PLEASANT VALLEY COLONY
WELLHEAD PROTECTION PLAN

PWSID# MT0003304

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PURPOSE
To meet the requirements of the 1986 SDWA amendments, Montana has implemented a wellhead protection program in which each community voluntarily submits a plan following the format developed by the Department of Environmental Quality.

In 1991 the National Rural Water Association, under EPA guidance, established their Wellhead Protection Program for small water systems in thirteen states. As of May 1994, Montana Rural Water Systems received funding to begin offering wellhead protection plans to Montana's small groundwater utilities.

This report presents the technical requirements for the completion of the wellhead protection plan for the Pleasant Valley Colony, Belt, Montana, as required by the 1986 amendments to the Safe Drinking Water Act (SDWA).

A wellhead protection plan is designed to protect the groundwater used by communities from contamination. The plan establishes protected areas overlying the aquifer yielding water to the well and extends upgradient a prescribed distance. The extent of the upgradient protection area is determined by computer modeling of the aquifer and projecting the well's capture zone as determined for one, five, and ten year scenarios. Such long term planning is necessary to provide an early warning mechanism in the event of upgradient contamination, however, preventing the contamination of a water supply through education and public awareness remains the primary goal.

Most instances of aquifer contamination become known when trace levels of a contaminant are detected through routine monitoring. Drinking water systems that have completed a wellhead protection plan will have information on groundwater flow and aquifer hydraulic characteristics as well as a contaminant source inventory and thus will be in a good position to determine the best response to ensure the continued quality of the water supply.

CHAPTER 1
INTRODUCTION

Pleasant Valley Colony is in north central Montana approximately twenty miles southeast of Great Falls in Section 1, T18N, R5E (see appendix 1) . The colony is located on rolling bench land on the north side of the Little Belt Mountains at approximately 4200 feet above mean sea level (see figure). The geology of the area consists of Cretaceous conglomerate, shales, mudstone, and sandstones of the Kootenai formation overlying the lower Mesozoic and upper Paleozoic formations which includes the Madison limestone, the aquifer tapped by the colony well.

The Little Belt Mountains south of the colony were formed as a result of a faulted crustal arch which brought the older Paleozoic formation to the surface. The Madison limestone is one of the most prominent of these formations. The depth to the top of the Madison limestone at Pleasant Valley Colony is about 500 feet (see appendix 2).

The colony had approximately 83 residents and livestock operations which include approximately 3000 hogs, swine processing operations, a dairy operation with approximately 400 cows, and other farm related activities. Additionally, the well is used for seasonal irrigation of garden.
A single 1062' deep well which taps the Madison limestone aquifer provides water to the PWS (see appendix 9, well log). The PWS system also includes a 56,000 gallon cistern, 2-800 gallon pressure tanks, water softening equipment, and a distribution system as shown in Appendix 3. The PWS has 15 service connections.

The Pleasant Valley Colony production well located in T18N, R5E, Section 1 CBD was completed in 1987 and produces 45 gallons per minute (GPM) of water. The static water level is 905 feet below ground surface'(BGS). Another well with similar geologic and hydrogeologic properties was drilled in 1986 for the colony but was abandoned due to well collapse. The production well log shows 517 feet' of shale and dry sandstone overlying the limestone aquifer. The limestone formation is described by the well log as being at least 500 feet thick. The shales act as a protective layer by inhibiting the downward migration of contaminants. Recharge to the Madison limestone occurs where the formation is exposed in the Little Belt Mountains 15 miles south of the colony and groundwater flow is north from the mountains toward the Missouri river, (see appendix 4).

The great depth to the aquifer and the presence of significant impermeable layers above it were important considerations when drafting this wellhead protection plan. Protection of the control zone around the wellhead is considered to be most important since this is the only likely location that contaminants could pose a significant risk to the well through conditions such as casing or grout failure.

The Pleasant Valley Colony public water supply system is under the control of Peter J. Waldner, certified operator, and John Waldner, president who will make all management decisions regarding wellhead protection plan implementation (see also chapter 3).


Pleasant Valley Colony
Great Falls
Highway 200
Belt
89
N
sewage lagoons
garden
irrigation storage
0
250
500
1,000 Feet
Slope

CHAPTER 2
DELINEATION

The capture zones for the well were modeled using the semi-analytical option for the General Particle Tracking Module and Multiple Well Capture modules of the WHPA model package. The WHPA Code, version 2.1, 1991 was developed for the U.S. EPA, Office of Groundwater Protection, by HydroGeoLogic, Inc.

The capture zone delineated for the Pleasant Valley Colony is for a ten year scenario. The model was constructed assuming the well was pumped continuously at maximum capacity for the duration of each step. The model requires values be assigned for the following parameters to delineate a capture zone:

- Transmissivity - the rate at which water can move through a unit width of an aquifer under a unit hydraulic gradient. It is a function of the type and thickness of the aquifer material. The transmissivity for this model was calculated using its relationship to specific capacity as determined by the well log where **$T=33.6(Q/s)^{0.67}=33.6(5775ft^3/d/119\ ft)^{0.67}=452ft^2/day$**. This calculated transmissivity corresponds with a hydraulic conductivity of approximately 1/ft/d which is within the expected range for a limestone aquifer.

- Hydraulic gradient - the change in total head per unit distance along the direction of maximum head decrease. The hydraulic gradient in the Madison limestone is 0.005 as derived from the regional flow map (see appendix 4).

- Formation thickness - estimated to be 579 feet based on the well log. Saturated thickness is approximately 157 ft.

- Discharge rate – the model assumes a constant discharge over a 24-hour period. The input value is based on an estimated maximum production of 30 GPM per 24 hour period or 5775 ft^3/day. This yields a conservative capture zone delineation that will still be safe as the water demand increases.

The WHPA delineation for a 10-year time of travel is shown on the base map (see appendix 5).

Two major assumptions are used in the application of groundwater flow models; 1) flow in the aquifer is uniform, and 2) flow in the aquifer is horizontal. A groundwater flow model for any specific set of conditions should be considered horizontal. Any particular modeling effort merely represents the best estimate of groundwater flow conditions based on known and estimated hydrogeologic and pumping conditions and should be modified as additional information becomes available.

Specific limitations on the Pleasant Valley Colony delineation include potential unknown factors relating to the structural configuration of the Madison formation. For instance, solution channels or karst conditions can allow groundwater to travel large distances in short time periods and while

the potentiometric map generally shows groundwater flow to be from the southeast to the northwest joints, fractures, and/or faults may affect groundwater flow in local areas. These local effects cannot be factored by the WHPA model. Additionally, the model assumes the discharge rate is valid for every day of the model run time while the actual rate is probably much lower.

The delineation shown on the base map (appendix 5) represents the estimated capture zone which assumes the flow direction is valid within 45 degrees and is based on a maximum daily pumping rate. This should yield a capture zone that will still be safe as the water demand increases.

The depth of the water bearing formation, the distance to the nearest surface water, and the bacteriological history of the source indicate the Pleasant Valley Colony well is not under the direct influence of surface water. A Montana Department of Environmental Quality (DEQ) "Preliminary Assessment" form is attached as appendix 6.

CHAPTER 3
INVENTORY

A potential contaminant source inventory generally lists the location of potential contaminant sources in relation to the well. At Pleasant Valley Colony the confined nature, possible upward gradient, and great depth of the aquifer (Feltis, 1980) render an assessment of the recharge area to be of little practical value.

Therefore, the main area of interest upon which to focus is in the vicinity of the wellhead and relates to contamination threats which could enter the well through the casing or borehole.

The land area above the identified 10 year capture zone is controlled by the Colony. The well's depth and the shale and dry sandstone formations above the aquifer protect the well from any potential surface contaminant sources while an existing monitoring well provides a means for determining the potential impact of a large surface spill to the shallow groundwater.

The colony complex consists of 5 barns, a slaughterhouse, kitchen, school, and 2 sets of barracks. Waste water from the kitchen, barracks, and school is collected by a central sewer system and treated in the sewage lagoon located down-gradient from the production well. Lagoon effluent is land applied as needed on an approved site also northeast or down-gradient from the well. Domestic waste is not considered to be a potential threat to the well.

Waste from the slaughterhouse is pumped to the lagoon.

Above ground fuel storage tanks are located as shown on appendix 3.

Fertilizer is anhydrous ammonia.

Weed control is used in the colony complex area, on crops, and along the county road and is all 2-4-D.

The well is sited within 50 feet of two structures (see appendix 3). The north building is the hog barn and the south building is the chicken barn. Both buildings are modern facilities on concrete foundations with internal manure handling facilities. All manure and contact water is collected and land applied on crop land down-gradient of the well. A monitoring well is available approximately 100 feet upgradient from the production well and can be used to monitor conditions in the very shallow groundwater. Additionally, the colony has installed a series of best management practices to control run-off and to ensure the nutrient enriched waste are routed away from the production well.

For organic chemical monitoring waiver application purposes, all land uses within one mile of the well are shown on the attached 7.5 minute quad map (appendix 5), Completed MDHES Forms 1 and 2 are as well as a MDF1ES Form 3 for each identified land use with the 1 mile radius of the well are found in appendix 9.

The inventory will be updated by the certified operator annually with the update forwarded to DEQ every five years in order to ensure continued certification of the wellhead protection plan.

CHAPTER 4
MANAGEMENT

The goal of the Pleasant Valley Wellhead Protection Plan is to, 1) protect the source water by keeping activities and associated potential contaminant sources out of the control zone, and, 2) to manage the inventory region by ensuring that land use activities pose minimal threats to the source water.

Three source water protection areas: the control zone, inventory region, and recharge region are delineated for the Pleasant Valley Colony as it is a community PWS (DEQ, 1999). The control zone is the area within a 100- foot radius of the Pleasant Valley Colony well. Within this radius all development will be restricted to existing levels only. Maintenance of surface water run-off away from the wellhead will be a priority and all potential contaminant spills will be promptly cleaned up.

The next source water protection area is the inventory region. The inventory region will include land that is owned by the colony and which is located upgradient from the well. The inventory region extends southward from the colony complex to the county road. Within this area best management practices will be used to protect the aquifer. For example, pesticides will be applied at label rates by licensed applicators. Lagoon effluent will be applied only on approved sites at calculated agronomic rates. Wells will be constructed in accordance with the applicable administrative rules to ensure they are properly constructed and maintained.

The third source water protection area is the recharge region for the well. This is the outcrop area of the Madison formation in the Little Belt Mountains approximately 20 miles south of the colony. The recharge region is generally under the control of the U.S. Forest Service. No special management efforts relating to groundwater protection in this area are proposed at this time due to the very long time of travel between the recharge area and the well (estimated by USGS to be in excess of 500 years).

The land use activities identified in this section will be managed by:

Peter J. Waldner	Certified Operator	(406)736-5204	Rte2, Box l31 Belt MT 59412

The certified operator maintains the PWS wells and distribution system in satisfactory condition. The operator will also be responsible for all spills, spill clean-up, and for keeping potential contaminant sources out of the 100- foot control zone around the well.

John Waldner	SWP Contact	(406) 736-5204	Rte 2, Box 131 Belt MT 59412

This position works with the operator to ensure proper water protection practices are used in the inventory region or recharge region. He will also be responsible to ensure that colony bosses understand the wellhead protection management plan and that land use activities reflect this understanding. Training will be done annually.

The success of the management effort will be measured by changes noted on the annual inventory update. A decrease in land use activities in the inventory region or managed area recharge region which require the use of water quality protection practices will be considered an indicator of success.

Conversely, an increase in activities and associated potential contaminant sources in this area will indicate that the education component is insufficient and additional efforts will need to be employed. This type of evaluation will be performed every five years at the same time the inventory is updated to maintain state certification.

The following table identifies potential contaminant sources in the control zone and inventory region, identifies the susceptibility of the well to these potential contaminant sources, and identifies management recommendations that can be implemented to protect the source of drinking water to the Pleasant Valley Colony well.

Table 1. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendation
Wastewater treatment facilities (lagoons), sludge handling sites, or land application areas	VOCs, SOCs, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into groundwater	**Low** -Deep Confined Aquifer -Proper Well Construction -No other wells in inventory region	None	**Moderate to Low**	Review permit status (contact DEQ Permitting and Compliance Water Protection Bureau – 406-444-3080 for more information) and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention and BMPs.
Cropped Agricultural Land Use	SOCs, Nitrates, Pathogens	Contaminants leaching into groundwater	**Low** -Deep Confined Aquifer -Proper Well Construction -No other wells in inventory region	None	**Moderate**	Notify landowners of well and protection area locations. *E*ncourage and support efforts to provide educational information, materials, and resources to land owners on the proper application and storage of pesticides and fertilizers and implementing agricultural best management practices (BMPs).
Animal Feeding Operation	Nitrates, Pathogens	Improper storage and management of animal wastes may impact drinking water supply.	**Low** -Deep Confined Aquifer -Proper Well Construction -No other wells in inventory region	CAFO or AFO plant is operating within its regulatory permit.	**Low**	Notify landowners of well and protection area locations. Encourage use of agricultural best management practices (BMPs) to ensure wastes do not impact groundwater. Support efforts to monitor integrity of animal waste storage units/areas and encourage disposal of wastes outside of inventory region. Encourage use of agricultural best management practices (BMPs) in the watershed to keep cattle away from the wells and stream especially directly upstream of the well locations.

Above Ground Fuel Tanks	VOCs, petroleum hydrocarbons	Spilled Contaminants leaching into groundwater	**Low** -Deep Confined Aquifer -Proper Well Construction -No other wells in inventory region	Spill prevention	Low	Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, and BMPs.

Notes: VOCs - Volatile organic compounds (i.e. solvents, fuel components) SOCs - Synthetic Organic Compounds (i.e. pesticides, herbicides, plasticizers)

UST - Underground Storage Tank LUST - Leaking Underground Storage Tank_

BMPs - Best Management Practices DEQ - Montana Department of Environmental Quality

NOTE: WELL IS A DEEP MADISON COMPLETION AND APPEARS TO BE PROPERLY GROUTED AND SEALED.

CHAPTER 5
EMERGENCY PLANNING

The emergency plan for Pleasant Valley Colony was developed with the assistance of DEQ and the Cascade County Disaster and Emergency Services (DES) coordinator. An overview of the emergency plan is described here, however, the emergency plan document can be found in its entirety as appendix 7.

The emergency plan 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 arises. Other important aspects of the plan is an estimate of the equipment and materials that would be needed in the event of an emergency, 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.

Important emergency contacts and phone numbers

Peter J. Waldner	736-5204	Emergency coordinator and PWS operator	all PWS issues
John Waldner	(406)736-5204	President. Pleasant Valley	all PWS issues
Vince Kolar	(406) 454-6900 Office	Cascade County Disaster and Emergency Services	all spills or releases of hazardous materials
Sandy Johnson	(406) 454-6950 Office	Cascade City-County Health Department	PWS regulatory questions, spill questions
MT DES 24-hr Spill Reporting	(406) 431-0411	DES Duty Officer	all reportable spills
DEQ 24-hr Spill Reporting	(406) 431-0014	DEQ Duty Officer	all reportable spills
Chad Anderson	(406) 444-2711	DEQ Enforcement Division	spill regulatory and response questions
Greg Murfitt	(406) 444-5400	MT Dept of Agriculture	All agricultural chemical or fertilizer spills or questions

CHAPTER 6
ALTERNATE WATER SOURCES

The current well has proven adequate for the needs of the colony and no new wells are anticipated in the foreseeable future.

REFERENCES

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