Oregon Department of Transportation

# DESIGN DRAWINGS REQUIREMENTS FOR FISH PASSAGE PLANS (OAR 635-412)

Version 1, Updated 4/13/2020.

The following design drawings with the below specified information should be included with every fish passage plan to allow for regulatory review and approval.

***For All Fish Passage Applications:***

- Vicinity Map with North Arrow
- Adjacent Structures / Infrastructure
- Property Boundaries and Easements
- Temporary water management details showing:
  - Volitional downstream passage for fish. Upstream passage may also be required
  - Dimensions and slope of pipe
  - Pump Screen mesh size meeting state and federal criteria
  - Plan for pump failure, redundancy, fueling, oils spill prevention, screen fowling, and monitoring
  - If work is planned during a dry channel include a contingency water management plan or statement
  - Instructions for TWM pre-con meeting

***For All Plans Not Using the Hydraulic Approval Method***:

Plan View(s) showing:

- Active channel (i.e., ordinary high water or bankfull lines), including active channel width
- Existing crossing
- Proposed crossing
- Temporary crossings such as bypass roads or bridges
- Additional structures (such as wing walls, scour protection, trash racks, etc.)
- Fish passage structures (such as fish rocks, baffles, grade controls, weirs, etc.)
- Locations of cross-sections
- Dimensions of structure
- Location of stream channel cross-sections
- Direction of stream flow
- Temporary water management, work area isolation and volitional fish passage through the work area(s)
- Streambed composition and elevation(s) for stream channel reconstruction

Longitudinal Profile(s) View, showing:

- Existing and proposed gradient of the streambed upstream, downstream, and through the crossing. Include upstream and downstream influencing features, controls, slopes, etc (Stream Profile requirements are described in section 6.4.4.2 of the ODOT Hydraulics Manual)
- Existing and proposed crossing including road
- Road crest elevations and bridge low chord or culvert crown elevations
- Additional structures (such as wing walls, scour protection, trash racks, etc.)
- Grade control elements and size

- Fish passage structures (such as fish rocks, baffles, grade controls, weirs, etc.) including quantities, locations, elevations, and orientations
- Dimensions including channel slopes
- Location of stream channel cross-sections
- Water surface elevations at high and low design flows for the proposed crossing, **if** the proposed crossing will not be as wide as the active channel width or will not be embedded
- Elevations of stream bed / crossing structure at the crossing inlet and outlet
- If weirs are used in design, then include:
    - Weir type, and size
    - Elevations of weir crests*
    - Water Depth at design flows at weir locations

  ** Weirs may be constructed to elevations that anticipate settling over time. If this is part of the design, then the weir should have a call out explaining the anticipated settling elevation*
- If pools are included, indicate elevations of pool bottoms
- Direction of stream flow
- Temporary water management, work area isolation and volitional downstream fish passage through the work area(s)
- Streambed composition and elevation(s) for stream channel reconstruction

Cross-section(s) view showing:

- Channel at proposed crossing, including bed details (such as low flow channel, substrate composition, scour protection, depth of fill, fish passage structures, etc.)
- Channel at proposed crossing showing active channel width (ACW) elevations, with distance call out from ACW elevation to inside top of the crossing. Include freeboard in crossing with any armoring mechanism
- Channel at any grade control structure, weir, rock sill, or roughened channel section that is part of the project
- Stream channel cross-sections:
    - Section view should be relevant to how many structures and crossings; for ODOT this may be one site, or may have multiple sites if installing a roughened channel, multiple weirs, riffles, etc.
    - Include cross sections outside of the influence of the existing structure up and downstream of the project area
    - Cross sections should be 2 x ACW and perpendicular to the flow of the stream
- Streambed composition and elevation(s) for stream channel reconstruction

Details of Fish Passage Structures showing:

- Grade control measures and/or bed retention measures
- Weirs and/or baffles, rock sills, other fish passage structures and fish rocks
- If Fish Rocks are included, show rock size and footer rocks
- Elevations of tops of weirs, sills, and/or grade control features
- Roughened channels including call out or table of anticipated substrate mix sizes*. Show augmented or imported material thickness in design

  ** Roughened channels should not be used in gradients above 6% slope*
- Fish rock size and placement
- Detail drawing or call out for depth of embeddedness of habitat boulder or rock weirs, including rock size
- Channel restoration/scour remediation measures including large wood

- Table of velocities and water depth through the crossing at low and high Fish Passage Design Flow
- Develop flow values for the 1.5, 2, 5, 10, 25, 50 and 100 year flows with particular attention to bankfull for channel forming flow determination. Determine the 5% and 95% probability discharges used for fish passage analysis using flow duration method techniques

***For Plans Using the Hydraulic Approval Method:***

- Hydraulic modeling and associated report to evaluate the drainage basin size and characteristics above the crossing.
- Develop flow values for the 1.5, 2, 5, 10, 25, 50 and 100 year flows at the crossing with particular attention to bankfull for channel forming flow determination. Determine the 5% and 95% probability discharges used for fish passage analysis using flow duration method techniques.
- Predict depths, velocities, shear stress, lateral changes in flow, and stream power under design discharges determined from the hydrologic analysis.
- Provide analysis for supercritical flow* and show how any baffles used are designed to achieve subcritical* flow

  ** Supercritical flow is high flow velocity, shallow flow (less than critical depth) on a steep channel slope that has Froude number greater than one. Subcritical flow is characterized by slower flow velocity, deeper flow depth (more than critical depth) on a shallow channel slope with Froude number less than one.*
- Develop a table of depths and velocities in the crossing based on design at 95% and 5% exceedance flow, and corresponding design criteria. See example table below.

| Design Flow | CFS | Depth | Velocity |
|---|---|---|---|
| 5% | X | X | X |
| 95% | X | X | X |
| ODFW / NMFS Criteria | - | 1.0ft | 2.0fps |

*Example table for Expected Hydraulic Conditions*

Note: Construction of fish passage structures, weirs, and channel reconstruction should be supervised by a qualified hydraulics engineer or fish biologist. These features will be field-fit based on site constraints and the materials provided. However, the plans should be detailed enough for ODFW and NMFS to evaluate the fish passage performance of the proposed project. The plans should also communicate to the contractor what is expected in terms of quantity and location of materials and structures as well as general level and complexity of construction effort.