Assessing Salmonid Passage Through Culverts in the Coast Dairies, CA
Sara Kelly and Colin Nicol
Division of Science and Environmental Policy, California State University Monterey Bay

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 Vince 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 limit 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.

Results

Several culverts along the Coast Dairies Property were assessed for salmonid passage under various winter flow conditions. Our models suggest that San Vicente Creek and Laguna 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 Ferrari 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.

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 Ferrari 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
We are grateful for funding and support from UROC and BLM; special thanks to Casey Lainer for field assistance and many thanks to Dr. Doug Smith for mentoring this project.