BAE 495R Homework 3 Stream Restoration

Create a concept design for restoration of Horrible Creek shown if the photograph below. Include sketches of the cross-section and plan view of the restored stream. The stream is currently an incised ditch on a golf course with no constraints upstream, downstream, or laterally. It is 4000 feet long with a channel cross-section that is 22 feet wide and 5 feet deep. The average slope is 0.01 ft/ft. The channel capacity is 660 cubic feet per second, which is the peak flow that occurs during a 6-inch rainfall on the watershed draining into Horrible Creek. At this flow rate, the average stream velocity is 6 feet per second, and the streambank erosion is severe.

The goals of the restoration are to create a more stable stream, improve water quality, enhance habitat, and provide two golf cart crossings. Flooding cannot occur on the golf course during the 6-inch rain. To accomplish stream stability, assume that the active channel should be no more than 2 feet deep with a capacity of 160 cubic feet per second and a velocity of 4 feet per second.

Your plan should include the following restoration components:

- Channel morphology and floodplain connection
- In-stream structures
- Streambank stabilization
- Streamside forest (riparian buffer)
- Habitat enhancements
- Stormwater management
- Crossings
- Monitoring and maintenance plan
- Public access and education

To help in designing your restoration plan, consider the following steps:

1. Select a floodplain connection plan (Priority 1, 2, or 3)

2. To reduce the average velocity at bankfull flow from 6 ft/s to 4 ft/s, the active channel must be shallower, flatter, and have a higher roughness.
    a. Set the design riffle Bankfull Mean Depth, $d_{bkf} = 2$ ft
    b. Reduce the slope of the channel by increasing the sinuosity (meandering) of the channel so that channel meanders through a floodplain that is 4 times as wide as the active channel
    c. Increase the channel roughness by adding structures and vegetation to the channel

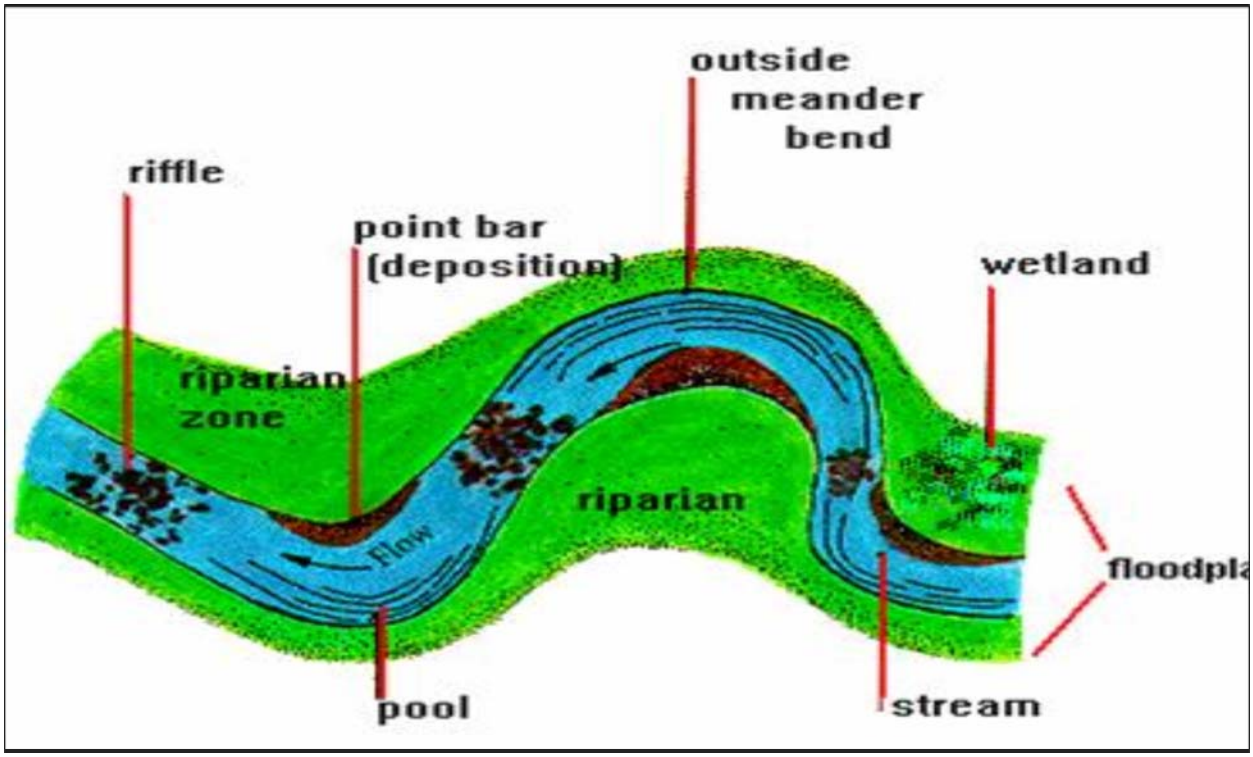
3. Use the Continuity Equation to calculate the channel's riffle Bankfull Cross-Section Area, A_{bkf}, based on the design Bankfull Discharge, $Q_{bkf} = 160$ cfs and Bankfull Mean Velocity, $V_{bkf} = 4$ ft/s:

$$A_{bkf} = \frac{Q_{bkf}}{V_{bkf}} =$$

4. After the Bankfull Area is determined in Step 3, use the design Bankfull Mean Depth, d_{bkf} = 2 ft, to calculate the design riffle Bankfull Width, d_{bkf}:

$$W_{bkf} = \frac{A_{bkf}}{d_{bkf}} =$$

5. Based on natural reference streams, the design Meander Length Ratio ranges from 5 to 8. This means that the length of each stream meander should be 5 to 8 times the active channel width (see schematic below). When creating a concept design plan view, the meanders should be drawn to scale using this ratio.



Meander Length from outside of bend to outside of the next bend on the same side of floodplain

Horrible Creek photograph (January, 2009)