Fish Passage Construction

Update to Fish Passage and Stream Restoration Training
2021 Fish Passage Construction Season

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Fish Passage Design Manager
HQ Hydraulics
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River Restoration Northwest
To inform Fish Passage practitioners on the challenges associated with fish passage construction and implementing the designs and specification to meet the project intent and provide a water crossing that is sustainable to fish passage for the life of the crossing.

Water is the driving force of all nature.

Leonardo da Vinci
Learning Objectives

- Understanding **high risk** items and how to avoid them
- Seeking **opportunities** for improvements
- Interpreting and understand the designs & specifications pertaining to;
  - Streambed alignment/geometry
  - Streambed materials,
  - Channel complexities,
  - Large woody material,
  - Design plans & details
SR 9 MP 70.60
UNT to Landingstrip Creek #991106
**Alignment & Profile**

Ex Culvert: 30 inch CMP

Flow

Longitudinal Profile in Vicinity of

Slope = 11%
Existing SR 9 Culvert Inlet

Slope = 3.5%
Existing SR 9 Culvert Outlet

4.9%
Existing Farm Path Crossing

Slope = 3.5%
Streambed Material

- Reuse of existing streambed material?

Streambed Sediment and/or Streambed Cobbles may be available from the existing streambed excavation limits as shown in the Plans. Components of the excavated streambed which meet the criteria for the specific material may be used to supplement the Streambed Sediment and/or Streambed Cobbles and will be based upon visual acceptance by the Engineer.

Streambed Material matching the design streambed gradation may be available from unprocessed pit run sources. Pit run sources to be reviewed for use, shall require a submittal of a sieve analysis completed within the same calendar year of placement. If the material is confirmed as a potential source, the material will be sampled and tested by the Engineer for final acceptance. Submittal of these materials for use shall be submitted before the first working day.
Samples:
Work within the wetted perimeter may only occur during the time periods authorized in the APP ID 21036 entitled "Allowable Freshwater Work Times May 2018". Work outside of the wetted perimeter may occur year-round. APPS website:
https://www.govonlinesaas.com/WA/WDFW/Public/Client/WA_WDFW/Shared/Pages/Main/Login.aspx

<table>
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<tr>
<th>Were any sample(s) collected from below the OHWM?</th>
<th>No ☐ If no, then stop here.</th>
<th>Yes ☐ If yes, then fill out the proceeding section for each sample.</th>
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<th>Sample #:</th>
<th>Work Start:</th>
<th>Work End:</th>
<th>Latitude:</th>
<th>Longitude:</th>
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</table>

Summary/description of location:

Summarize/describe the sample location.

Description of work below the OHWL:

Describe the work below the OHWL, including equipment used and quantity of sediment sampled.

Description of problems encountered:

Describe any problems encountered, such as provision violations, notification, corrective action, and impacts to fish life and water quality from problems that arose.
Proposed Alignment/Profile/Section

Flow

Proposed: 14 ft x 10 ft x 80 ft
Streambed Geometry & Meander Bar
Minimum Hydraulic Opening

What drives MHO?

1. **BFW** – (stream simulation/confined bridge)
2. **Velocity Ratio 1.1** – (unconfined bridge)
3. Floodplain Connectivity
4. Lateral Migration
5. Flood Prone Width
6. Valley Width
7. Aggradation/Degradation
8. Hydraulic Backwater
9. 100yr WSE
10. Stream Sinuosity
11. Meander Amplitude
12. Channel Complexities (Boulders/LWM)
13. Model Comparison of Widths Smaller/Larger (sensitivity analysis)
Structure Size

Dingos

“Micro” Excavator
Structure Size
LWM Installation

- LWM not drawn to scale
- LWM typical details didn’t work all the time
- Consider clearing & grubbing limits
LWM Installation

- Very large rootwads for channel.

11 ft RW, 14 ft channel
LWM Installation
## Lessons Learned

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Success</th>
<th>Opportunities</th>
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<tbody>
<tr>
<td>Downstream project tie-in</td>
<td>Contractor – wanted to be successful</td>
<td>Show LWM to scale</td>
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<td>Limited water resources for watering in</td>
<td>Early start in fish window</td>
<td>Additional Freeboard clearance</td>
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<td>Consider proposed condition with clearing/grubbing areas</td>
<td>Layering &amp; Watering in Blended materials</td>
<td>Shorter crossing structure</td>
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<td>High flows before bank stabilization</td>
<td>Good LWM design &amp; details</td>
<td>Extension of Meander Bars</td>
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<td>Added Meander Bar in the field</td>
<td>Coarser Meander Bars</td>
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<td>Better coordination with downstream project</td>
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Proposed Design

Upstream time-lapse video location

Downstream time-lapse video location
Proposed Design

LARGE WOODY DEBRIS (LWD) TOTALS

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<thead>
<tr>
<th>TYPE</th>
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LARGE WOODY MATERIAL (LWM) LOCATION TABLE

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<th>SHEET</th>
<th>LWM NO.</th>
<th>TYPE</th>
<th>MIN. LENGTH</th>
<th>DIAM.</th>
<th>ROOFTOP (Y/M)</th>
<th>STATION OFFSET</th>
<th>ANGLE A (DEG.)</th>
<th>ANGLE B (DEG.)</th>
<th>DISTANCE C (FT)</th>
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LARGE WOODY MATERIAL (LWM) TYPE A, B & C STATION OFFSET (Y/M)

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<th>SHEET</th>
<th>LWM NO.</th>
<th>TYPE</th>
<th>MIN. LENGTH</th>
<th>DIAM.</th>
<th>ROOFTOP (Y/M)</th>
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<th>ANGLE A (DEG.)</th>
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NOTES:
- NEGATIVE VALUE INDICATES DEPTH BELOW TALUS/SCOUR
- POSITIVE VALUE INDICATES DEPTH ABOVE TALUS/SCOUR
- SEE STREAM DETAILS SHEETS FOR LWM DETAILS

LARGE WOODY DEBRIS (LWD) TOTALS

<table>
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<tr>
<th>TYPE</th>
<th>TOTAL</th>
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<tr>
<td>3-MAN BOULDER</td>
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</table>
Proposed Design
LWM Installation
LWM Installation
LWM Installation
Blended Streambed Material

Streambed Material shall be a mix of the following aggregates with the percentages as called out in the plans:

- Streambed Material
- Streambed Sediment: 60%, by volume
- Streambed Cobbles 4 In.: 40%, by volume
SR 9 MP 37.3
UNT to Pilchuck Creek (WDFW #LP19)
Proposed Design
Construction
Blended Streambed Material

Streambed Material
Streambed Sediment: 30%, by volume
Streambed Cobbles 12 IN.: 24%, by volume
Streambed Boulders One Man: 23%, by volume
Streambed Boulders Two Man: 23%, by volume
Streambed Materials

9-03.11(1) Streambed Sediment

Streambed sediment shall meet the following requirements for grading when placed in hauling vehicles for delivery to the project or during manufacture and placement into temporary stockpile. Alternate gradations may be used if proposed by the Contractor and accepted by the Engineer. The Contractor shall submit a Type 2 Working Drawing.

9-03.11(2) Streambed Cobbles

The grading of the cobbles shall be determined by the Engineer by visual inspection of the load before it is dumped into place, or, if so ordered by the Engineer, by dumping individual loads on a flat surface and sorting and measuring the individual rocks contained in the load.
Streambed Mixes

Standard Specification 9-03.11(2)

Streambed cobbles shall be clean, naturally occurring water-rounded gravel material. Streambed cobbles shall have a well-graded distribution of cobbles sizes and conform to one or more of the following gradings as shown in the Plan:

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Particle Size (Inches)
Streambed Material

Streambed Material shall be a mix of the following aggregates with the associated ratios, as called out in the plans:

Streambed Material
Streambed Sediment: 50%, by volume
Streambed Cobbles 6 In.: 50%, by volume

Figure 42 Proposed Sediment Gradation
Streambed Sediment
Construction

Three-Man (Type 3)
Construction
Construction
## Lessons Learned

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Success</th>
<th>Opportunities</th>
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<tr>
<td>Contractor – Not in it to win it</td>
<td>Steep Step-Pool Bed Design</td>
<td>More LWM and MWM</td>
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<tr>
<td>Communication – PEO to Contractor to HQ</td>
<td>Good team work once initiated</td>
<td>Increase structure height</td>
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<td>Contractor - Unsure how to execute, lack urgency</td>
<td>Mixing and placement of material</td>
<td>Minimized impact – US grading and slope grading</td>
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<tr>
<td>Schedule uncertainty – extension of fish window</td>
<td>Layering &amp; Watering in Blended materials &amp; Boulders</td>
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Placing Streambed Material

Placement of Aggregates for Streams, Rivers, and Waterbodies

Stockpiling Aggregate
Streambed Sediment and Streambed Cobbles as described above, shall be blended into single well graded stockpiles separate from other aggregates.

Placing Aggregate in Streambed
Streambed Material shall be placed in the prepared channel excavation to the lines and grades shown on the Plans and in such a way as to prevent material segregation. Streambed Material shall be placed in lifts no thicker than 12 inches. Streambed Material in its final location shall be a well graded mix.

Placement of Streambed Material shall be constructed to ensure that stream low flow rate of 30 gallons per minute, or as determined by the Engineer, is conveyed above each lift. The Contractor shall apply water and 1-inch depth of Streambed Sand to each lift to facilitate filling the interstitial voids of the Streambed Materials. The voids are satisfactorily filled when water equivalent to the low flow rate of the stream does not go subsurface and there is no perceivable difference in the low flow rate from upstream of the project limits to the downstream of project limits. The Contractor shall apply water at the low flow rate to the stream channel for visual acceptance by the Engineer. Water shall be free from contaminates, chlorination and any additive that has a risk on fish and other ecological life.
Placing Streambed Material

**STREAMBED MATERIAL PLACEMENT**

**SEQUENCE OF WORK**

**NOT TO SCALE**

**STREAMBED CHANNEL PREPARATION**

**STEP 1**
Excavate channel to accommodate streambed material.

**STEP 2**
Place 1/2 lift of streambed material.

**STEP 3**
Place a layer of streambed sand uniformly over streambed material. Apply water to streambed sand. See detail note 2.

**STEP 4**
(Repeat step 3)

**STEP 5**
Place remaining 1/2 lift of streambed material. Grade as shown in streambed section details. See detail note 3.

**ALTERNATIVE - FLOOD PLAIN EXTENSION**

**NOT TO SCALE**

**THALWEG ELEV. 337.3’**

**THALWEG ELEV. 332.4’**

**100 YR 8.81%**

**FOOTING OF CONTRACTOR**

**DESIGNED BURIED STRUCTURE NO.2**

**CONSTRUCTION GEOTEXTILE**

**COMPACTED AQUIFAR MATERIAL (SEE NOTE 2)**

**COMPACTED AQUIFAR MATERIAL (SEE NOTE 2)**
Streambed Sand
Sealing the Bed
Sealing the Bed
Sealing the Bed
Sealing the Bed
Sealing the Bed
Entrainment
Plane bed
Channel Complexities

- Coarse bands
- Meander bars
- Boulder clusters
- Large Woody Material
- Deformable Grade Control
Meander Bars & Boulder Clusters
Deformable Grade Controls
Structure Scour

Local Scour
- Boulders
- Large Woody Material
- Deflection
Bank Stabilization

- Transition
  - Margins
  - Plant establishment
    - Coir mats/wraps
    - Willow plantings
    - Staking
Large Woody Material

**Onsite Evaluation Meeting**

An onsite evaluation meeting shall be held at least held at least 3 working days prior to the reintroduction of flows into the new channel or removal of the temporary stream diversion, whichever occurs first.

Those attending shall include:

1. Contractor: The superintendent, on site supervisor, foreman, the Environmental Compliance Lead and any other personnel that will have on-site responsibility for in-channel streambed Work.

1. WSDOT: The WSDOT Engineer, key inspection personnel, Region Environmental, Headquarters Hydraulics and Headquarters Environmental Service Office (Fish Passage Biologist & Monitoring Program Lead).

1. Representatives from interested permitting agencies (WDFW) and affected Tribes shall be invited by WSDOT.

The Contractor shall provide notice to the Engineer 14 calendar days prior to this meeting taking place.

The meeting will evaluate and discuss the streambed installation and large woody material placement to ensure the streambed will performing as intended. As a result of the onsite evaluation meeting, modifications to the streambed materials, features or large woody materials may be made by the Engineer.
SR 20 MP 88.82
Lorenzan Creek (WDFW GR23)
Additional Information

- Final Hydraulic Design Report (link in Special Provisions)
- HQ site inspection
- Just-In-Time (JIT) Training – hosted annually
- WSDOT Fish Passage Training Certification
  - [Hydraulics & hydrology training | WSDOT (wa.gov)]
- WSDOT Certified Inspector Training – March 2022
- Me nggabe@wsdot.wa.gov or gabe.ng@jacobs.com
Meander Bar

WINGWALL

ONE ROW OF HALF-SURIED THREE MAN BOULDERS

(TYP.)
10'

ONE ROW OF TWO MAN BOULDERS

5'

17'

20'
(TYP.)

PROPOSED GRADATION A