Smith Valley Schools, Upper & Lower Public Water Systems

Upper: PWS ID # MT0003161

Lower: PWS ID # MT0000935

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report was prepared under the Federal Safe Drinking Water Act and the Montana Source Water Assessment Plan. The Department of Environmental Quality (DEQ) is ensuring that assessments are completed for all public water systems in Montana. The purpose of these reports is to provide information so that the public water system operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water (i.e., the Inventory Region), an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system. Jeffrey Frank Herrick with DEQ's Source Water Protection Program completed this report.

The drinking water for the Smith Valley Schools, *Upper and Lower Campuses* is supplied by wells located on each of the campuses (Figures 7 & 8). Based on the sanitary surveys, well logs, and the depth of the wells, it appears that a deep bedrock confined aquifer underlies a large area in the area beneath and surrounding the Smith Valley. This aquifer appears to be confined and is providing water to the PWS wells for each of the campuses. In accordance with the Montana Source Water Protection Program criteria (1999), this aquifer (source water) is considered to have a low sensitivity to potential contaminant sources since it is both a deeper bedrock aquifer and a confined aquifer. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Three types of source water protection management regions for the Smith Valley Schools public water system were mapped as part of this assessment. They are the Control Zone, Inventory Region, and the Recharge Region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- The Control Zone is delineated as a 100-foot radius around each of the wells and all sources of potential contaminants should be excluded in this region. The goal of management in the Control Zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. The only significant potential contaminant source identified within the Control Zones was noted in the last Sanitary Survey (2000) and indicates that there is a sewage drainfield that may be located about 65 feet east of the Upper Campus PWS well.
- Since the source water is confined, the Inventory Region for the 2 PWS wells consists of a 1000-foot radius circle around the wellheads (Figures 7 and 8). These Inventory Regions should be managed to prevent contaminants from reaching the wells before natural processes reduce their concentrations. Significant potential contaminant sources that were identified within the *Lower Campus'* Inventory Region include: large septic systems associated with the school or the nearby gas station, chemical spills that may occur along Highway 2, fuel leaks associated with underground fuel storage tanks at the gas station, and an area of increased density of private septic systems located west and southwest of the well (upgradient). Significant potential contaminant sources that were identified within the *Upper Campus'* Inventory Region include: the large septic system(s) associated with the school, animal waste associated with potential concentrations of animals at the farmstead located west-southwest of the school, and operations that may concentrate and release chemicals in and around the same farmstead. No evidence of these last 2 potential contaminant sources were found during this evaluation.
- The Recharge Region was delineated based upon topographic mapping of the watershed above the public water supply (Figure 9). The goal of management in the Recharge Region is to maintain and improve water quality over long periods or increased usage. This confined bedrock aquifer beneath the water supplies' production wells is probably recharged west and northwest of the well. Within this confined aquifer, groundwater generally flows from the west toward the east paralleling local streams and Ashley Creek in the Smith Valley. Groundwater recharge to the confined bedrock aquifer is probably occurring mostly in the higher elevations where the glacial till mantling the bedrock is thin or

absent. The only significant potential contaminant sources identified within the Recharge Region were the increased septic density that is associated with residential development along the Highway 2 corridor southeast of the Smith Valley Schools, large capacity septic systems along the same corridor, an UST site, and spills that could occur along Highway 2. These potential contaminant sources are not considered an immediate threat to water quality at the PWS, but may influence long-term quality.

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried contaminant sources at concentrations that would pose concern. Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the public water supply well intakes. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource. The Smith Valley Schools, *Lower Campus* public water supply well appears to have a low susceptibility to its own large capacity septic system and that of the nearby gasoline station. It also has a low susceptibility to contamination associated with spills along the highway and to fuel that is leaking or has leaked from the underground fuel storage tanks at the Conoco gasoline station. The Smith Valley Schools, *Upper Campus* public water supply well appears to have a moderate susceptibility to its own large capacity septic system. It has a low susceptibility to activities that may occur at or around the nearby farmstead. If activities at this farmstead are verified, it would boost the susceptibility of the well.

The costs associated with contaminated drinking water are high. Developing an approach to protect that drinking water resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Region) and have identified potential sources of contamination within that area. In addition, we provide you with recommendations (i.e., Best Management Practices) regarding the proper use and practices associated with some common potential contamination sources. We believe public awareness is a powerful tool for protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality. Refer to the figures within the document to better understand the spatial relationship of the area. The susceptibility of the PWS to the significant potential contaminant sources is discussed on Tables 11a and 11b. Overall, there appear to be only a few nearby threats to the production wells beyond the onsite large capacity septic systems.

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INTRODUCTION

This Delineation and Assessment Report was completed by Jeffrey Frank Herrick, a Hydrogeologist working with the Source Water Protection Program in the Montana Department of Environmental Quality. It was completed on behalf of:

Smith Valley Schools, Upper & Lower Water Systems
PWS IDs MT0003161 & MT0000935
Primary School District No. 89

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Smith Valley Schools, Upper & Lower Public Water Supplies (PWSs) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

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

Limitations

This report was prepared to assess threats to the Smith Valley Schools, Upper & Lower PWSs, and is based on published information and information obtained from local residents familiar with the community. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the Smith Valley Schools, Upper & Lower PWSs and not any other public or private water supply. In addition, not all potential or existing sources of groundwater or surface water contamination in the area of the Smith Valley Schools are identified. Only potential sources of contamination in areas estimated to contribute water to its drinking water sources are considered.

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

CHAPTER 1
BACKGROUND

The Community

The Smith Valley Schools, *Upper & Lower Campus*' water systems serve the 2 campuses of the Smith Valley Schools. The Smith Valley School, *Lower Campus* is along Highway 2 about 5 miles west of the City of Kalispell. The Smith Valley School, *Upper Campus* is about 1.5 miles west of the *Lower Campus* on Batavia Lane (Figures 1 through 5). The 2 schools lie just outside of the planning area that was designated in ***Water, Sewer and Storm Drainage Systems Facility Plan 2000,*** a document that was recently adopted by the City of Kalispell. That study area was used to evaluate the water supplies and their system characteristics in and around the City of Kalispell. A map of the study area (borrowed from the City of Kalispell plan) is contained in Appendix B. The study area is bounded by the Flathead River on the east, the north border of Sections 26, 27, 28, 29, and 30 of Township 29 North, Range 21 West and Sections 25, 26, and 27 of Township 29 North, Range 22 West on the north, West Valley Drive on the west, Lower Valley Road and Foys Lake on the south. The plan is mentioned here because relevant portions of this report were borrowed from information contained in SWDARs written for PWSs located east of the schools and within the Kalispell study area.

Kalispell serves as the population and commercial center of Flathead County and portions of four surrounding counties. Kalispell is the Flathead County seat. Major industrial, health care and government facilities are also located in the Kalispell area. The economic base of the Kalispell area and Flathead County is diverse. The county's leading industries are wood products manufacturing, microelectronics manufacturing, metals refining, railroad, agriculture, tourism, and the federal government. The area is also attractive to retired individuals and the local retirement income represents a substantial and growing portion of the local economy. The area's proximity to Glacier National Park and Big Mountain, a destination park and ski resort, makes Kalispell a year-round center for the tourist trade.

The Kalispell valley is a growth area and in recent decades, growth rates in the City–County planning jurisdiction have fluctuated in a cyclical pattern between moderate and boom levels. The average annual growth rate of the planning jurisdiction population was 1.7 percent in the 1960's, 3.7 percent in the 1970's, and 1.8 percent in the 1980's. The 1990 census data was adjusted using recent tax information to estimate the current year (2000) population. The overall population growth in the Kalispell study area between 1990 and 2000 was approximately 17 percent. Population and employment data for the study area is summarized in Table 1.

Table 1. Existing Population and Employment

Category	1990		2000	
	Population	Employment	Population	Employment
Study Area [1]	26,672	15,246	32,007	22,753

1 Population data for all analysis zones combined

Figure 1. Regional Map

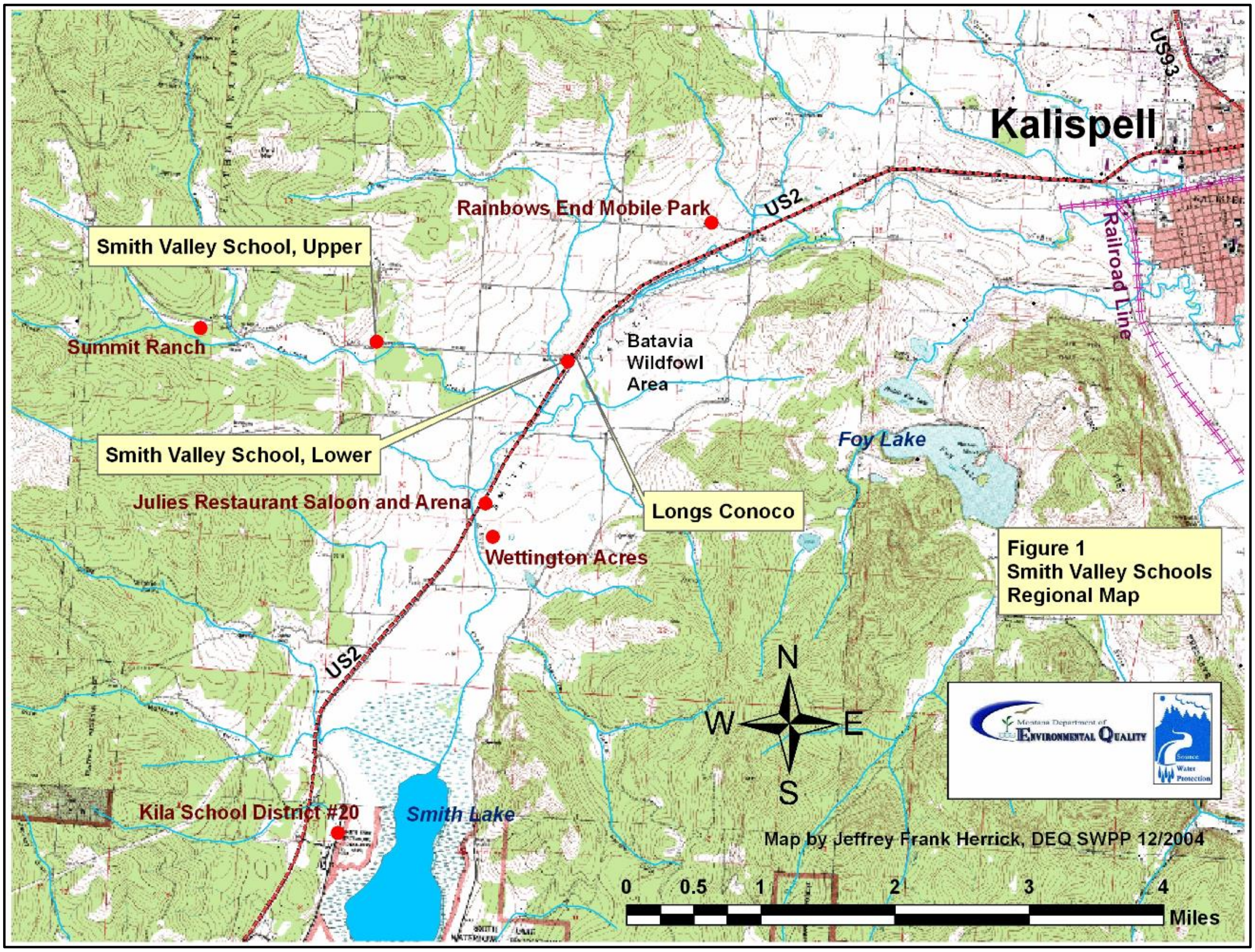


Figure 2. Vicinity Map

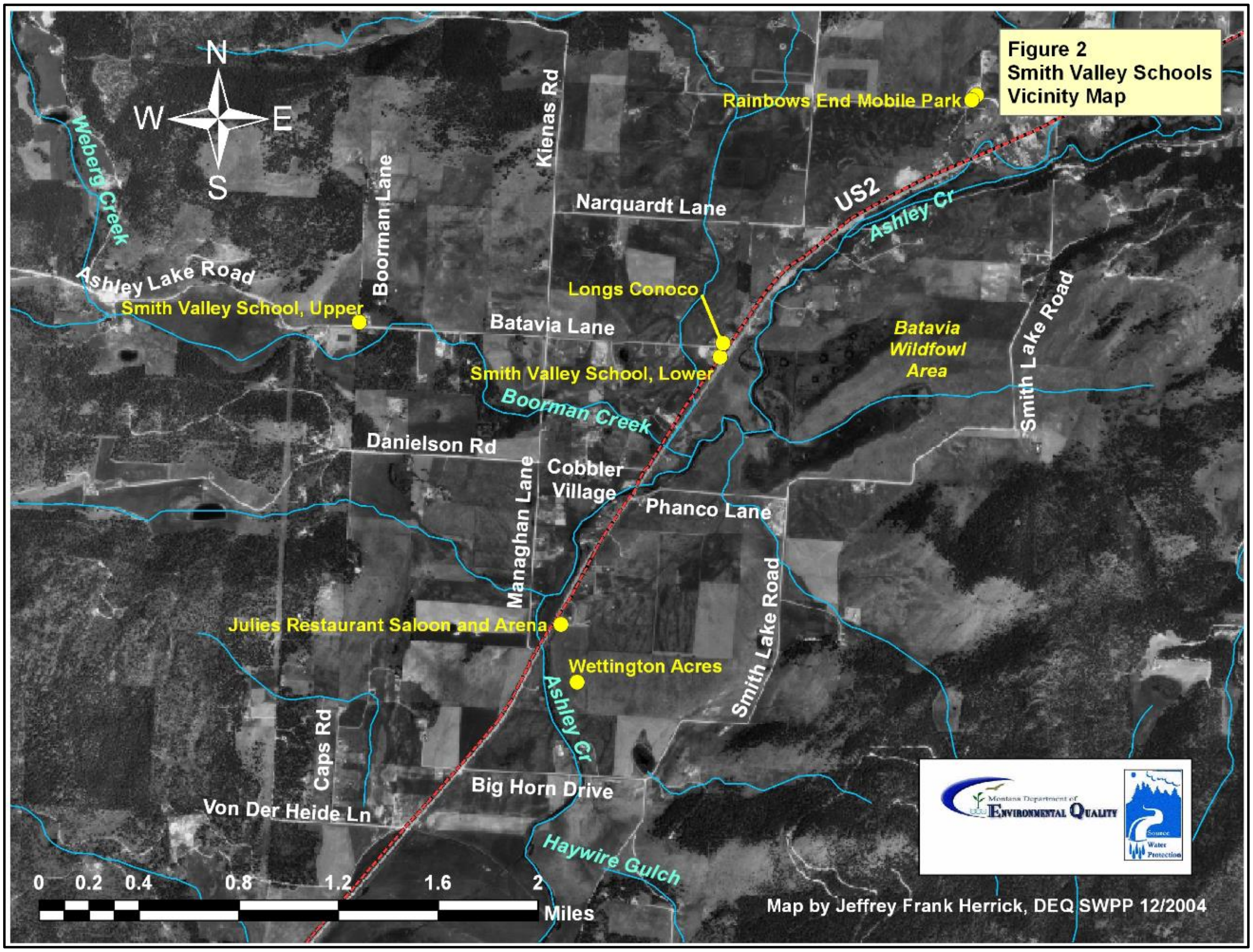


Figure 3. Area Topo Map

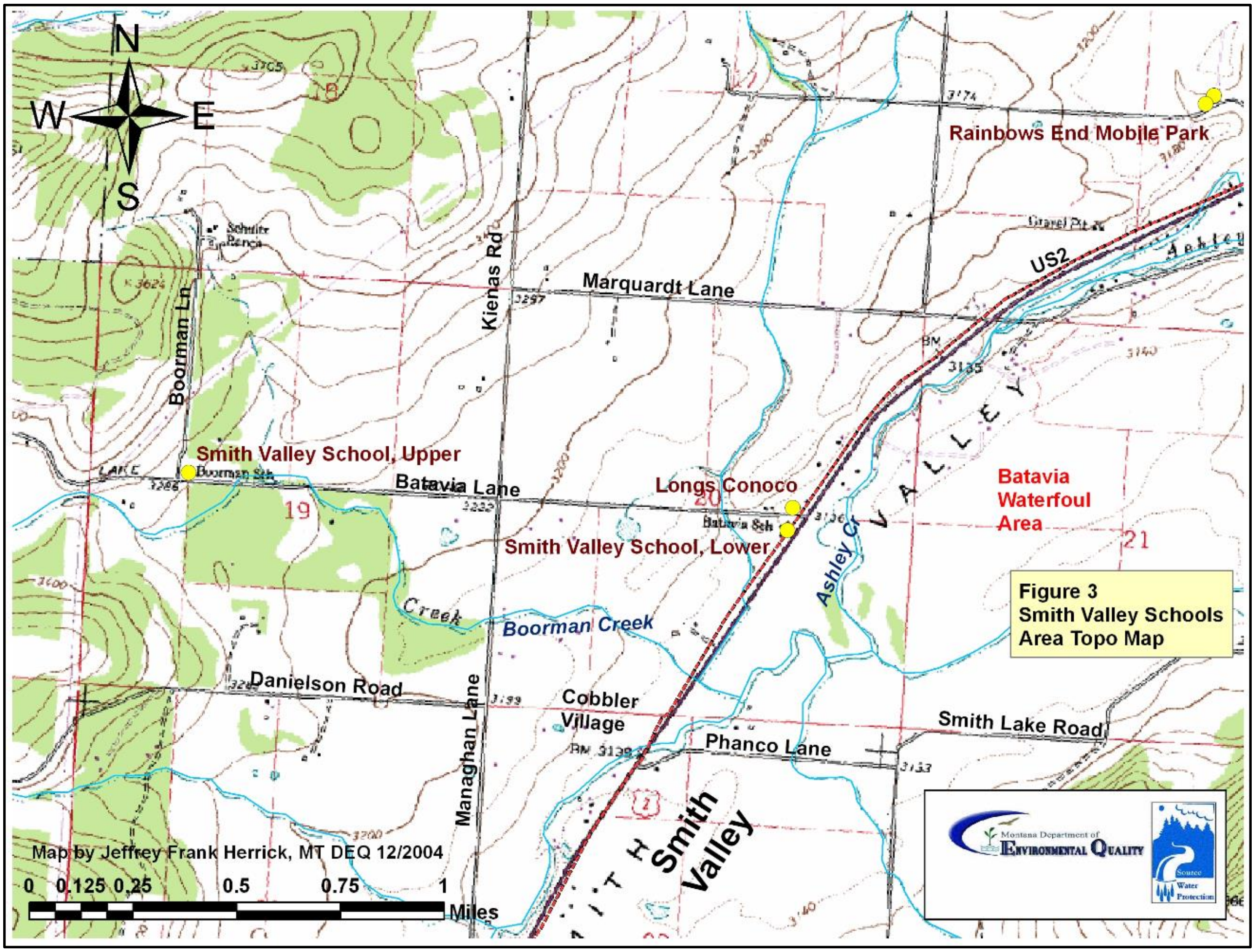
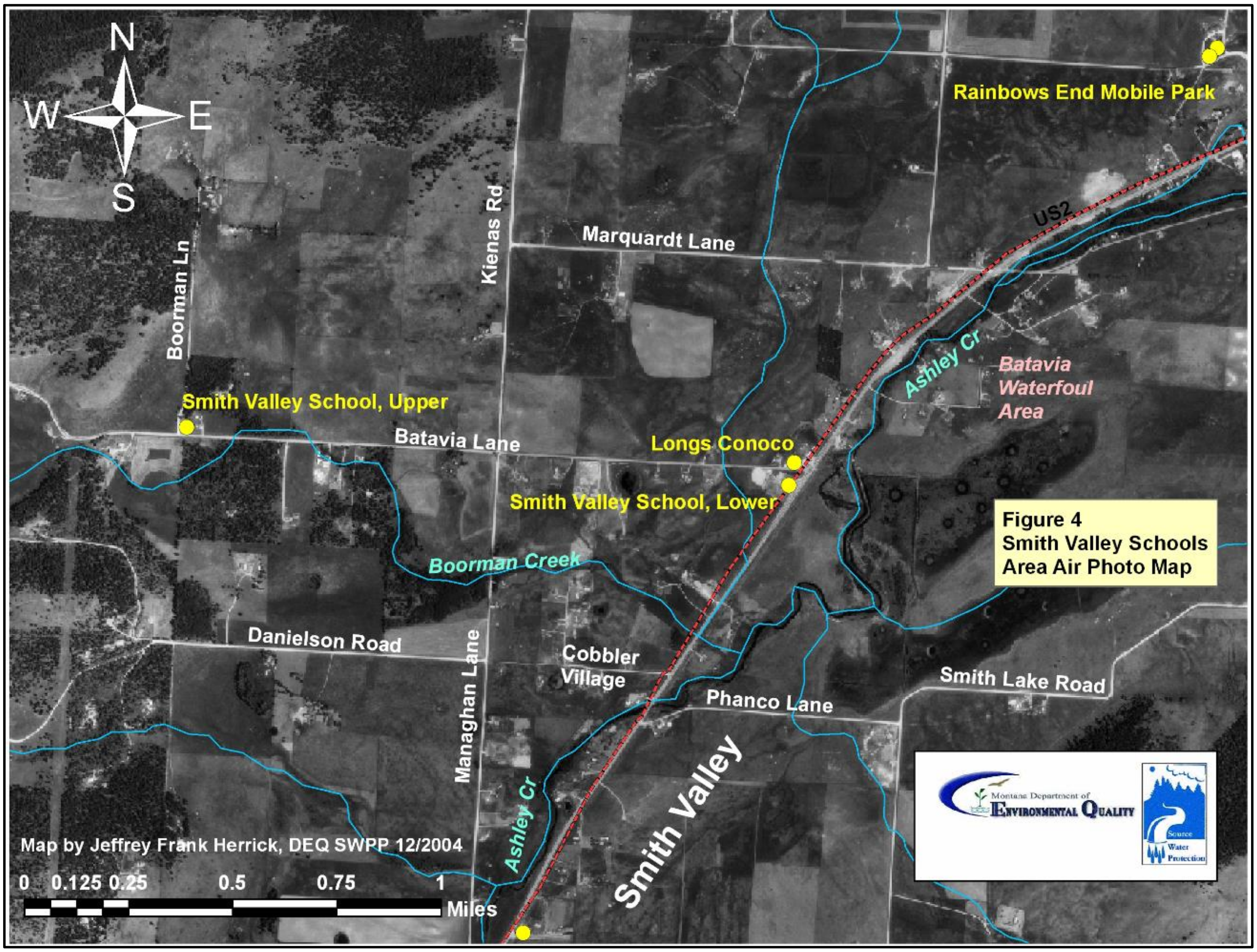


Figure 4. Area Air Photo Map



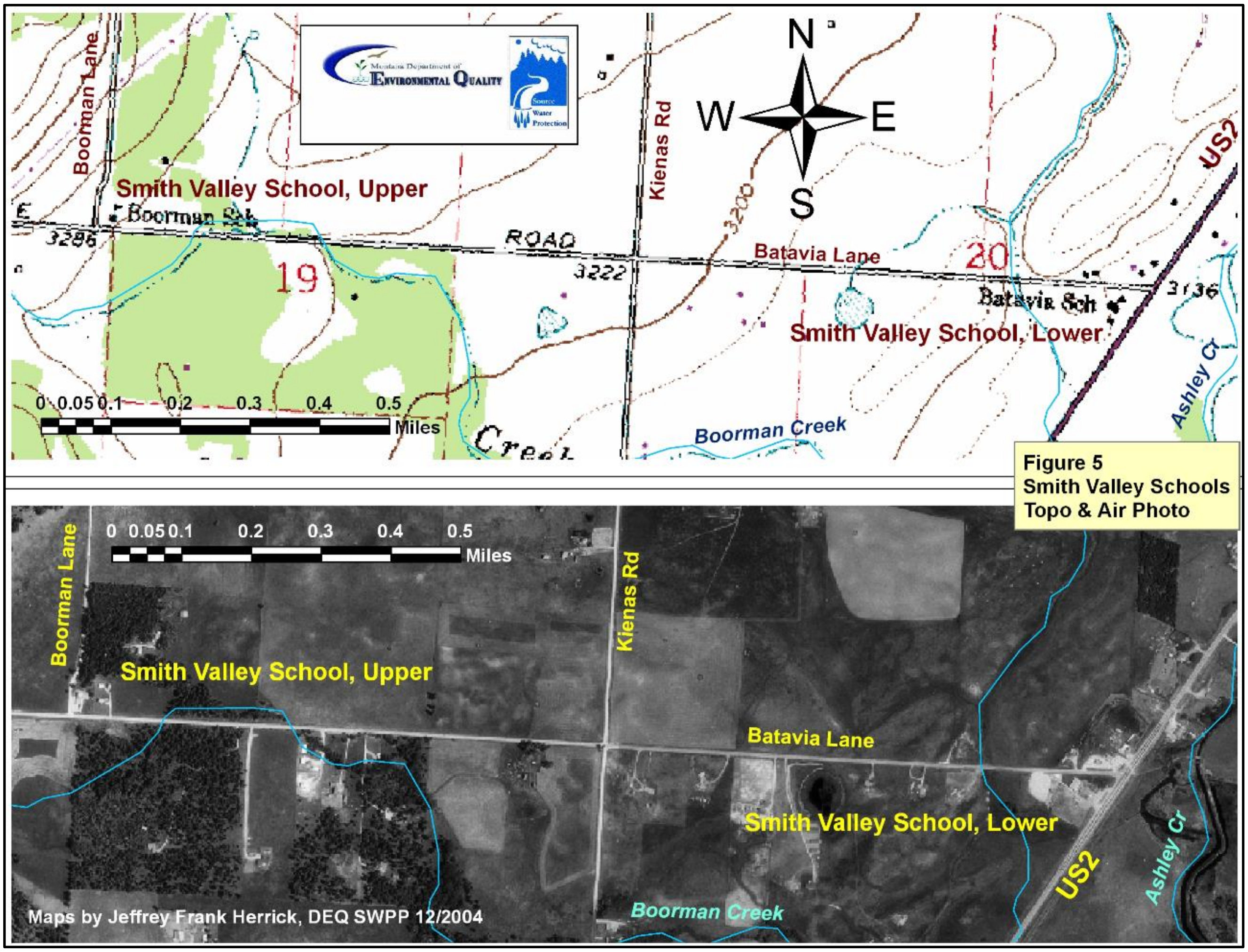


Figure 5. Topo and Air Photo

Much of the study area is currently served by City of Kalispell water and sewer utilities, which serve the area inside the Kalispell city limits, the Evergreen Water and Sewer District, which is located northeast of the City of Kalispell and the Village Sewer District, located north of Kalispell. The City of Kalispell provides water and sewer service to the majority of the population in the study area. The Evergreen Water and Sewer District discharges sewage to the City of Kalispell and provides water to a portion of the City. The Village Sewer District receives sewer service from the City of Kalispell and water service from the Evergreen Water and Sewer District. Table 2 is a summary of population and employment currently served by these utilities.

Table 2. Existing Population and Employment Served By Utilities

Category	2000	
	Population	Employment
Kalispell Sewer	14,639	15,573
Kalispell Water	14,639	15,573
Evergreen Sewer District	5,072	2,740
Evergreen Water District	7,372	3,289
Village Sewer District	813	119

Water services outside the City of Kalispell and the Evergreen and Village service areas consist of a variety of small public and private water systems utilizing groundwater as their source. Wastewater treatment for the areas outside the sewer service areas described above, is accomplished with on-site septic systems.

The major transportation corridors include Montana State Highway 93, which is the primary north-south corridor connecting Kalispell with Whitefish to the north and Polson and Missoula to the south. Montana State Highway 2 is the major east-west corridor connecting Kalispell to Libby on the west and Columbia Falls to the northeast. The Burlington Northern/Santa Fe Railroad also passes through the City of Kalispell.

Geographic setting

The 2 Smith Valley Schools campuses, identified as the *Upper & Lower Campus* are located around 5 miles west of the City of Kalispell in the Smith Valley (Figures 1-4). The Smith Valley is located directly west of Kalispell and the Flathead Valley. The Flathead Valley itself is a south to northwest trending intermountain valley in western Montana. The valley is surrounded by the Flathead and Mission mountains in the east and the Cabinet and Salish mountains to the west and north. Glacier National Park is north and east of the valley. The eastern half of the Kalispell study area encompasses the confluence of the Flathead, Whitefish, and Stillwater Rivers (a map of the Kalispell study area is found in Appendix B). This area is characterized as a large complex of swales, streams, wetlands, and alluvial terraces comprised of a significant amount of floodplain and hydric soils. The Evergreen alluvial aquifer located generally along the Flathead River floodplain, is a highly permeable sand and gravel aquifer controlled by the flows of the river. These hydrogeologic features were a factor driving the construction of a public sewer system for Evergreen.

The western half of the study area, just east of the Smith Valley, is characterized by agricultural land with foothills to the southwest. Ashley Creek is the main drainage, flowing southwest to northeast into the Flathead Valley. Ashley Creek is the main creek draining through the center of the Smith Valley. Foys Lake is located in the southwestern foothills relative to Kalispell and is east of the Smith Valley Schools.

The climate of the Flathead Valley is consistent with that of other lower elevation basins in the northern Rocky Mountains, west of the Continental Divide. The elevation at Kalispell is 2,970 feet. The average high and low temperatures at the weather station in Kalispell are 81 and 48 degrees F in July and 28 and 13 degrees F in January. Average annual precipitation falls mostly as winter snow and totals an average of 16.6 inches.

General Description of the Source Water

The majority of drinking water in the Kalispell area comes from a deep artesian aquifer that spans the region. This groundwater aquifer generally flows from northwest to southeast across the area, toward Flathead Lake. Because of the depth and semi-confined or confined nature of the aquifer, contamination from septic systems or other sources is unlikely. Flathead Lake, one of the cleanest lakes of its size in the world, is fed by waters from the Flathead, Stillwater, and Whitefish Rivers, as well as Ashley Creek, all of which flow through the study area.

Flathead Lake, the Whitefish River, and Ashley Creek are all on the State of Montana Section 303(d) list of water quality impaired water bodies for nutrients. Concerns over declining water quality in Flathead Lake have led to development of a TMDL (Total Maximum Daily Load) and voluntary nutrient reduction strategy for Flathead Lake. Although nutrients significantly impact surface water quality, the impact to the drinking water taken from the groundwater sources in the area is negligible.

The City of Kalispell is served by a potable water system consisting of groundwater wells, with a distribution pipe network, an elevated storage tank and ground level storage tanks; a sanitary sewer collection system consisting of a network of gravity sewers and lift stations leading to a wastewater treatment plant; and a storm sewer collection system consisting of a network of gravity piping as well as several above grade detention basins. Demands on these facilities are increasing as Kalispell grows and more stringent water quality standards are implemented. A public sewer system was installed in Evergreen in 1993 due to concerns about pollution of Flathead Lake from septic systems within the alluvial aquifer, located generally along the Flathead River floodplain. The wastewater from the City of Kalispell and Evergreen areas is treated at the Kalispell Advanced Wastewater Treatment Facility, located on the south edge of the City of Kalispell, and discharges to Ashley Creek. The wastewater that is generated by the Smith Valley Schools, *Upper & Lower Campuses* is treated in individual septic systems located at each property. These septic systems are by definition large capacity septic systems.

The Public Water Supply

The Smith Valley Schools, *Upper & Lower Campus*' water systems are both classified by DEQ as non-transient non-community PWSs. The Smith Valley School, *Upper Campus* PWS supplies water to approximately 45 students and staff through 2 service connections. The system has 1 well that pumps the drinking water from a depth of around 132 feet bgs (below ground surface). No well log has been located for this well, but it has been suggested that the well was drilled in 1953. No information on static water level, pumping water level, or annular seal information is available. The well yield is reported to be 16 gpm. Details of the water system and its layout are provided in the most recent DEQ Sanitary Survey (2000) that is provided in Appendix B.

The Smith Valley School, *Lower Campus* PWS supplies water to approximately 175 students and staff through 3 service connections. The system has 1 well that was drilled to 420 feet bgs and pumps the drinking water from a depth of around 416 feet bgs. There are 2 other wells on the property that are no longer used and are separated from the water system, but it does not appear that they have been properly abandoned in accordance with the Administrative Rules of Montana (ARM 36.21). The well log for the PWS well indicates that it was drilled in 1998. The well casing extends to 417 feet bgs, with the casing grouted only to 20 feet bgs. The static water level was recorded as 20 feet bgs. The pumping water level was recorded as being 384 feet bgs while the well was pumped at 19.6 gpm. The well log is included in Appendix B. Details of the water system and its layout are provided in the most recent DEQ Sanitary Survey (2000) that is provided in Appendix B. The following is a summary of the PWS facilities present at the Smith Valley Schools, *Upper & Lower Campuses*.

Table 3. PWS Facilities Information
Smith Valley Schools, *Upper & Lower Campuses* PWSs

PWS Class	**Non-Transient Non-Community (NTNC) for both PWSs**			
	Smith Valley School, ***Upper Campus*** **MT0003161**	**Smith Valley School,** ***Lower Campus*** **MT0000935**		
Well/Intake Source Code	**WL002**	**WL002**	**WL003**	**WL004**
Well/Intake Name	Well 1 1953 **Active** w/ **EP502**	Well 1 1945 Inactive	Well 2 1955 Inactive	Well 3 1998 **Active** w/ **EP503**
Common Headers	NA	**CH001** Common Header for Well 1 and 2 Inactive w/ **EP502**		NA
Well Location	Within utility room in the southeast corner of the south building	Next to each other on the east side of the old school house		West corner of school property
Treatment System	No treatment is currently being used	No treatment is currently being used		
Pressure Control Assembly	**PC001** This is an old-style 50 gallon pressure tank, located within utility room in the southeast corner of the south building	**PC001** 2 new X-Trol WX-404 pressure tanks and pump controls located in storage area over the bathroom in the gymnasium		
Distribution System	**DS001** Distribution System Active w/ **SP001**	**DS001** Distribution System Active w/ **SP001**		

Public Water Supply Source/Well Information

Included in Appendix C are the well logs for several of the wells found in proximity to these PWSs. Information regarding the wells at Smith Valley Schools is summarized in Table 4 below.

Table 4. PWS Source/Well Information
Smith Valley Schools, *Upper & Lower Campuses* PWSs

Smith Valley School Campus	***Upper Campus***	***Lower Campus***
Source Name	**Well 1 1953** **Not listed in GWIC**	**Well 3**
DEQ Source Code	WL002	WL003
MBMG GWIC #	Unknown	168746
DNRC Water Right #	Unknown	C105420-00
Date completed	1953 (?) No well log is available.	29 July 1998
Well Total Depth (feet bgs)	132 (?) No well log is available	417 Borehole was drilled to 420 feet bgs, with no record of backfill or plugging of bottom of hole
Depth Casing is Grouted (feet bgs)	Unknown	417
Perforated Interval (ft bgs)	Unknown	398-416, perforated
Static Water Level (ft bgs)	Unknown	14
Pumping Water Level (ft bgs)	Unknown	380
Draw Down (ft)	Unknown	366
Test Pumping Rate (gpm)	Unknown	20
Yield (gpm)	Unknown	Unknown

Water Quality

The somewhat shallower aquifer used by the *Upper Campus* well has not been characterized, but it is assumed to be within or just beneath the glacial till and/or glaciofluvial materials that extensively cover the area. These are typically fine-grained, chaotic, and act together as a unit that confines groundwater. Because of the probable aquifer confinement, the sensitivity of this aquifer to surface contamination is thought to be low. The deep confined bedrock aquifer that is utilized for the supply of drinking water for the *Lower Campus* well has a low sensitivity to surface contamination.

Water samples are collected from PWS wells on a variety of schedules and are analyzed for a variety of parameters. In samples collected from the *Upper Campus* system, Coliform bacteria (total Coliform) have been detected in several samplings during the past five years, though no *E. coli* or fecal coliform were detected. Nitrate levels in the past five years have fallen within the range of not detected to 0.51 mg/L, but usually between 0.41-0.51 mg/L. These values are well below the federal maximum regulatory limit of 10.0 mg/L. No other analytical parameters have been present in elevated concentrations. In samples collected from the *Lower Campus* system, Coliform bacteria have been detected several times during the past five years, though no *E. coli* or fecal coliform were detected. Nitrate levels in the past five years have fallen within the range of not detected to 0.49 mg/L, but usually between 0.31-0.33 mg/L. These values are well below the federal maximum regulatory limit of 10 mg/L. No other analytical parameters have shown elevated levels. A summary of the information on these 2 water systems was found in the most recent Sanitary Survey (2000), which is found in Appendix B and is also found summarized in printouts of the DEQ PWS Database found in Appendix A. Water quality data is also included in these database printouts.

CHAPTER 2
DELINEATION

Purpose of Delineation

The source water protection area, the land area that contributes water to the Smith Valley Schools, Upper & Lower public water supplies, is identified in this chapter. Three management areas are typically identified and delineated: the Control Zone, Inventory Region, and Recharge Region. The Control Zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The Inventory Region represents the zone of contribution of the wells, which approximates a three-year groundwater time-of-travel. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The Recharge Region represents the entire portion of the aquifer that contributes water to the Smith Valley Schools, *Upper & Lower Campuses* water systems.

Background

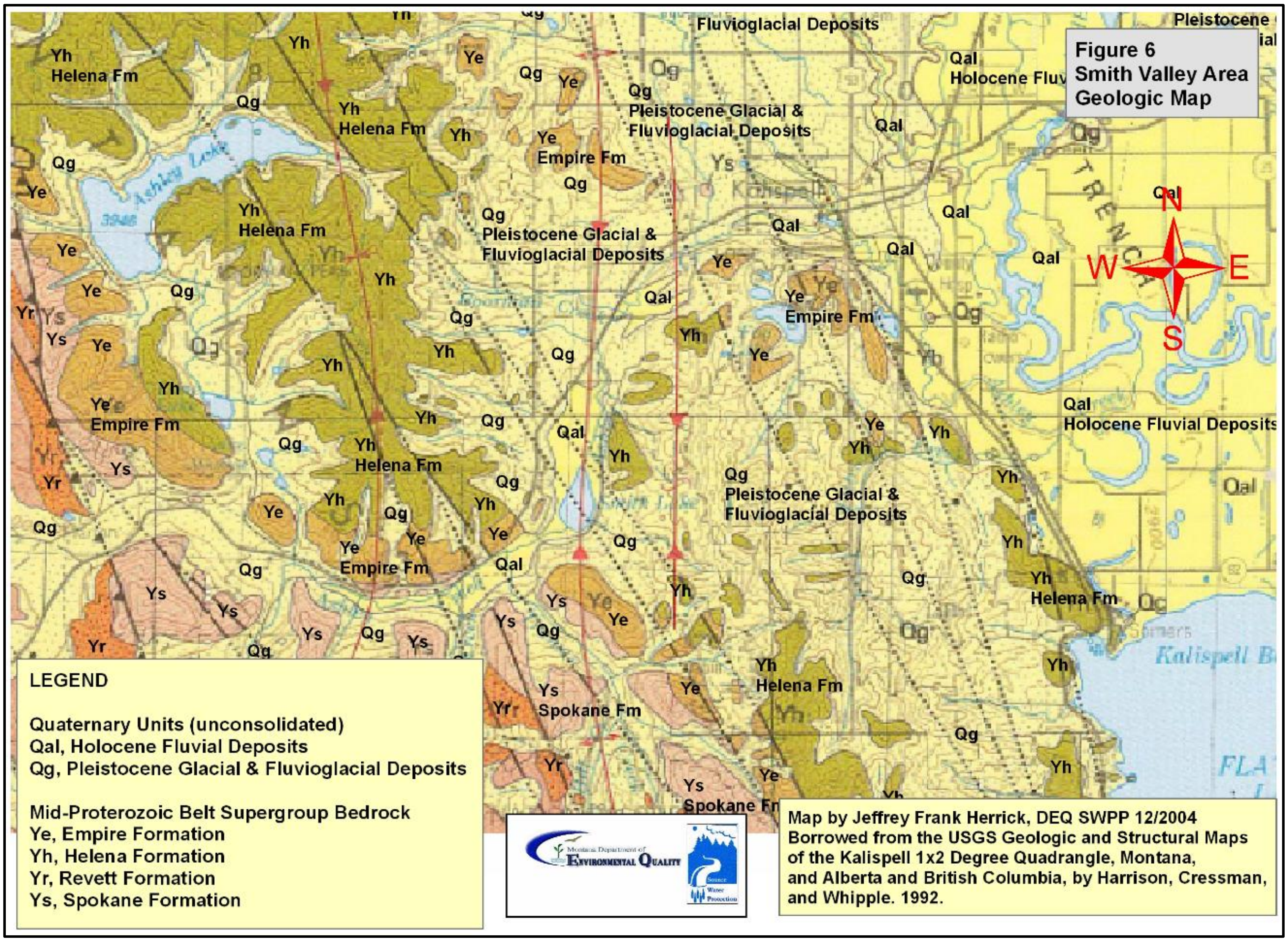
Geology

Kalispell is located within the center of the Flathead Valley in northwestern Montana. The Flathead Valley is a northwest trending intermontane basin forming the southern extension of the Rocky Mountain Trench. The Flathead Valley is bounded on the east by the Swan-Whitefish fault located along the base of the Swan Range and on the west by the Kalispell fault at the base of the Salish Mountains. The mountains rise abruptly 4,500 feet above the valley floor. Gravity data indicate the Cenozoic basin-fill in the central part of the valley may be as much as 4,000 feet thick (Noble and others, 1982). Although Tertiary rocks are not exposed, it is believed that Miocene and Oligocene sediments rest unconformably on Precambrian bedrock. Pleistocene continental and mountain glaciation advanced southward through the Trench around present day Kalispell depositing a layer of glacial till. As the glaciers receded, meltwater lakes pooled in areas where drainage was impeded, leaving lakebed deposits. In contrast, fluvial outwash deposits (eroded and water reworked glacial till) accumulated where discharge flowed unrestricted both during glacial events and after glacial retreat. Depending on the location, it is estimated that 600 to 1,000 feet of Wisconsin-age Pleistocene glacial deposits overlie the Tertiary sediments. The Flathead Lobe of the continental glaciers appears to have overridden much of the Salish Mountains north and south of the Smith Valley leaving a thick veneer of glacial till and glaciofluvial deposits covering bedrock in all but the highest terrain. A geologic and structural map of the area is shown on Figure 6.

Hydrogeology

The two primary aquifers recognized in the Kalispell area are the shallow alluvial aquifer and the deep so-called artesian aquifer (Konizeski and others, 1968; MBMG, 20000). The shallow alluvial aquifer is composed of younger unconsolidated fluvial sediments (sand and gravel) that are deposited along the floodplain of the Flathead, Whitefish, and Stillwater Rivers. The aquifer thickness ranges from 20 to 100 feet and the aquifer is not confined. A similar situation is present in the easternmost reaches of the Smith Valley (Ashley Creek) as it enters the Flathead Valley. Geologic logs for that area clearly show a shallow unconfined aquifer present in the alluvium. The shallow very transmissive alluvial materials are always present above low permeability glacial till and lakebed deposits of various thicknesses. These glacial till and lakebed sediments separate the shallow unconfined aquifer from the deeper so-called artesian aquifer of the Flathead Valley. The low permeability deposits are laterally very continuous in the area and generally separate surface water and shallow groundwater from the deep confined aquifer.

Figure 6. Geologic Map



The deep aquifer is typically confined by the laterally extensive low permeability glacial deposits and the water is under considerable head / pressure. By definition, a confined aquifer is a major water-bearing unit with its water under pressure greater than atmospheric pressure. This means that the water will rise in a well casing above the top of the aquifer. If the water level in the well rises above the ground surface, it is considered an artesian well, but the aquifer itself shouldn't be described as being artesian or non-artesian. The deep confined aquifer within the Kalispell Valley consists of a series of intercalated (inter-fingered and complexly cross cutting) sand and gravel layers with fine-grained interbeds. These deposits probably represent the meandering and cross cutting paleo-channels of the Flathead River system. Recent work in the central and eastern portions of the valley indicate this package of deeper sediments is hydraulically interconnected and responds as a single aquifer demonstrating anisotropic characteristics (Shapley, 1992; and Noble, 1998). The thickness of the deep confined aquifer within the middle of the Kalispell Valley is unknown, but a well located in Section 18 of Township 29 North, Range 21 West was drilled to a depth of more than 800 feet and had not penetrated the base of the aquifer. In the western portion of the Flathead Valley the confining unit overlying the deep artesian aquifer consists of glacial till and lakebed deposits that are composed of clayey and silty gravel. Northwest of Kalispell, the till is overlain by glacial outwash deposits. See Figure 6. West of the Flathead Valley and on the lower elevations of the Salish Mountains, glacial till lays directly on bedrock. In these areas where the lower very transmissive aquifer sediments are absent, the deep aquifer is present within the fractured bedrock itself. The glacial till in these areas is clearly a confining unit, but the potentiometric surface of the aquifer (the level of water in area wells) may not always be above the top of the aquifer. Thus the bedrock aquifer isn't always a true (per the definition) confined aquifer, but can be treated as a confined system from a source water protection perspective.

The Smith Valley School, *Upper Campus* PWS is located about 1.5 miles west of the *Lower Campus* and is against the foothills of the Salish Mountains. Its well probably derives groundwater from within or from beneath the thick mantle of glacial till that covers the entire area. Lithologies described in other area well logs support this assertion. Well logs and a map of well locations for other area wells are found in Appendix C. It isn't clear to the author if the PWS well for the *Upper Campus* actually penetrates the glacial till and is installed into the underlying bedrock. The well is believed to be 132 feet deep. Alternately it may withdraw water from a water-bearing unit within the glacial till (possibly a buried stream channel within glacial materials). In this area, the upper surface of the aquifer generally is not present within unconsolidated sediments (glacial till or outwash), but is present in the fractured bedrock of the Belt Supergroup. Much of the area is covered by glacial till and the aquifer can be considered to behave as if it were confined (in a practical sense). Groundwater flow directions in the confined bedrock aquifer beneath the *Upper Campus* is interpreted as being generally parallel or sub-parallel to surface water flow, which is from the west-northwest toward the east-southeast (toward Ashley Creek). Recharge to the bedrock aquifer happens at higher elevations where the glacial till mantle is thin or absent. Discharge from the aquifer occurs before the aquifer is adequately covered by the glacial till (evidenced by numerous springs in most major tributary stream valleys) and when the aquifer approaches the main drainage streams within the Kalispell Valley. Well logs for wells in the area of the *Upper Campus* PWS well are provided in Appendix C along with a map of their locations.

The Smith Valley School, *Lower Campus* PWS also probably derives groundwater from beneath a mantle of glacial till that covers the entire area and fills the Smith Valley. Younger fluvial alluvium is present in the valley and contains a shallow unconfined aquifer, but local domestic wells typically do not use this shallow sediment as a water source. The *Lower Campus* PWS well clearly penetrates the glacial till (which is around 190 feet thick at the school) and is installed into the underlying bedrock. The log for the school well does not indicate that there is an unconsolidated aquifer sitting above the bedrock, but this doesn't demonstrate its absence. The borehole for Well #3 was drilled to 420 feet bgs, but the screen zone was set between 398-416 feet bgs. No logs were available for the original 2 school wells. Well logs for other area wells are found in Appendix C. Within the area around the Smith Valley, the upper surface of the aquifer is usually not found within the unconsolidated sediments. It is more often present in fractured bedrock of the Belt Supergroup. Much of the area is covered by glacial till (especially thick within the broad drainages like Ashley Creek) and the aquifer can be considered to behave as if it were confined. Groundwater flow directions in the confined bedrock aquifer beneath the *Lower Campus* is interpreted as being generally parallel or sub-parallel to surface water flow, which is from the southwest to northeast beneath Ashley Creek. Recharge to the bedrock aquifer happens at higher elevations where the glacial till mantle is thin or absent. Discharge from the aquifer occurs before the aquifer is adequately covered by the glacial till (evidenced by numerous springs in most major tributary stream valleys) and when the aquifer approaches the main drainage streams within the Kalispell Valley. Well logs for wells in the area of the *Lower Campus* PWS well are provided in Appendix C along with a map of their locations.

Sensitivity

Based on hydrogeologic conditions, **the Smith Valley Schools, Upper & Lower PWS wells are both classified as having Low Source Water Sensitivity**, according to the following Table 5. The aquifer is generally a deep bedrock aquifer that is capped by low permeable glacial till. Water levels may or may not be elevated by pressure greater than atmospheric, but the aquifer can clearly be treated as a confined groundwater system.

Table 5. Source Water Sensitivity

High Source Water Sensitivity
Surface water and GWUDISW
Unconsolidated Alluvium (unconfined)
Fluvial-Glacial Gravel
Terrace and Pediment Gravel
Shallow Fractured or Carbonate Bedrock
Moderate Source Water Sensitivity
Semi-consolidated Valley Fill sediments
Unconsolidated Alluvium (semi-confined)
Low Source Water Sensitivity
Consolidated Sandstone Bedrock
Deep Fractured or Carbonate Bedrock
Semi-consolidated Valley Fill Sediments (confined)

Sources of Information

A summary of the published and unpublished sources of information were used in this assessment and are presented in Tables 6 and 7.

Table 6. Geologic & Hydrogeologic References

Title of Project	Period of Project	Area Covered	Project Purpose
Montana Groundwater Assessment Atlas for the Flathead Lake Area. MBMG, (2000)	Compilation of data and interpretations from approximately 1968 to 2000	Flathead Valley north of Flathead Lake	Groundwater Characterization
Occurrence and Characteristics of Ground Water in Montana: Montana Bureau of Mines and Geology Open-File Report 99, vol. 2, 132 p. Noble and Others (1982)	Compilation of data and interpretations prior to 1982	Montana	Groundwater Characterization
Geology and Ground Water Resources of the Kalispell Valley, Northwestern Montana: Montana Bureau of Mines and Geology Bulletin 68, 42 p. Konizeski and Others (1968)	Compilation of data and interpretations prior to 1968	Flathead Valley north of Flathead Lake	Groundwater Characterization
Analysis of Evans Farm's Aquifer Test, East Flathead Valley, unpublished report on MDNRC Provisional Permit Application No. 066522 Shapley (1990)	1990	Eastern Flathead valley	Characterization of Aquifer
Groundwater Resources of the Upper Flathead Basin, Interpreting the Landscape Through Science Symposium, Flathead Valley Community College, pp 11-14. Noble (1998)	Compilation of data and interpretations prior to 1998	Upper Flathead Valley	Characterization of Aquifer

Table 7. Geologic or Hydrogeologic Maps

Title or Description	Date	Area Covered	Reference
Montana Groundwater Assessment Atlas for the Flathead Lake Area	2000	Flathead Valley north of Flathead Lake	(MBMG, 2000)
Geologic and Structure Maps of the Kalispell 1 x2 Quadrangle, Montana, and Alberta and British Columbia. USGS Miscellaneous Investigation Series	1992	Northwest Montana, Southern Alberta and British Columbia	(Harrison and Others, 1992)

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. The primary water source for the Smith Valley Schools (both campuses) is an aquifer that is contained within the relatively deep fractured bedrock of Belt Supergroup rocks, which is mantled by glacial till. In areas where the till is thicker and the valley is deeper, the aquifer may be present in valley fill sediments beneath the glacial till, but this doesn't appear to be the case beneath these 2 drinking water systems. Within the Smith Valley and along Ashley Creek, there is probably a shallow unconfined aquifer present within the stream alluvium, which is essentially perched on top of the low permeability glacial till. Evidence of the shallow aquifer is the abundance of shallow water and saturated environments such as Smith Lake and the Batavia Waterfowl Production Area. This shallow aquifer was not encountered during the drilling of either of the Smith Valley School wells. The low permeability glacial till likely impedes or limits direct surface infiltration of rain or snowmelt to the deep aquifer, so recharge probably occurs higher in the mountains where the mantle of glacial till is thin or absent. Groundwater flow direction in the deep bedrock aquifer generally is parallel to the trend of surface water, which is downstream along Boorman Creek toward Ashley Creek, then northeast to east along the Smith Valley paralleling Ashley Creek.

Methods and Criteria

Source water protection areas are divided into zones or regions according to the amount of time water takes to reach the water supply intake or the hydrogeologic sensitivity of the source water. The PWS well intake for both of the Smith Valley Schools' water supply is the screen interval (or open hole interval) of the water supply wells. Source water protection areas for groundwater-based systems, in order of increasing size and time of travel to intakes are the Control Zone, Inventory Region, and Recharge Region. The methods and criteria used to delineate the source water protection zones for PWSs are specified in the DEQ's SWPP (DEQ, 1999).

For a confined aquifer, the Control Zone is based on a fixed distance of 100 feet radius around each wellhead; the Inventory Region is based on a 1,000-foot radius circle around the wellhead; and the Recharge Region is based on geologic mapping and locations of hydrologic boundaries. If the aquifer is semi-confined or unconfined, the control and Recharge Regions are the same as for a confined aquifer, but the Inventory Region is determined using a calculation of groundwater velocity and an estimated three-year groundwater time-of-travel (TOT) distance.

Based on the available information, the aquifer supplying the Smith Valley Schools *Upper & Lower Campus* PWS wells is a confined aquifer. The wells' screened/intake intervals are relatively deep, the area is generally is covered with low permeability glacial till, and water levels in wells are higher than the top of the water-bearing formation (at least the well for the *Lower Campus* has a documented elevation of pressure head). From a source water protection perspective, these factors indicate that the aquifer beneath both campuses can be justifiably treated as if it were confined. Thus, the 1,000-foot radius circle Inventory Region should be delineated around the wellheads.

Delineation Results

The results of the delineation of source water protection areas are shown on Figures 7, 8, and 9. The Control Zone is based on a fixed distance of 100-foot radius from the wells. The Inventory Regions are based on a 1,000-foot radius circle around the wellheads as depicted on Figures 7 and 8. The Recharge Region is based on geologic mapping, probable groundwater flow directions, and locations of hydrologic boundaries. Principally the Recharge Region is the watershed north, east, and south of the wells and encompasses the watershed surrounding Smith Lake and Ashley Lake. The Recharge Region is depicted on Figure 9.

Limiting Factors

The available geologic evidence and regional geologic studies suggests that the aquifer beneath the 2 different campuses of the Smith Valley Schools can be treated as a confined aquifer, thus the Inventory Regions were delineated using criteria for confined aquifers. The assumed groundwater flow direction and gradients in the area are based on regional data, but actual local gradients and flow directions may vary considerably. This is especially true in glacial materials and in fractured bedrock settings, which can be chaotic on a local scale. Fractured bedrock aquifers can be quite difficult to characterize on a local basis and can exhibit rapid changes in hydraulic properties, so hydraulic gradients and flow directions can change over very short distances. Additionally, the actual geologic stratigraphy and the degree of confinement of the aquifer beneath the *Upper Campus* is not well documented.

Figure 7. **Lower Campus Inventory Region**

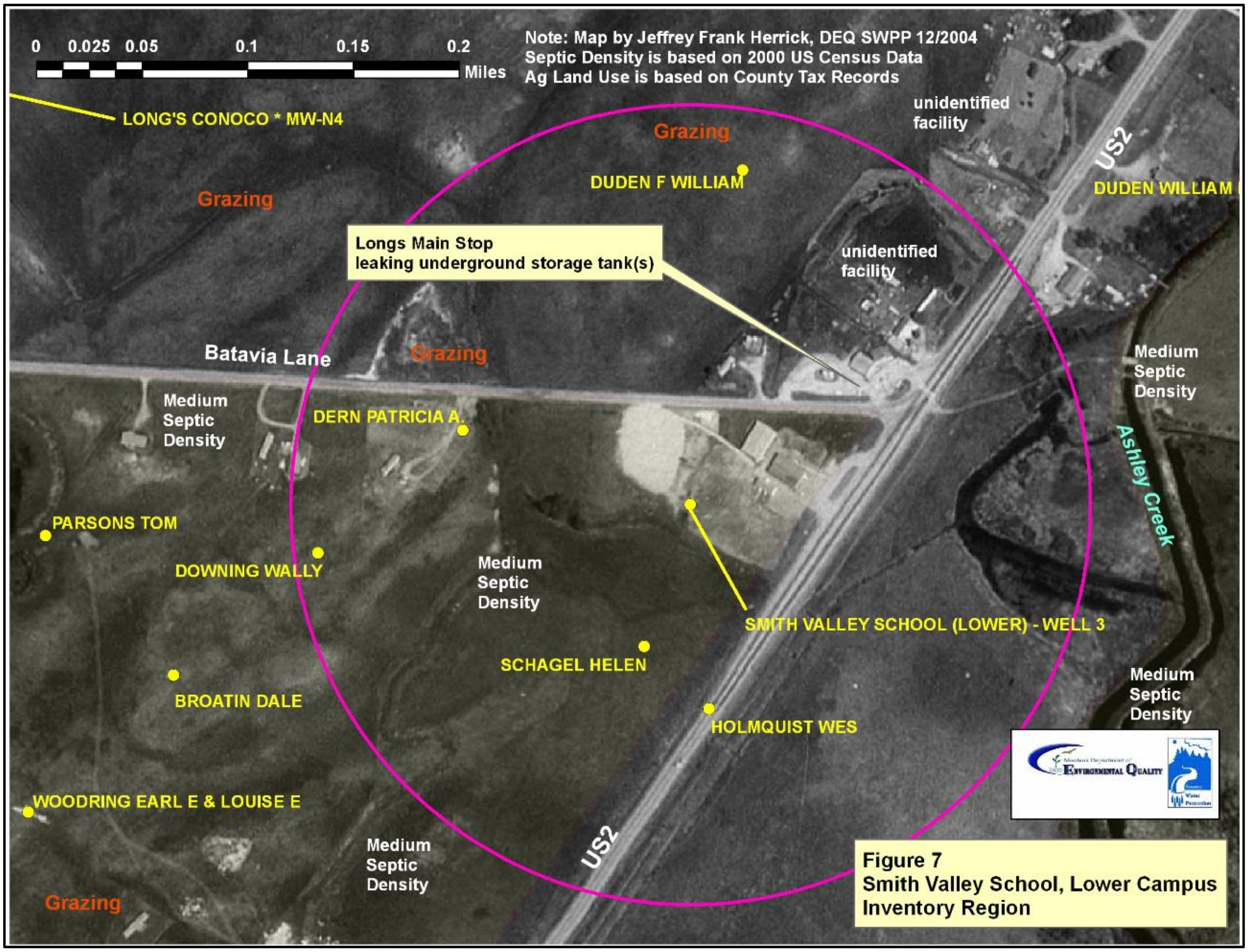


Figure 8. Upper Campus Inventory Region

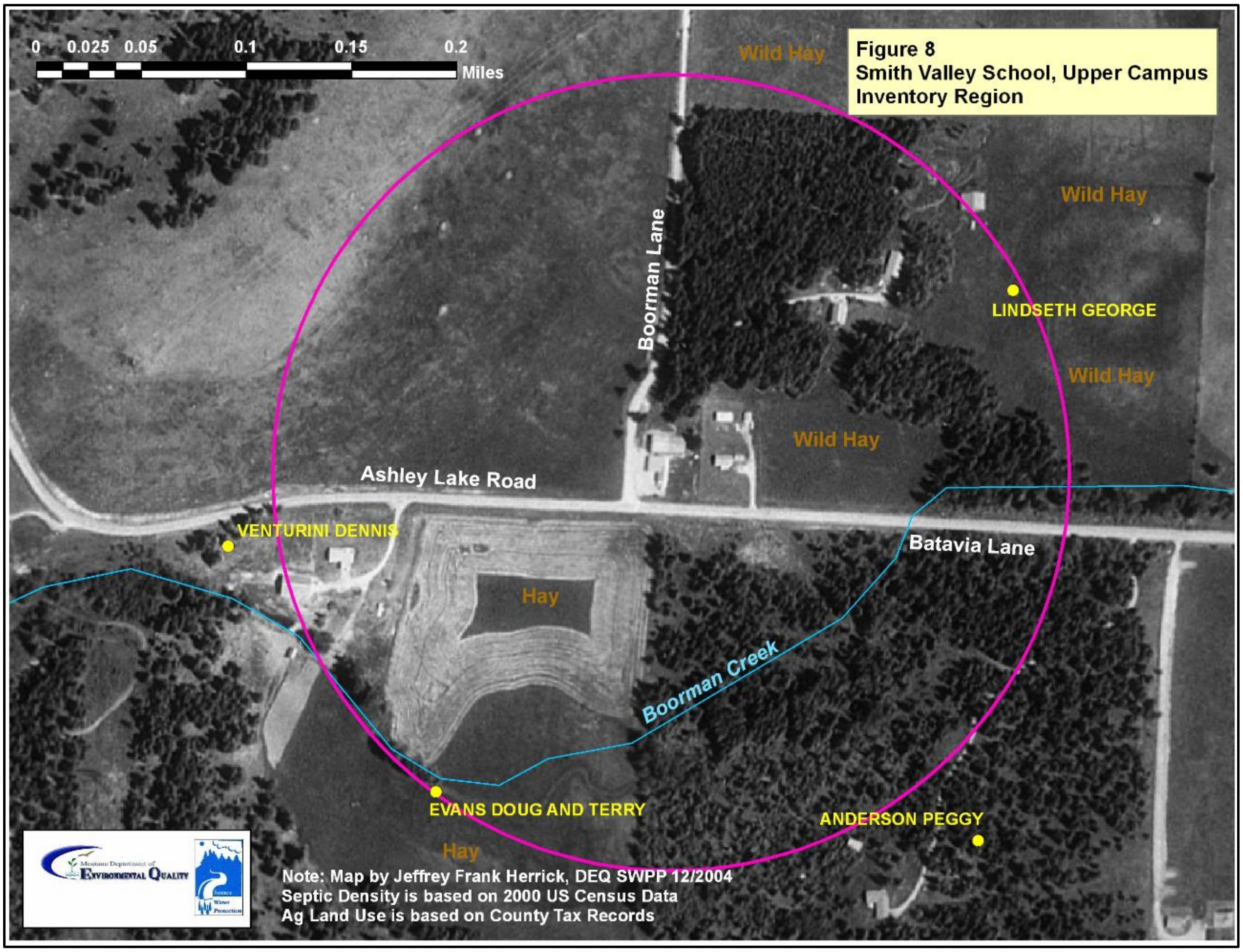
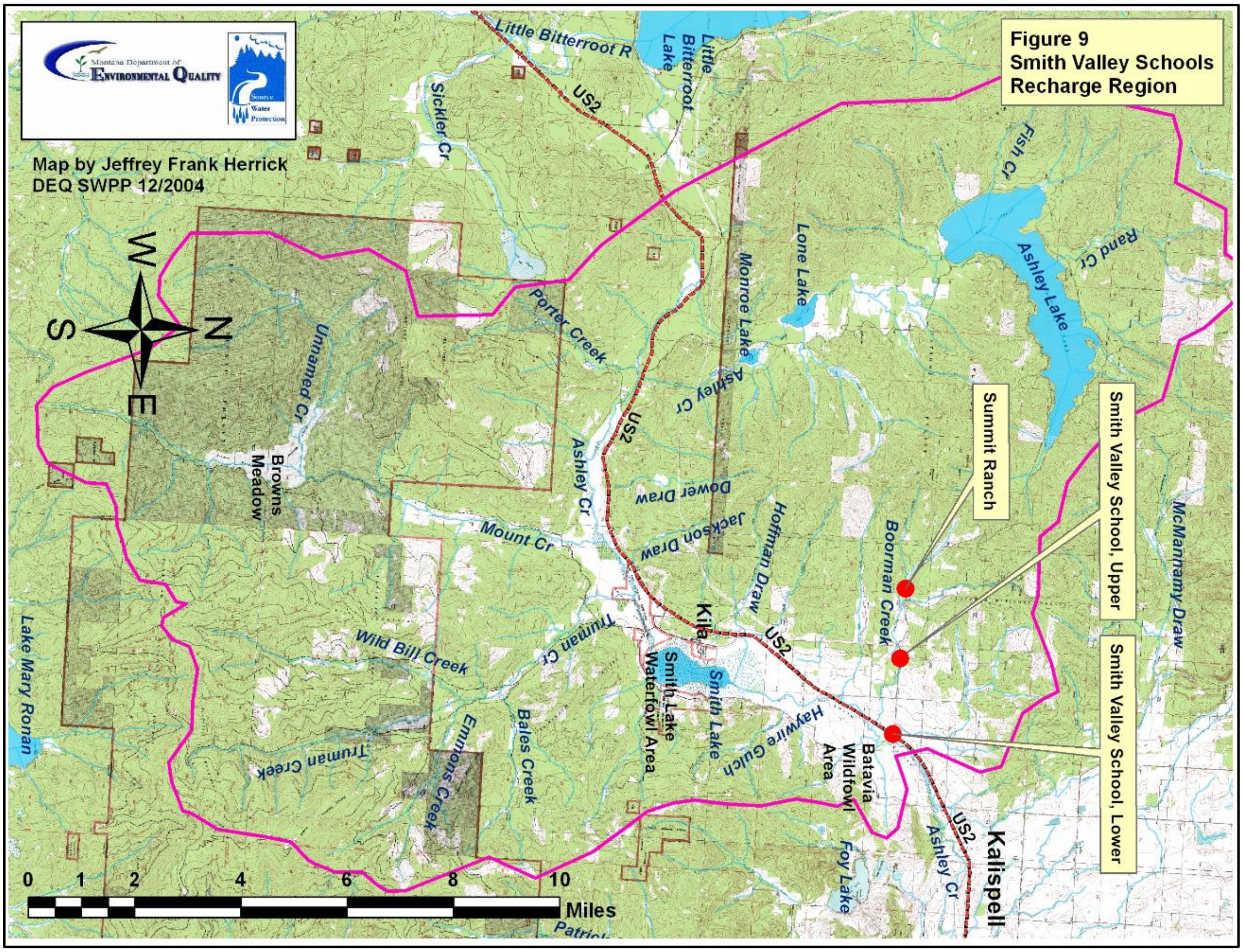


Figure 9. Recharge Region



CHAPTER 3
INVENTORY

General Discussion of Inventory

An inventory of potential sources of contamination was conducted for the Smith Valley Schools PWSs within the Control and Inventory Regions. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory that is used for the susceptibility determination. The most significant potential contaminant sources in the Smith Valley Schools PWS Inventory Region include septic systems and underground fuel storage tanks. The inventory for the Smith Valley Schools PWSs focuses on all activities in the Control Zone, certain sites or land use activities in the Inventory Region, and general land uses and large facilities in the Recharge Region.

Inventory Method

The initial inventory of the three zones included a search of available databases to identify potential sources of impacts. Available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the Inventory Region. The following steps were followed:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). A review of the data provided in the county tax records was made. Specifically, the appraisal of predominate agricultural land use for tax purposes were accessed through the cadastral data found on the Montana State Library site (http://nris.state.mt.us). Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from the Lake County. Figure 5 shows the agricultural land use in the area of the water supply wells.

Step 2: As appropriate, the EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: As appropriate, the Permit Compliance System (PCS) was queried using Envirofacts (http://www.epa.gov/enviro/) to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the Inventory Region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the Inventory Region: Underground Storage Tanks (UST) (http://webdev.deq.state.mt.us/UST/), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills, abandoned mines and active mines including gravel pits (http://nris.state.mt.us/gis/datalist.html). Any information on past releases and present compliance status was noted.

Step 5: Major road and rail transportation routes were identified throughout the Inventory Region (http://nris.state.mt.us/gis/datalist.html).

Step 6. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the Recharge Region and identified on the base map.

Step 7: All wells located within and around the Inventory Region were identified and well logs were obtained when available.

Potential contaminant sources are designated as significant (DEQ, 2000) if they fall into one of the following categories:

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

Inventory Results/Control Zone

The Control Zone is the area immediately surrounding the wellheads (within 100 feet of the wells). The Smith Valley Schools' wells are located adjacent to the school buildings and other facilities. The most recent sanitary survey (2000) suggests that the *Upper Campus* well is located in a utility room (with the pressure tank) within the southeast corner of the south building of the school. A sewage drainfield is located approximately 65 feet east of the well, which places this drainfield within the Control Zone. Groundwater monitoring data suggest that there isn't a problem with the system chronically impacting the well. No other potential contaminant sources were identified. The most recent sanitary survey (2000) suggests that the *Lower Campus* well is located in the west corner of the school property. The area within the Control Zone appears to be an athletic field / playground on the east side and grassland / pasture on the west side. These land uses would only be a concern if they were heavily irrigated. Groundwater monitoring data suggest that these land uses are not chronically impacting the well.

Inventory Results/Inventory Region

The Inventory Region (the area within ~1,000 feet of the wellhead) for the Smith Valley School, *Lower Campus* contains 4 significant potential contaminant sources as displayed on Figure 7. These are: 1) localized area of increased septic density southwest of the school; 2) large capacity septic systems associated with the school, the gasoline station, and the unidentified facility/business located just northeast of the gasoline station; 3) spills and or other releases of chemicals associated with vehicular accidents along the highway; and 4) Fuel releases from surface spills or underground leaks at the gasoline station (Long's Conoco). It should be noted that there is a documented leak of fuel from an underground fuel storage tank at the gasoline station. The Inventory Region (the area within ~1,000 feet of the wellhead) for the Smith Valley School, *Upper Campus* contains 3 significant potential contaminant sources as displayed on Figure 8. These are: 1) the large capacity septic system associated with the school; 2) concentrated animal feeding areas/operations (CAFOs) around farm buildings that are not regulated (these concentrate animal wastes); and 3) Operations that may occur around or within the farm buildings that can release chemicals, such as mechanical work, storage & mixing of farm chemicals, stockpiling of manure, or other activities. It should be noted that there is no documentation of CAFOs or other activities around the farmstead just southwest of the school.

Inventory Results/Recharge Region

The most significant potential contaminant sources located within the Recharge Region are displayed on Figures 9 and 10. These potential contaminant sources are: 1) UST / LUST sites mostly situated along the Highway 2 corridor; 2) localized areas of increased septic density along Highway 2, mostly seen between Batavia Lane area and Kila; 3) large capacity septic systems associated with businesses or other facilities mostly located along the Highway 2 corridor; 4) infrequent but large spills of chemicals along the highway corridor; and 5) extensive agricultural land along Ashley Creek in the Smith Valley. It should be noted that only a small percentage of that agricultural land is continuously cropped and none was identified as irrigated, so this land use isn't considered to be a major threat to the Smith Valley Schools' water systems. All of these significant potential contaminant sources are located in an area that has the extensive and thick glacial till covering the aquifer and are not located in an area where active recharge of the confined aquifer is thought to be occurring. The author believes that this probably reduces the chances of these contaminant sources impacting groundwater that can in-turn reach the Smith Valley Schools' wells in a short period of time. Note that the Recharge Region as delineated is mostly addressing the aquifer and recharge areas upgradient from the Smith Valley School, *Lower Campus* PWS well. If the author were to break out the Recharge Region for the Smith Valley School, *Upper Campus* PWS well, it would be the watershed of Boorman Creek that is located directly west and northwest of the school. The most significant potential contaminant source in that watershed would be the housing development of Summit Ranch. This development is serviced by a single water supply system, but it was not clear at the time of this writing if it is serviced by a large septic waste treatment system or if the homes are serviced by individual onsite septic systems. Either way, the potential contaminants from that development are nitrates and pathogens that may enter the aquifer in a location that is inferred to be upgradient from the Smith Valley School, *Upper Campus* PWS well.

Figure 10. **Recharge Region Inventory**

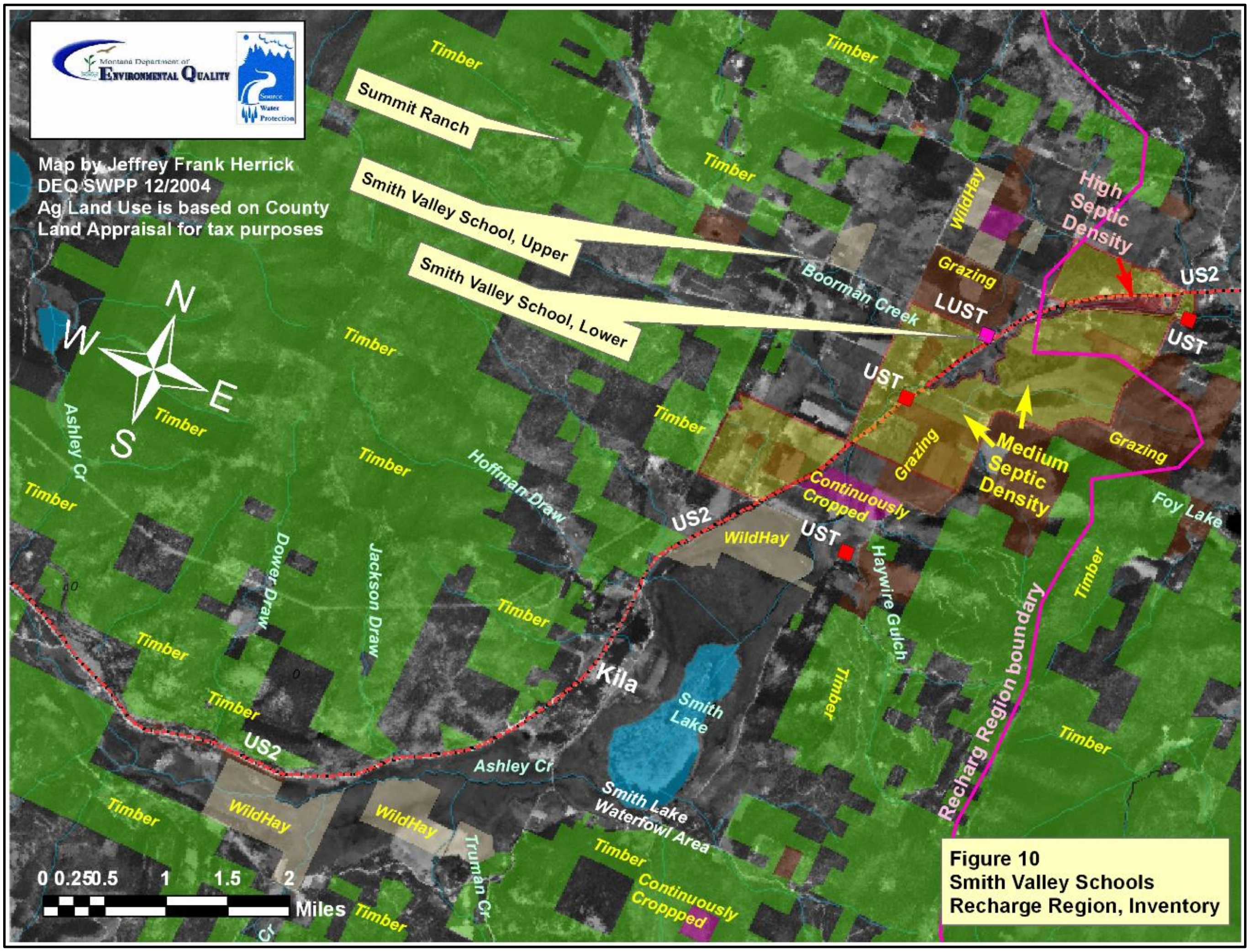


Table 8. Significant Potential Contaminant Sources
for the Smith Valley Schools PWSs

	Potential Contaminant Source	**Contaminants**
Inventory Region ***Lower Campus*** **(Figure 7)**	Localized areas of high density of private onsite septic systems located along US 2 southwest of the PWS	Pathogens and Nitrates
	Large capacity septic systems (those serving >20 persons/day) School's septic system Long's Conoco Septic system Other large capacity septic system at business northeast of Longs along Hwy 2	Pathogens, Nitrates, other
	Spills or releases of chemicals associated with accidents along Highway 2 corridor, these are very infrequent but can be catastrophic to a water supply.	VOCs, SOCs, metals, other
	Fuel released from surface or subsurface leaks of USTs (underground fuel storage tank site) and LUSTs (leaking underground fuel storage tanks at Long's Conoco, northeast of the school	VOCs, other
Inventory Region ***Upper Campus*** **(Figure 8)**	Large capacity septic system (those serve >20 persons/day) School's septic system	Pathogens, Nitrates, other
	CAFOs (concentrated animal feeding around the farm buildings) that aren't regulated. These operations don't show up in one of DEQ's databases, but a large farmstead is seen directly southwest of the school on the south side of Ashley Lake Road. This farmstead may or may not confine and feed animals.	Pathogens and Nitrates
	Operations that may occur around or within the farm buildings that can release chemicals, such as: mechanical work, storage & mixing of farm chemicals, stockpiling of manure, other activities	SOCs and VOCs
Recharge Region (Figures 9 & 10)	Underground fuel storage tank (UST) sites and leaking underground fuel storage tank (LUST) sites along US 2. These are mostly around the Smith Valley School, *Lower Campus* and around Cobbler Village southwest of the school.	VOCs and petroleum hydrocarbons
	Localized areas of high density of private onsite septic systems located along US 2	Pathogens and Nitrates
	Large capacity septic systems associated with other PWSs or businesses along the US 2 corridor.	Pathogens and Nitrates
	Spills or releases that are infrequent but catastrophic, associated with accidents along Highway 2 corridor.	VOCs, SOCs, metals, other
	Extensive agricultural land present throughout the Smith Valley. If this ag land consists of heavy concentrations of animals (concentrated animal feeding operations) or if the crop land is heavily irrigated, this would constitute significant potential contaminant sources	Nitrates and SOCs

Note:

- Septic density is based upon the 2000 US Census and the coverage reflects census blocks. Septic density is this area is considered to be low overall, with several areas of medium density arranged around Highway 2.
- Large capacity septic system locations are inferred. These are systems that service >20 persons per day. Since there are not community sewers in the area, both of the school campuses, the gas station, and any other facilities and/or businesses will probably have one of these systems. Examples are Julie's Restaurant Saloon and Arena, Long's Conoco, and the Kila School.
- Agricultural land use is based on county land appraisal (for tax purposes) and the data was taken from that cadastral data provided by Lake County. This cadastral data is found on the Montana

State Library's Natural Resources Information System (NRIS) site.

- Information of UST and LUST sites comes from DEQ records.

Inventory Update

The Smith Valley Schools PWS should update the inventory for their records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years to ensure that this source water delineation and assessment report remains current in the public record.

Inventory Limitations

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data that is readily available through state documents, published maps and reports, GIS data, and discussions with people that are familiar with the area. In addition, documentation may not be readily available on some potential sources. Examples of this are the large capacity septic systems that are present within or around the Inventory Regions. The businesses or other facilities identified are located in unsewered areas, and as such must be serviced by large capacity septic systems. Still, every potential contaminant source may not have been identified or recognized as being a significant potential contaminant source. The author of this SWDAR is depending on local knowledge of the PWS owners and/or operators for site-specific knowledge.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

General Discussion

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case Smith Valley Schools PWS owners and the operators. The goal of Source Water Management is to protect the source water by 1) controlling activities in the Control Zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that major land use activities or other significant activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the PWS owners and the operators to reduce susceptibility are recommended in this chapter.

Hazard Determination

The Susceptibility of the Smith Valley Schools' PWS production wells to various types of contamination is assessed in the following paragraphs. The proximity of a potential contaminant source to a spring or well intake, potential contaminant migration pathways, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as hazard (Table 9). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 10. Table 9 below describes the criteria to determine hazard within the Inventory Regions as they were delineated in this SWDAR. Note that this table is specific to PWSs that draw their water from confined aquifers. The determination of hazard is somewhat different for other types of water sources. For the situation involving the Smith Valley Schools, its deep production wells draw water from what has been characterized as a deep bedrock confined aquifer. For PWS wells drawing water from confined aquifers, it is fundamentally important to understand the potential contaminant sources around the wellhead and to understand if there are any avenues for that contamination to migrate from the near surface downward into the confined aquifer. A very common way for contamination to travel from the surface to a confined aquifer is directly down the outside of a well casing where the outside annulus has not been adequately grouted (sealed) between that casing and the confining geologic formations. For the evaluation of Hazard as addressed here, the seal of the PWS well and the seal of other nearby wells are examined. Hazard is increased if one or more of the wells are not adequately sealed to prevent contaminant migration down the outside of the casing.

<u>Lower Campus PWS Well</u>

The well log for the *Lower Campus* PWS well indicates that the well casing was grouted to seal the annulus between the outside of the casing and the confining formation through which it was installed. The log indicates that the grout extends to around 20 feet bgs, which is considered to be adequately sealed when the glacial materials are present all the way to the surface. This log is provided in Appendix B. Other wells in the area (there are 4 within the Inventory Region and 1 that probably should be) are displayed on Figure 7 with a yellow dot and yellow label. It should be noted that the well names and locations were provided by the Montana Bureau of Mines and Geology (MBMG) and the method that they record well locations results in rough approximations. As such, the well locations listed on the map are rough, but are probably adequate for the purposes of this evaluation. The Long's Conoco monitoring well MW-N4 may or may not actually be within the inventory region, but these types of wells are shallow and not actually relevant to this evaluation as an avenue of contaminant migration into the confined aquifer. Of the wells within the Inventory Region, the Helen Schagel well has no record of an adequate seal. Well logs for the 2 historic wells for the *Lower Campus* PWS were not found in DEQ files or in the MBMG database. As such, these wells are not assumed to be adequately sealed and are conservatively assumed not to be sealed. A map depicting nearby well locations is also provided along with the well logs in Appendix C. Because the PWS well in the Inventory Region is adequately sealed and other wells are inadequately sealed, the 3rd column of Table 9 below should be used to determine hazard and it indicates that point sources of contamination should be assigned a Moderate Hazard.

Upper Campus PWS Well

No well log for the *Upper Campus* PWS well exists, thus records do not indicate that the well casing was grouted to seal the annulus between the outside of the casing and the confining formation through which it was installed. As such, the well is not considered to be adequately sealed. Other wells in the area (there are 2-4 within the Inventory Region) are displayed on Figure 8 with a yellow dot and yellow label. It should be noted that the well names and locations were provided by the Montana Bureau of Mines and Geology (MBMG) and the method that they record well locations results in rough approximations. As such, the well locations listed on the map are rough, but are probably adequate for the purposes of this evaluation. A map depicting these well locations is also provided along with the well logs in Appendix C. Because the *Upper Campus* PWS well in the Inventory Region is inadequately sealed the 2nd column of Table 9 below should be used to determine hazard and it indicates that point sources of contamination should be assigned a High Hazard.

Table 9. Hazard of Potential Contaminant Sources

For wells drawing water from confined aquifers

Potential Contaminate Sources within the Inventory Region	The PWS well is not sealed through the confining layer	Other wells in the Inventory Region are not sealed through the confining layer	All wells in the Inventory Region are sealed through the confining layer
Point Sources	High Hazard	Moderate Hazard	Low Hazard
Septic System Density (# per square mile)	High: > 300 Moderate: 50 to 300 Low: < 50	Moderate: > 300 Low: < 300	Low Hazard
Municipal or Community Sanitary Sewer Mains (% land are)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low Hazard
Cropland (% land use)	High: > 50 Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low Hazard

Notes:

- There are few areas agricultural land (mostly grazing and wild hay) within and surrounding the Inventory Regions for both campuses. This land is considered to have a negligible to low hazard to the wells.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the PWS well/intake. First, hazard is rated by the proximity of a potential contaminant source to the PWS well and the quality of sealing through a confining unit above the well intake. The Smith Valley Schools, *Upper Campus'* PWS well was not sealed into the confining unit and the Smith Valley Schools, *Lower Campus'* PWS well was sealed into the confining unit. Susceptibility ratings are then determined individually for each significant potential contaminant source and/or contaminant based on Table 10. These susceptibility ratings are the evaluation of the vulnerability of well to the potential contaminant sources and are presented on Tables 11a and 11b.

Table 10. Susceptibility, based on Hazard and Barriers.

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

Discussion of Susceptibility

A summary of the susceptibility assessment for the Smith Valley Schools' PWS wells is located in Tables 11a and 11b. It is a very brief discussion of the susceptibility assessment for the significant potential contaminant sources because the wells have a very low susceptibility to potential contaminant sources located within the Inventory Region. Because a contaminant source has not been identified in the inventory or susceptibility assessment of this report, it doesn't mean that the potential for contamination does not exist or is not a threat. Therefore, if potential contaminant sources were present near or upgradient of any PWS, it would be prudent to understand the threat from these sources.

Table 11a. Susceptibility Assessment – Lower Campus Well

Smith Valley Schools PWS – Inventory Region (Figure 7)

Potential Contaminant Source	Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Large capacity septic systems (those serving >20 persons/day) =School's septic system =Long's Conoco septic system =Other large capacity septic systems at business northeast of Longs along Hwy 2	Pathogens, Nitrates, other	Failure of these systems due to leakage or poor maintenance, resulting in septic impacts to groundwater	**Moderate Hazard**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure); most or all of these systems are located downgradient from the wellhead	**Low Susceptibility**	Area wide promotion of engineered septic systems to replace existing systems or be required for future systems; educational mailings to area businesses; posting of notices at sinks and drains to prevent the improper disposal or dumping of waste to groundwater; promotion of area-wide recycling program for liquid wastes; promotion of dry shops for any auto or mechanical shops in the area
Spills or releases of chemicals associated with accidents along Highway 2 corridor, these are very infrequent but can be catastrophic to a water supply.	VOCs, SOCs, metals, other	These infrequent but large scale releases can be catastrophic if they occur near a PWS well	**Moderate Hazard**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure); the highway is located downgradient from the wellhead	**Low Susceptibility**	Promote good contact with local and regional (Kalispell) emergency responders; identify local resources for spill control and cleanup; promote the allocation of local resources and training for emergency response.
Fuel released from surface or subsurface leaks of USTs (underground fuel storage tank site) and LUSTs (leaking underground fuel storage tanks) at Long's Conoco, northeast of the school	VOCs, other	Releases of fuel can be chronic, catastrophic, or even historic, and they can be to the surface or subsurface. The Conoco station has a historic LUST	**Moderate Hazard**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure); the LUST and other USTs are located downgradient from the wellhead; monitoring groundwater on some interval; DEQ involvement in managing the historic release	**Low Susceptibility**	Promote good housekeeping at the store (regarding fuels); promote groundwater monitoring; evaluate and encourage the involvement of DEQ in the monitoring and/or cleanup of contaminated soil and groundwater at the station
Localized areas of high density of private onsite septic systems located along US 2 southwest of the PWS	Pathogens and Nitrates	Failure of these systems due to leakage or poor maintenance, resulting in septic impacts to groundwater	**Low Hazard** **(<50/ mile square)**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure); there is a small stream or canal running north-south just upgradient from the well, and this probably acts as a barrier	**Very Low Susceptibility**	Area wide promotion of engineered septic systems to replace existing systems or be required for future systems; educational mailings to residences; promotion of area-wide recycling program for liquid wastes

Table 11b. Susceptibility Assessment – Upper Campus Well
Smith Valley Schools PWS – Inventory Region (Figure 8)

Potential Contaminant Source	**Contaminants**	**Hazard**	**Hazard Rating**	**Barriers**	**Susceptibility**	**Management**
Large capacity septic system (serving >20 persons/day) =School's septic system	Pathogens, Nitrates, other	Failure of this system due to leakage or poor maintenance, resulting in septic impacts to groundwater	**High Hazard**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure)	**Moderate Susceptibility**	At the school and area wide promotion of engineered septic systems to replace existing systems or be required for future systems; posting of notices at sinks and drains to prevent the improper disposal or dumping of waste to groundwater; promotion of area-wide recycling program for liquid wastes
CAFOs (concentrated animal feeding around the farm buildings) that aren't regulated (they don't show up in one of DEQ's databases	Pathogens and Nitrates	Animal waste that might reach the wellhead (at the surface or below the surface) and leak downward along the well casing to the intakes	**Low Hazard (the author doesn't have evidence of this contaminant Source)**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure)	**Very Low Susceptibility**	BMPs for animal feeding; good animal waste handling practices
Operations that may occur around or within the farm buildings	SOCs, VOCs, Pathogens, and Nitrates	These are activities that can release chemicals, such as: mechanical work, storage & mixing of farm chemicals, stockpiling of manure, other activities that could concentrate or release these chemicals	**Low Hazard (the author doesn't have evidence of this contaminant Source)**	Depth to well intake below mean static water level; vertically upward groundwater gradient (pressure)	**Very Low Susceptibility**	Careful storage, handling, and disposal of farm and shop chemicals; use secondary containment for storage; isolate from wellheads.

Summary of Susceptibility

The Smith Valley Schools, *Upper and Lower Campuses* public water supply uses 2 production wells located on each of the school properties as seen on Figures 7 and 8. Both of the wells are installed into bedrock that is topped by a thick deposit of low conductivity glacial till materials. A log wasn't actually located for the *Upper Campus* well, so the geology at that location is inferred. The bedrock aquifer can be treated as a laterally extensive confined aquifer, because it appears to be topped by glacial till over much of the area around both wells. The Inventory Region for both wells consisted of a 1,000-foot radius circle around the wellheads. The Recharge Region for this aquifer extends north and northwest of the schools in the Salish Mountains (as seen on Figure 9) and groundwater recharge occurs mostly higher in the mountains where the mantle of glacial till covering the bedrock is thin or absent. The groundwater beneath the area of the Smith Valley Schools' PWS wells is believed to flow east toward the Smith Valley, then northeast to east and parallel to Ashley Creek. For the purposes of this delineation and assessment, the Inventory Regions are 1,000-foot radius circles around the wellheads as seen on Figures 7 and 8. The Recharge Region boundaries encompass the local watersheds and are as seen on Figure 9. The few significant potential contaminant sources identified within the Inventory Regions may affect water quality at the PWS.

The Smith Valley School, *Lower Campus* PWS well has a low susceptibility to its own large capacity septic system located onsite and to other large capacity septic systems located downgradient from the well. The hazard of these septic waste disposal systems was considered moderate because the school's PWS well log indicated that the PWS well was adequately sealed to prevent contaminant migration down the outside of the well casing. Unfortunately, well logs for other wells in the area did not indicate that they were adequately sealed (or evidence for adequate sealing was missing). The well had a very low susceptibility to chemical spills along the highway, fuel releases (past or present) at the Conoco gas station, and to an area of increased septic density located upgradient from the well.

The Smith Valley School, *Upper Campus* PWS well has a moderate susceptibility to its own large capacity septic system(s) located onsite and somewhat near the well. The hazard from this septic system was considered high because no well log was found indicating that the PWS well had been adequately sealed to prevent contaminant migration down the outside of the well casing. The well had a very low susceptibility to concentrated animal feeding operations and other waste or chemical handling that may (or may not) occur at a large farmstead southwest of the school. These last 2 farm-related potential contaminant sources were assigned a low hazard because of the tentative nature of there presence.

The susceptibility of the Smith Valley Schools PWSs are discussed on Tables 11a and 11b above. Overall, there appear to be few nearby threats to the production wells beyond their own septic systems.

CHAPTER 5
WAIVER RECOMMENDATION

General Discussion

This section addresses the Smith Valley Schools, *Upper and Lower Campuses* PWSs that DEQ has classified as Non-Community Non-Transient. The authors' recommendation is based upon the determination of susceptibility as described in the last section.

Monitoring Waiver Requirements

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers.

<u>Use Waivers</u>

A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific organic chemicals were not used, manufactured, or stored in the area of a water source (or source area). If certain organic chemicals have been used, or if the use is unknown, the system would be determined to be vulnerable to organic chemical contamination and ineligible for a Use Waiver for those particular contaminants.

<u>Susceptibility Waivers</u>

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. Susceptibility is based on prior analytical or vulnerability assessment results, environmental persistence, and transport of the contaminants, natural protection of the source, wellhead protection program efforts, and the level of susceptibility indicators (such as nitrate and coliform bacteria). The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals. Shallow groundwater sources under the direct influence of surface water (GWUDISW) should use the same area of investigation as surface water systems; that is, the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the point of diversion. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include will logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; Time-of-Travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. Review of an organic chemical monitoring waiver application will be conducted by

DEQ's PWS Section and DEQ's Source Water Protection Program. Other state agencies may be asked for assistance.

<u>Susceptibility Waiver for Confined Aquifers</u>
Confined groundwater is isolated from overlying material by relatively impermeable geologic formations. A confined aquifer is subject to pressures higher than atmospheric pressure that would exist at the top of the aquifer if the aquifer were not geologically confined. A well that is drilled through the impervious layer into a confined aquifer will enable the water to rise in the borehole to a level that is proportional to the water pressure (hydrostatic head) that exists at the top of a confined aquifer.

The susceptibility of a confined aquifer relates to the probability of an introduced contaminant to travel from the source of contamination to the aquifer. Susceptibility of an aquifer to contamination will be influenced by the hydrogeologic characteristics of the soil, vadose zone (the unsaturated geologic materials between the ground surface and the aquifer), and confining layers. Important hydrogeologic controls include the thickness of the soil, the depth of the aquifer, the permeability of the soil and vadose zones, the thickness and uniformity of low permeability and confining layers between the surface and the aquifer, and hydrostatic head of the aquifer. These factors will control how readily a contaminant will infiltrate and percolate toward the groundwater.

The Susceptibility Waiver has the objective of assessing the potential of contaminants reaching the groundwater used by the PWS. A groundwater source that appears to be confined from surface infiltration in the immediate area of the wellhead may eventually be affected by contaminated groundwater flow from elsewhere in the recharge area. Contaminants could also enter the confined aquifer through improper well construction or abandonment creating a hydraulic connection from the surface to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. Regional conditions that define the confinement of a groundwater source must be demonstrated by the PWS in order to be considered for a confined aquifer Susceptibility Waiver. Confinement of an aquifer can be demonstrated by pump test data (storage coefficient), geologic mapping, and well logs. Site-specific information is required to sufficiently represent the recharge area of the aquifer and the zone of contribution to the PWS well. The following information should be provided:

- Abandoned wells in the region (zone of contribution to the well),
- Other wells in the region (zone of contribution to the well),
- Nitrate/Coliform bacteria analytical history of the PWS well,
- Organic chemical analytical history of the PWS well,

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration of contaminants into water that is used as a source. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the water source development, monitoring history of the source, geologic/hydrologic characteristics of the source water, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The area of contribution to the aquifer into which the PWS intake is installed must be defined and plotted. This should describe the subsurface stratigraphy, groundwater and aquifer characteristics, well construction, groundwater flow direction(s), and a listing (and a map) of other wells in the area that draw from the same formations. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well(s) should also be provided as part of the susceptibility waiver application.

Waiver Recommendation of this SWDAR

Based on past monitoring results and the susceptibility assessment of the Smith Valley Schools, *Upper and Lower Campuses* PWSs (as they are now configured, using deep fractured bedrock confined aquifer wells), both of the PWS appear to be eligible for several monitoring waivers. DEQ records suggest that the PWS currently has no monitoring waivers in place. Based on the monitoring history for the well, the results of the inventory, the susceptibility assessment of this SWDAR, the geology of the area, the nature of the aquifer from which the well draws water, the PWS production well may be eligible for volatile organics (VOCs) waivers, synthetic organics (SOCs) waivers, and some inorganic chemicals (IOC) waivers. For monitoring waiver consideration, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. If requested by DEQ, the PWS may also need to provide additional information.

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GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

Concentrated Animal Feeding Operations (CAFOs). Permitted facilities where animals are often confined and fed, resulting in a concentration of animal wastes. These concentrated wastes are a hazard to surface water and groundwater.

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

Delineation. A process of mapping source water management areas.

Effective Porosity. The percent of soil, sediment, or rock through which fluids, such as air or water, can pass. Effective porosity is always less than total porosity because fluids can not pass through all openings.

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

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

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

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

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

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

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

Pathogens. A bacterial organism or virus typically found in the intestinal tracts of mammals, capable of producing disease.

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

Porosity. The percent of soil, sediment, or rock filled by air, water, or other fluid.

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

SIC Code. The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy.

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

Susceptibility (of a PWS). The potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. pesticides).

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

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

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

Transmissivity. The ability of an aquifer to transmit water.

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

Volatile Organic Compounds (VOC). Any organic compound which evaporates readily to the atmosphere (e.g. fuels and solvents).

Recharge Region / Watershed. The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations and other sources

APPENDICES

Available Upon Request

Appendix A

DEQ PWS Database – Facilities Summary
DEQ PWS Database – Water Quality Data

Appendix B

Map of the Kalispell Study Area (for SWDARs)
Sanitary Surveys
Relevant Correspondence

Appendix C

Map of Area Wells
Well Logs for Wells Surrounding Upper Campus
Well Logs for Wells Surrounding Lower Campus

Appendix D

Underground Fuel Storage Tanks Summary

Appendix E

Concurrence Letter