Source Water Delineation and Assessment Report

Public Water Supply: **Moonlight Basin Ranch (PWSID #MT0004023)**
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Introduction

This delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (DEQ, 1999) and the Federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). Laura Rennick, an intern with the Source Water Protection Program (SWPP) at the Montana Department of Environmental Quality (DEQ) prepared this report and Jim Stimson, Hydrogeologist with the SWPP reviewed and edited the report. Information on land use and potential contaminant sources comes from a variety of sources including a preliminary land cover data layer produced by the United States Geological Survey (USGS), DEQ Public Water Supply files (including sanitary surveys), and other public sources of information. A web-based GIS application was also used to query and generate maps to support the writing of this report. This application is called the Source Water Protection Program Query System and is available at the following web address or URL: http://nris.mt.gov/wis/swap/swapquery.asp. The application was developed by the DEQ Source Water Protection Program (SWPP) and provides access to data from the U.S. EPA, DEQ, Montana Bureau of Mines and Geology (MBMG) and other sources.

Purpose

The purpose of this delineation and assessment report is to assess threats to The Moonlight Basin Ranch public water supply using information obtained from personnel managing the site, the most recent sanitary survey, which was completed July 16, 2002, by Janet Cherry, of The Cadmus Group, Inc., and from published reports. Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water are identified on a map. These areas are referred to as source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

This report is modified to include information relating to multiple proposed wells and fulfill the PWS-6 requirements for this transient public water supply. Sections pertaining to the proposed wells are denoted by a "*PWS-6 Related*" heading. This report fulfills the PWS-6 requirements for this public water supply. The locations selected for the proposed wells will not result in this public water supply being highly susceptible to any

potential contaminant source identified and located within the inventory region shown in Figure 1 and Figure 2. PWS-6 related information and revised site plans are included in Appendix A at the end of this report.

Public Water Supply Information

The Moonlight Basin Ranch is located just west of Big Sky on Highway 64, about 15 miles west of Highway 191. The system consists of one lodge, 85 townhouses, 37 rental cabins, 4 condominiums, and 26 lots for future homes. Water for the system is supplied from two ground water wells (Figure 1 and Figure 2). The water system supplies water to a transient population of about 20 people daily in the summer and about 200 people daily in the winter. Because the water supply does not regularly serve the same 25 persons for at least six months a year, it is classified as a transient, non-community public water supply (Sanitary Survey, 2002).

Well #1 is located to the south of the lodge. The well log states that Well #1 was drilled on October 25, 1995 to a depth of 296 feet, cased with 6-inch steel to a depth of 138 feet and cased with 4.5-inch PVC from a depth 135 feet, to 296 feet. The well is grouted to a depth of 20 feet with cement. The well's casing extends 30 inches above ground level. The static water level is 52 feet, while the pumping water level is 127 feet. The well yields 175 gpm. Water is pumped with a 30 horsepower submersible pump (Sanitary Survey, 2002).

Well #2 is located to the south of the lodge, about 40 feet from Well #1. The well log states that Well #2 was drilled on November 15, 1996 to a depth of 320 feet, cased with 6-inch steel to a depth of 86 feet and cased with 4.5-inch PVC from a depth 83 feet, to 320 feet. The well is grouted to a depth of 22 feet with cement. The well's casing extends 24 inches above ground level. The static water level is 3 feet, while the pumping water level is 78 feet. The well yields 250 gpm. Water is pumped with a 40 horsepower submersible pump. Well #2 is the primary water supply for the system (Sanitary Survey, 2002).

Both wells pump to a common header. Water then travels through a 6-inch transmission main to a 318,000-gallon storage tank. The tank is periodically disinfected with chlorination. Water then travels through 10-inch distribution mains to the distribution system (Sanitary Survey, 2002).

The well logs state the lithology of the aquifer consists of mostly shale, sandstone, and clay layers. For the purpose of this assessment, the aquifer that Moonlight Basin Ranch wells tap is interpreted to be confined. The aquifer is assigned a low sensitivity rating to potential contaminant sources in the area, in accordance with the Source Water Protection Guideline document (MT DEQ, 1999). If additional accurate well completion information becomes available in the future please forward a copy to DEQ.

Moonlight Basin Ranch is required to test for microbiological contaminants and nitrate. The well system must complete monthly bacteriological samples, as well as an annual nitrate sample. In the past five years (2000-2004), the water supply has had 12 positive

total coliform detects, and 1 positive fecal detect in July 2002. Samples have been good since that time. The highest nitrate reading recorded for water system in the past five years was 0.23 mg/L in 2003. The lowest nitrate reading recorded for the system in the past five years was 0.11 mg/L in 2004. There was no nitrate sample for 2000. The average nitrate reading for the past five years is 0.15 mg/L. These levels are below the maximum concentration level (MCL) for nitrate is 10 mg/L set by the U.S. Environmental Protection Agency (EPA).

The sanitary survey for Moonlight Basin Ranch recommends doing a routine disinfection of the storage tanks. Regulations state that storage tanks should be drained, cleaned, and disinfected once every 5 years. In addition, as maintenance and improvements or additions are made to the system, system disinfection should be practiced on a regular basis. It would be beneficial to install a full time treatment system (Sanitary Survey, 2002). At this time it is unknown if these recommendations have been implemented.

PWS-6 Related Information: In April 2005 a PWS-6 report was submitted for six proposed wells to serve a golf course, clubhouse, and 250 residential units. At the time of submittal, the public water supply serving the golf course was separate from the Moonlight Basin public water supply. Currently Treeline Springs plans to operate the Moonlight Basin and the golf course as a single public water supply that will eventually include up to 13 wells (Figure 1 and Figure 2, and Appendix A (Cover letter from Stahly Engineering). Proposed well locations are shown on Figure 1 and Figure 2 and on the revised site plans for the public water supply (Appendix A). The proposed wells will be completed in a fractured bedrock aquifer present at 35 to 300+ feet below the land surface. As with the existing wells, the aquifer is assigned a low sensitivity rating to potential contaminants located at the land surface. Due to the proposed well locations, there are no potential contaminant sources present up-gradient within the inventory region.

Delineation

Two source water protection zones are delineated for Moonlight Basin Ranch. They include a 100-foot radius control zone and an inventory region terminated along local watershed and ridgelines (Figure 1 and Figure 2). Ground water flow direction in this area is interpreted to be generally from the higher elevations down into the valleys. Close to streams ground water flow direction is interpreted to be generally parallel to the stream. Ground water flow direction in this area is interpreted to be generally from the south-southwest toward the north-northeast. The control zone is the most critical area from which direct introduction of contaminants into the well or immediate area can occur. The inventory region encompasses the area from which water or contaminants can flow into the Ranch's water supply over a period of months to years.

PWS-6 Related Information: The inventory region described above is adequate for all of the proposed wells based on the locations show on the revised site plans in Appendix A.

Inventory

The Montana Source Water Protection Program (Montana DEQ, 1999) requires that land uses and all potential sources of nitrate and microbial pathogens within the control zone and inventory region be identified.

Analysis of the area surrounding Moonlight Basin Ranch reveals that the predominant land covers are grassland, shrubland, forest, and bare rock. None of these land uses are considered to represent a significant source of contamination.

Moonlight Basin Ranch and its related development are served by a waste water treatment plant located at the Ulreys Lake site Septic density is used to assess the extent of individual septic tanks in the area, which can be potential sources of contamination (Figure 1). Most of the land in the inventory region is low; there is a small area of land that is medium septic density.

PWS-6 Related Information: There are no identifiable potential contaminant sources in up-gradient locations within the inventory region due to the remote location of the ski resort and the proposed public water supply wells.

Susceptibility Assessment

Susceptibility to potential contaminant sources is assessed for a public water supply well. As previously mentioned the well log for Well #1 states that it was sealed to a depth of 20 feet with cement, and the well log for Well #2 states that it was sealed to a depth of 22 feet with cement. Well log information helps verify that the well is constructed properly and helps identify the aquifer that the well is completed in. When constructed properly, shallow ground water that is more vulnerable to contaminant sources at the land surface is prevented from entering the well's bore hole and co-mingling with water from the deeper aquifer. Under some circumstances, the well bore would act as a conduit for contaminants entering the deeper aquifer. In this case, the aquifer is considered to be confined and is assigned a low sensitivity to potential contaminant sources located in the area (Montana DEQ, 2000, Table 2). The cross or down-gradient location of some of the potential contaminant sources is used as a barrier for the water supply system. This means ground water is flowing parallel or away from the well and not towards it.

A significant potential source of nitrate and bacteriological contamination is the wastewater treatment facility and service lines from the development. This waste water system is given a hazard rating of high. However, with the down-gradient location and confined nature of the aquifer, susceptibility is set to low (Montana DEQ, 2000, Table 9b).

PWS-6 Related Information: The susceptibility analysis completed for the existing wells is also valid for the proposed well locations.

Management Options

Possible management options for potential contamination consists primarily of directing future development and sewer service lines away form up-gradient locations for the proposed wells and, if there is a weed control program, not using pesticides or herbicides in close proximity to the wells once they are constructed. The hazard and susceptibility ratings for each potential contaminant source as well as management options are summarized in Table 1.

References:

DEQ Permitting and Compliance Division, 2002. Sanitary Survey for Moonlight Basin Ranch PWS- PWS ID: #MT0004023.

Montana DEQ, 1999. Montana Source Water Protection Program, Approved by EPA in November 1999.

Montana DEQ, 2000. Montana Source Water Protection Program, Template for Non-Community Transient Public Water Supplies, Revised 2002.

Montana State Library - Natural Resources Information System (NRIS) 2000 map base of the USGS Topographical coverage at 1:24,000 scale in MrSID format.

U.S. EPA, Office of Water, 1991. Manual of Small Public Water Supply Systems, EPA 570/9-91-003, 211 p.

U.S. Geological Survey, 2000. National Landcover Dataset, Montana. 30-meter electronic digital landcover/land use dataset interpreted from satellite imagery.

Table 1. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendation
Wastewater Treatment Facility and service lines	Nitrates, Pathogens	Ongoing or catastrophic leakage of sewage into ground water	**High**	Down-gradient Location Confining layer of aquifer	**Low**	Maintain service lines and facility. Direct development away from up-gradient locations and well locations.

Figures
Figure 1 and Figure 2

Sanitary Survey

APPENDIX A – PWS-6 Related Information.