



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Kai T. Narum	Project Number J0119
Project Title Baffling Baffles: Culvert Design for Fish Passage	
Abstract Objectives/Goals Salmon populations are decreasing, in part because they can not reach their spawning grounds due to poorly designed culverts. Engineers have been putting baffles (devices that impede the flow of water) in culverts to improve fish passage conditions by increasing the depth and decreasing the velocity of water. My objective was to evaluate different baffle designs in culverts to determine which one is most effective in doing this. Methods/Materials This project was conducted in a hydraulic flume at Humboldt State University. I tested three culvert models (big baffles, small baffles, no baffles) under high (0.247 ft ³ /s), medium (0.138 ft ³ /s), and low flow conditions (0.009 ft ³ /s). I also ran the experiment with clear water only, water and sand, and water and gravel. The laboratory flume allowed me to control water flow, channel slope, and sediment input. I measured the water depth (feet) with a point depth gauge and velocity (ft/s) by timing a float over a known distance. Each depth and velocity measurement was repeated four times and a total of 27 flume runs were conducted. Results The culvert with no baffles had the highest velocity and lowest water depths of the three culverts under all flow and sediment input conditions. Adding baffles increased water depth by 39-524% and decreased the velocity by 30-80% over the range of conditions tested. The big baffles had a higher depth than the culvert with small baffles (26-196%), however, the big baffles did not significantly decrease the velocity compared to the small baffles (0-10%). In addition, the culvert with big baffles was the most effective at moving sediment through the culvert and had the highest calculated shear stress (the force applied to the sediment by the water). In small baffles, sand and gravel filled in the fish resting areas behind the baffles because of lower shear stress. Conclusions/Discussion I can conclude that the culvert with no baffles was the least effective at increasing depth and decreasing velocity, and that overall the culvert with big baffles was the most effective. My background research suggested that most baffle designs in culverts are based on experiments with water only. Adding sediment into the culvert significantly decreases the effectiveness of the design, and including sediment is a very important factor to consider in culverts designed for fish passage.	
Summary Statement This project evaluates the effects of baffles on water flow in culverts modified for fish passage.	
Help Received Used hydraulic flume at HSU under the supervision of Dr. Cashman; Teacher and parents helped with editing.	