Appendix D

Proposed Criteria for reviewing written plans for fish passage

1. Written Plan Checklist

A. Physical Information:

1. Location of stream crossing
   - Road name/number
   - Legal description
   - Georegion

2. Size of basin above crossing.

3. Calculation of 50 year peak flow.

4. Culvert data:
   - Type (circular, pipe-arch, box, arch, baffled)
   - Material (corrugated metal, plastic)
   - Size (diameter, span, rise)
   - Length

For fish bearing streams (all fish bearing stream crossings require written plans)

5. Existing stream gradient (percent):
   - Requiring a channel profile may be appropriate with some installations.
   - Rule-of-thumb; channel profile should be a minimum distance of 100 feet downstream and upstream of installation site
   - For replacement installations where sediment deposition has artificially flattened the channel upslope of the inlet, estimate “natural” stream channel gradient.

5. Resulting culvert gradient (percent): This is the design slope of the resulting culvert after installation.

6. Stream channel data:

   - Bed material of the existing stream (for streambed simulation designs only): Note the predominant sediment type in the stream and the predominant type in the middle of the stream where water velocities are greater.
• Active channel width of existing stream (for streambed simulation designs only): See guidance manual on how to determine and measure active channel width.
• Depth of fill material associated with stream. Estimate the depth of streambed channel fill material. Streambed channel fill refers to layers of unconsolidated gravel, sand, cobble, and other sediment that lie over the top of the bedrock.

9. Information on downstream backwatering structures (for culverts placed flat and backwatered designs or any other designs requiring outlet work).

10. Degree of sinking and embedding (for streambed simulation designs that use sinking): Depth and sizes of material embedding the culvert and depth of sinking. Please refer to fish passage restoration guide for minimum values.

11. Calculation of flow capacity of crossing structure versus flow potential of watershed.

    Information needed for bridges and open bottomed structures:

These alternatives require calculations to insure that flow capacity with freeboard are adequate to pass a 50 year flow. Information on how to do this calculation includes determining a design representative channel cross-section under the bridge and getting an average stream slope measurement. Open bottom designs not placed on bedrock footings need information on stream width compared to crossing width as well as information regarding material underneath the footings.

B. Justification for alternative chosen (i.e. is there information on which design strategy will be used with some reasoning on why the alternative was chosen and why the designer thinks it will work?)

    In the fish passage restoration guide there are several alternatives given, did the designer pick one or a combination of alternatives?

C. Are the design specifications within the limits presented in Table 1?

    1. Are the slopes chosen within the acceptable range?
    2. Is there adequate sinking specified if a countersunk culvert?
    3. Does the valley fill depth estimated match with the design alternative chosen? For instance, if an open bottom design is chosen with concrete footings was the valley fill depth shallow?
Table 1. Water Crossing Structures and fish passage design acceptance/rejection conditions for ODF written plans

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Accept</th>
<th>Further Review</th>
<th>Reject/Resubmit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges</td>
<td>Can be used over all slopes. Bridges need to be adequately sized to pass 50 year peak flow with adequate freeboard. As a rule of thumb bridges span should be at least as wide as stream.</td>
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<tr>
<td>Open bottomed culverts</td>
<td>Can be used over all slopes. Needs to be adequately sized. A rule of thumb span should equal or exceed bankfull stream width.</td>
<td>While an open arch will always meet fish/water passage requirements if adequately sized, in situations where the channel area has thick valley fill material the existing channel installation can become expensive as well as damaging to the environment. For this reason further review is often required in these instances.</td>
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<tr>
<td>Streambed Simulation</td>
<td>Stream grade is less than or equal to 8% Culvert gradient is less than or equal to 6.5%. Width/span of the culvert meets or exceeds bankfull width. Adequate depth of valley fill is indicated. If culvert is placed at stream grade over 4% the culvert gradient is less than stream gradient meaning the inlet is planned to be sunk more than outlet. Embedding is planned and material meets or exceeds material size in the stream. The culvert is sunk adequately minimum two feet or more.</td>
<td>Concerned that embedding is not adequately described. Concerned about possible bedrock below the surface. The plan indicates the culvert is less than bankfull width but meets the 50 year flow requirement on sizing.</td>
<td>Stream gradient is greater than 8%. Resulting culvert gradient is greater than 6.5%. Hard bedrock is near surface meaning the culvert can not be sunk in stream. The details of the plan do not indicate what the slope, valley width, or stream width is. There is inadequate detail embedding or how culvert will be installed.</td>
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<tr>
<td>Sunken Culverts</td>
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<tr>
<td>Culvert placed flat</td>
<td>Stream gradient is less than 2.0%. Difference in culvert gradient is greater than one foot. Plan calls for excavating a significant amount of upstream deposited material. Overall stream slope is greater than 2%. Concerned about downstream weir.</td>
<td>The culvert gradient is over 0.5%. Downstream weir does not back up eight inches of water. Overall stream gradient is greater than 2.5%. Overall stream gradient is measured over long distances minimum 100 feet above and below crossing.</td>
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Table 1. (Cont.) Water Crossing Structures and fish passage design acceptance/rejection conditions for ODF written plans

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<tr>
<td>Culvert with backwatering</td>
<td>Overall stream gradient less than 4%. Resulting culvert gradient is less than 2%. Difference in elevation between downstream and upstream end of culvert no more than one foot. Height of downstream weir greater than bottom of inlet and at least eight inches greater in elevation than outlet end. Detail is given on how weirs will be installed.</td>
<td>Concerned about excessive drops of downstream weirs. Log wiers with more than six inches drop or rock weirs greater than one foot drop. Resulting culvert gradient greater than 2%.</td>
<td>Stream gradient is greater than 4%. Inlet elevation is greater than top elevation of downstream weir. Plan lacks sufficient detail about location of weirs.</td>
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<tr>
<td>Baffle/Weir Culvert</td>
<td>Always require further review. In general should be developed by Specialist with hydraulic engineering Skills.</td>
<td>If stream slope is greater than 12%. If resulting culvert slope is greater than 12%.</td>
<td>Streams that are low gradient with mucky bottoms. Roads that may moderate to heavy traffic.</td>
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<tr>
<td>Fords</td>
<td>Demonstrated that road is extremely low traffic. Ford has hardened cobbles and approach that has diversion structures on it. Amount of fill is not excessive as to create a fish passage barrier.</td>
<td>Concern about approaches. Concern that excessive material at the ford may create an artificial blockage.</td>
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