

Use of the Manning Equation to Estimate Stream Discharge through Natural Slot Canyons and Artificial Slots

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Abstract. Stream discharge through narrow, deep slot canyons can be a major source of groundwater recharge in the arid Southwest U.S. However, the discharge is nearly impossible to measure as most slot canyons are dry except when filled with dangerous short-lived floods. The objective of this research is to determine whether the empirical Manning Equation gives an acceptable estimate of discharge through natural slot canyons and artificial slots. The advantage of the Manning Equation is that it estimates discharge without the need to directly measure stream velocity on-site. However, it is not obvious that the Manning Equation could be applied to natural slot canyons or artificial slots as the database used for development of the Manning Equation did not include either natural streams or artificial structures for which most of the friction occurs along the sides of the channel. The objective is being addressed by studying natural slot canyons and artificial slots that are fed either by perennial springs or rivers or by dam or mine drainage outlets so that it is possible to directly measure discharge at a wide range of stream depths throughout the year. Field sites for natural slot canyons within and outside of Zion National Park in southern Utah include Kanarrville Falls, Kolob Reservoir, The Narrows, The Right Fork, The Subway, Taylor Creek, and Water Canyon. Field sites for artificial slots include outlets for monitoring coal mine drainage constructed by Utah DNR in the Wasatch Plateau / Book Cliffs area. Results will be reported at the meeting.

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