH is neutral or slightly alkaline, which is normally favorable for use in a municipal distribution system.

TABLE 1-5

AMBIENT GROUNDWATER QUALITY DATA

| Parameter | Near Hamilton 6N/20W-4bc1 | Near Stevensville 9N/20W-34ac | Hamilton Well No. 7 |
|---|---|---|---|
| Sample Date | 10/24/55 | 10/18/55 | 4/14/99 |
| Well Depth (ft) | 43 | 54 | 40 |
| Temperature (F) | 52 | 55 | 46 |
| pH (std. units) | 7.7 | 7.1 | 7.3 |
| Alkalinity (mg/L as $CaCO_3$) | 211 | 111 | 177 |
| Total Dissolved Solids (mg/L) | 278 | 139 | 187 |
| Hardness (mg/L as $CaCO_3$) | 183 | 103 | 184 |
| Nitrate (mg/L as N) | 0.88 | 0.38 | 1.66 |

The state of Montana DEQ database for public water systems was also reviewed for each of the water systems. The water systems comply with the present standards required under the Safe Drinking Water Act. Raw source sampling has not detected any organic contaminants in the water supply. Trace metals, which exist naturally in some areas, are normally undetected, with a limited number of detections at the sample detection limit. Nitrate concentrations average near 1 mg/L as N, with high values up to 3 mg/L as N, whereas the limit is 10 mg/L as N. Values of nitrate greater than 1 to 2 mg/L as N suggest groundwater that has received a nitrogen contribution from agriculture and/or on-site sewage systems. Values of nitrate less than 1 mg/L are more typical of pristine groundwater, as shown by recent water quality sampling (Briar and Dutton 2000). To date, the community water supply sources have not been subject to contamination and it does not appear the existing contamination sources are located in proximity to either well or surface water supplies.

The Bitterroot Watershed has been subject to a general review of water quality conditions for the state TMDL (Total Maximum Daily Load) program. This program is required to develop total maximum daily loads of specific contaminants occurring in point-source and non-point source waste streams that ultimately discharge to surface waters. Surface water bodies including the Bitterroot River and many tributaries have been prioritized for TMDL development. Forty-four miles of the Bitterroot River, from Hamilton to the Clark Fork confluence, has been designated as high-priority. Burnt Fork Creek, Mill Creek, and North Swamp Creek, which are the surface waters related to the Stevensville Filtration Plant source, were not included in the TMDL priority assignments. Tin Cup Creek, immediately south of Darby, is included in the TMDL list as low priority.

## 2. DELINEATION

Delineation refers to the mapping of the land area below which groundwater flows to the sources of water supply. This land area, also called a Source Water Protection Area, must be protected from contamination in order to ensure the water supply sources are not impacted. Thus, delineation provides the Source Water Protection Plan with a focus area for management – the Source Water Protection Area.

Delineation is performed by applying the technical methods of hydrogeology to the water sources and the aquifers from which they withdraw groundwater. In order to properly apply these methods, it is necessary to have an understanding of the geological materials and their hydraulic properties. It is also necessary to understand where groundwater recharge occurs, the direction of groundwater flow, and the areas where groundwater is discharged. Tasked with these requirements, it would appear necessary to launch an expensive field investigation requiring many tests and many years of study. Fortunately, a wealth of information exists (many expensive studies have already been done), and in fact, the state of Montana and EPA advocate the use of existing information whenever possible in Source Water Protection planning.

As mentioned above, delineation provides simply the area of focus for Source Water Protection planning. In this light, delineation mapping is only intended to provide a planning area. While it is necessary to be generally correct and to error on the conservative side (too large rather than too small), it is not necessary to perform a rigorous analysis of groundwater hydraulics, as would be required for example in the development of a new municipal wellfield. It is important not to lose sight of the application needs and the level of effort required.

## 2.1 Conceptual Model Overview

In the Bitterroot Valley, groundwater occurs within the loose soils, consisting of clay, silt, sand and gravel mixtures. Most wells in the valley center will penetrate groundwater within 10 to 25 feet from the ground surface. This groundwater occurs in an unconfined aquifer that does not have a protective cover. Spills and waste disposal onto the land surface have the potential to be washed down to the aquifer.

The groundwater is replenished, or recharged, by precipitation and irrigation water that infiltrates the land surface, and also by leakage from irrigation canals, streams and rivers. The leakage from surface water appears to be the dominant groundwater recharge process. In certain areas, the infiltration of excess irrigation water may dominate. Throughout the Bitterroot Valley, the groundwater level will rise each spring with the onset of runoff, filling of irrigation canals, and also the application of irrigation water to the land surface. The groundwater level will in turn decline in elevation through the fall and winter months.

The groundwater is not a static water body beneath the land surface. Flow of groundwater occurs from areas of higher groundwater elevation to lower groundwater elevation. In the Bitterroot Valley, groundwater flow occurs from the margins of the valley toward the center, and also downstream. Groundwater continuously discharges into the lower elevation surface streams, and ultimately the Bitterroot River. At locations east of the Bitterroot River, the groundwater flow direction is primarily westerly and northerly. At locations west of the Bitterroot River, groundwater flow direction is primarily easterly and northerly.

Appendix A provides additional general information that can be used to understand groundwater flow in the Bitterroot Valley. A geological map and map of the water table elevation are also provided, as prepared by Briar and Dutton (2000) and McMurtrey and others (1972).Topographic maps are provided for the areas of each community involved in this SWPP in the respective appendices.

## 2.2 Geological Conditions

As for most of western Montana, the geology of the Bitterroot Valley is very interesting. Most of the complexity that is enjoyed by geologists, however, is located in the mountainous areas and the foothills. The valley itself has an interesting but more tractable geological history and is the most important to the sources of water supply under study for this plan.

Figures 2-1, 2-2, and 2-3 provide surface geological maps for the three community areas. Generalized geological cross-sections are provided on Figures 2-4a, 2-4b, and 2-4c. The map symbols used on the surface maps and the cross sections are described in Table 2-1. This information is based on the work of Lonn and Sears (1999), McMurtrey and others (1972), Weber (1972), and Norbeck (1980).

Stevensville is located on a large alluvial fan (map symbol Qafy) that was developed by deposition from the Burnt Fork and related streams (Figures 2-1 and 2-4a). The alluvial fan directly overlies older sand, gravel, silt and clay formations, identified by map units Tbg and Tbc. Stevensville Well No. 1 and the Test Well penetrate into the older sand and gravel deposits, map units Tbg/Tbc. Both wells draw groundwater from sand and gravel at approximately 330 feet below ground surface. The aquifer at this depth would be classified as semi-confined, as there are many intervening low permeability materials that prevent vertical flow and act as barriers, or confining layers, to the aquifer zone. It is most likely that Well Nos. 2 and 3 are screened at the base of the alluvial fan, map unit Qafy, as the total depths of these wells are 56 and 75 ft, respectively. At most, these two wells could be screened in the uppermost portion of the older sand and gravel deposits, map unit Tbg.

Hamilton lies on top of the Riverside and Hamilton Terraces, which are sand and gravel deposits identified by map units Qatr and Qath (Figures 2-2 and 2-4b). The geological cross section on Figure 2-4b generally shows the conditions in the Hamilton area. Well Nos. 1, 2, 4, 6 and 7 draw groundwater from the base of the Hamilton Terrace, map unit Qath, at depths ranging from about 40 to 65 ft. The aquifer penetrated by these wells is unconfined, without any protective barrier layers. Well No. 5 penetrates into the deeper clay and silt, map unit Tbc, and finds water in a thin sand and gravel layer between 80 and 90 feet below ground surface.

Darby also is situated on the Riverside and Hamilton Terraces, identified by map units Qatr and Qath (Figures 2-3 and 2-4c). Interestingly, however, low permeability materials consisting of clay and silt, and bedrock crop out along the terrace slope to the west of Town (map units Tbc and TYb). The occurrence of these units indicates the possibility that the aquifer is bounded to the west of Town. The Darby wells are generally of similar depth, ranging from 70 to 100 ft below ground surface. It is most likely that these wells are screened within the Hamilton terrace, map unit Qath, or recurring deeper sands and gravels within the older sand and gravel deposits, Tbg/Tbc map units. If true, the Hamilton terrace (Qath unit) is several tens of feet thicker at Darby than at Hamilton. The greater thickness may be simply due to the narrower valley that occurs in the Darby area.

TABLE 2-1

GEOLOGICAL FORMATION DESCRIPTIONS[1]

| Period | Map Symbol | Description |
|---|---|---|
| Quaternary (present to 40,000(?) yrs) | Qal | Alluvial deposits of active channels and present flood plains (Holocene). Well-rounded, well sorted gravel and sand with minor amounts of silt and clay. Average thickness of 40 ft. |
| | Qatr | Alluvial deposits of the riverside terrace (late Pleistocene (?)). Well-rounded, well-sorted gravel and sand underlying the youngest terrace along the Bitterroot River. Thickness estimated at 10 to 20 feet. |
| | Qath | Alluvium of the Hamilton Terrace (late Pleistocene (?)). Well-rounded, well-sorted gravel and sand underlying the second youngest terrace along the Bitterroot River. Thickness is from 10 to 30 feet. |
| | Qafy | Younger alluvial outwash terrace and fan complex deposits (late Pleistocene (?)). Well-rounded, unweathered, cobbles and boulders in a matrix of sand and gravel deposited in braided stream environments that formed between and below the dissected remnants of older fans (Taf). Thickness averages 40 feet. |
| | Qafo | Older alluvial outwash terrace and fan complex deposits (late Pleistocene (?)). Well-rounded, locally derived cobbles in a matrix of sand and gravel deposited in outwash fan environments. Surfaces of these deposits are now perched above younger alluvial fan deposits (Qafy). |
| | Qgt | Glacial till (Pleistocene). Unsorted, mostly massive, clay, silt, sand, and gravel with boulders up to 20 feet in diameter. Moraines record at least three stages of glaciation beginning in the early Pleistocene. |
| Tertiary (2,000,000 to 25,000,000 yrs) | Taf | Alluvial fan deposits (Pliocene (?)). Brown, unconsolidated to weakly lithified, poorly sorted, moderately stratified subangular to rounded boulders, cobbles, and sandy silt deposited in alluvial fan environments. |
| | Tbg | Fluvial (river) gravel of the ancestral Bitterroot River channel (Oligocene to late Miocene (?)). Predominantly light gray to white, unconsolidated, well-sorted, well-rounded, well-stratified, sand, pebbles, and cobbles. Contains interbedded light tan clay and silt that predominate in the adjacent blue clay facies (Tbc) with which this unit |

| | | |
|---|---|---|
| | | interfingers. Deep drill holes show that unconsolidated sedimentary rocks similar to Tbg and Tbc are up to 2400 feet thick in places. |
| | Tbc | Clay, silt and tephra of the ancestral Bitterroot River channel, "Blue Clay Facies" (Oligocene to late Miocene). Mostly light gray clay and silt in beds 6 inches to 5 feet thick, with abundant interbedded tephra. Contains lenses of well-sorted, cross-stratified, fluvial gravel like that described for Tbg, and interfingers with Tbg. |
| Tertiary to Proterozoic | TYb | Berdock, undivided (middle Proterozoic to Eocene). Includes Proterozoic Belt Supergroup sedimentary rocks, and younger amphibolite grade metamorphic rocks, and plutonic rocks. |
| [1]Adapted from Lonn, J. D. and J. W. Sears (1999) Preliminary Geologic Map of the Bitterroot Valley, Montana, Montana Bureau of Mines and Geology Map MBMG-362, Butte, MT. | | |

### 2.3 Source Water Sensitivity

Based on the types of sources from which the communities obtain their water supply, the source may be classified in terms of its sensitivity. Sensitivity refers to the ability of the source to be contaminated, or otherwise impacted, by man's activities. Sources that have low sensitivity have a natural protective barrier. Sources that have high sensitivity are essentially without a barrier. Releases of contaminants can migrate freely to a high sensitivity source, whereas many years of travel are required for a contaminant to reach a low sensitivity source. Table 2-2 summarizes the sensitivity classes for the Stevensville, Hamilton, and Darby water supply sources. The unconfined aquifer conditions of the Bitterroot Valley are classified as high sensitivity. Sand and gravel materials exist at the land surface and there are no protective barriers above the aquifer. A couple of the sources draw groundwater from a semi-confined aquifer, which is sheltered from surface activities by naturally occurring layers of silt and clay materials. The Stevensville Filter Plant has high sensitivity because surface water and groundwater under the direct influence of surface water provide the water supply to this source.

TABLE 2-2
SOURCE WATER SENSITIVITY

| Owner | Source Name | Source Type | Sensitivity Classification |
|---|---|---|---|
| Stevensville | Filter Plant | Surface Water | High |
| | Well No. 1 | Semi-Confined Aquifer | Moderate |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 3 | Unconfined Aquifer | High |
| Hamilton | Well No. 1 | Unconfined Aquifer | High |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 4 | Unconfined Aquifer | High |
| | Well No. 5 | Semi-Confined Aquifer | Moderate |
| | Well No. 6 | Unconfined Aquifer | High |
| | Well No. 7 | Unconfined Aquifer | High |
| Darby | Well No. 1 | Unconfined Aquifer | High |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 4 | Unconfined Aquifer | High |

## 2.4 Hydraulic Properties

Aquifer transmissivity and hydraulic conductivity are the two primary parameters used to describe the hydraulic properties of aquifers. Large values of either are indicative of highly permeable conditions. Low values indicate low, or impermeable conditions. Parameter values must be obtained in order to delineate Source Water Protection Areas.

Existing data provided for the subject wells of this Plan were used to assess transmissivity and hydraulic conductivity. These data primarily consisted of the well specific capacity (pumping rate divided by drawdown) from short-term pumping tests. One exception was the data set for Hamilton Well No. 7, which consisted of a 24-hour pumping test with drawdown and recovery analysis. Table 2-3 summarizes the specific capacity data for the wells.

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TABLE 2-3

WELL SPECIFIC CAPACITY DATA

| Owner | Well No. | Pumping Rate (gpm) | Drawdown (ft) | Specific Capacity[1] (gpm/ft) |
|---|---|---|---|---|
| Stevensville | 1 | 400 | 70 | 14.3 |
| | 2 | 100 | 6 | 41.7 |
| | Test Well | 218 | 45 | 12.1 |
| Hamilton | 6 | 882 | 39 | 56.5 |
| Darby | 2 | 500 | 52 | 24.0 |
| | 4 | 250 | 50 | 12.5 |

[1]A well efficiency (Ew) of 40% was assumed for the tests, with the exception of Hamilton No. 6, which was assumed to have 50% efficiency. Tested specific capacity is divided by the well efficiency to determine the table value (i.e., Table Value = (Q/s)/Ew).

Specific capacity values were used to compute the aquifer transmissivity using an approximate method (Driscoll 1986). Hydraulic conductivity was obtained by dividing the transmissivity by the estimated aquifer thickness for the pumping test. These aquifer thickness values were selected from the well logs. Transmissivity for the Hamilton Well No. 7 pumping test was computed by the Cooper-Jacob method and the Theis Recovery method using specialized computer software (Aquifer Test undated). Transmissivity and hydraulic conductivity values are summarized in Table 2-4.

Delineation of Source Water Protection Areas utilizes a computer model for groundwater flow to wells. In application, where multiple wells tap the same aquifer, it is useful to use average hydraulic conductivity and thickness values. In completing the modeling work, hydraulic conductivity average values were computed as the geometric mean value. Average thickness was determined as the simple average. Averages were computed for Stevensville Well No. 1 and the Test Well, for Hamilton Well Nos. 6 and 7, and for Darby Well Nos. 2 and 4. Table 2-5 summarizes the hydraulic conductivity, aquifer thickness, and boundary conditions used in the groundwater delineation modeling.

TABLE 2-4

AQUIFER HYDRAULIC DATA

| Owner | Well No. | Aquifer Type | Transmissivity ($ft^2/d$) | Thickness[1] (ft) | Hydraulic Conductivity (ft/d) |
|---|---|---|---|---|---|
| Stevensville | 1 | Semi-Confined | 3,818 | 35 | 109 |
| | 2 | Unconfined | 8,358 | 39 | 214 |
| | Test Well | Semi-Confined | 3,235 | 57 | 57 |
| Hamilton | 6 | Unconfined | 11,338 | 53 | 214 |
| | 7 | Unconfined | 29,000 | 22 | 1,289 |
| Darby | 2 | Unconfined | 6,427 | 45 | 143 |
| | 4 | Unconfined | 3,342 | 30 | 111 |

[1] Thickness was assigned a value equal to 1.5 x Screen Interval, unless the top and bottom of the aquifer could be identified from the well log.

TABLE 2-5

SUMMARY OF MODELING PARAMETERS

| Delineation | Aquifer Thickness (ft) | Hydraulic Conductivity (ft/d) | Boundary Conditions |
|---|---|---|---|
| Stevensville Well No. 1 | 46 | 79 | Bitterroot Irrigation Canal Bitterroot River |
| Stevensville Well Nos. 1, 2 | 39 | 213 | Bitterroot Irrigation Canal Bitterroot River |
| Hamilton Well Nos. 1 – 7 | 37.5 | 538 115* | Bitterroot Irrigation Canal Bitterroot River |
| Darby Well Nos., 1,2,4 | 37.5 | 128 | West-side Irrigation Canal Bitterroot River |
| * This value of hydraulic conductivity was applied to the east-side terrace area. | | | |

Other existing hydraulic property data exist in McMurtrey and others (1972), however, they were not used in the delineation calculations. In general, these data were obtained by short-duration tests in shallow wells. The well testing locations also were away from the community water wells addressed in this Plan. Aquifer hydraulic data were also summarized in Briar and Dutton (2000). These data, obtained from driller's records on well logs, were applicable to the terrace areas on either side of the floodplain. Consequently, using the data presented in Table 2-4 is considered to provide a more accurate delineation of the subject wells.

**2.5 Groundwater Flow**

McMurtrey and others (1972) present a water table elevation map for the valley aquifer extending from south of Hamilton to Stevensville. Montana Bureau of Mines and Geology also collected water level data and prepared a water table contour map for the City of Hamilton (MBMG 1996). These information sources were used to generally assess groundwater flow direction, hydraulic gradient, recharge areas, and discharge areas. Unfortunately, similar data do not yet exist for the Darby area. In this case, map interpretations were made to arrive at the same information.

In the Stevensville area, water table elevation mimics land surface elevation. The dominant groundwater flow occurs down the alluvial fan of the Burnt Fork drainage, in a northwesterly direction. Water table contours are very similar in shape to the topographic contours of the alluvial fan. The hydraulic gradient is approximately 0.02 ft/ft, or 2 ft per 100 ft of horizontal distance. Recharge occurs from tributary streams and irrigation canals. Discharge occurs to the Stevensville wells, private wells, and the Bitterroot River.

In the Hamilton area, the water table slopes downward to the northwest. The direction of flow is approximately 20 to 30 degrees west of true north (N 20 W, N 30 W). Both the Bureau of Mines (1996) and the McMurtrey and others (1972) water table maps are consistent with one another. The hydraulic gradient is approximately 0.01 ft/ft, or 1 ft per 100 ft of horizontal distance. Recharge occurs from irrigation canals on the east terrace, and also from tributary streams in the Skalkaho Creek drainage. Discharge occurs to the Hamilton wells, other privately-owned wells, and ultimately the Bitterroot River on the northwest side of Hamilton.

Conditions are slightly different at Darby in comparison to Stevensville and Hamilton. The valley is considerably narrower and the occurrence of bedrock on either side is much closer to the Bitterroot River channel (Figure 2-3). A fine-grained unconsolidated clay and silt formation (map unit Tbc) also occurs at the surface to the west of Town. This surface geology suggests that recharge into the valley plain area from the adjacent highlands will be limited. It is likely that most recharge to the valley plain area will come primarily from the Bitterroot River, and also Tin Cup Creek on the south side of Town where it crosses the valley plain. Given this conceptual model, it is expected that groundwater flow occurs parallel to the Bitterroot River channel in the Darby area. The hydraulic gradient should be similar to that at either Stevensville or Hamilton, in the range of 0.01 to 0.02 ft/ft, or could be flatter.

**2.6 Delineation Modeling**

The state of Montana and EPA have requirements to delineate Source Water Protection Areas. The state recognizes multiple Source Water Protection Areas for water supply sources. The intent of multiple Source Water Protection Areas is to assist in management. Those areas close to the well or surface water intake are managed with more care and detail than the areas farther away.

Three distinct Source Water Protection Areas are defined for each well supply, and referred to as: 1) the control area; 2) the inventory region; and 3) the recharge area. The control area is a 100-ft radius circle surrounding the well casing. The inventory region is defined by the 3-yr time of travel for groundwater to reach the well (3-yr TOT), and must extend at least 1,000 feet from the well. The recharge area encompasses the total recharge area to the water supply well. The work completed also provided a delineation of the 1-yr time of travel boundary (1-yr TOT). Although this region is not required for Source Water Protection Area delineation in Montana, it provides a useful zone for management of water supply sources. It is needed to complete the hazard rankings of the susceptibility analysis.

There is one additional requirement for groundwater sources in unconfined aquifers. An additional Source Water Protection Area must be delineated showing a ½-mile wide buffer surrounding all hydraulically connected surface waters and extending 10-miles upstream. This region is named the acute contaminants inventory area. Acute contaminants include pathogens, such as giardia and cryptosporidium, and nitrate.

Two distinct Source Water Protection Areas are recognized for surface water supplies, referred to as: 1) the spill response region; and 2) the watershed region. The spill response region is defined by a ½-mile wide buffer extending 10-miles upstream from the source intake. The watershed region encompasses the entire watershed, including tributary streams, upstream from the intake.

1. Delineation Methods

Source Water Protection Areas for groundwater sources (all sources except the Stevensville Filter Plant) were delineated using a computer model called TWODAN (TWODAN undated). This model provides simulation of regional groundwater flow with multiple, interacting pumping wells. The model was setup by assigning constant water levels (heads) along irrigation canals and the Bitterroot River, and assigning the average thickness and hydraulic conductivity values documented in Table 2-5. Where geologic formations occurred with different hydraulic conductivity values (heterogeneity) than the aquifer, they were represented in the model. During the modeling process, time was spent to develop model output that was consistent with existing information on the groundwater flow system (primarily flow direction and gradient). The modeling was completed to emulate the published groundwater flow maps for the valley in steady-state conditions, and does not account directly for the influences of multiple irrigation ditches and tributary streams to the Bitterroot River, and the effects of seasonal changes in the direction of groundwater flow. Three separate models were developed for the Stevensville, Hamilton, and Darby areas, respectively. Detailed listings of the model configuration and a graphic output are provided in the appendices (all model output are listed in length units of meters and time units of days due to the state of Montana GIS base mapping which also uses meters).

Source Water Protection Areas based on the ½-mile buffer method were developed using the ArcView GIS software (ArcView GIS undated). In application, new linear elements, drawn as polylines, were temporarily added to the surface water shape file, extending from a point of origin upstream for 10-miles along the selected tributary or irrigation canal. Software commands were used to draw the ½-mile buffers (2,640 ft) on either side of the linear elements. For groundwater sources, the point of origin was taken as the location where the surface water body intersected a Source Water Protection Area region (control area, inventory region, or recharge area). For surface water sources, the point of origin was taken as the location of the source intake. In the case of Stevensville, the point of origin was taken as the Filter Plant.

2. Stevensville

Figures 2-5, 2-6, and 2-7 present the Source Water Protection Areas for the Stevensville water supply. Source Water Protection Areas for the well supplies have been combined due to the proximity of the wells to one another. The modeled protection area also has been modified by widening it to cover more of the valley (compare with model output in Appendix B). The 3-yr TOT boundary shown on Figure 2-5 delineates the inventory region for the groundwater sources. The recharge area extends upgradient to the location of the Bitterroot Irrigation District Canal, which was selected as the upgradient boundary for modeling purposes. It is assumed that this canal marks the uppermost significant recharge source to the shallow groundwater system, and recharge to the well sources does not extend beyond the canal. It is possible, however, for both surface and groundwater higher in the watershed to contribute to the recharge to the groundwater sources. These contributions would occur during periods when the irrigation canal was dry.

Figure 2-5 also presents a confined aquifer inventory region for Well No. 1. This region extends radially for a distance of 1,000 ft, and has been included on the delineation map due to the semi-confined aquifer tapped by Well No. 1. Other wells, private, commercial or public, located within this region are of concern as they can act as conduits for contaminants to reach the deep aquifer utilized by Well No. 1.

The acute contaminants inventory region shown on Figure 2-6 is based on hydraulic connection with two irrigation canals, Supply Ditch and the Bitterroot Irrigation District canal, and also Burnt Fork Creek. It applies only to Well Nos. 2 and 3, as Well No. 1 is considered to be installed into a semi-confined aquifer.

Figure 2-7 presents the Source Water Protection Areas for the Filter Plant source. The ½-mile buffers are drawn to surround the Bitterroot Irrigation District canal, and the tributary streams that exist upstream from the source intake, which include Mill Creek, North Swamp Creek, and North Burnt Fork Creek. The watershed region encompasses the entire Burnt Fork drainage and related tributaries. The 1-yr and 3-yr TOT boundaries are located onto the Spill Response Region (dashed lines) because the Filter Plant intake consists of a large infiltration gallery fed by groundwater. These boundaries indicate the travel time for groundwater flow to reach the infiltration gallery, and are based on Darcy's Law calculations.

3. Hamilton

Figures 2-8 and 2-9 present the Source Water Protection Areas for the Hamilton wells. For individual wells, the 3-yr TOT boundary is shown, and would normally delineate the inventory region. However, based on the proximity of these areas to one another, a composite inventory region is proposed for Hamilton. The composite inventory region surrounds all of the wells, extending to the limits of the 3-yr TOT boundary for Well Nos. 1, 4, 5, and 7.

The recharge area shown on Figure 2-8 extends up the east-side terrace to the Bitterroot Irrigation Canal, which coincides approximately with the first outcrop of bedrock. It is a reasonable assumption that the irrigation canal is the uppermost location of significant recharge to the shallow groundwater system. The bedrock terrain to the east has low hydraulic conductivity and will transmit relatively small quantities of water as groundwater. It is possible, however, for some groundwater recharge to occur within the bedrock region.

Figure 2-9 presents the acute contaminants inventory area for Hamilton. This area is based on three irrigation canals, Republican Ditch, Hedge Ditch, and Bitterroot Irrigation, and also one unnamed tributary which runs near to the fish hatchery.

4. Darby

Figures 2-10 and 2-11 present the Source Water Protection Areas for Darby. The delineations based on the TWODAN model were more interesting for Darby than for either Hamilton or Stevensville. Review of the pathlines to the wells that are shown on the graphic provided in Appendix D will provide greater insight as to the shapes of these areas.

Based on the conceptual model (and computer model), groundwater recharge to the wells occurs primarily from the Bitterroot River. Recharge also likely occurs from the Tin Cup Creek channel, however, it was not represented in the model as a simplifying assumption. It has also been assumed in the delineation modeling that little recharge occurs from the terrace to the west of Town due to the occurrence of low permeability bedrock and clay materials (geologic map units TYb and Tbc). The recharge area to the wells, however, has been extended 1,000 ft onto the terrace due to the uncertainty associated with this assumption. Shortest travel time from the Bitterroot River to the well supplies varies from slightly less than one-year (Well No. 1) to about 2.5 years (Well No. 4). Most recharge water to the wells is below ground for longer periods of time. The 3-yr TOT boundary for each well coincides with the inventory region. The recharge area also extends to the Bitterroot River, to the locations where surface water flows into the shallow groundwater system.

Figure 2-11 presents the acute contaminants inventory region, which extends for 10-miles upstream along the Bitterroot River. It is also shown to extend a short distance up Tin Cup Creek, which is a major tributary flowing out of the Selway-Bitterroot Wilderness Area.

### 2.7 Analysis Limitations

Analysis of groundwater flow is fraught with uncertainty. The simple matter is that the subsurface conditions are extremely complex and cannot be seen. Even if we could see them, we likely could not measure the properties in sufficient detail. There are natural variations in hydrogeologic properties on a variety of scales, from millimeters, to feet, to miles.

On top of this natural variability, we are limited by the ability to mathematically model a groundwater flow system. Modeling equations and solutions are extremely complex. The formulas in use are developed by implementation of a variety of simplifying assumptions. Thus, the modeling effort, by its tools alone, requires a simplification of the groundwater flow system.

So what does this mean for Source Water Protection Area delineation? The most important uncertainties are related to the direction of groundwater flow, the hydraulic gradient, and the effective hydraulic conductivity of the flow system that are used in the modeling effort.

Uncertainty in the direction of groundwater flow has obvious implications to our analysis of Source Water Protection Areas. Uncertainty in the hydraulic gradient and the hydraulic conductivity together result in uncertainty in our ability to correctly model groundwater velocity. A few examples as to how these uncertainties affect Source Water Protection Area delineation follow:

- If we simulate a velocity of groundwater that is slower than actual, we will compute a region that is too wide and too short. The wideness does not bother us. However, we will have under-predicted the "upstream" extent of the protection area, an undesirable outcome.

- If we simulate a velocity that is too fast, the opposite occurs. Our delineated area is too narrow and extends too far upstream. Similarly, we are not bothered by the greater upstream length, but the narrowness of the delineated area is undesirable.

- If our flow direction is a few degrees different from actual (which incidentally will vary with time of year), we will delineate a protection area that extends at least partially into the wrong area.

There is not too much that can be done to resolve these limitations of delineation modeling. Additional study could be performed, but it is also associated with additional project expense. Most additional study will be better justified if it can be coupled with other projects, such as development of a new well site or general water resources investigations. In Source Water Protection planning it is prudent to be conservative in utilizing the delineated protection areas. In the conservative approach, the source inventory (next chapter) would not be limited exactly to the protection area boundary. Rather, it may be extended beyond the calculated area, perhaps up to 500 ft or more. Users of the delineated areas should understand they are only guides for the management and protection of water supply sources. It must be understood that they are subject to uncertainty and are not exact.

## 3. INVENTORY AND SUSCEPTIBILITY

This section provides information pertaining to the potential for contamination of water supply wells, and in the case of Stevensville, the surface water treatment plant. This information provides a basis for evaluating the management activities that will be conducted to preserve drinking water quality. There are two parts to this section. In part one, information is presented to document the potential sources of contamination that exist in the source water protection regions. Part two applies a hazard and susceptibility classification system to the potential contaminant sources. Its purpose is to prioritize the types of potential contaminant sources, providing a focus for developing management activities.

Section 2 mapped the source water protection areas for each water supply source that is being evaluated in this SWPP. For a detailed description of these areas, please refer back to Section 2. In summary, for groundwater sources, there are three source water protection regions: 1) the Control Region (100-foot radius); 2) the Inventory Region (3-year time of travel); and 3) the Recharge Region. For surface water sources, there are two source water protection areas: 1) the Spill Response Region; and 2) the Watershed Region. For the purposes of determining contaminant source susceptibility it is also necessary to map the 1-year time-of-travel (TOT) region for groundwater to reach a water supply well. This region occurs between the Inventory Region boundary (3-year TOT), and the Control Region boundary.

### 3.1 Inventory of Potential Contaminant Sources

1. Inventory Method

The primary effort of the contaminant source inventory was a field survey completed by each of the communities. To complete the survey, base maps at a large scale were produced covering the entire Inventory Region, and showing in detail the city streets. A data entry form was also created including fields for a business ID number, the business name, the address, and the type of business or activity that is important for the purpose of the inventory. City and town staff went "door-to-door" locating potential contaminant sources, noting the source location on the map, and filling out the data form. The same approach was used in the Acute Contaminants Inventory Region. The information obtained was entered into the ArcView GIS mapping and database software. Each of the communities also provided information on sewer and stormwater collection systems. This information was provided on maps from existing records.

Other existing data on contaminant sources were obtained to supplement the field survey data. These other data consisted of computerized mapping information and database listings. Mapping data were obtained primarily from the state of Montana Natural Resources Information System, and included:

Land-use; 2) Population (1990) by census tracts; 3) Highways; 4) Railroads; and 5) Petroleum Pipelines (http://nris.state.mt.us/gis/gis.html). Database listings were obtained from the U.S. Environmental Protection Agency Envirofacts Query internet site (http://www.epa.gov/enviro/index_java.html). This listing included EPA-regulated facilities in Ravalli County, Montana. Database listings were also obtained from the state of Montana for active leaking underground storage tank sites, state cleanup sites, and existing operational underground storage tanks. These listings were obtained by contacting Montana Department of Environmental Quality directly, who provided the lists by e-mail. US EPA was contacted to obtain information on Class V Injection Wells in the area. Unfortunately, US EPA has not collected any data for Ravalli County, although activity in the county will begin in the near future.

2. Inventory Results

Discussion is provided below regarding the potential contaminant sources in each community. Additional information pertaining to EPA regulated facilities, state of Montana cleanup sites, leaking underground storage tank sites, and existing underground storage tanks is also provided in Appendix A.

Stevensville

Inventory data for Stevensville are provided on Figures 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, and Table 3-1. There are a limited number of potential contaminant sources present in the Stevensville area, due primarily to the small level of development and also the Town's location away from the valley center. The majority of the land use (Figure 3-1) in the Inventory Region is agricultural. The city center land is primarily residential, and only small areas exist that are considered urban (commercial, industrial, "built-up" areas).

Agricultural land use occupies the largest area in both the well inventory regions (Figure 3-1) and also the Filter Plant spill response region (Figure 3-6). Depending on the actual usage, agricultural practices can pose a threat to ground- and surface-waters. Land applied chemicals can be dissolved in runoff and washed downward into the soil penetrating to groundwater. Chemical spills can occur at mixing stations. Best Management Practices (BMPs) exist for land application of chemicals and also the mixing of chemicals for agriculture. Implementation of these BMPs will reduce the risk of water contamination.

A total of 19 potential contaminant sources (Figure 3-2) were identified directly inside of or near to the Inventory Region (Well Nos. 1, 2, & 3). Additional information on these potential sources is annotated onto Figure 3-2 and provided in Table 3-1. The potential contaminant sources included a mixture of facilities with no major type dominant. Two gas stations and one dry cleaner were present. One of the gas stations, CENEX, is under investigation for leaking underground storage tanks. Two machine shops were present. No unusually large or uncommon industries were present. One feed lot exists, but it is located to the north of the Well No. 1 Inventory Region. There were no confined animal feeding areas within the Acute Contaminants Inventory Region for the wells and the hazard posed by septic systems is considered low (Figure 3-5).

Well No. 1 is generally protected from point sources in the area due to the depth at which it extracts groundwater (362 – 370 feet). A concern for deep wells, however, is the existence of neighboring wells that can act as conduits for contaminants to move deeply in the groundwater system. The circular Confined Aquifer Inventory Region identified for Well No. 1 was used as a focus area for identifying other existing wells that may pose this threat. A well inventory list was obtained from the Groundwater Information Center (Montana Bureau of Mines and Geology) for this area and is presented in Appendix B. There were 18 wells identified from the inventory list that could possibly be located within the Confined Aquifer Inventory Region. Twelve of these wells may actually occur outside of the region, as the location provided indicated only the section number. Six wells appear to be located in the same quarter section as Well No. 1. These six wells range in depth from 5 to 65 feet. They were installed from 1957 to 1984 (one well was undated). Because the wells are shallow, they are not considered to pose a significant threat to Well No. 1. However, it is noteworthy that in all likelihood these wells are not constructed with proper surface seals. If any of these wells are no longer in use, the owners should be requested to properly abandon the well.

Septic systems (Figure 3-3) are used for sewage treatment in the areas outside of the city and are known sources of nitrate contamination in groundwater. The City wastewater is collected by a sewer system and treated at a lagoon treatment plant to the northwest of town (a map of the sewer collection system is provided in Appendix B). All development outside of the city utilizes septic systems. Based on evaluation of septic hazard, Well Nos. 1, 2 and 3 appear to be at a moderate risk level for contamination from septic systems. The higher density development is occurring along the Eastside Highway, in a pattern that is elongated from north to south. In contrast, the Inventory Regions extend up the Burnt Fork Creek drainage, and are elongated in the east to west direction. Consequently, little of the Inventory Region is considered presently (1990) at risk from septic system discharges. This condition could change in the future as a result of growth in the area.

Infrastructure for stormwater management in Stevensville is limited to a collection system that runs north along the East Side Highway, through the downtown area. This system is owned and operated by the state of Montana. Inlets collect stormwater that then enters a pipeline and is routed to a surface water discharge approximately 1,000 feet northwest of Well No. 1. If a spill were to occur in the downtown area, this stormwater system would be protective of groundwater, assuming the pipeline is not prone to leaking. Stormwater in the Stevensville area that is not collected by this system flows along roadsides from east to west, following the main gradient of the land surface. Discharge that does not collect in depressions within the town area will ultimately be discharged on the west side of town into a wetland/surface water area, adjacent to the Bitterroot River. There are no dry wells used to dispose of stormwater in the Stevensville area.

Major transportation corridors in the Stevensville area include only the railroad (Figure 3-4). Most truck traffic passing through the area will use US Highway 93 located about 1.5 miles west of Stevensville. The Northern Pacific railroad spur exists in proximity to the well sources and poses a significant potential risk when bulk chemicals are transported. A greater risk exists for Well Nos. 2 and 3 than for Well No. 1.

There are no known point sources or discharges to surface water in the Spill Response Region for the Filtration Treatment Plant (Figures 3-6 and 3-7). The most significant threat to water quality at the Filter Plant is related to agricultural land uses in the area. Where chemicals are applied or mixed and where animal wastes become concentrated, it is possible for impacts to occur to the water quality feeding the plant. Otherwise, the location of this plant is favorable in terms of source water protection, as it is upstream from most development. The Burnt Fork watershed has limited forestry activity and the rocks do not provide mineral resources for mining. The only potential sources of contamination known to exist in this area are septic systems, which occur sparsely, and the agricultural lands as mentioned above. The hazard posed by septic systems (Figure 3-7) is considered low. Most of the lower watershed is within agricultural lands (Figure 3-5), primarily pasture used for growing hay and grazing livestock. There are no known concentrated animal feeding areas within the Spill Response Region or the Watershed. There is also no major transportation routes, although county roads exist. There are also no railroad crossings above the Filter Plant.

TABLE 3-1
STEVENSVILLE FIELD SURVEY DATA

| Well No. | SWPA Region | Map ID | Facility Name | Facility Street Address | Source Type (Database Listing) |
|---|---|---|---|---|---|
| 1 | 1 Yr | S-001 | Cenex Gas Station | 107 Main Street | Gas Stations (UST)(LUST)(**F**) |
| 1 | 1 - 3 Yr | S-002 | Ace Hardware & Fertilizer | 4054 Eastside Hwy | Hardware/Lumber/Parts Stores |
| 1 | 1 - 3 Yr | S-003 | Omega II | 4072 Eastside Hwy | (EPA)(**F**) |
| 1 | 1 - 3 Yr (outside) | S-004 | Western Montana Millwork & Mfg. | 4071 Eastside Hwy | Wood Products |
| 1 | 1 - 3 Yr | S-005 | Kenyon Machine Shop | 931 East 2nd Street | Machine Shops (**F**) |
| 1 | 1 - 3 Yr | S-006 | Montana Power Sub Station | 938 East 2nd Street | Electrical |
| 1 | 1 Yr | S-007 | Montana Power Sub Station | 3700 Eastside Hwy | Electrical |
| 1 | 1 - 3 Yr | S-008 | Cenex Fertilizer Plant | 215 East 3rd Street | Fertilizer (**F**) |
| 1 | Outside | S-009 | Ellison Feed Lot | 4161 Eastside Hwy | Animal Feeding |
| 1 | 1 - 3 Yr (outside) | S-010 | Pollard Machine Shop | 3753 Eastside Hwy | Machine Shops |
| 1 | Outside | S-011 | The Works Conoco Gas Station | 324 Main Street | Gas Stations (UST) |
| 1 | >3 Yr | S-012 | Stevensville Water Plant | Middle Burnt Fork Rd. | Water Treatment |
| 2-3 | 1 Yr | S-013 | IGA Grocery Store | 601 Main Street | - |
| 2-3 | 1 Yr | S-014 | Alpine Dry Cleaners | 201 Barbara Street | Dry Cleaning (**F**) |
| 2-3 | 1 Yr | S-015 | Maple Wood Cemetary | - | Graveyards |

| | | | | | |
|---|---|---|---|---|---|
| 2-3 | 1 Yr | S-016 | Car Wash | 604 Main Street | - |
| 2-3 | 1 Yr (outside) | S-017 | Montana Saw Shop | 183 Middle Burnt Fork | Wood Products |
| 2-3 | 1 - 3 Yr | S-018 | United Auto Wrecking Yard | 208 Middle Burnt Fork | Salvage Yards (**F**) |
| 2-3 | Outside | S-019 | Stevi Feed & Farm Supply | 407 Main Street | Pesticide/Fertilizer |

Notes: UST indicates site listed in state of Montana underground storage tanks database; LUST indicates site listed in state of Montana active leaking underground storage tanks database; EPA indicates site listed in EPA-regulated database; **F** indicates a detailed inventory form exists for the source in Appendix B.

Hamilton

Inventory data for Hamilton are provided on Figures 3-8, 3-9, 3-10, 3-11, 3-12, and in Table 3-2. Hamilton is the largest community in Ravalli County, and therefore has the most development and consequently, the greatest number of potential contaminant sources. Land use in the Hamilton area (Figure 3-8) is dominated by agricultural and residential lands. A small proportion of the area is actually designated as urban land by the U.S. Geological Survey's analysis. There is a large urban/commercial land use area not shown on Figure 3-8. It is located along Highway 93 through the Hamilton area.

The agricultural land use, at least for the present, dominates the upland recharge area to the Hamilton wells. As stated for Stevensville, agricultural practices can impact groundwater quality due to land application of chemicals, spills at chemical mixing stations, and concentration of animal wastes. BMPs exist to protect against water contamination from these activities and should be implemented.

There are 50 potential contaminant sources identified within the Inventory Region (Figure 3-9). Information is provided on these potential contaminant sources on the figure and in Table 3-2. There are a large number of potential sources related to the automobile industry, either providing repairs to engines or performing body work. Several gas stations are present and there are two dry cleaners. The CENEX gas station (Map ID 6) is under investigation for leaking underground storage tanks. Rocky Mountain Laboratory also is under investigation for leaking of contaminants to the subsurface. Thirty-four of the 49 sources exist within the Inventory Region of Well No. 6. Well Nos. 2, 5 and 7, located on the east side of town are essentially free of any potential point-sources of contamination. Based on the number of sources and the handling of hydrocarbons and chlorinated solvents, point sources pose a substantial risk to the Hamilton area aquifer. Well No. 6 has the largest risk of contamination by point sources in comparison to the other city wells.

Septic systems are used abundantly to the east and south of Hamilton and may pose a significant threat to groundwater quality (Figure 3-10). An area designated as a high septic hazard exists within the Inventory Regions of Well Nos. 1 and 2. Inventory Regions for the other city wells are either within the sewered area or the lower-density outlying areas of the city. A map of the sewer collection system used by the city of Hamilton is provided in Appendix C. The septic hazard in the Acute Contaminants Inventory Region is considered to be low in general, although there are areas where the hazard is moderate and high (Figure 3-12). In this area there was also one confined animal feeding area identified. This feeding area is used for about two-days per month related to transportation of cattle.

Stormwater management in the Hamilton area consists of dry wells that discharge directly to groundwater. These facilities are used on public right-of-ways, public lands, and commercial properties. In the event of spilled chemicals entering a dry well, a significant impact to groundwater may occur.

US Highway 93 and the Montana Rail Link railroad pass through the center of Hamilton (Figure 3-11). These transportation routes pose a significant risk to Well Nos. 1, 2, and 6 whenever large quantities of chemicals are transported. The reduced speed limits through the Hamilton area will provide a degree of reduced risk in the Inventory Regions.

TABLE 3-2
HAMILTON FIELD SURVEY DATA

| Well No. | SWPA Region | Map ID | Facility Name | Facility Street Address | Source Type (Database Listing) |
|---|---|---|---|---|---|
| 6 | 1 Yr (outside) | H-001 | Custom Cabinets and Refinishing | 309 Pennsylvania Street | Furniture |
| 6 | 1 Yr | H-002 | Specialty Woodworks | 212 Pennsylvania Street | Furniture |
| 6 | 1 Yr | H-003 | Ray's Auto Body | 112 Pennsylvania Street | Automobile (**F**) |
| 6 | 1 Yr | H-004 | Big Sky Auto Body | 221 Lyndale Street | Automobile (**F**) |
| 6 | 1 Yr | H-005 | Wrights Radiator Shop | 106 Pennsylvania Street | Automobile |
| 6 | 1 Yr | H-006 | CENEX | 1001 North Hwy 93 | Gas Stations (UST)(LUST)(**F**) |
| 6 | 1 Yr | H-007 | Lube Quick | 1000 North Hwy 93 | Automobile |
| 6 | 1 Yr | H-008 | Wimps Auto Body | 998 North Hwy 93 | Automobile (**F**) |
| 6 | 1 Yr | H-009 | Small Engine Repairs | - | Engine Repair |
| 6 | 1 Yr | H-010 | Auto Electric | 111 Adirondac Street | Automobile |
| 6 | 1 Yr | H-011 | M & M Transmission and Auto | 804 North Hwy 93 | Automobile |
| 6 | 1 Yr | H-012 | Phil's Radiator Repairs | 806 N. 1st Street | Automobile |
| 6 | 1 Yr (outside) | H-013 | J & B Welding Shop | 105 Fairgrounds Road | - |
| 6 | 1 Yr | H-014 | S & S Auto Body | 801 North Hwy 93 | Automobile (EPA) |
| 6 | 1 Yr | H-015 | The Paint Center | 931 North Hwy 93 | - |

| | | | | | |
|---|---|---|---|---|---|
| 6 | 1 Yr | H-016 | Town Pump – Exxon | 1015 North Hwy 93 | Gas Stations (UST)(**F**) |
| 6 | 1 Yr (outside) | H-017 | Ravalli County Fairgrounds | 100 Old Corvallis Road | Public (UST) |
| 6 | 1 Yr (outside) | H-018 | Engine Rebuilder | 217 Fairgrounds Road | Automobile |
| 6 | 1 Yr (outside) | H-019 | Ravalli County Maintenance Shop | - | Public |
| 1 | 1 Yr | H-020 | Town Pump – Exxon | 920 South Hwy 93 | Gas Stations (UST)(**F**) |
| 1 | 1 Yr | H-021 | Evergreen Square | 906 South Hwy 93 | - |
| 1 | 1 Yr | H-022 | Montana Power Substation | 800 South Hwy 93 | Electrical |
| 6 | 1 - 3 Yr | H-023 | Power Wash of Hamilton | 521 South Hwy 93 | - |
| 6 | 1 - 3 Yr | H-024 | Ole's Country Store No. 3 | 501 South Hwy 93 | Gas Stations (UST) |
| 6 | 1 - 3 Yr | H-025 | Silent Knight Muffler | 421 South Hwy 93 | Automobile |
| 6 | 1 - 3 Yr | H-026 | Davison Distributors | 410 South Hwy 93 | Gas Stations (UST) |
| 6 | 1 - 3 Yr | H-027 | U-Haul, Al's Car Care | 324 South Hwy 93 | Automobile |
| 6 | 1 - 3 Yr | H-028 | Chevron Thompson Distributing | 320 South Hwy 93 | Petroleum (EPA) |
| 6 | 1 - 3 Yr | H-029 | Jerry Wessels Tire Shop | 315 N. 2nd Street | Automobile |
| 6 | 1 - 3 Yr | H-030 | Sign Pro | 320 North Hwy 93 | - |
| 6 | 1 - 3 Yr | H-031 | Mickey’s Fast Lube | 400 North Hwy 93 | Gas Stations (UST) |
| 6 | 1 Yr | H-032 | Conoco Gas & Grub | 401 North Hwy 93 | Gas Stations (UST) |

| | | | | | |
|---|---|---|---|---|---|
| 6 | 1 Yr | H-033 | Fast & Fluffy Laundromat | 111 S. 3rd Street | - |
| 6 | 1 - 3 Yr | H-034 | Jerry Wessels Tire Center | 211 N. 1st Street | Automobile |
| 6 | 1 - 3 Yr | H-035 | Custom Truck | 270 N. 2nd Street | Automobile |
| 6 | 1 - 3 Yr | H-036 | Dowling Funeral Home | 415 S. 2nd Street | Funeral Services |
| 4 | 1 - 3 Yr | H-037 | Rocky Mountain Laboratories | 906 S. 4th Street | Research (LUST)(MT-CECRA)(EPA) |
| 4 | 1 Yr | H-038 | Robert Long Memorial Pool | 406 Main Street | - |
| 4 | 1 Yr | H-039 | Hamilton High School | 209 S. 5th Street | Schools |
| 1 | 1 Yr (outside) | H-040 | Valley Auto Body & Repair | 247 Daly Avenue | Automobile (**F**) |
| 1 | 1 Yr | H-041 | Hamilton Floral Nursery | 173 Golf Course Road | - |
| 7 | 1 Yr | H-042 | HSD Bus Maintenance | - | Automobile (**F**) |
| 4 | 1 – 3 Yr | H-043 | Northern Energy | 1282 South Hwy 93 | - |
| 4 | 1 – 3 Yr | H-044 | Abandoned Petroleum Plant (?) | - | - |
| 4 | 1 – 3 Yr | H-045 | Ed's Automotive and Transmission | 1242 South Hwy 93 | Automobile |
| 4 | 1 – 3 Yr (outside) | H-046 | Montana Power Company | 1140 South Hwy 93 | Electrical |
| 6 | 1 – 3 Yr | H-047 | Bell McCall | 300 W. Main Street | - |
| 4 | 1 Yr (outside) | H-048 | Bitterroot Laundry | 111 S. 3rd Street | Dry Cleaning (**F**) |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 1 Yr (outside) | H-049 | Bitterroot Laundry | 164 S. 3rd Street | Dry Cleaning (EPA)(**F**) |
| 6 | 1 – 3 Yr | H-050 | Ravalli County Courthouse | 205 Bedford | Emergency Generator (UST) |
| Notes: UST indicates site listed in state of Montana underground storage tanks database; LUST indicates site listed in state of Montana active leaking underground storage tanks database; EPA indicates site listed in EPA-regulated database; MT-CECRA indicates site listed in state of Montana State Superfund Program; **F** indicates a detailed inventory form exists for the potential source in Appendix C. | | | | | |

Darby

Inventory data for Darby are provided on Figures 3-13, 3-14, 3-15, 3-16) through 3-17, and in Table 3-3. Darby is a small community with greater similarity to Stevensville than Hamilton. However, it is also located along US Highway 93, which increases the amount of traffic through the area. Land use in the Darby area (Figure 3-13) is dominated by agricultural and residential lands. Within the Inventory Region, most of the land is residential, with little agricultural land. Consequently, the potential for impacts to groundwater from agriculture is considered low. A relatively large area identified as urban land exists on the north side of the town, within the source water protection area for Well No. 2.

There were 12 point sources identified by the Darby field survey (Figure 3-14, Table 3-3). The Darby Landfill (Map ID D-006) is shown on Figure 3-17 because it exists southwest from town, well outside of the Inventory Region, and also outside of the Acute Contaminants Inventory Region. There are a mixture of source types in the Darby area, including gas stations, automobile repair and other service industries. The Town's wastewater lagoons are also located within the Recharge Region of Well No. 2. There are two sites under investigation. One of these is the Old Mill located north of town (Map ID D-001). The other is the Ole's gas station (Map ID D-005) located to the south of town. The Old Mill is a state of Montana Superfund Site (CECRA). Ole's is under investigation for leaking underground storage tanks. A pump and treat system was installed at Ole's several years ago, and treatment appears to be nearly completed.

Septic systems occur primarily to the south of Town (Figure 3-15). The Town area is served by a sewer collection system that is connected to the treatment plant. Well Nos. 1 and 2 have little to no hazard of contamination from septic systems. Well No. 4, however, has a moderate hazard, which likely will increase in the future as more growth occurs in the area. A map of the sewer collection system in Darby is provided in Appendix D. Septic hazard is considered low throughout the Acute Contaminants Inventory Region (Figure 3-17), and there are no known confined animal feeding operations present.

Stormwater management infrastructure in Darby exists along US93, and is owned and operated by the state of Montana. Curbside inlets to a main storm sewer exist along the roadway. The storm sewer runs from south to north with two discharge points. One discharge occurs into a french drain north of town. The other discharge occurs at the end of a sewer branch near to the Town's wastewater treatment lagoons. Elsewhere in the town stormwater runoff follows the natural gradient, toward the east and toward the north, collecting in small depressions, and discharging into the floodplain of the Bitterroot River.

US Highway 93 bisects Darby from north to south, passing in proximity to the water well sources (Figure 3-16). The Northern Pacific railroad is also located near to the Town's wells. When used for transport of chemicals, both transportation routes pose a hazard to the wells. Well No. 1 is at greatest potential risk, as both US93 and the railroad cross the 1-year time-of-travel zone, and US93 is only a block west of the well.

TABLE 3-3

DARBY FIELD SURVEY DATA

| Well No. | SWPA Region | Map ID | Facility Name | Facility Street Address | Source Type |
|---|---|---|---|---|---|
| 2 | >3 (outside) | D-001 | Old Mill Treatment Pit | - | Wood Products (MT-CECRA) (**F**) |
| 1 | 1 Yr | D-002 | Mr. T's | 107 S. Main | Automobile |
| 1 | 1 Yr | D-003 | Glacier Furs | 105 N. Main | - |
| 1 | 1 Yr (outside) | D-004 | J & D Auto Body | 105 Tin Cup Road | Automobile |
| 1 | 1 – 3 Yr | D-005 | Ole's | - | Gas Stations (UST)(LUST)(**F**) |
| 4 | Outside | D-006 | Darby Landfill (Closed) | - | Landfill |
| 2 | 1 - 3 Yr | D-007 | Bitterroot Taxidermy/Fur | 405 N. Main | Taxidermy/Tannery (EPA) (**F**) |
| 2 | >3 Yr | D-008 | Town of Darby | - | Wastewater Lagoons |
| 2 | 1 Yr | D-009 | Darby School | - | Schools (UST) (**F**) |
| 2 | >3 Yr | D-010 | Darby Auto | 105 Tin Cup Road | Automobile |
| 1 | 1 Yr | D-011 | Sober Auto | - | Automobile (**F**) |
| 1 | 1 - 3 Yr | D-012 | Wolfe Auto | 223 S. Main | Automobile |

Notes: UST indicates site listed in state of Montana underground storage tanks database; LUST indicates site listed in state of Montana active leaking underground storage tanks database; EPA indicates site listed in EPA-regulated database; MT-CECRA indicates site listed in state of Montana State Superfund Program; **F** indicates a detailed inventory form exists for the potential source in Appendix D.

Chemicals

A wide variety of chemicals may be in use or transported within source water protection areas. Table 3-4 provides a correlation of chemicals and business application for selected industries that typically pose the highest risk for groundwater contamination. With regard to chemical usage, there are basically two types of chemicals that have been important contaminants in groundwater. These include chlorinated solvents and gasoline. There are many other chemicals that can impact groundwater, however, the number of occurrences are in comparison minor.

Chlorinated solvents include chemicals such as trichloroethylene. They are generally dense liquids used for cleaning purposes (parts etc.). Toxicity is very high and consequently, maximum contaminant levels in a public water system are very low. Therefore a very low concentration can impact a well to where it can no longer be used without treatment. Chlorinated solvents typically sink vertically downward in an aquifer and eventually collect on the bottom. They also do not degrade rapidly, thus, they can persist for long periods. Once in groundwater, it is very difficult (or impossible) to restore the aquifer.

Gasoline includes a mixture of chemicals that can contaminate groundwater. Fortunately, over the past 15 years, underground storage tank technology and regulations have reduced the risk of gasoline contamination of groundwater. During this same period, it was also found that many gas spills in groundwater did not cause extensive damage because the fuel was readily adsorbed onto soil and biodegraded. A gas additive, methyl tertiary-butyl ether (MTBE), is bringing attention back to gasoline. MTBE has been used in gasoline for years. However, beginning in 1992 its concentration has been increased dramatically to levels in excess of 10% (100,000 mg/L). Its purpose is to improve fuel combustion and it is used primarily during the winter months. Unfortunately, it is highly mobile and does not readily degrade in groundwater. U.S. EPA has set an advisory limit for MTBE in drinking water of 20 to 40 ug/L for taste and odor reasons. Releases of gasoline with the MTBE additive have potential to cause widespread groundwater contamination. At present, U.S. EPA is considering proposals to ban the use of MTBE in gasoline products.

Agricultural chemicals are important contaminants of groundwater in the western states, and certainly in Montana. The most important agricultural contaminant is nitrate nitrogen, resulting primarily from the use of fertilizer or the breakdown of organic matter. Pesticides in groundwater is an issue that is presently being addressed in the United States. Typically pesticides occur at low concentrations, substantially lower than maximum drinking water standards. More information on pesticides in groundwater will become available in the near future.

Nitrate nitrogen contamination of groundwater can also occur due to the use of septic systems. In moderately dense developments that are not served by sewers, nitrate concentrations in groundwater will increase from the normal background level (typically 0.5 to 1.5 mg/L as N). It is possible but fortunately unusual to find that a municipal water well is contaminated by nitrogen from septic system sources. More often, septic systems are a source of nitrogen contamination to home-owner wells or small subdivision wells that are operated at low rates (e.g., 1 – 35 gpm).

TABLE 3-4

CHEMICAL USAGE ACCORDING TO BUSINESS TYPE[1]

| Type of Business | Possible Chemicals in Use |
|---|---|
| Auto repair, parts, fuel, machine shop services | Gasoline: Benzene, Ethylbenzene, Toluene, Xylenes, Methyl tertiary-butyl ether (MTBE), Ethanol, Motor oil, Ethylene Glycol, Methyl alcohol, Lead in auto batteries |
| Auto body shops | Methylene chloride, Xylenes, Hydrocarbon solvents, Ethylene glycol |
| Dry cleaning | Trichloroethene, Tetrachloroethylene, 1,1,1-Trichloroethane, Hydrocarbon solvents |
| Furniture refinishing | Methylene chloride, Acetone, Methyl ethyl ketone, Xylenes, Hydrocarbon solvents |
| Radiator repair | Ethylene glycol, Hydrocarbon solvents, 1,1,1-Trichloroethane, Lead (various compounds), Sodium hydroxide |
| [1] Information obtained from Miller, S. "Identification of Critical Materials Users Using a General Tabulation of Chemical Use and SIC Code", Spokane County Water Quality Management Program, Spokane, WA. | |

**3.2 Susceptibility of Potential Contaminant Sources**

The state of Montana has developed a method to assign significant potential contaminant sources into a category of susceptibility. The categories are identified as very-low, low, moderate, high, and very-high. Potential contaminant sources put into the low category are considered to pose a low risk of contaminating a source of water supply. In contrast, those sources put into the very high category are considered to pose the greatest risk of contamination to the water supply.

Susceptibility assignments are made to significant potential contaminant sources identified in the source inventory, including point and non-point sources. There are two steps to determining susceptibility. First, the source is assigned a hazard level, based simply on its occurrence within a source water protection area. Hazard levels are categorized as low, moderate, and high. Those sources that are nearest to a source of water supply (or occupy a large land area) will have a higher hazard classification than sources that are farther away (or occupy a small land area).

In step two, the contaminant source is evaluated for the occurrence of barriers, either natural or engineered, that may protect the water source from contamination. If there are no barriers then little protection exists to prevent contamination in the event of a spill or leak. In these cases, the susceptibility assignment would be into a higher level, reflecting the absence of barriers. On the other hand, if multiple barriers are present, a spill or leak is likely to be captured or impeded. The presence of one or more barriers will tend to reduce the susceptibility level assigned to the potential contaminant source. Once the hazard level and number of barriers has been determined for each potential contaminant source, it is put into a susceptibility category. Table 3-5 summarizes the susceptibility categories with respect to the hazard level and the existence of barriers.

TABLE 3-5

SUSCEPTIBILITY CATEGORIES

| Presence of Barriers | Hazard Level | | |
|---|---|---|---|
| | High | Moderate | Low |
| No Barriers | Very High | High | Moderate |
| One Barrier | High | Moderate | Low |
| Two or more Barriers | Moderate | Low | Very Low |

1. Stevensville

Table 3-6 presents the susceptibility assignments for significant potential contaminant sources inventoried in the Stevensville Source Water Protection Areas. With respect to barriers, one barrier could be credited to those sources occurring within the Inventory Region of Well No. 1. This well has an intake greater than 50-feet below the static water level, which provides for a barrier due to the well construction. A barrier could also be credited to gas stations, as all tanks in Ravalli County comply with the 1998 regulations, which include provisions for leak detection. Note that a barrier was not credited to a site which has a known leaking tank (LUST site). Barriers may exist for other potential contaminant sources, however, at present there is insufficient information to make this determination. Therefore, the susceptibility levels will have a tendency to be conservatively high.

The results of susceptibility assignments for Stevensville are summarized as follows:

- **Point Sources** There were seven point sources included in the susceptibility assessment. The CENEX station (Source S-001) due to its proximity to Well No. 1 and its leaking underground tank status (LUST) is scored as Very High. The Alpine Dry Cleaners is also scored Very High due to its proximity to Well Nos. 2 and 3. The other point sources were scored Moderate and Low.

- **Class V Injection Wells** At present, there is no inventory for these types of sources. The US EPA will be conducting an inventory of Class V Injection Wells in Ravalli County in the near future. When this information becomes available, the town of Stevensville should incorporate it into their source inventory.

- **Cropped Agricultural Land** Based on the assumption that all of the agricultural land was cropped, this source type was scored to have Very High susceptibility. The basis for this score is that over 50% of the inventory areas are cropped agricultural land, and that there are no barriers in place, such as BMPs. Additional information on agricultural land in the source water protection areas can be used to reassess the susceptibility level for this source type.

- **Septic Systems** The hazard level for septic systems is low, but an absence of barriers results in a Moderate susceptibility. Stevensville will need to evaluate this source type as new growth occurs, as the hazard level and the susceptibility will both be likely to increase.

- **Sanitary Sewers** Leaking sewers, due to proximity to the well sources and location within the 1-year time-of-travel zone, present a High hazard and Very High susceptibility. There is a history for public water wells to be impacted by sewer failures. One of these cases occurred in Missoula several years ago. Stevensville should consider this susceptibility level when considering upgrades and maintenance of the sanitary sewer system.

- **Stormwater Discharge** There are no known concentrated discharges of stormwater within the source water protection areas for the Stevensville water sources. There is no assignment of susceptibility made for this source type. Whenever stormwater management decisions are made by the town or which affect the town, however, consideration should be given to the source water protection areas for the water supply.

- **Highways/Railroads/Pipelines** The railroad passes through Stevensville in proximity to Well Nos. 1, 2, and 3. It is assigned a High hazard because it passes through the 1-year time-of-travel zone (barely). Due to an absence of barriers for Well Nos. 2 and 3, it receives a Very High susceptibility assignment. Transportation of hazardous chemicals by rail poses a significant risk to the wells, particularly Well Nos. 2 and 3.

2. Hamilton

Table 3-7 presents the susceptibility assignments for potential contaminant sources in the Hamilton Source Water Protection Areas. As all of the Hamilton wells draw groundwater from less than 50-feet (with the exception of Well No. 5), no barrier existed for well construction. Only underground storage tanks could be assigned one barrier, as all the tanks that exist meet the

1998 regulations, requiring leak detection ability. However, leaking underground tanks (LUST sites) where not credited with a barrier. Barriers may exist for other potential contaminant sources, however, at present there is insufficient information to make this determination. Therefore, the susceptibility levels will have a tendency to be conservatively high.

The results of susceptibility assignments for Hamilton are summarized as follows:

- **Point Sources** There are 20 point sources in the Hamilton inventory that were included in the susceptibility assessment. All of these are associated with underground fuel storage and/or automobile repair. The CENEX gas station (source H-006) and Rocky Mountain Laboratories (source H-037) are the only two sites with leaking underground tank status. The susceptibility assignments vary depending on location of the facility within source water protection areas. Those sources within the 1-year time-of-travel boundary will generally be assigned High or Very High susceptibility. Sources in the 1 to 3 year zone will be assigned to a lower susceptibility category.

- **Class V Injection Wells** At present, there is no inventory for these types of sources. The US EPA will be conducting an inventory of Class V Injection Wells in Ravalli County in the near future. When this information becomes available, the city of Hamilton should incorporate it into their source inventory.

- **Cropped Agricultural Land** Based on the assumption that all of the agricultural land was cropped, this source type was scored to have High susceptibility. The basis for this score is that 20 to 50% of the inventory areas are cropped agricultural land, which presents a moderate hazard. Without barriers, such as BMPs, which is assumed, the susceptibility is elevated to High. Additional information on agricultural land in the source water protection areas can be used to reassess the susceptibility level for this source type.

- **Septic Systems** The hazard level for septic systems is High, and combined with an absence of barriers, the susceptibility is Very High. Well Nos. 1, 2, 4 and 6 are at the greatest risk from this source type, which can lead to elevated nitrate and pathogens in groundwater. Extension of the city sewer system should be made with consideration of reducing the risk posed by this source type.

- **Sanitary Sewers** Leaking sewers, due to proximity to the well sources and location within the 1-year time-of-travel zone, present a High hazard and Very High susceptibility. There is a history for public water wells to be impacted by sewer failures. One of these cases occurred in Missoula several years ago. Hamilton should consider this susceptibility level when considering upgrades and maintenance of the sanitary sewer system.

- **Stormwater Discharge** This source type presents High hazard, and without barriers, is assigned a Very High susceptibility. Hamilton utilizes dry wells, or sumps, to discharge stormwater directly to the subsurface. It is presumed that many sumps exist within the inventory region of the water supply wells. A number of the sump installations are located on commercial properties. Infiltration of direct runoff through the sumps is not anticipated to contaminate groundwater. However, spills or illegal dumps into the sumps can cause a significant problem. Hamilton should address the use of sumps, with consideration for spill containment features, in order to reduce the risk from this source type. Fortunately, a stormsewer is located along Highway 93, which helps to protect groundwater in this area from spilled contaminants. This storm sewer discharges at two locations, to the north and west of town, outside of the source water protection areas.

- **Highways/Railroads/Pipelines** Highway 93 and the railroad pass through Hamilton in proximity to Well Nos. 1, 2, and 6. Well No. 1 is within 25-feet of Highway 93. Both the highway and the railroad pass through the 1-year time-of-travel zone for Well Nos. 1 and 6. Chemical spills occurring due to transportation through the area could impact these wells.

3. Darby

Susceptibility assignments for potential contaminant sources in Darby are provided in Table 3-8. One barrier could be credited for potential sources that occur within the source water protection areas for Well No. 1, as this well draws groundwater from depths greater than 50-feet below the static water level. The barrier is provided due to the well construction. Underground storage tanks were also assigned a barrier, as all operating fuel tanks meet the 1998 regulations requiring leak detection. However, a barrier was not credited to a leaking underground tank site (LUST). Barriers may exist for other potential contaminant sources, however, at present there is insufficient information to make this determination. Therefore, the susceptibility levels will have a tendency to be conservatively high.

The results of susceptibility assignments for Darby are summarized as follows:

- **Point Sources** There are nine point sources in the Darby inventory included in the susceptibility assessment. The CENEX gas station (source D-005) on the south side of town has a High susceptibility score. It has leaking underground storage tank status (LUST), and has a treatment facility installed. The undergound storage tank at Darby school scores a Very High susceptibility due to its proximity to Well No. 2. The Old Mill Treatment Pit (source D-001) has a Low hazard because it is outside the 3-year time-of-travel to any of the wells. The other point sources were scored Moderate and High due to an absence of barriers and low to moderate hazard ratings.

- **Class V Injection Wells** At present, there is no inventory for these types of sources. The US EPA will be conducting an inventory of Class V Injection Wells in Ravalli County in the near future. When this information becomes available, the town of Darby should incorporate it into their source inventory.

- **Cropped Agricultural Land** Based on the assumption that all of the agricultural land was cropped, this source type was scored to have Moderate susceptibility. The basis for this score is that less than 20% of the inventory areas are cropped agricultural land, which presents a Low hazard. Without barriers, the susceptibility is elevated to Moderate.

**Septic Systems** The hazard level for septic systems in the source water protection areas for Well No. 4 is Moderate. Without barriers, the susceptibility is High. Continued growth in this area is may be a concern for the town due to the increased loading of nitrate and pathogens to groundwater. The Town should consider this area for sewer extension.

**Sanitary Sewers** Leaking sewers, due to proximity to the well sources and location within the 1-year time-of-travel zone, present a High hazard and Very High susceptibility. This risk affects only Well Nos. 1 and 2. There is a history for public water wells to be impacted by sewer failures. One of these cases occurred in Missoula several years ago. Darby should consider this susceptibility level when considering upgrades and maintenance of the sanitary sewer system.

**Stormwater Discharge** There are no known concentrated discharges of stormwater within the source water protection areas for the Darby water sources. There is no assignment of susceptibility made for this source type. Whenever stormwater management decisions are made by the town or which affect the town, consideration should be given to the source water protection areas for the water supply.

**Highways/Railroads/Pipelines** Highway 93 and the railroad pass through Hamilton in proximity to Well Nos. 1, 2, and 6. Well No. 1 is within 25-feet of Highway 93. Both the highway and the railroad pass through the 1-year time-of-travel zone for Well Nos. 1 and 6. Chemical spills occurring due to transportation through the area could impact these wells.

TABLE 3-6
STEVENSVILLE SUSCEPTIBILITY

| Map ID | Facility Name | Potential Contaminants | Contaminant Origin | Hazard Rating | Barriers | Susceptibility |
|---|---|---|---|---|---|---|
| S-001 | Cenex Gas Station | VOCs | Leaking UST | High | 1 (LUST) | High |
| S-003 | Omega II | VOCs | Spill | Moderate | 1 | Moderate |
| S-005 | Kenyon Machine Shop | VOCs | Spill | Moderate | 1 | Moderate |
| S-008 | CENEX Fertilizer Plant | Nitrogen | Spill | Moderate | 1 | Moderate |
| S-010 | Pollard Machine Shop | VOCs | Spill | Low | 1 | Low |
| S-011 | The Works Conoco Gas Station | VOCs | Leaking UST | High | 2 | Low |
| S-014 | Alpine Dry Cleaners | VOCs | Spill | High | 0 | Very High |
| NA | Class V Injection Wells* | VOCs,SOCs,IOCs | Spill | Unknown | Unknown | Unknown |
| NA | Cropped Agricultural Land** | SOCs, Nitrate, pathogens | Spill, Runoff | High | 0 | Very High |
| NA | Septic Systems | Nitrate, pathogens | Infiltration Recharge | Low | 0 | Moderate |
| NA | Sanitary Sewers | Nitrate, pathogens | Leaking Sewer | High | 0 | Very High |
| NA | Stormwater Drainage | SOCs, IOCs | Infiltration Recharge | None | 0 | None |
| NA | Highways/Railroads/Pipelines | VOCs, SOCs, IOCs | Spill | High (RR) | 0 | Very High |

Notes:VOCs = volatile organic compounds; SOCs = synthetic organic compounds; IOCs = inorganic compounds; UST = underground storage tank; AST = above ground storage tank; NA = not applicable; * Data are not presently available; ** It has been conservatively assumed that all agricultural lands are cropped.

TABLE 3-7

HAMILTON SUSCEPTIBILITY

| Map ID | Facility Name | Potential Contaminants | Contaminant Origin | Hazard | Barriers | Susceptibility |
|---|---|---|---|---|---|---|
| H-001 | Custom Cabinets and Refinishing | VOCs | Spill | High | 0 | Very High |
| H-002 | Specialty Woodworks | VOCs | Spill | High | 0 | Very High |
| H-003 | Ray’s Auto Body | VOCs | Spill | High | 0 | Very High |
| H-006 | CENEX | VOCs | Leaking UST | High | 0 | Very High |
| H-008 | Wimps Auto Body | VOCs | Spill | High | 0 | Very High |
| H-014 | S & S Auto Body | VOCs | Spill | High | 0 | Very High |
| H-016 | Town Pump – Exxon | VOCs | Leaking UST | High | 1 | High |
| H-017 | Ravalli County Fairgrounds | VOCs, SOCs, Pathogens, Nitrate | Leaking UST,Spill, Animal Wastes | Moderate | 1 | Moderate |
| H-020 | Town Pump – Exxon | VOCs | Leaking UST | High | 1 | Very High |
| H-024 | Ole's Country Store No. 3 | VOCs | Leaking UST | Moderate | 1 | Moderate |
| H-026 | Davison Distributors | VOCs | Leaking UST | Moderate | 1 | Moderate |
| H-028 | Chevron Thompson Distributing | VOCs,SOCs | Leaking AST/UST | Moderate | 1 | Moderate |
| H-031 | Mickey’s Fast Lube | VOCs | Leaking UST | Moderate | 0 | High |
| H-032 | Conoco Gas & Grub | VOCs | Leaking UST | High | 1 | High |
| H-037 | Rocky Mountain Laboratories | VOCs,SOCs | Spill, Leaking UST | Moderate | 0 | High |
| H-040 | Valley Auto Body & Repair | VOCs | Spill | Moderate | 0 | High |

| | | | | | | |
|---|---|---|---|---|---|---|
| H-042 | HSD Bus Maintenance | VOCs, SOCs | Spill | High | 0 | Very High |
| H-048 | Bitterroot Laundry | VOCs | Spill | High | 0 | Very High |
| H-049 | Bitterroot Laundry | VOCs | Spill | High | 0 | Very High |
| H-050 | Ravalli County Courthouse | VOCs | Leaking UST | Moderate | 1 | Moderate |
| NA | Class V Injection Wells* | VOCs,SOCs,IOCs | Spill | Unknown | Unknown | Unknown |
| NA | Cropped Agricultural Land** | SOCs, Pathogens, Nitrate | Spill, runoff | Moderate | 0 | High |
| NA | Septic Systems | Nitrate | Infiltration Recharge | High | 0 | Very High |
| NA | Sanitary Sewers | Nitrate | Leaking Sewer | High | 0 | Very High |
| NA | Stormwater Drainage | SOCs, IOCs | Infiltration Recharge | High | 0 | Very High |
| NA | Highways/Railroads/Pipelines | VOCs, SOCs, IOCs | Spill | High | 0 | Very High |

Notes:

VOCs = volatile organic compounds; SOCs = synthetic organic compounds; IOCs = inorganic compounds; UST = underground storage tank; AST = above ground storage tank; NA = not applicable; * Data are not presently available; ** It has been conservatively assumed that all agricultural lands are cropped.

TABLE 3-8
DARBY SUSCEPTIBILITY

| Map ID | Facility Name | Potential Contaminants | Contaminant Origin | Hazard | Barriers | Susceptibility |
|---|---|---|---|---|---|---|
| D-001 | Old Mill Treatment Pit | VOCs,SOCs | Spill,Seepage | Low | 0 | Moderate |
| D-004 | J & D Auto Body | VOCs | Spill | Low | 0 | Moderate |
| D-005 | Ole's | VOCs | Leaking UST | Moderate | 0 | High |
| D-007 | Bitterroot Taxidermy/Fur | VOCs | Spill | Moderate | 0 | High |
| D-008 | Town of Darby | Nitrate | Infiltration | Low | 0 | Moderate |
| D-009 | Darby School | VOCs,SOCs | Leaking UST | High | 1 | High |
| D-010 | Darby Auto | VOCs | Spill | Low | 0 | Moderate |
| D-011 | Sober Auto | VOCs | Spill | High | 0 | Very High |
| D-012 | Wolfe Auto | VOCs | Spill | Moderate | 0 | High |
| NA | Class V Injection Wells* | VOCs,SOCs,IOCs | Spill | Unknown | Unknown | Unknown |
| NA | Cropped Agricultural Land** | SOCs, pathogens, nitrate | Spill, runoff | Low | 0 | Moderate |
| NA | Septic Systems | Nitrate, pathogens | Infiltration Recharge | Moderate | 0 | High |
| NA | Sanitary Sewers | Nitrate, pathogens | Leaking Sewer | High | 0 | Very High |
| NA | Stormwater Drainage | SOCs, IOCs | Infiltration Recharge | None | 0 | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| NA | Highways/Railroads/Pipelines | VOCs, SOCs, IOCs | Spill | High | 1 | High |
| Notes:<br><br>VOCs = volatile organic compounds; SOCs = synthetic organic compounds; IOCs = inorganic compounds; UST = underground storage tank; AST = above ground storage tank; NA = not applicable; * Data are not presently available; ** It has been conservatively assumed that all agricultural lands are cropped. | | | | | | |

## 4. CONTINGENCY PLAN

Emergency planning identifies the principal threats to the source water, designates an emergency coordinator, and then describes a series of potential responses planned in the event of a problem. Another important aspect of emergency planning is an estimate of the equipment and materials that would be needed, a description of how a short-term replacement water supply would be handled, and a description of the funding available to deal with an emergency response.

### 4.1 Disruption Threats

The principal threat to water supply wells has been identified as a spill, leak, or discharge in the Control Zone that could contaminate the source water by entering the well through a failed casing or poorly sealed annulus. Included are spills from vehicles, spills from mobile liquid holding tanks, and leaks from above or underground tanks. Disruption of water service may also occur due to natural disasters, such as earthquakes, flooding and loss of power.

### 4.2 Emergency Coordinator

TABLE 4-1

EMERGENCY COORDINATORS

| City/Town | Primary | Backup |
|---|---|---|
| Darby | Bill Decker (406) 821-3753 | Nancy McKinney (406) 821-3753 |
| Hamilton | Lorin Lowry (406) 363-2101 | Dave Szeszycki (406) 363-2101 |
| Stevensville | Bruce Park (406) 777-5271 | George Thomas (406) 777-5271 |

The emergency coordinator is familiar with the county and state Disaster and Emergency Services (DES) procedures and is responsible for contacting the appropriate officials should a spill or other threat to the source water occur.

- Ravalli County DES coordinator (Lacy M. Marks) 24-hour, (406)375-6233
- State of Montana 24-hour Spill Hotline, (406)841-3911

## 4.3 Equipment and Material Resources

The principal identified threats to the water supply wells are limited to spills in the Control Zone. Resources that may be needed to respond to a spill are heavy equipment for berm and excavation work and absorbent materials. The local Public Works and Fire Departments will provide this equipment and materials.

Should additional resources be needed due to the magnitude or chemical nature of a spill the city/town or First Responders will contract with an emergency response firm properly trained and equipped. A list of possible contractors that can provide these services is provided in Table 4-2.

<u>TABLE 4-2</u>

LOCAL SPILL RESPONSE CONTRACTORS

| Darby | Hamilton | Stevensville |
|---|---|---|
| 1. C. R. Wildey, Inc. (406) 821-3537 | 1. Blahnie Construction, Inc. (406) 961-4719 | 1. |
| 2. Rapid Excavating (406) 363-4639 | 2. Stewart Excavating (406) 961-4059 | 2. |
| - | 3. Rapid Excavating (406) 363-4639 | 3. |

Additional information on spill response contractors can be obtained from the Montana DEQ Enforcement Division (406) 444-0379. A catastrophic loss of water may require the contracted services of a water hauler to provide water supply to those customers affected by the shortage.

## 4.4 Source Isolation Procedures

Darby, Stevensville, and Hamilton water supply wells are equipped with operation switches and valves to isolate each facility from the distribution system. Isolation valves are located at each well site in the well building or adjacent to the well casing. Operation switches are located at the well site and where telemetry has been installed, at the city offices. Water Department staff know how to operate this equipment from experience and special training.

The city/town can continue to provide water during an emergency from wells that are not impacted. In the unlikely event that all wells were impacted, the city/town can provide water from storage. Stored capacity will normally provide for 6 to 12 hours of water use at the average day demand. If rationing methods are implemented, stored water could be used for a longer period.

Specific isolation procedures for the water sources are presented in Tables 4-3 for Stevensville, Table 4-4 for Hamilton, and Table 4-5 for Darby. All sources are isolated by closing a manual valve located near to the source. The power supply to the source, where pumps are used, must also be disconnected. This disconnect is made by moving the ON/OFF lever to the OFF position on the pump control box, or by setting the main power service disconnect to the OFF position. Where winter freezing conditions are possible, only the pump disconnect should be set to the OFF position.

TABLE 4-3

SOURCE ISOLATION PROCEDURES FOR STEVENSVILLE

| Source | Isolation Procedure |
|---|---|
| Well 1 | Disable power. Close manual gate valve on system line in well building. |
| Well 2 | Disable power. Close manual gate valve on system line in well vault. |
| Well 3 | Disable power. Close manual gate valve on system line in well vault. |
| Filter Plant | Close manual gate valve on system line from plant to transmission line |

TABLE 4-4
SOURCE ISOLATION PROCEDURES FOR HAMILTON

| Source | Isolation Procedure |
|---|---|
| Well 1 | Lock-out circuit breaker. Close manual gate valve on system pipeline outside well building. |
| Well 2 | Lock-out circuit breaker. Close manual gate valve on system pipeline in well building. |
| Well 4 | Lock-out circuit breaker. Close manual gate valve on system pipeline outside well building. |
| Well 5 | Lock-out circuit breaker. Close manual gate valve east of well. |
| Well 6 | Lock-out circuit breaker. Close manual gate valve on system pipeline in well building. |
| Well 7 | Not presently equipped for operation. |

TABLE 4-5

SOURCE ISOLATION PROCEDURES FOR DARBY

| Source | Isolation Procedure |
|---|---|
| Well 1 | Disable power. Close manual gate valve on system water line in building. |
| Well 2 | Disable power. Close manual gate valve on system water line in well vault. |
| Well 4 | Disable power. Close manual gate valve on system water line outside well vault. |

**4.5 Coordination Procedures**

This Source Water Protection Plan has been made available to the Ravalli County DES coordinator as part of implementation. Additionally, reportable spills will be handled as per the mandated reporting requirements as follows:

- Agricultural chemical or fertilizer spills will be reported to the Montana Department of Agriculture (406)444-5400

- Any refined petroleum product such as gasoline, diesel, asphalt, road oil, kerosene, fuel oil, and derivatives of mineral, animal, or vegetable oil spills in excess of 25 gallons will be reported to the DES hotline (406) 841-3911.

**4.6 Communication with Water Users**

The nature of the Darby, Hamilton and Stevensville water systems should allow any impacted source to be isolated from the distribution system in the event of a spill which threatens water quality. If it is determined that the well was exposed to a contaminant, the well will remain off line until sampling proves the water to be safe, an evaluation done in cooperation with the Montana DEQ, Public Water System Section.

Depending on the severity of the incident, several options will be pursued to communicate the event to the public. A severe incident requiring water rationing will be immediately broadcast by local radio and TV news stations, and published in the newspaper. Lesser incidents that do not require any changes in water use will be reported only as deemed necessary by the city/town. It is most likely that any significant spill event will be reported in the local newspaper regardless of city involvement.

## 4.7 Emergency Water Supply

The water systems evaluated in this plan have the benefit of multiple supply sources, which provides redundancy to the water system. The Stevensville water system includes three wells and a filtration treatment plant. Hamilton has five operating wells, with a sixth well drilled and planned to come online in 2000 or 2001. Darby uses three wells to serve their water system. There is low probability for these water systems to lose all of the capacity provided by the multiple sources due to a contamination event.

In the event a water supply well is lost due to contamination, the city/town will continue to provide water service from the other existing wells and sources. If needed, water rationing may be pursued to limit the demand to the supply capacity available during an emergency. Water rationing would only be needed if a well was lost during the peak water use period of the year.

In the event of substantial water loss, the city/town may request the services of the Montana DEQ-PWS Section, which is required by law to provide water to a community in an emergency. DEQ will retain the services of a qualified water hauler to transport water to the area. The water hauler will normally provide cisterns, from which citizens can fill containers of potable water. DEQ or the water hauler can and will provide containers for citizens as needed.

In the event that DEQ provides water services to a city/town, DEQ may attempt to recover costs, directly from the city/town or other responsible party. If the water loss has occurred without negligent acts, then it is unlikely that DEQ will seek payment for water hauling services.

## 4.8 Disinfection and Resumption of Water Service

If loss of water service requires repairs or new construction, work will be completed according to water system standards. In particular, the well, storage tank, or distribution system will be disinfected for bacteriological contamination as per the city/town standard disinfection and tank cleaning procedures under the direction of the certified operator. Normal water service resumption will occur only after sample results indicate the supply is safe as approved by the Montana DEQ Public Water System Section and the certified operator.

## 4.9 Emergency Funding

The city/town general fund will be used to pay for emergency services. If new facilities are developed, the city/town will apply to the state of Montana and/or the Department of Agriculture for financial assistance in the form of a loan or grant, with matching funds, as needed. The city/town may also use bond sales and rate increases to cover the costs of new water source development.

TABLE 4-6

EMERGENCY CONTACTS AND TELEPHONE NUMBERS

| CONTACT NAME | TITLE | PHONE | RESPONSIBILITY |
|---|---|---|---|
| DARBY Bill Decker | Director of Public Works | (406)821-3753 | Water/Sewer/Roads |
| Nancy McKinney | Town Clerk | (406)821-3753 | Town Administration |
| HAMILTON Lorin Lowry | Director of Public Works | (406)363-2101 | Water/Sewer/Roads |
| Dave Szeszycki | Water Operator | (406)363-2101 | Water Operations |
| STEVENSVILLE Bruce Park | Director of Public Works | (406)777-5271 | Water/Sewer/Roads |
| George Thomas | Water Operator | (406)777-5271 | Water Operations |
| RAVALLI COUNTY Lacy M. Marks | DES Coordinator | (406)375-6233 | Ravalli County |
| STATE OF MONTANA Montana 24-hour Spill Hotline | - | (406)841-3911 | All reportable spills. |
| Greg Murfitt | MT Dept of Agriculture | (406)444-5400 | All agricultural chemical or fertilizer spills or response questions. |
| Jim Melstadt | MT DEQ | (406)444-2544 | Public water systems |
| DEQ Enforcement Division | - | (406)444-0379 | Responds to any event which will pollute surface or ground waters. |

## 5. ALTERNATIVE WATER SOURCES

This section of the SWPP provides information that can be used during a project to develop an alternative or replacement water supply. It is assumed that for the communities involved in this SWPP that any new source development will consist of vertical wells installed into the local aquifers.

Development of new wells or wellfields is normally done in a phased manner. Initially, the need for water and the use of vertical wells (versus horizontal wells or surface water) will be identified in a Water Facility Plan. This Plan undergoes state review and approval, and is required to obtain state or federal funding for water improvement projects. The Water Facility Plan should include or identify the need for a groundwater evaluation to locate candidate well sites. Candidate wells sites should be subject to a ranking process considering groundwater quantity and quality, water right issues, source water protection, and infrastructure needs, including property acquisition. Influence of surface water on the groundwater quality at the site should also be carefully reviewed. The highest ranking sites are selected for new well development.

Selected sites for well development are first tested by drilling one or more test wells. For small capacity wells (<300 gpm) and shallow well depths (<100 ft), it will normally be cost-effective to immediately drill a production-size well. For larger or deeper wells, it will normally be more cost-effective to first drill a 6-inch or 8-inch diameter test well. Under favorable conditions, a full-size production well would be installed afterwards.

Production wells installed into unconsolidated sand and gravel aquifers should be completed with high-quality stainless steel well screens. A sanitary surface seal should be grouted into an oversize borehole to a depth of at least 18-feet. Where the well is vulnerable to surface contamination, such as in water table aquifers, it can be beneficial to install a grouted seal to within 15-feet of the top of the well screen. In these cases, the surface seal may extend to depths of 30- to 50-feet (or more) below ground surface. Figure 5-1 diagrams a properly constructed well installed into an unconsolidated sand and gravel aquifer.

### 5.1 Stevensville

A general area for consideration of new well development for the town of Stevensville is shown on Figure 5-2 (please refer to Section 2 for a discussion of geology and map symbols). The area shown is located south and southeast from town, along Middle Burnt Fork Rd. The target aquifer for new wells in this area will be the alluvial fan deposits (map symbol Qafy) or the older sand and gravels (map symbol Tbg), which underlie the alluvial fan. Based on the existing wells, it appears more cost-effective for Stevensville to develop wells in the alluvial fan deposits (well depth 45- to 65-feet), assuming that capacity and quality requirements can be met. New wells installed into the alluvial fan deposits may have similar production capacity as Well Nos. 2 and 3.

The area shown on Figure 5-2 has several favorable properties that suggest it may be useful for new well development. These include: 1) it is generally up gradient from point sources; 2) it overlies the alluvial fan aquifer and the older sand and gravel aquifer occurring at depth; 3) for wells installed in the east-half of the hatched area, connection to the water system may be facilitated by the pipeline from the Filter Plant that runs along Middle Burnt Fork Rd.; and 4) connection to the water system for wells installed in the west-half should be reasonably feasible by pipeline extension from the town center area. It is noteworthy, that if groundwater capacity and quality are acceptable, the east-half of the area is preferable for new wells in comparison to the west-half.

**5.2 Hamilton**

Potential areas for development of new wells in the Hamilton area are shown on Figure 5-3. Two hatched areas are identified. One is a relatively large area extending from Fairgrounds Rd. to Golf Course Rd. The other is a small area located due south of the city center area. Both of these areas overlie the water table aquifer that is tapped by the other existing city wells.

The favorable aspects of the hatched areas shown on Figure 5-3 include the following: 1) the south and east locations place wells up-gradient from most point sources; 2) the alluvial aquifer is anticipated to be productive in either location, with potential for successful municipal wells; and 3) the locations are generally in proximity to existing waterlines, facilitating connection to the water system. It is undesirable, however, that the large area on the east side of town will undergo substantial development in the near future. Septic hazard will increase up until the time when the city extends sewer service into this area.

**5.3 Darby**

Areas that may be considered for new well development by the town of Darby are shown on Figure 5-4. Two areas were identified. One of these areas exists within the downtown area, extending from Well No. 2 to Well No. 4. The other area is south of town. Both areas are anticipated to overlie the water table aquifer system that is tapped by the Town's existing wells.

The smaller hatched area located south of town appears to be the most favorable for new well sites. It is up-gradient from the developed area and at least 500 feet from surface water. New wells would be installed into a shallow alluvial aquifer that may be highly productive. Unfortunately, at a minimum, 2,500- to 3,000-feet of new waterline would be required to develop the site. Flooding from the Bitterroot River and Tin Cup Creek may also occur in this area.

The larger hatched area spanning the town center should accommodate up to two new wells, assuming about a 1,000-foot spacing. It is necessary to make well hydraulics calculations in order to predict the most appropriate spacing for locating new wells in this area. The area is subject to growth and is therefore more vulnerable to contamination than the small hatched area to the south. However, new wells would be central to the water system and could be connected relatively easily.

## 6. MANAGEMENT PLAN

This section describes activities for each community to complete in order to maintain a certified SWPP and to protect the quality of water in their water system. The activities described here are based on the information presented in the previous sections of this document and input from the Source Water Protection Advisory Committee. The activities have been separated into three categories, including administrative, educational, and regulatory. The estimated implementation budget for each community is presented in Section 6.5.

As stated earlier in this document, protection of public water supplies is intended to help protect the public health of the citizens, young and old alike. It is also a fiscally responsible activity for water systems. Loss of a water source due to contamination has high and uncertain costs associated with it. The water supply source in question must be treated or replaced. Stevensville, Darby, and Hamilton would likely be involved in project fees on the order of $500,000 to $1,000,000 in order to respond to a water loss event caused by contamination. These fees would only cover restoration of the water source by treatment or replacement. Liability settlements and attorney fees would be additional.

Beyond the costs of a water contamination event, consumers will lose confidence in the city and city support will decline. Media coverage of the event will be statewide and possibly national and generally unfavorable for the parties involved. City staff and council efforts will shift from the normal priorities of the city operations to the emergency issue. There is no guarantee that the implementation of source water protection management activities will prevent water supply contamination. It is certain, however, that implementation of these activities will reduce the risk.

### 6.1 Administrative

**1. Resolution** City/Town Council shall pass a resolution requiring the Director of Public Works to set forth an adequate budget and to implement the Source Water Protection Plan in order to maintain a high-quality water supply for the citizens of the community. A copy of the resolution shall be submitted by each City/Town to the state of Montana Department of Environmental Quality, requesting certification of the Source Water Protection Plan.

**2. DPW in Charge** City/Town Council shall appoint the Public Works Director as the individual responsible for Source Water Protection planning in the community. The Public Works Director will designate a Contact Person that is an employee of the City/Town to oversee Source Water Protection activities. The Contact Person may be the Public Works Director or staff working under the Public Works Director.

**3. Update Inventory** The Contact Person shall be responsible to update the inventory of potential contaminant sources each year and submit the updated list to the state of Montana once every five years (or as otherwise required). Contact Person shall request a letter at the time of each submittal verifying the certification status of the SWPP.

**4. Ravalli County** Contact Person shall coordinate with Ravalli County staff. A goal of this coordination is to educate county staff on the location and vulnerability of the community water sources, and to develop a notification procedure with Ravalli County. Specifically, Ravalli County would notify the public water system whenever: 1) a residential subdivision and/or commercial development is proposed inside of a Source Water Protection Area; and 2) an on-site sewage system will be installed inside of the Inventory Region (3-year TOT boundary).

**5. First Responders** Contact Person shall develop a relationship with local First Responders and shall develop a notification protocol for spills that occur in proximity to Source Water Protection Areas.

**6. Other Organizations** Contact Person shall develop a relationship with the local watershed group (Bitter Root Water Forum), the US Forest Service, the County Extension Office, and the local Conservation District. Each entity should be educated on the location and vulnerability of the community water sources. Partnering approaches should be used to educate the public on source water protection and to maintain inventory data on potential contaminant sources. A centralized geographic database of source water protection areas and inventory data, maintained and supported by one of the entities, should be considered for long-term management of water supply sources in Ravalli County.

**7. Facility Planning** Contact Person shall ensure that Wastewater Facility Planning undertaken by the city/town is completed with recognition of the Source Water Protection Areas and the existing hazard level posed by septic systems.

**8. Montana DOT** Contact Person shall coordinate with Montana Department of Transportation regarding source water protection areas and stormwater management along state highways.

**9. Class V Injection Wells** Contact Person shall coordinate with the US EPA Helena, Montana office regarding the occurrence of Class V Injection Wells in the source water protection areas (406-441-1140). Pending the outcome of this inventory, a determination must be made regarding further actions to manage Class V Injection Wells in Source Water Protection Areas.

**10. Technical Assistance** For a period of 1 to 3 years after adoption of the SWPP, each community shall retain outside technical assistance to provide input on the implementation efforts. Contact Person shall work with outside assistance to review and plan implementation progress.

**11. MTBE Technical Assistance** Contact Person shall request technical assistance from Montana DEQ to inventory use of MTBE in fuels in the Bitterroot Valley, and to assess potential risk to groundwater. Pending the outcome of this investigation, a determination must be made regarding further actions regarding MTBE in groundwater.

**12. Control Zone** Contact Person shall inventory and develop a specific management plan for the Control Zone surrounding each water source (100-ft radius circle). Each property in the Control Zone shall be included in the potential contaminant source inventory. Property owners shall be met with annually and educated on source water protection.

## 6.2 Educational

**1. Site Visits** Contact Person shall conduct annual site visits to each identified potential contaminant source property, and to agricultural properties located within the Inventory Region. During each visit, the Contact Person shall inform the property occupant of the Source Water Protection Program and shall tour the facility with the occupant. Contact Person shall complete or update a detailed inventory form during each visit, and shall develop a filing system at the city/town offices for each facility.

**2. School Programs** Contact Person shall develop a relationship with the local school district to initiate education of students on the water resources of the area and source water protection. The Contact Person and a school district representative shall work together to develop a curriculum. Curriculum materials, or information to assist with curriculum development, may be available from the American Water Works Association, Denver, CO (800-926-7337).

**3. Fair/Events Exhibit** Contact Persons from each community and the Source Water Protection Advisory Committee shall work together to develop an exhibit for use at the Ravalli County Fair and/or other group activities. The exhibit will provide information on water resources in the county, and also the locations and vulnerabilities of water supply wells in each community.

**4. Media Coverage** Contact Person shall develop and implement a newspaper article at least once per year describing source water protection activities, the community water supply, its vulnerabilities, and how to protect ground/surface waters. This article may be prepared and published with Consumer Confidence Reports.

**5. Conservation Field Day** A Contact Person from each town/city will serve as a resource and assist with the CONSERVATION FIELD DAY, held each May for Ravalli County Sixth Graders. They will assist the coordinator of the unit on watershed and present information about source water protection for the valley.

## 6.3 Regulatory

**1. Stormwater Facilities** Director of Public Works shall initiate review of design standards for stormwater management. Design standards for stormwater management on commercial properties, US93, and Northern Pacific railroad shall be amended to include spill containment features. Stevensville would not evaluate design standards on US93. Hamilton will have immediate benefit of this activity, with Stevensville and Darby obtaining benefit in the future as stormwater management increases in their communities.

**2. Source Water Ordinance** Director of Public Works shall initiate an ordinance that gives the City/Town Council the authority to review the practices of businesses applying for licensure to operate and which use or generate hazardous chemicals. The ordinance shall give the City/Town council the legal authority to deny a business license on the basis of hazardous chemical use, or to require special conditions for operation of the facility, regardless of existing compliance with state and federal laws.

## 6.4 Implementation Schedule

Figure 6-1 presents a schedule that may be used to implement the management activities identified in Sections 6.1 through 6.3. The schedule applies to a one-year period, and it is assumed that it begins in September, which should coincide with certification of the Source Water Delineation and Assessment Report elements of this SWPP. Explanation regarding the schedule is provided below.

- Initial activities completed in September include passing of the resolution and appointment of the Director of Public Works as the person in charge of source water protection planning. The county fair exhibit will be displayed at the Ravalli County fair and the local newspaper should be contacted to print an article on the program.

- The next priority is to coordinate with Ravalli County and First Responders. Ravalli County coordination focuses on new property development. Coordination with First Responders focuses on spilled chemicals. This coordination activity should occur during October of each year.

- The remainder of the schedule is more flexible, as the activities have equal priority. It is anticipated that source inventory work and the associated site visits may be completed more easily during winter months. Coordination with local schools may be effective during March, as it would then be followed by the Conservation Field Day in May.

- Assessment of stormwater management design standards, focusing on dry wells, and development of a source water protection ordinance are both one-time tasks. They can be completed during separate years if desirable. It would be preferable to make decisions about accomplishing these tasks during 2001 and complete the tasks before 2003.

## 6.5 Implementation Budget

Estimated expenditures to implement the activities identified in Sections 6.1 through 6.3 are provided below. Each community budget is presented in a table, which reflects adjustments in costs due to variation in population and development density. The following details are provided for interpreting the information presented in the tables:

- Labor hours for city/town staff were budgeted at an assumed rate of $35/hr, which is inclusive of labor wages, worker’s compensation insurance, unemployment insurance, and other costs related to employment.

- Cost data for activities 6.1.3 through 6.2.5 are annual costs, occurring each year. Cost data for activities 6.3.1 and 6.3.2 would occur only during the year these activities are implemented.

- A direct cost for activity 6.2.3 of $4,000 was not shown in the tables, as this amount is available from the U.S. EPA grant that was used to fund the preparation of the SWPP. The amount of $4,000 has been used to prepare a display.

- It was assumed for budgeting purposes that completion of activities 6.3.1 and 6.3.2 would be a joint effort among the communities. Direct costs shown for these activities cover a portion of the fees for a consulting engineer (6.3.1) and an attorney (6.3.2). Because the work on stormwater (6.3.1) will benefit Hamilton immediately, two-thirds of the estimated consultant fee is paid by Hamilton, with Stevensville and Darby splitting the remaining one-third of the fee.

TABLE 6-1

STEVENSVILLE IMPLEMENTATION BUDGET

| Activity | Labor (hrs) | Labor Cost | Direct Cost | Total |
|---|---|---|---|---|
| Administrative | - | - | - | - |
| 6.1.1 | 4 | $ 140 | $ 20 | $ 160 |
| 6.1.2 | 0 | $ - | $ - | $ - |
| 6.1.3 | 8 | $ 280 | $ 20 | $ 300 |
| 6.1.4 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.5 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.6 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.7 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.8 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.9 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.10 | 8 | $ 280 | $ 680 | $ 960 |
| 6.1.11 | 8 | $ 280 | $ 20 | $ 300 |
| 6.1.12 | 6 | $ 210 | $ 20 | $ 230 |
| Educational | - | - | - | - |
| 6.2.1 | 20 | $ 700 | $ 20 | $ 720 |
| 6.2.2 | 4 | $ 140 | $ 500 | $ 640 |
| 6.2.3 | 4 | $ 140 | $ 20 | $ 160 |
| 6.2.4 | 1 | $ 35 | $ - | $ 35 |
| 6.2.5 | 4 | $ 140 | $ 20 | $ 160 |
| Regulatory | - | - | - | - |
| 6.3.1 | 12 | $ 420 | $ 500 | $ 920 |
| 6.3.2 | 12 | $ 420 | $ 400 | $ 820 |
| - | - | - | TOTAL | $ 5,945 |

TABLE 6-2

HAMILTON IMPLEMENTATION BUDGET

| Activity | Labor (hrs) | Labor Cost | Direct Cost | Total |
|---|---|---|---|---|
| Administrative | - | - | - | - |
| 6.1.1 | 4 | $ 140 | $ 20 | $ 160 |
| 6.1.2 | 0 | $ - | $ - | $ - |
| 6.1.3 | 16 | $ 560 | $ 20 | $ 580 |
| 6.1.4 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.5 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.6 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.7 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.8 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.9 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.10 | 8 | $ 280 | $ 680 | $ 960 |
| 6.1.11 | 8 | $ 280 | $ 20 | $ 300 |
| 6.1.12 | 6 | $ 210 | $ 20 | $ 230 |
| Educational | - | - | - | - |
| 6.2.1 | 40 | $ 1,400 | $ 20 | $ 1,420 |
| 6.2.2 | 4 | $ 140 | $ 500 | $ 640 |
| 6.2.3 | 4 | $ 140 | $ 20 | $ 160 |
| 6.2.4 | 1 | $ 35 | $ - | $ 35 |
| 6.2.5 | 4 | $ 140 | $ 20 | $ 160 |
| Regulatory | - | - | - | - |
| 6.3.1 | 12 | $ 420 | $ 2,000 | $ 2,420 |
| 6.3.2 | 12 | $ 420 | $ 400 | $ 820 |
| - | - | - | TOTAL | $ 8,425 |

TABLE 6-3

DARBY IMPLEMENTATION BUDGET

| Activity | Labor (hrs) | Labor Cost | Direct Cost | Total |
|---|---|---|---|---|
| Administrative | - | - | - | - |
| 6.1.1 | 4 | $ 140 | $ 20 | $ 160 |
| 6.1.2 | 0 | $ - | $ - | $ - |
| 6.1.3 | 8 | $ 280 | $ 20 | $ 300 |
| 6.1.4 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.5 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.6 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.7 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.8 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.9 | 2 | $ 70 | $ 20 | $ 90 |
| 6.1.10 | 8 | $ 280 | $ 680 | $ 960 |
| 6.1.11 | 8 | $ 280 | $ 20 | $ 300 |
| 6.1.12 | 6 | $ 210 | $ 20 | $ 230 |
| Educational | - | - | - | - |
| 6.2.1 | 12 | $ 420 | $ 20 | $ 440 |
| 6.2.2 | 4 | $ 140 | $ 300 | $ 440 |
| 6.2.3 | 4 | $ 140 | $ 20 | $ 160 |
| 6.2.4 | 1 | $ 35 | $ - | $ 35 |
| 6.2.5 | 4 | $ 140 | $ 20 | $ 160 |
| Regulatory | - | - | - | - |
| 6.3.1 | 12 | $ 420 | $ 500 | $ 920 |
| 6.3.2 | 12 | $ 420 | $ 400 | $ 820 |
| - | - | - | TOTAL | $ 5,465 |

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