Bridge Analysis
Workshop

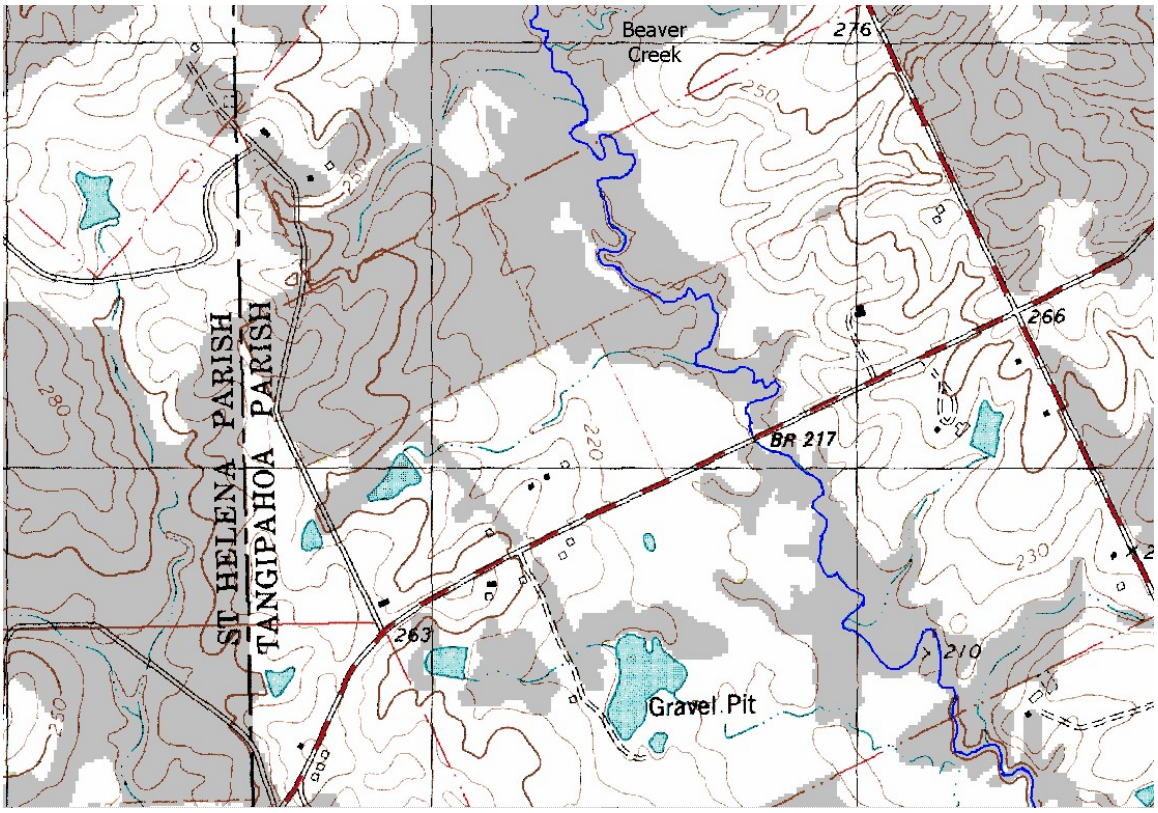
1 Objective

This workshop will help students learn how to use HEC-RAS to perform water surface profile computations through a bridge. Students will review and understand pertinent bridge output for the different modeling approaches and adjust the geometry to improve the bridge solution.

This workshop is a continuation from the previous Bridge Development workshop that guided student though adding a bridge to an existing geometry.

2 Background

The stream for this example is a section of Beaver Creek located near Kentwood, Louisiana. The bridge crossing is located along State Highway 1049, near the middle of the river reach. The field data for this example was obtained from the USGS study "Backwater at Bridges and Densely Wooded Flood Plains, Beaver Creek Near Kentwood, Louisiana" by George J. Arcement, B.E. Colson, and C.O. Ming.



3 Compute Steady Flow Plans

1. **Start HEC-RAS**
2. **Open** the **"BridgeAnalysis"** workshop in the Bridge Analysis Workshop folder.
    a. **Note** if you are confident in your work, use your completed Bridge Development workshop as a starting point.
3. **Compute** each of the plans:
    a. **"**Bvr Crk" : *Existing geometry without a bridge*
    b. "Bvr Crk Br.–*Energy": Geometry w/ bridge using Energy for High Flow*
    c. "Bvr Crk Br.-*PW": Geometry w/ bridge using Pressure Weir for High Flow*

4 Review Initial Results

4. **Compare** the initial results of the three plans using the Cross-Section Plots and Profile Plots. Answer the question below.

Question: What plan resulted in the Highest WSELs upstream of the bridge for the May 1974 Profile (14,000 cfs). For both bridge plans, how much higher were WSELs than the without bridge plan?

Question: How far upstream does the bridge impact WSELs?

Question: For the May 1974 profile, what difference do you see in the shape of the profile through the bridge for the two bridge plans?

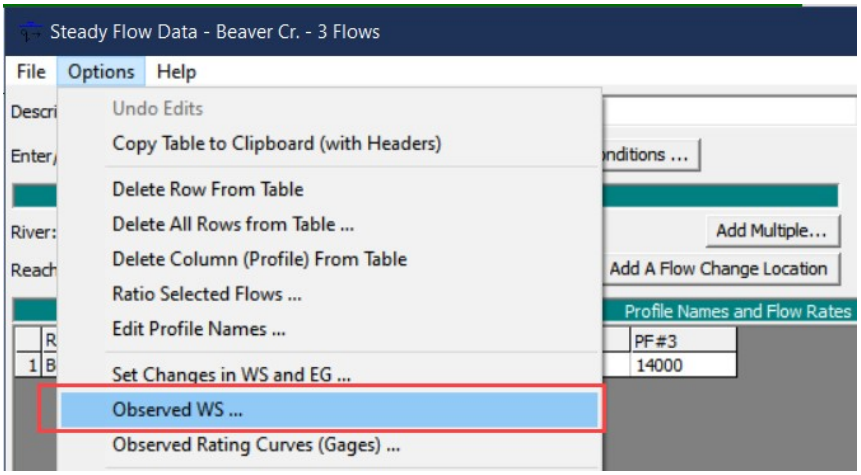
5 Compare Computed Results with Observed Data

Lucky you, there are observed data for the 14000 cfs event that occurred 22 May 1974. The USGS observed high water marks are provided below.

Cross Section River Station	Observed WSE (ft)
5.99	220.0
5.76	218.4
5.61	218.1
5.44	217.8
5.41	217.8*
Bridge 5.4	
5.39	215.2*
5.3	214.9
5.13	213.6
5.0	211.8

*The observed high water mark at this location is questionable.

5. Enter the High Water marks for each XS in the Steady Flow Data Editor



6. **Compute** and compare results against observerd

Question: Which bridge high flow modeling approach looks more appropriate for this bridge and why? Does this line up with your initial guess from the previous workshop?

6 Adjust Ineffective Flow Areas for the Pressure Weir

7. Looking at the results for the bridge cross section plot, **adjust the trigger elevations** of the ineffective flow areas for the **pressure weir** bridge Geometry.
    a. When using pressure weir, the goal is for the ineffective areas to turn off as the *energy grade* exceeds the roadway on either side (i.e. when we begin to compute weir flow over the roadway).

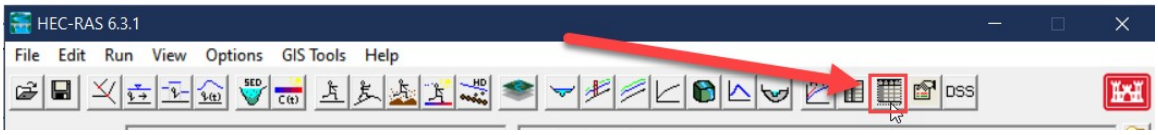
Question: Was any adjustment to the trigger elevation needed? Why or why not?

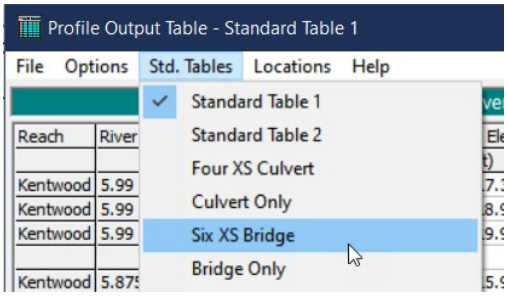
7 Adjust Manning's n to Balance Bridge Flow

When using the pressure weir method, the flow in the overbanks of the upstream and downstream cross-sections, should be reasonably close to the weir flow over the bridge roadway. In order to balance the flow distribution in the cross sections, you will adjust Manning's n for the upstream and downstream cross-sections.

8. **Create** a new **Geometry** from the pressure weir geometry and call it "Bvr Crk-PW-Balance". **Create** a new corresponding **Plan**

9. For the pressure weir Plan, open the Six XS Bridge Table, and the Bridge Only Table





10. Compare the total overbank flow at the upstream cross-section (5.41) to the weir flow for the bridge.
11. **Adjust** the **overbank Manning's n value** in the **upstream cross-section** in an attempt to match the brdige weir flow to the total overbank flow.
    a. Note you the total weir flow includes the weir flow over the center of the bridge as well
12. Similarly, **adjust** the **downstream cross-section** Manning's n to mathc the weir flow.

Question: How did this overbank Manning's n adjustment impact the results?