Pre-Design and Project Layout

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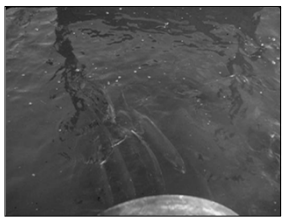

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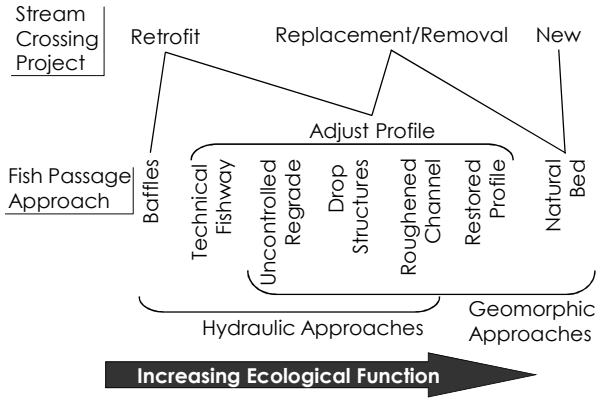
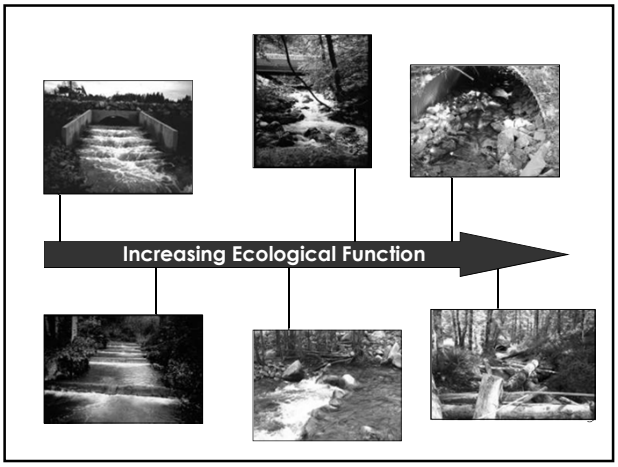
Tools for Aquatic Organism Passage





Passage Design Process

Pre-Design

- Project Objective
- Assessment, Suitability
- Project profile and alignment
- Select design method

Design: Stream Simulation, Low slope, Hydraulic, or other

FINAL DESIGN

Or other option

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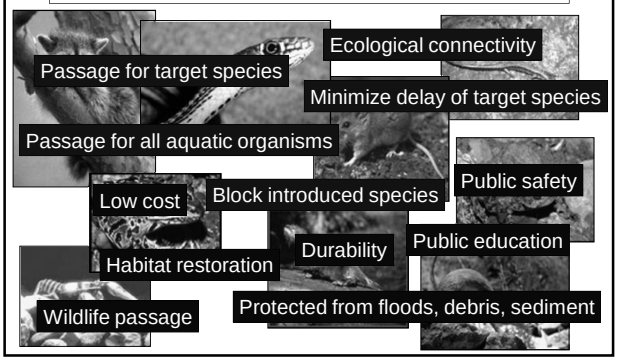
Project Objectives – What is Success?

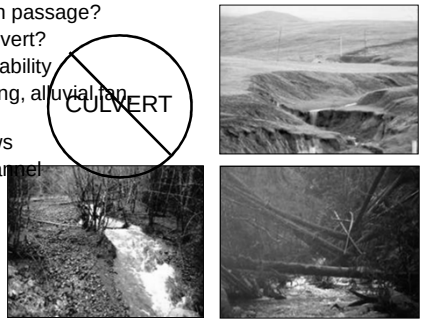


Site Assessment, Suitability

Suitability for fish passage?

Suitability for culvert?

- Channel stability
  - aggrading, alluvial fan incising
- Debris flows
- Size of channel



Passage Design Process

Pre-Design

Project Objective
↓
Assessment, Suitability
↓
Project alignment and profile
↓
Select design method

- Alignment issues
- Scour or incision, scale of the problem
- Variability over time and distance
- Sensitivity
- Headcut issues
- Restoration

Design: Stream Simulation, No slope, Hydraulic, or other

FINAL DESIGN
Or other option

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Alignment

- Concurrent with profile design
- Important factor for debris blockage and failure
- Consider existing and future stream channel.

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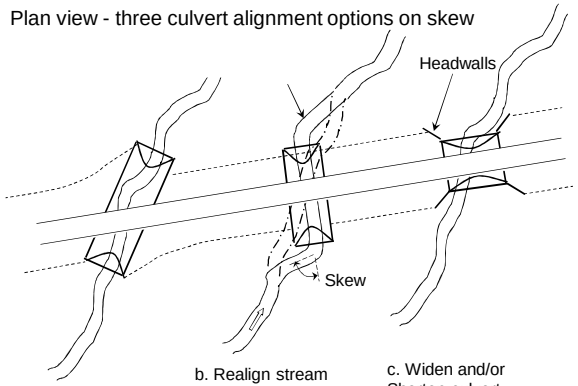
Plan view - three culvert alignment options on skew



a. Culvert on stream alignment

b. Realign stream To minimize culvert length

c. Widen and/or Shorten culvert

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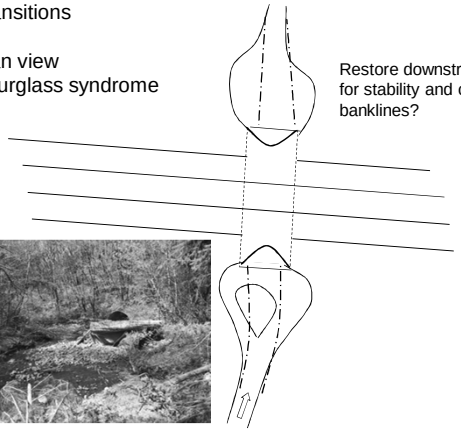
Transitions

Plan view
Hourglass syndrome



Restore downstream banks for stability and continuous banklines?

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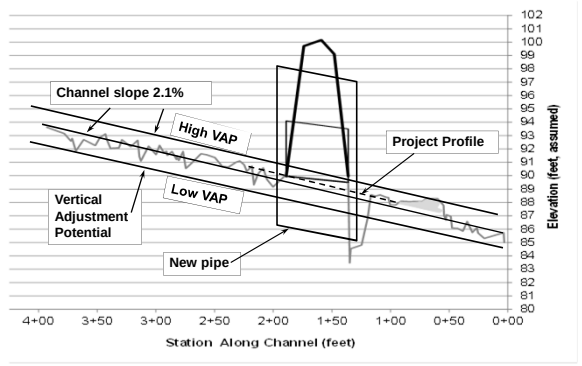
Vertical Adjustment Potential



VAP - Vertical Adjustment Potential

- Range of possible profiles for life of project
- Considerations
  - Existing profile
    - Controls, mobility, bedrock
    - Effect of old culvert
  - History and future of watershed
    - Hydrology, debris, sediment, incision / local scour
  - Bankfull, floodplain
  - Infrastructure to be protected
- If it's too wide, get help

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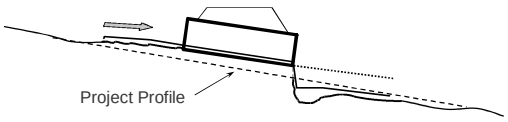
Project Profile

- Project profile is what is actually constructed
- Start with initial vertical adjustment potential from site assessment
- Consider profile and alignment issues concurrently
- Consider headcut issues
- A forced profile might be necessary



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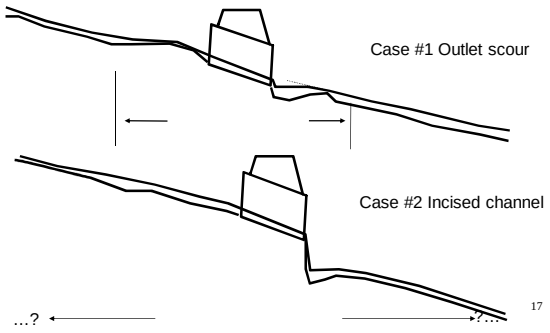
Scale of Solution = Scale of Problem



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Jones Creek
From downstream

Any problem here?

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Jones Creek upstream

Inlet Control
Backwater deposition

Culvert outlet plunge

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Foster Cr
Clackamas County
2001

Allow regrade?

Outlet Creek – 2005

Upstream channel

Downstream channel incised

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Headcut issues
Bed material

Wynoochee trib - 1983

Culvert replaced

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Headcut issues
Bed material

Wynoochee trib – 2002

Channel regraded to bedrock

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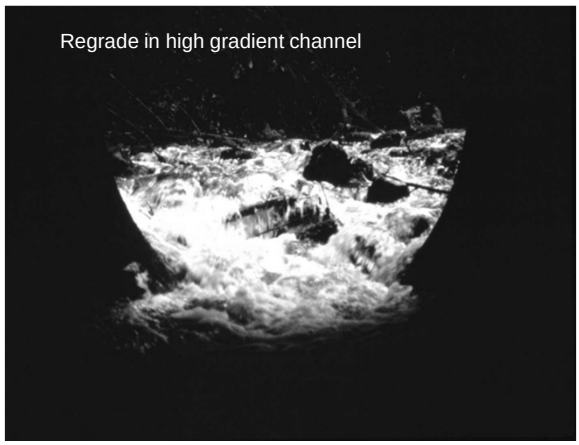
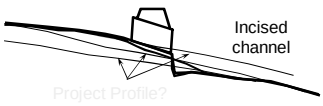
Headcut issues – Sediment slug

Downstream channel overwhelmed by sediment slug from headcut



Channel regrade considerations - 1

- Extent and evolution of regrade expected
- Adjacent channel
  - Upstream banks – stability, riparian, impounded wetlands?
  - Is there value of culvert as nick point? Habitat, infrastructure



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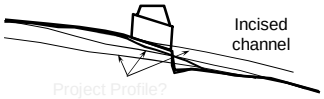
Channel regrade considerations - 2

- Bed material
  - Backwater wedge?
  - Potential bedrock exposure?
  - Protect existing armored bed



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Channel regrade considerations – 3

- Culvert and channel capacity with sediment slug
- Potential passage barriers created upstream
- Construction access to build regrade
- Opportunities for channel restoration downstream

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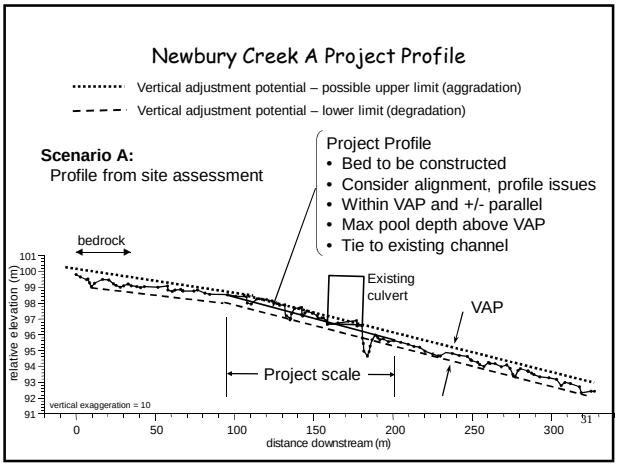

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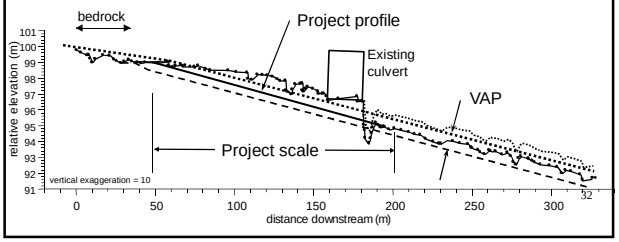
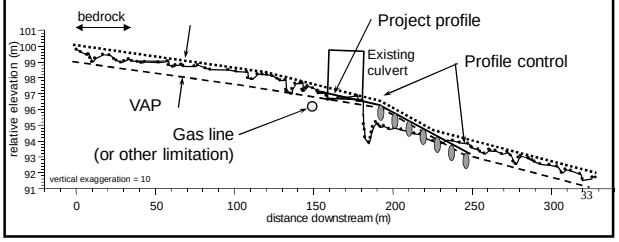
Newbury Creek B Project Profile With incised channel

Scenario B:
Regional incision.
Vertical adjustment potential assumes no culvert.



Newbury Creek C Project Profile With a forced profile

Scenario C:
Regional incision.
Forced profile necessary.



Design method determined by project objectives

Project objectives
- Habitat protection, restoration
- River and stream continuity
- Passage of fish
- Passage of other aquatic organisms
- Wildlife passage
- Traffic, road, safety, other
- Funding limits and requirements
- Regulatory

Design methods
- Hydraulic
- Stream Simulation
- Low slope (active channel, No slope)
- Low water crossings

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Three design options - Premises

- Low-slope: The design of an oversized culvert in a low risk site can be simplified and built with little risk
- Hydraulic: A structure with appropriate hydraulic conditions will allow target species to swim through it.
- Stream Simulation: A channel that simulates characteristics of the adjacent channel, will present no more of a challenge to movement of organisms than that channel.

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