

Jun 5th, 1:50 PM - 2:10 PM

Session C2 - Bed and Bank Design Considerations When Selecting Culvert Width

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Bed and Bank Considerations in Culvert Design



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Culvert Designs

Stream Simulation

Pass Game Fish
(hydraulic design)

Range of culvert designs

Worse

Better

Range of ecological functions

Flood
Capacity

Pass adult
salmon

Pass sediment, debris,
all aquatic organisms

Floodplain
Continuity

Floodplain
Process
Permitted
(meander
migration)

Make the Road Crossing “Invisible”





Bankfull a good estimator of channel forming flows (Wohlman and Miller, 1960).



Objectives

- **Fish and Other Aquatic Organism Movement**
- **Stream Functions (Sediment, Debris, Water)**
- **Minimize Risk of Road Failure**
- **Terrestrial Animal Movement**

60-INCH DIAMETER
CULVERT

Streambanks

Streambed

BANKFULL WIDTH &
ELEVATION

FIRST ESTIMATE OF
ABLE ROCK SIZE FOR
BANKS = 0.4 FOOT

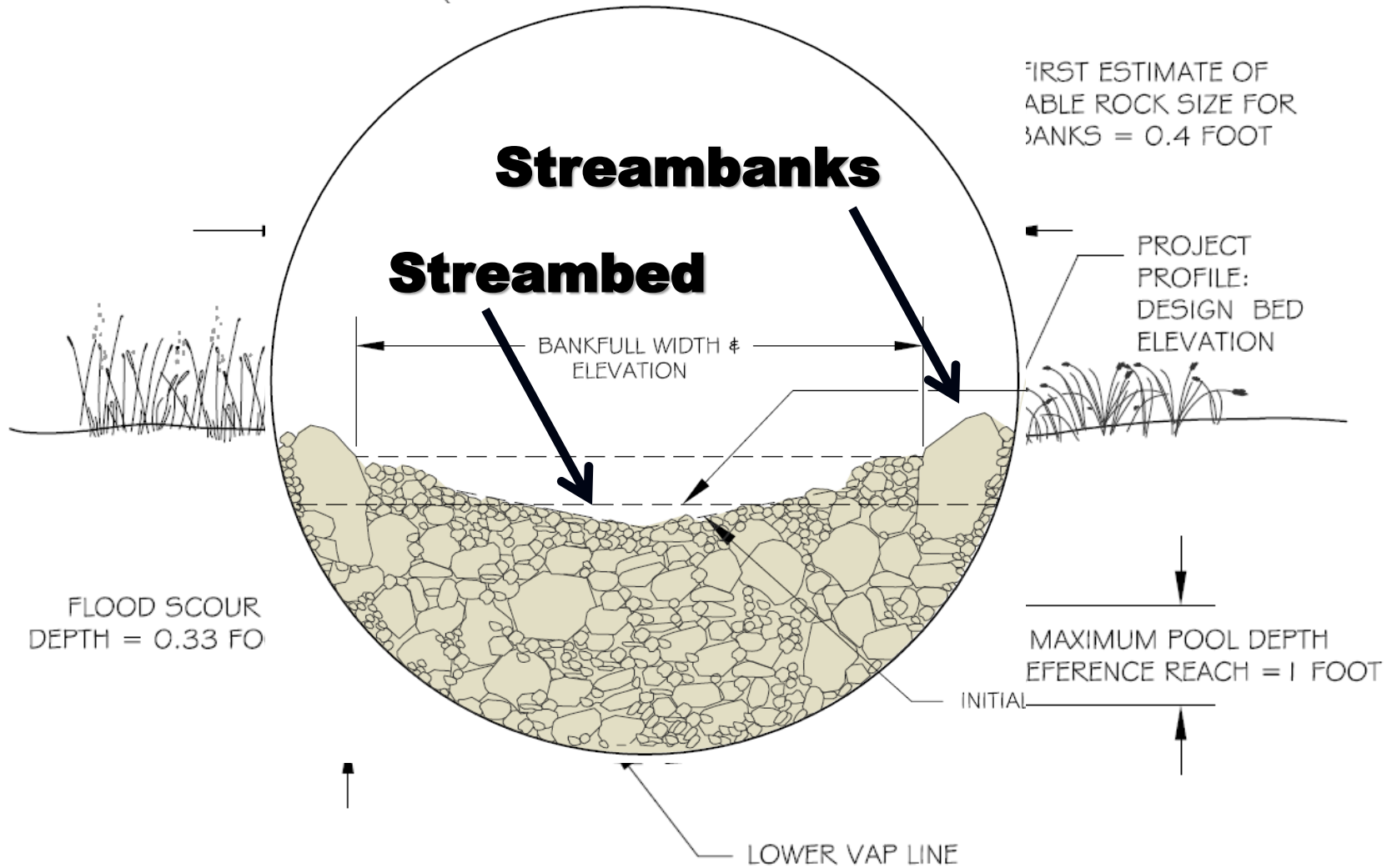
PROJECT
PROFILE:
DESIGN BED
ELEVATION

FLOOD SCOUR
DEPTH = 0.33 FO

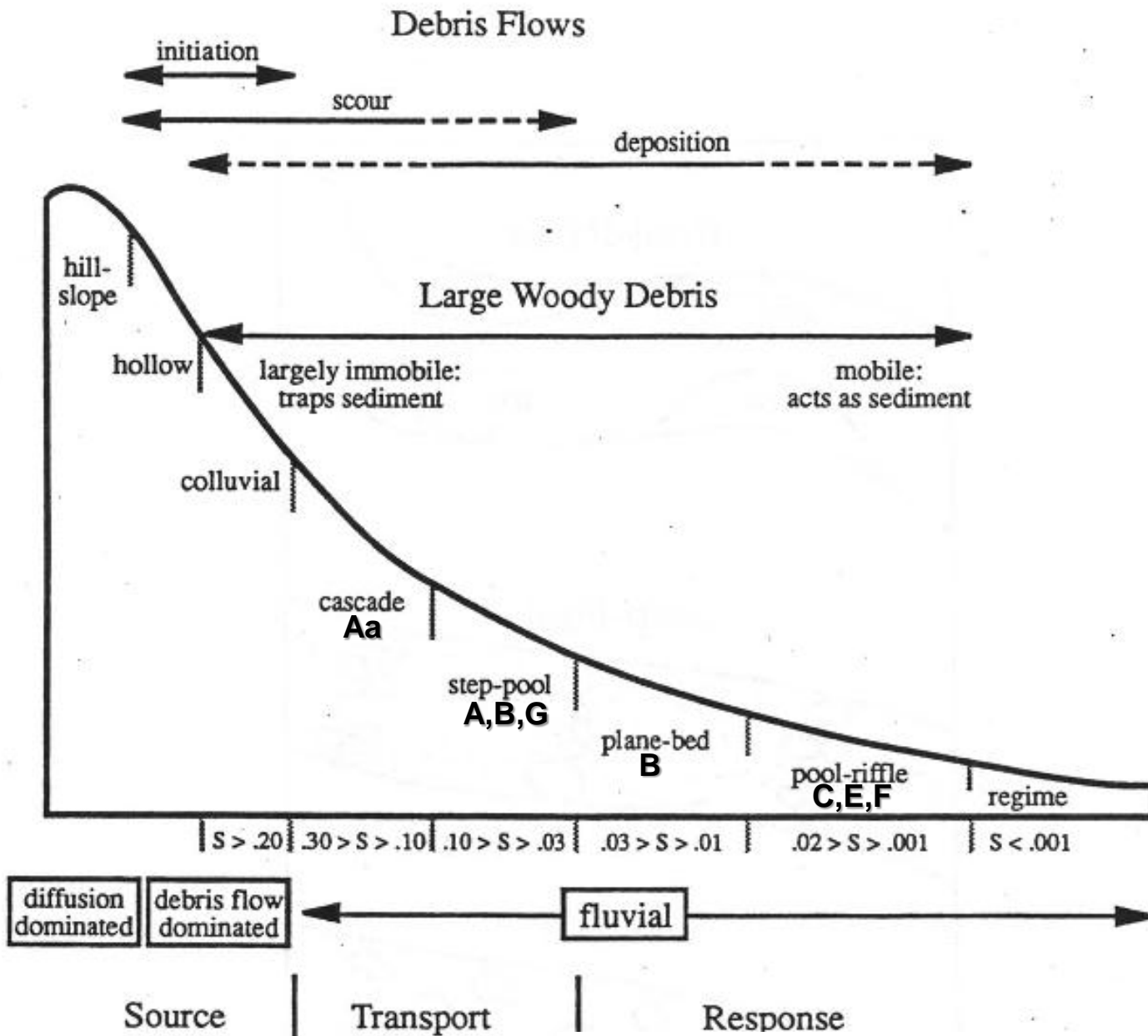
MAXIMUM POOL DEPTH
REFERENCE REACH = 1 FOOT

INITIAL

LOWER VAP LINE



Watershed Position and Geomorphic Processes

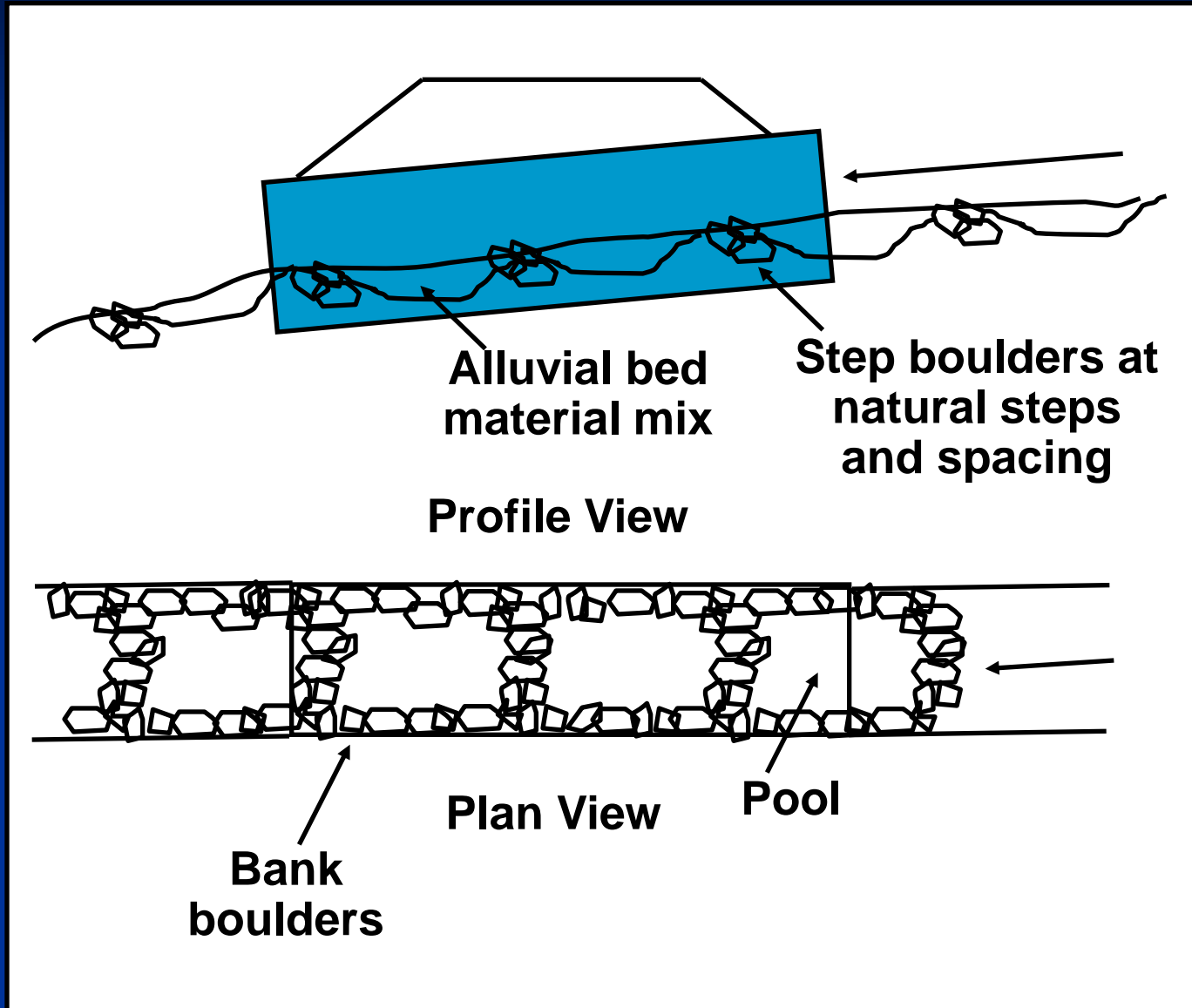


From Montgomery & Buffington, 1993

Step-Pools



Steps



Riffle-Pool



Edgerton Parks Road, Elk Creek - Matanuska-Susitna Borough

Roughened Riffle



Schwald Road, Unnamed Creek - Matanuska-Susitna Borough

Riffle with Low Flow Channel



Streambanks



Duncan Drive, Kenai
(6 foot channel)

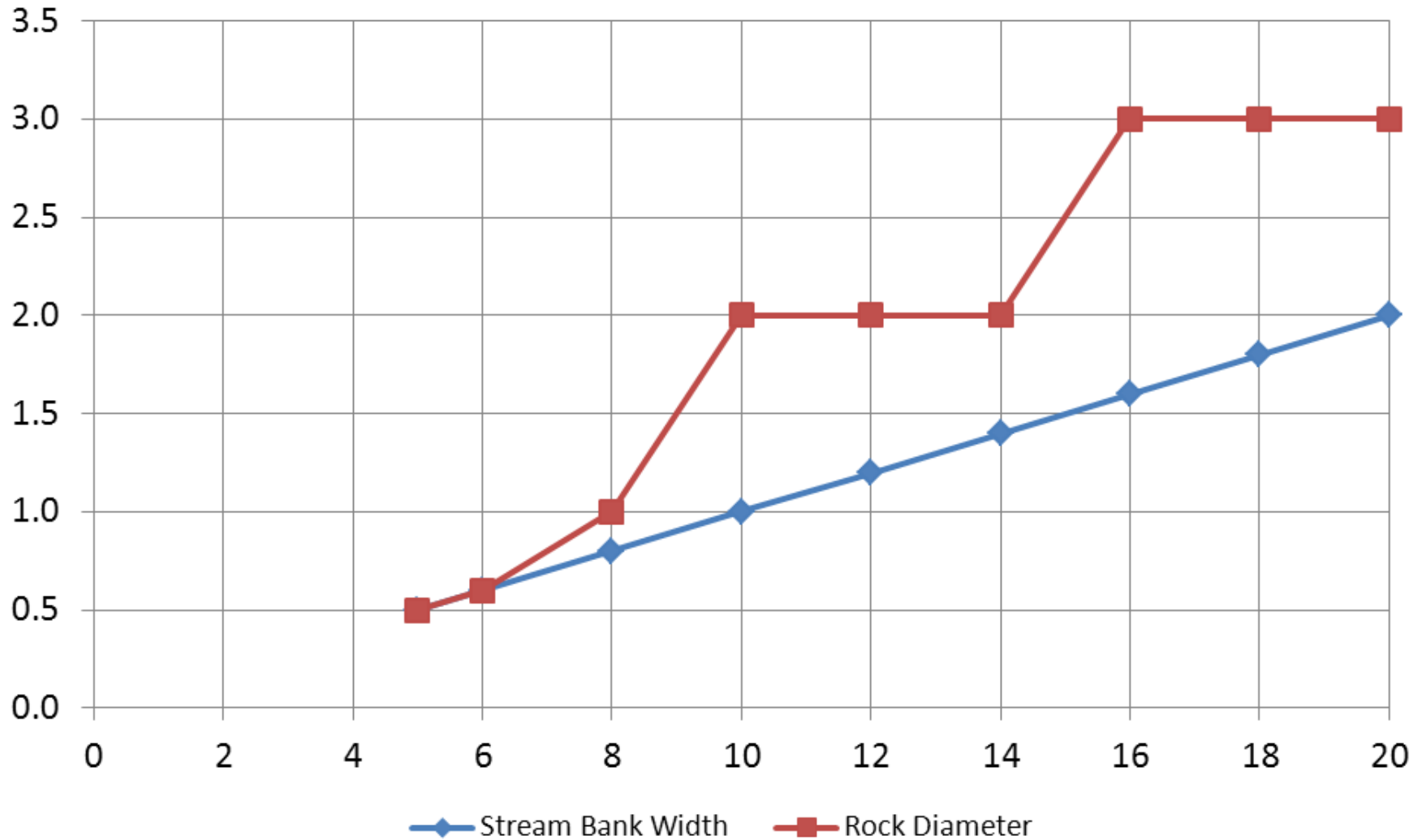
Streambanks are to be immovable at design flows – consider in low entrenched environments!



Coal Creek, Kenai
(12 foot channel in 18 foot pipe)

1.2 Bankfull (Alluvial Systems)

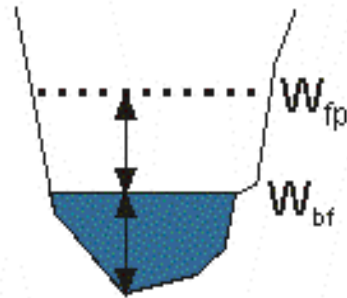
Feet



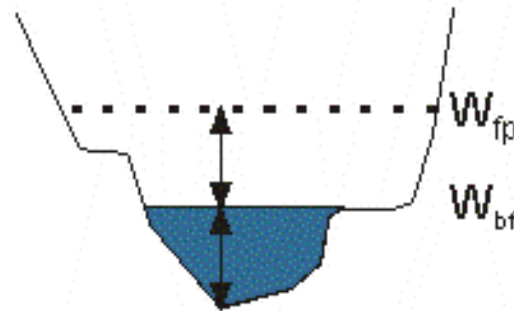
Culvert Diameter (ft)

Streambanks

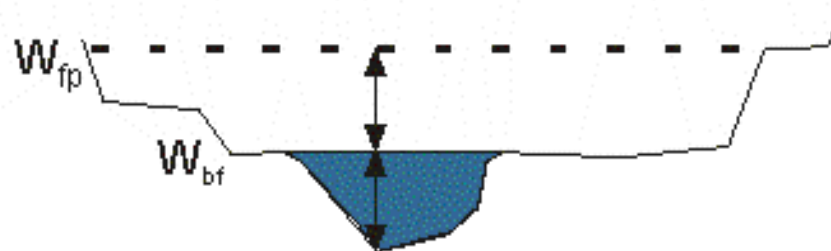
Entrenched
(ER < 1.4)



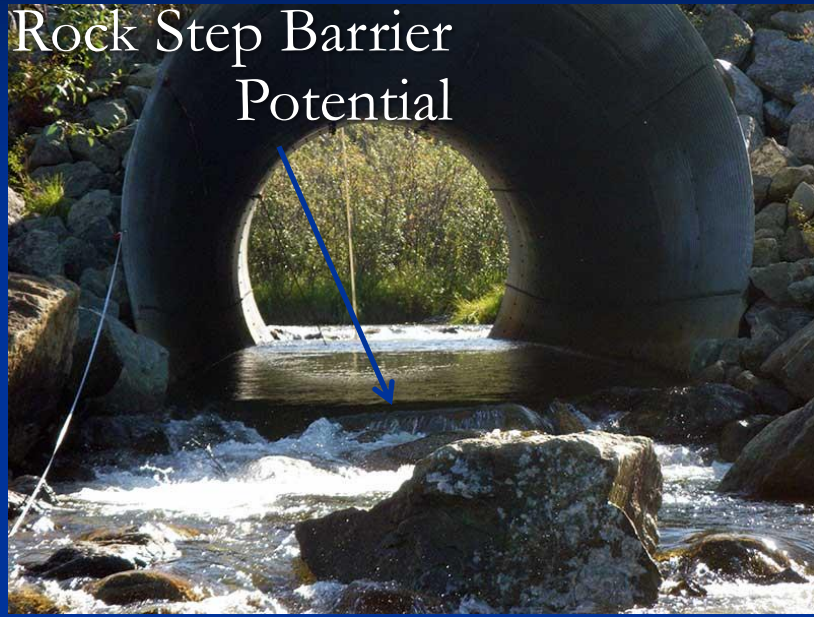
Moderately
Entrenched
(ER = 1.4 - 2.2)



Slightly
Entrenched
(ER > 2.2)



Transition Zones



Rosie Creek, Northern Region

Remember to
transition rock banks
to natural banks!!



Streambank Transition from Rock
to Rootwads, Coal Creek, Kenai



Points to Remember

- What are your objectives?
- Emulate the stream type in your culvert and make bed features that reflect it.
- Size your stream banks to reflect stability at large flow events, not to a set standard.
- Culverts are not bridges. Consider risk, design conservatively.