Hydrogeology of Snowy River Passage, Fort Stanton Cave, New Mexico

Brad Talon Newton

NM Bureau of Geology, 801 Leroy Place, Socorro, NM, 87801, talon.newton@nmt.edu

Fort Stanton Cave is located in the upper Rio Hondo Basin in the northern Sacramento Mountains in south central New Mexico. Until recently, this cave has been mainly of recreational interest, but in 2001, the Snowy River Passage was discovered due to digging efforts. Since its discovery, the length of the cave has increased from three miles of known passage to over forty miles, making it the second largest cave in New Mexico behind Lechuguilla Cave. There are many exceptional aspects of Snowy River including the white calcite formation that lines the stream bed along most of the known length of the passage. Several ephemeral flooding events in Snowy River Passage over the last 12 years sparked interest by researchers about the local hydrogeology of Fort Stanton Cave, specifically Snowy River. The primary goal of the study is to develop a conceptual model that describes the mechanisms by which water from the surface makes its way into the cave to flood the Snowy River channel based on available hydrologic and geologic data.

Flood hydrographs for Snowy River at Turtle Junction (the main access point to Snowy River Passage) are very interesting and provide clues about important processes in this hydrologic system. The shape and characteristics of these ephemeral hydrographs are peculiar and very different from most ephemeral flood hydrographs. All hydrographs at Turtle Junction show a very steep climbing limb where the depth of water at the measurement location at Turtle Junction increases from zero to over 30 cm in one to four hours. The duration of the observed floods ranged between two months and two years. All floods in Snowy River also exhibit similar shaped recession curves, which appear to be the result of the discontinuation of streamflow and downward drainage of water, rather than a gradual decrease in flow rate. The time that it takes for all of the water to drain from Snowy River ranges from a few days to several weeks. The peak flow, which exists between the climbing limb and the recession curve, usually maintains a depth between 30 and 35 cm, which correlates to the approximate location of the upper edge of the Snowy River calcite deposit.

Eagle Creek, an ephemeral stream located within the projected pathway of Snowy River Passage, is about five miles from the current known extent of the Passage. Chemistry and stream discharge data indicate that Eagle Creek is likely the main source of water for Snowy River. Seepage from Eagle Creek recharges a perched aquifer in the fluvial sediments that lie below the Snowy River calcite formation that lines the stream channel. Water in this aquifer leaks downward to recharge the regional aquifer. During periods of high stream discharge in Eagle Creek, when recharge rates exceed leakage rates, a pressure response to the head increase in the recharge area causes the water table to quickly rise above the streambed, initiating stream flow in Snowy River, which ultimately discharges at Government Spring and flows into the Rio Bonito.

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