Assessments

Calaveras River Fish Migration Barriers Assessment Report

RESOURCE RESTORATION DIVISION OF PLANNING & LOCAL ASSISTANCE DEPARTMENT OF WATER RESOURCES

SEPTEMBER 2007

Front cover photos (clockwise from top):
Hosie Low Flow Crossing; Mormon Slough Tressel;
Caprini Low Flow Crossing; Calaveras Headworks

Fish Passage Improvement Program

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September 2007

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State of California

Mike Chrisman
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The Resources Agency

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Foreword

In 2005, The California Department of Water Resources published the inaugural *Bulletin 250 – Fish Passage Improvement*. The bulletin was the result of a joint interagency collaboration between the Department, the Department of Fish and Game, NOAA's National Marine Fisheries Service, and the US Fish and Wildlife Service through CALFED's Ecosystem Restoration Program. The document recognized the depletion of migratory fish species caused by artificial structures in the Sacramento and San Joaquin River systems. Bulletin 250 promoted continued and increased actions by governments and private organizations for the protection and recovery of listed anadromous salmonid species in California.

This publication, *Calaveras Fish Migration Barriers Assessment Report*, is one of those actions. The Department in cooperation with Stockton East Water District and with assistance from the Department of Fish and Game, NOAA's National Marine Fisheries Service, and US Fish and Wildlife Service produced this document to be used for improving access into the lower Calaveras River for migrating seaward rainbow trout (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*).

This publication provides an inventory and evaluation of barriers on the Calaveras River system—its confluence with the San Joaquin River to New Hogan Dam, the Mormon Slough flood control channel, and the Stockton Diverting Canal. Numerous low flow road crossings, flashboard dams, and other structures exist in the Calaveras River and Mormon Slough that impede fish migration. The largest structure is Bellota Weir. The screening of the diversion and development of a permanent fish ladder at Bellota Weir are being addressed by Stockton East Water District. The results of this report will be used in conjunction with salmon and migratory rainbow trout life history data to identify and prioritize potential fish passage improvement projects to assist in the restoration of habitat and migratory pathways in the Calaveras River system.

The information that this report provides will promote the establishment of additional studies, programs, and projects, leading to cooperative efforts to improve listed and non-listed anadromous fish populations in the Calaveras River and Bay-Delta ecosystem.

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Executive Summary

Artificial structures play a major role in reducing Calaveras River's productivity as a migrating seaward rainbow trout (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*) fishery. The river is in the range of historical and essential fish habitat for fall-run Chinook salmon and part of the historical distribution of Central Valley rainbow trout. In cooperation with Stockton East Water District, the Department of Water Resources' Fish Passage Improvement Program studied and assessed the physical and hydraulic conditions of 97 artificial structures in the Calaveras River from New Hogan Dam downstream to the confluence with the San Joaquin River.

These structures are low-flow road crossings with culverts, low-flow road crossings without culverts, bridges, permanent dams and weirs, and flashboard dams with the flashboards removed. Each structure was evaluated for fish passage and scored on its potential as a barrier to fish passage. Possible scores ranged from 0 to 7, with 7 designating the greatest potential to impair fish passage. Clements Road Flashboard Dam on the Calaveras River was the only structure to score 7. Forty-nine structures received a score of 0; all of them are bridges that have no apron or riprap. A ranking of 0 does not guarantee passage; it only indicates the structure has similar passage performance to normal channel cross sections.

The seasonal flashboard dams were also evaluated with their flashboards installed. A revised scoring system was developed to incorporate the unique characteristics of these structures. The possible scores ranged from 0 to 9, with 9 designating the greatest potential to impair fish passage. Cherryland, Panella, Lavaggi, McLean, Prato, and Clements dams all received 9 points. Murphy Flashboard Dam had the lowest score of 3 points.

Seventeen structures were selected to be modeled using HEC-RAS, the US Army Corps of Engineers one-dimensional open channel flow model. These structures were selected because they are representative of the different structure types and are the most severe in regard to impaired fish passage. The model allowed the calculation of the percentage of time that adult and juvenile fish can pass through a structure during their migration period. Clements Road Flashboard Dam was the most severe, allowing *O. tshawytscha* and *O. mykiss* passage only 2% and 5% of their migration periods, respectively. Additionally, juveniles only have passage during 15% of their migration period. None of the 17 structures allowed 100% passage during the adult Chinook, *O. mykiss*, or juvenile migration periods. This implies that all 97 structures on Calaveras River, Mormon Slough, and Stockton Diverting Canal represented by the modeled structures are likely to be impassable at some point during each migration season. Riprap was often the feature that had the greatest impact on fish passage at modeled structures, indicating that the use of riprap should be eliminated at structures and in the channel where possible.

To increase the Calaveras River's productivity as an *O. tshawytscha* and *O. mykiss* fishery, many structures on the Calaveras River system must be retrofitted to allow passage for adult and juvenile salmonids. Both temporary and permanent modifications are needed to prevent further decline in fish populations. This report provides a basis for various temporary and permanent structure solutions to the impaired fish passage these structures create. Such solutions are being developed on a preliminary or conceptual level for eight of the structures identified in this report.

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Acronyms and Abbreviations

af	acre-feet
cfs	cubic feet per second
DFG	California Department of Fish and Game
DO	dissolved oxygen
DWR	California Department of Water Resources
ESU	Evolutionarily Significant Unit
FFC	Fishery Foundation of California
FPIP	Fish Passage Improvement Program
fps	feet per second
HEC-RAS	Hydrologic Engineering Centers River Analysis System
NMFS	National Marine Fisheries Service
SEWD	Stockton East Water District
USACE	US Army Corps of Engineers
USBR	US Bureau of Reclamation
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey

Metric Conversion Table

Quantity	*To Convert from Metric Unit*	*To Customary Unit*	*Multiply Metric Unit By*	*To Convert to Metric Unit Multiply Customary Unit By*
Length	millimeters (mm)	inches (in)	0.03937	25.4
	centimeters (cm) for snow depth	inches (in)	0.3937	2.54
	meters (m)	feet (ft)	3.2808	0.3048
	kilometers (km)	miles (mi)	0.62139	1.6093
Area	square millimeters (mm^2)	square inches (in^2)	0.00155	645.16
	square meters (m^2)	square feet (ft^2)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometers (km^2)	square miles (mi^2)	0.3861	2.590
Volume	liters (L)	gallons (gal)	0.26417	3.7854
	megaliters (ML)	million gallons (10*)	0.26417	3.7854
	cubic meters (m^3)	cubic feet (ft^3)	35.315	0.028317
	cubic meters (m^3)	cubic yards (yd^3)	1.308	0.76455
	cubic dekameters (dam^3)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic meters per second (m^3/s)	cubic feet per second (ft^3/s)	35.315	0.028317
	liters per minute (L/mn)	gallons per minute (gal/mn)	0.26417	3.7854
	liters per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megaliters per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekameters per day (dam^3/day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lbs)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb.)	1.1023	0.90718
Velocity	meters per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (kW)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	feet head of water	0.32456	2.989
Specific capacity	liters per minute per meter drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per liter (mg/L)	parts per million (ppm)	1.0	1.0
Electrical conductivity	microsiemens per centimeter (µS/cm)	micromhos per centimeter (µmhos/cm)	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8X°C)+32	0.56(°F-32)