

ABSTRACT

Cunningham, Randy S. M.S.C.E., Purdue University, May 2012. Effects of Bendway Weir Size on Flow and Bank Stability in Erodible Channel Bends. Major Professor: Dr. Dennis Lyn.

Laboratory experiments were conducted to study the relationship between bendway weir size on both flow velocities and bank stability in a live-bed channel bend. Previous research has focused on fixed-bed experiments which relate velocity to shear stress and specific field applications. In this study, nine different experiments were conducted which consisted of a baseline case and three different weir configurations. Each weir configuration examined an increasing weir size, an area of concern in some field investigations which have shown bank erosion above the weir crest. These experiments were conducted with three different durations and two approach velocities; permitting analysis of duration in a non-equilibrium environment.

For each run, detailed velocity data were collected at selected cross-sections using an Acoustic Doppler Velocimeter. Velocity guidelines are conspicuously absent from bendway weir guidelines in HEC-23 and this information can be used to identify bank stability hotspots. This information can be correlated to channel locations which exhibited the most significant sediment transport effects. Bed elevations were obtained for each run with an acoustic sensor and used to analyze the sediment transport. The changes in bed elevation were used to identify and locate the impacts of increasing weir size. It was found that the HEC-23 guidelines for weir size provided less extensive bank protection than the experimental weirs which were considered oversized by those guidelines. It was also determined that weirs in the channel would invariably locate the highest velocity flow at the weir toes which would indicate a need for weir toe armoring in the guidelines.