

BIE 5300/6300 Assignment #4 Broad-Crested Weir Calibrations

28 Sep 04 (due 05 Oct 04)

*Show your calculations in an organized and neat format. Indicate any assumptions or relevant comments. You can use **ACA** or **WinFlume** if you like, or you can do calculations in a spreadsheet or other program.*

- I. You have to design a BCW for a concrete-lined trapezoidal canal with a bottom width of 2.0 m, inverse sides slopes of 1.25:1 (H:V), lining depth of 2.7 m, and maximum discharge of 12 m³/s. The Manning roughness is estimated to be 0.013, and the longitudinal bed slope is 0.000123 m/m. Make sure the BCW will operate under free-flow conditions up to $Q_{\max} = 12 \text{ m}^3/\text{s}$.
 - (a) Give the design dimensions for the BCW, and provide any relevant comments about the design and your assumptions.
 - (b) What is the minimum flow rate which can be accurately measured with your BCW design?
 - (c) Will the upstream canal walls need to be raised after installing the BCW when operating at $Q_{\max} = 12 \text{ m}^3/\text{s}$?
 - (d) Would you recommend including a DS ramp on the BCW? Why or why not?
 - (e) Suppose you include two 1-inch diameter PVC drainage pipes at the base of the BCW. What is the estimated discharge through the pipes at the 12 m³/s capacity of the BCW? Is this a significant fraction of Q_{\max} ?

- II. Use a spreadsheet or your own custom computer program to check the calibration of your BCW design from the problem above, but based only on energy-balance from upstream to the location of critical flow on the sill. In this case, you will assume free-flow conditions at the BCW.
 - (a) Do the comparison for the full flow range of the BCW.
 - (b) Make a graph (two curves) of h_u versus Q for the full calibration (from the problem above) and for the simpler energy-balance calibration.
 - (c) Are the two calibrations significantly different in this case?

- III. Suppose the Parshall flume at the location (Logan Canyon) of our field exercises is getting badly deteriorated and needs to be replaced. A decision is made to install a BCW instead of the Parshall flume, at approximately the same location. Based on your lab data, and a Q_{\max} of 40 cfs, what BCW design dimensions and features would you propose?