

APPENDIX A – PRELIMINARY HYDRAULIC RECOMMENDATIONS EXAMPLE

Preliminary Hydraulic Recommendations for Fish Passage Culverts

Peterson Tunnel – Turner Creek Section

Florence – Eugene Highway (OR #62)

Lane County

By _____ (name) _____

27 November 2002

Preliminary hydraulic recommendations for the fish passage culverts and embankment protection are presented in this report. The project team, concerned regulators, and other interested parties should review these recommendations. These recommendations will be revised, as needed, based on the review comments. Revised recommendations will be issued if the changes are major. The detailed replacement structure designs will proceed after the recommendations have been approved by the project team. If you have comments or questions, please contact me at (503) 986-____.

All dimensions and quantities in these preliminary recommendations are based on limited survey data. They are rough estimates at best, and they may vary significantly from the final design.

Fish Passage Culverts - All fish passage culverts will be designed to have a simulated stream bottom and a service life equal to or in excess of 75 years. Box culverts are recommended for the two larger streams. We are certain boxes will work at these locations. Corrugated metal pipes may also be recommended if the detailed designs show they are feasible.

Culvert Replacement at M.P. 20.55 - This culvert is a few hundred feet east of the west end of the project. Currently it is a single 24-inch diameter concrete pipe and it blocks fish passage. During a recent site visit ODFW requested that we restore passage. This culvert replacement will not create fish passage into the entire upstream watershed. A cross-culvert under a private logging road several hundred feet upstream from the highway culvert prevents further fish passage. A replacement fish passage culvert recommendation is shown in Drawing 1. Estimated fish passage characteristics are as follows:

- upstream watershed area is 0.055 square miles,
- an 8-foot diameter 100-foot long aluminum or aluminized steel corrugated metal pipe with mitered ends having reinforced concrete collars,
- the pipe invert is set at a flatter grade than the upstream channel,
- the pipe spans the active flow channel - the active flow channel width varies from 6 to 7 feet and the pipe span is about 7.5 feet at the streambed, and
- the invert would be buried 4 feet into the stream bottom - this allows for at least two feet of cover after an anticipated two feet degradation of the channel bottom.

The pipe would have a simulated natural stream bottom as follows:

- ODOT Class 700 loose riprap placed in a layer over the invert,
- ODOT Class 50 loose riprap placed in a layer over the coarse rock, and
- a layer of natural stream bed material placed over the Class 50 riprap. The natural bed material is expected to be continually washed out of the culvert and be replaced by natural bed material from upstream.

The channel bottom would need to be lowered about 4 feet at the inlet. A roughened channel would be needed upstream from the new culvert to prevent headcuts from undermining the culvert under the private road. Rocks and logs would be used for the roughened channel. It is estimated 50 to 100 feet of channel would need roughening.

We recommend this culvert be replaced with relatively small pipe sized to pass streamflow but not designed to pass fish. We recommend mitigation for this by installing a fish passage culvert just outside the project limits at M.P. 21.3.

Culvert Replacement at M.P. 20.85 - This culvert is in the middle of the project. Currently it is a pair of 24-inch diameter concrete pipes. High velocity discharge from these pipes has scoured soils and rock from around the outlets, as shown in Figure 1. This scour and the high velocities in the pipe block fish passage. The recommended replacement culvert is shown in Drawing 2. Estimated fish passage characteristics are as follows:

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- upstream watershed area is 0.157 square miles,
- an 8-foot span by 6-foot rise by 96-foot long box culvert with standard ODOT headwalls, wingwalls, and aprons,
- the box invert is set on a flatter slope than the natural stream channel,
- the box spans the active flow channel - the active flow channel width varies from 6 to 8 feet and the box span is 8 feet, and
- the invert would be buried 2 feet into the stream bottom - this provides 2 feet of cover over the invert. Little or no future channel degradation is predicted.

The box would have a simulated natural stream bottom as follows:

- ODOT Class 700 loose riprap placed in a layer over the invert, and
- a layer of natural stream bed material over the Class 700 riprap. The natural bed material will be continually washed out of the culvert and be replaced during floods.

The channel bottom would need to be lowered about 3 feet at the inlet. An estimated 50-foot long transition section will be needed between the culvert inlet and the natural bottom of the existing channel. This transition section can be excavated in the natural bed materials. It is not necessary to make a roughened channel section using rocks and logs.

Culvert Replacement at M.P. 21.3 - This culvert is located outside of the project area to the east. Currently it is a pair of 24-inch diameter concrete pipes. These pipes are undersized. ODOT maintenance has reported flooding at this location caused by excessive headwater upstream from the culverts. In addition, the high velocity discharge from these pipes has scoured soils and rock from around the outlets. Figure 2 shows the outlets and Figure 3 shows the side of the scour hole. These pipes block fish passage and they are listed as "High Priority" on the ODFW culvert replacement program. ODOT maintenance personnel have seen several different species of trout and salmon at the outlet of these pipes during floods. The recommended replacement culvert is shown in Drawing 3. Estimated fish passage characteristics are as follows:

- upstream watershed area is 0.240 square miles,
- a 10-foot span by 10-foot rise by 93-foot long box culvert with standard ODOT headwalls, wingwalls, and aprons,
- the box invert and stream grade would be the same,
- the box spans the active flow channel - the active flow channel width varies from 7 to 9 feet and the box span is 10 feet, and
- the invert would be buried 4 feet into the stream bottom - this allows for at least two feet of cover over the invert after up to 2 feet of predicted future channel degradation.

The box would have a simulated natural stream bottom as follows:

- sediment retention plates attached to the culvert bottom,
- ODOT Class 700 loose riprap placed in a layer over the invert and around the plates,
- ODOT Class 50 loose riprap placed in a layer over the coarse rock, and
- a layer of natural stream bed material over the Class 50 riprap. The natural bed material is expected to continually wash out of the culvert and be replaced by natural bed from upstream.

We recommend these pipes be replaced with a fish passage culvert as mitigation. The mitigation would be for replacing the culvert at M.P. 20.55 with a smaller hydraulically adequate culvert rather than a fish passage culvert.

Bank Protection - Roadway embankment protection will be needed where Turner Creek flows alongside the roadway. Currently the creek is undercutting the embankment at these places and it will eventually damage the highway. Figure 4 shows the undercutting as seen from the road shoulder. The exact location of this embankment protection will be determined by the geotechnical or foundation engineer. The bank protection recommendations are shown in Drawing 4.

The proposed embankment protection is made from boulders rather than riprap. The relatively large interstitial spaces between the boulders will be filled with topsoil and planted. Plants similar to those growing in the area will be used. Willows will not be used. They do not grow in the shady conditions at this site.

Temporary Water Management - It is anticipated the fish passage culverts will be installed when the streams are dry. This is estimated to be from July 15 through October 30. No workplace isolation or stream diversion measures are anticipated.

It is also expected there will be little or no flow in Turner Creek when the embankment protection is constructed. It is anticipated the creek will be dammed upstream from the construction area and either pumped past the construction site or allowed to flow through the site in a small culvert. Fish passage would be blocked in both directions if a pump is used. Upstream fish passage would be blocked if a bypass pipe is installed.



FIGURE 1

**FIGURE 2**



FIGURE 3

**FIGURE 4**







