

Nomination of Big Sky for GWIP Project Consideration

By DNRC-Water Resources Division

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The purpose of this document is to provide the GWIP Steering Committee with additional information for the consideration of Big Sky as a potential GWIP Watershed Study Area.

The DNRC (Bozeman Regional Office) has received applications for replacement wells in the Big Sky area in recent years. In order to issue these replacement well applications, applicants must show that the new well is completed in the same aquifer as the previous well. This criterion is difficult for applicants to show given the nature of the bedrock aquifer(s). It is also difficult to determine any potential adverse effects to neighboring water right owners because the volume of water stored in bedrock aquifers is difficult to estimate. A GWIP study might provide insight to the connectivity of the bedrock aquifers which would benefit the DNRC and water right applicants during review of water right applications.

The DNRC has heard discussion about developing water from the Madison Limestone Aquifer at Big Sky. This aquifer/formation covers much of Montana and is also thought linked to the Yellowstone hydrothermal system. The extent of this aquifer, the development potential of this aquifer, and the effects of developing this aquifer at Big Sky are currently unknown.

While the Madison and Gallatin surface water basins are clearly defined in the Big Sky area, the direction of groundwater flow is unknown. Determining whether groundwater underneath Big Sky is connected to the Gallatin River or Madison River would increase our ability to assess the viability of mitigation plans for new groundwater appropriations. For example, more water is available to be converted to a mitigation purpose in the Madison River watershed compared to the Gallatin River watershed. If wells drilled in Big Sky are shown to be connected to the Madison River watershed, future water development may be enabled through conversion of existing Madison River water rights to a mitigation purpose.

The Steering Committee may want to consider a new statistic of water right density when considering the criteria scoring of the Lower Madison Valley project versus the Big Sky project. For example, the Big Sky project area could encompass approximately 75 square miles in which there are currently 473 water rights, leading to a density of **6.31 water rights per square mile**. Similarly, the Lower Madison Valley (Ennis to Three Forks) is approximately 570 square miles with 1594 water rights, leading to a density of **2.80 water rights per square mile**. These water right density calculations help one visualize the potential impact/importance based on the size of a GWIP project. In this case, a project in Big Sky may provide relevant information to more water rights than a Lower Madison Valley project with respect to the areal extent of each project.

The Steering Committee may want to revisit the criterion evaluation of New Wells for the Lower Madison Valley and the Big Sky projects. Looking at wells drilled between 2006 and 2010, the Lower Madison Valley area experienced 106 new wells while the Big Sky area saw 142 wells completed.

Adjusting for project area leads to a density of **0.16 and 1.89 new wells per square mile for the Lower Madison Valley and Big Sky, respectively**. A density factor 10-times greater in Big Sky would suggest that the 3.5 value attributed to both projects for the “New wells 2010” criterion could be adjusted to reflect the large difference in new wells.

The Big Sky area has been subject to past and current hydrology studies. In 1972, the Montana Bureau of Mines and Geology published Wayne Van Voast’s *Hydrology of the West Fork Drainage of the Gallatin River, Southwestern Montana, Prior to Commercial Recreational Development*. The USDA Soil Conservation Service and the USGS have also published relevant hydrologic investigations for the Big Sky area (see Van Voast report). Current water quality monitoring programs are carried out by the Blue Water Task Force (<http://www.bluewatertaskforce.org/index.php>) and the Gallatin Local Water Quality District (http://www.gallatin.mt.gov/Public_Documents/GallatinCoMT_WQDPages/lwqdinfo). These past and current studies may warrant a re-evaluation of the “Information 2010” criterion for the Big Sky project in the GWIP steering committee’s prioritization matrix.