Assessing Salmonid Passage Through Culverts in the Coast Dairies, CA

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Abstract

Several streams along the Central California Coast support threatened and endangered anadromous steelhead (*O. mykiss*) and coho (*O. kisutch*) populations. Manmade stream modifications such as culverts can inhibit upstream salmonid migration due to a variety of unsuitable channel conditions, including high velocity and shallow depth. In the Coast Dairies Property near Davenport,CA, we assessed fish passage for four culverts running under Coast Highway 1. We modeled each culvert in a hydraulic modeling program using site surveyed cross sections. We ran each model under various flows and compared model results with depth and velocity thresholds recommended by CDFG. The results suggest that San Vicente Creek and Laguna Creek are likely passable under certain flow conditions. Existing populations of steelhead and coho on these streams verify our model results. Our models suggest culverts on Molino Creek and Ferrari Creek are not suitable for salmonid migration under any flow conditions. Low channel roughness in the concrete culverts on Molino and Ferrari likely limits availability of appropriate hydraulic conditions for salmonid migration. Baffle installation may reduce velocity and increase depth within these culverts.

Methods

We surveyed cross sections using a rotating laser level on each of the four streams in the Coast Dairies Property (Figure 1). We used a mixed steady flow analysis under various winter flow conditions in the HEC-RAS hydraulic modeling program to assess maximum culvert depth and average cross section velocity. We compared the model results to California Department of Fish and Game recommended culvert conditions.

Figure 1. Watershed boundaries of the four study streams. Coast Highway 1 crosses each stream near stream mouth.

Results

Laguna Creek

Figure 2. View upstream from culvert outlet

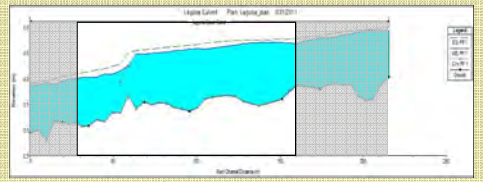

Figure 3. Longitudinal profile with noticeable culvert channel variability

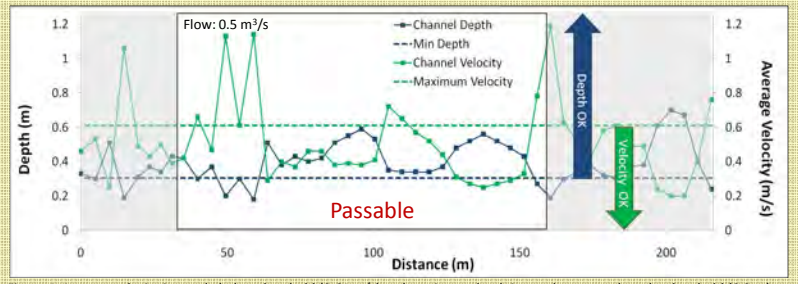

Figure 4. Average velocity is mostly below threshold (0.61 m/s) and maximum depth is mostly greater than the threshold (0.3 m)

San Vicente Creek

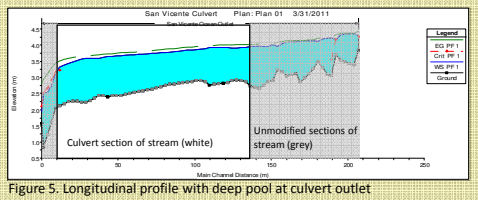

Figure 5. Longitudinal profile with deep pool at culvert outlet

Figure 6. Looking upstream inside bedrock culvert

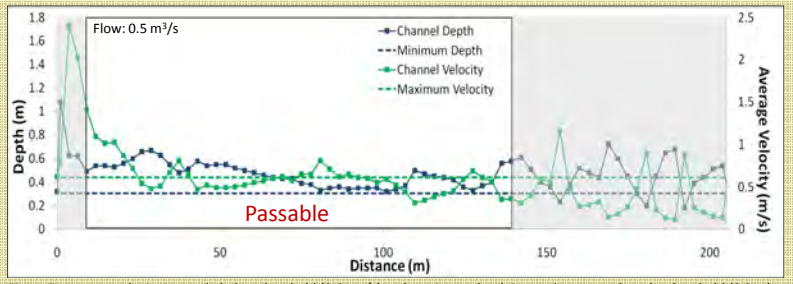

Figure 7. Average velocity is mostly below threshold (0.61 m/s) and maximum depth is mostly greater than the threshold (0.3 m)

Molino Creek

Figure 8. View downstream inside culvert outlet

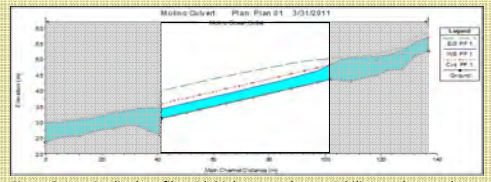

Figure 9. Longitudinal profile with high energy, low variability, and steep slope

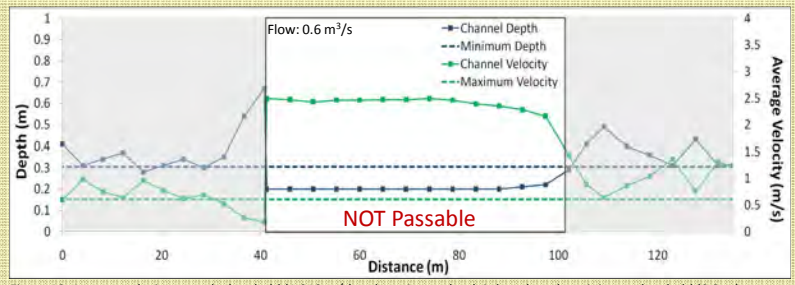

Figure 10. Average velocity exceeds threshold (1.219 m/s) and maximum depth is less than the minimum threshold (0.3 m)

Ferrari Creek

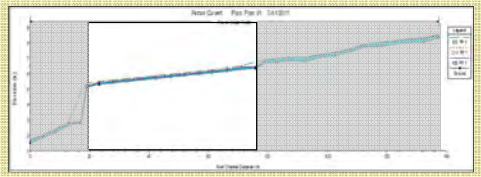

Figure 11. Longitudinal profile with >2 m hydraulic drop at the culvert outlet

Figure 12. Looking downstream inside Ferrari culvert

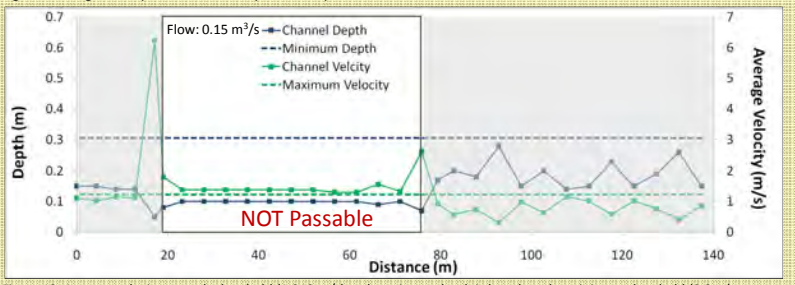

Figure 13. Average velocity exceeds threshold (1.219 m/s) and maximum depth is less than the minimum threshold (0.3 m)

Conclusions and Recommendations

Modeling results suggest the culverts on Laguna Creek and San Vicente Creek have generally suitable velocity and depth conditions for salmonid passage under certain winter flows (0.5 m³/s). Although not all cross sections exhibited suitable depth and velocity, in general conditions were passable. We assume fish are able to burst swim through small sections of higher channel velocities to migrate through the culverts. High velocities modeled at the downstream end of San Vicente may be overestimates due to modeling limitations. Molino Creek and Ferarri Creek do not appear to meet both velocity and depth conditions under any flow. Low channel roughness may contribute to unsuitable hydraulic conditions. Baffle installation may reduce velocity and increase depth within these culverts, improving the likelihood of salmonid migration in the future.

Acknowledgements

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