

DESIGN GUIDELINES APPROVED FOR USE IN DESIGNING WATER CROSSINGS OVER FISH-BEARING WATERS IN WASHINGTON STATE

Low-water crossings: geomorphic, biological, and engineering design considerations¹

Notes for appropriate use to comply with WAC 220-660-190

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Low-Water Crossings is the most comprehensive, practical and environmentally responsible guideline written to date on this topic. Before using these guidelines, WDFW recommends reading WAC 220-660-190(10) so that the designer is aware of all provisions relating to this type of structure. Since **Low-Water Crossings** was written for a national audience, the following notes should help guide you away from methods or practices that conflict with Washington standards.

Fords designed for fish-bearing waters in Washington State must pass all fish when they wish to move and maintain expected channel processes, including the movement of wood and sediment and shifting channel patterns. A ford crossing nonfish-bearing waters must be designed to pass wood and sediment expected in the stream reach in order to reduce the risk of catastrophic failure.

Chapter 1: Introduction

Figure 1.1 shows vented fords and low water bridges with multiple culverts or spans. This type of crossing is discouraged in Washington since debris is common during floods and tends to rack up on the web between structures. Multiple culvert installations also tend to have uneven flow distribution – one culvert takes most of the flow and the others fill with sediment causing a passage barrier in the preferred culvert. A single culvert or bridge span is recommended for each crossing.

Chapter 2: Planning

As part of the planning process, the designer should be aware that WAC20-660-190(10)(b) restricts the use of fords to specific situations.

Chapter 3: Selecting the Best Structure for the Site.

Table 3.3: To be consistent with Washington law and code, a primary factor in selecting a structure type must be *Resource Protection - Aquatic Organism Passage*.

¹ Clarkin, K., G. Keller, et al. (2006). Low-water crossings: geomorphic, biological, and engineering design considerations. San Dimas, CA, U. S. Dept of Agriculture, Forest Service.

Chapters 2 and 3 lead a designer along a path to an appropriate ford structure, although it should be emphasized that new fords will be authorized by WDFW only in limited situations when it is the least impacting water crossing alternative.

Chapter 4: DESIGN ELEMENTS, CONSIDERATIONS, AND TOOLS.

Table 4.1: Scour, Bank Protection and Preventing Channel Changes; some scour protection or energy dissipation measures that have the potential to impede fish passage (e.g., concrete aprons) should not be used because of low water depths and high velocity.

Page 4-18: *FishXing* calculates fish passage on the basis of swimming ability. WDFW classifies crossings designed with this criteria as Fish Passage Improvement Structures and are permitted under WAC 220-66-200.

Chapter 5: LOW-WATER CROSSING TYPES. Many of the techniques in this chapter are ideally suited to non-fish bearing streams. Passage over or through them must be provided when the stream is capable of supporting fish life.

5.1 At-grade fords.

The site and design considerations are appropriate, although paving an at-grade ford with concrete or asphalt is not recommended – a grade separated crossing should be considered in these cases.

5.2 Slab fords

Slab fords will create sheet flow and cause a barrier to fish passage. It may be possible to tilt the slab to one side and concentrate the flow, or other such manipulations, however using a grade-separated structure would be preferred in fish-bearing water.

5.3 Precast concrete planks

Do not allow flow to percolate through the space between the panels or the fill beneath where fish passage is required.

5.6 Porous fords

Above grade, unvented fords will block fish passage and will not be permitted in fish-bearing waters.

5.7 Gabion and Jersey fords

Above grade, unvented fords will block fish passage and will not be permitted in fish-bearing waters.

5.8, 5.9, 5.10 Vented fords

In fish-bearing waters vented fords must provide passage consistent with either WAC 220-660-190(6) or WAC 220-660-200. Multiple culverts are not recommended because they are prone to debris occlusion and tend to have uneven flow distribution – one

culvert takes most of the flow and the others fill with sediment causing a passage barrier in the preferred culvert.

5.11 Low-water bridges

In many ways a low-water bridge is like a bridge that is elevated above flood height and should be designed in a way that consistent with WAC 220-660-190(4) or an equivalent method.