WORKSHOP

DG1 – BENDWAY WEIRS
LEARNING OUTCOMES

• Describe the design concepts for bendway weirs

• Describe the design guidelines for bendway weirs

• Design bendway weirs for channel bank protection
PLAN VIEW

- LK - LENGTH OF KEY
- L - LENGTH OF WEIR
- S - SPACING
- W - CHANNEL WIDTH
- R - RADIUS OF CURVATURE
- PI - POINT OF MIDSTREAM TANGENT FLOWLINE INTERSECTION

[Diagram showing plan view with labeled components such as 'redirected flow', 'tangent line', 'captured flow', 'uncontrolled flow', and 'chord'].

[Legend for symbols: LK, L, S, W, R, PI]
CROSS SECTION

ORIGINAL BANKLINE

KEY

WEIR

DESIGN HIGH-WATER

MEAN ANNUAL HIGH-WATER LEVEL

MEAN LOW WATER

EXISTING CHANNEL

D_{100}(MIN)

A

SEASONAL MEAN WATER LEVEL

CROSS SECTION

SIDE SLOPES SET AT ANGLE OF REPOSE OR FLATTER

SECTION A-A-A
DESIGN CONCEPT

• Similar in appearance to stone spurs
• Not visible at stages above low water
• Intended to redirect flow using weir hydraulics over the structure
• Redirected flow is perpendicular to the weir axis and towards the channel centerline
DESIGN CONCEPT

- Not recommended for degrading or sediment deficient streams
- Bendway weirs have been constructed from stone, tree trunks, and grout filled bags and tubes
DESIGN GUIDELINES

• Based on experience

• Provided by LaGrone (COE), Saele (NRCS), and Derrick (COE)

• Formulas provided by LaGrone to consolidate many of the “rules of thumb” being used
DESIGN VARIABLES

- Height
- Angle
- Cross section
- Length
- Location
- Spacing
- Length of key
- Top width
- Number of weirs
- Construction
WEIR HEIGHT

• 30 to 50 percent of the depth at mean annual high water
• Below normal or seasonal mean water level
• Equal to or above mean low water
WEIR LENGTH

• Should cross the thalweg
• Should not exceed \(W/3\) (\(W/4\) for bank protection)
• Typically between \(W/10\) and \(W/4\)
• 1.5 to 2 times the distance from the bank to thalweg has proven satisfactory on some projects
WEIR SPACING

\[ S = 1.5L \left( \frac{R}{W} \right)^{0.8} \left( \frac{L}{W} \right)^{0.3} \]

\[ S = 4 \text{ to } 5 \]

\[ S_{\text{max}} = R \left( 1 - \left( 1 - \frac{L}{R} \right)^2 \right)^{0.5} \]
LENGTH OF KEY

\[ LK = S\tan(20^\circ) - L \]

for \( R > 5W \) and \( S > L / \tan(20^\circ) \)

\[ LK = \frac{L}{2} \left( \frac{W}{L} \right)^{0.3} \left( \frac{S}{R} \right)^{0.5} \]

for \( R < 5W \) and \( S < L / \tan(20^\circ) \)
MATERIAL SPECIFICATIONS

- Angular stone, no more than 30% of stones with $L > 2.5W$
- No stones with $L > 3.5W$
- Well graded, limited amount with $D < 0.5D_{50}$
- Standard riprap formulas for size
- HEC-11 or FHWA HI-95-038 for filter
DESIGN EXAMPLE

• Develop a preliminary layout for bendway weir placement at the outside bank of a stream bend

• The layout should include weir height, weir length, key length, and weir spacing
EXAMPLE SUMMARY

• Answers
• Other design constraints
• Further steps in design process
• Questions