

Use of the Manning Equation for the Design of High-Gradient Canals

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Abstract. The Manning Equation is an empirical equation for the estimation of stream or canal discharge based on the water depth, channel geometry, slope of the water surface, and an empirically-derived Manning roughness coefficient. The problem with use of the Manning Equation is that structures are being designed that have parameters outside of the database that was used to develop formulae for estimating the Manning roughness coefficient, including the high-gradient canals that are being permitted by Utah Division of Water Rights. Although formulae exist for steep mountain streams, natural streams tend to have a relationship among slope, depth and sediment size that would not apply to canals. The objective of this study is to develop a new formula for estimating the Manning roughness coefficient in high-gradient canals. The objective is being addressed by combining measurements on high-gradient canals of discharge, water depth, channel geometry, and slope of the water surface, in order to solve for the roughness coefficient. All study sites are in Utah County, Utah, and include earthen, concrete and rock-lined canals. Study sites include multiple measurements along the length of single canals at a wide range of slopes in order to emphasize the role of slope. As result of this study, it will be possible to determine the discharge that can be accommodated by a canal of a given material, size, shape and slope, which will allow for proper canal design that will avoid overflow or canal failure. Results will be reported at the meeting.