

**Supplemental Expert Witness Report
of Edward E. Donahue**

**Implementation of Fish Passage Measures Facilitating
the Upstream and Downstream Migration of Adult and
Juvenile Salmonids within the San Joaquin River from
Friant Dam to the Merced River Confluence with
Respect to the Flow Proposal
of Dr. G. Mathias Kondolf**

September 2005



2365 Iron Point Road, Suite 300
Folsom, CA 95630

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Purpose and Assignment

The purpose of the following document is to provide an evaluation of the report of Dr. G. Mathias Kondolf, with respect to the need for fish screens, barriers and passage.

This document presents my opinions regarding the design and probable construction costs for the implementation of those fish passage measures noted above along the San Joaquin River. This document also provides a comparison of Dr. Kondolf's proposal with the cost of the fish passage measures necessitated by the flow requirements and flow routing proposed by Dr. Charles Hansen. All bases for estimates and reference data remain the same as for my original report.

Summary of My Opinions

My engineering evaluation in this supplemental report focuses on fish protection screens, fish passage and barriers that relate to Dr. Kondolf's report as it differs from the original reports of Dr. Michael Harvey and Dr. Charles Hansen with respect to flows and flow routing. The main difference between the 3 reports is the migratory fish movement through Mendota Pool as proposed by Dr. Kondolf.

It should be noted that I did not include any associated estimates of cost for channel improvements or fish health issues in this report as they fall within the expertise of others, other than for the Sand Slough bypass, as it directly relates to a proposed unscreened diversion.

The main cost difference relates to Dr. Kondolf's proposed use of Mendota Pool for salmonid migration. The hydraulic interaction through the many flow regimes within the Mendota Pool

vs. a Mendota Pool bypass were not assessed in my original report. It appears that flow control in this section of the San Joaquin River may be more costly than a bypass system that would eliminate any such need. The costs derived were compared based on more detailed estimates provided in my original report to provide a similar basis for the numbers. However, more detailed investigation of the independent conditions at the points of interest through the Mendota Pool could provide different cost numbers.

San Joaquin River Passage Design Flows as Proposed by Dr. Kondolf

Alternative design flows for the proposed restoration efforts along the San Joaquin River were developed by Dr. Kondolf in the report titled “Expert Report of G. Mathias Kondolf, pH.D.,” dated August 2005. Table 1 provides a listing of the overall elements related to this comparative evaluation.

Table 1. Major Water-Supply and Flood Control Infrastructure that are Impediments to Fish Passage from Friant Dam to the Merced River

Element	Location (River Mile)	Description and Comments
Reach 1A		
Friant Dam	267.5	Forms Millerton Lake. Total storage is 520,500 acre-feet (af) of which 170,000 acre-feet can be reserved for flood control. Friant Dam is a major physical barrier and has blocked fish access to upstream reaches of the San Joaquin River since 1941.
Chowchilla Bypass Bifurcation Structure	216.1	Diverts flow from main stem San Joaquin River into Chowchilla Bypass Canal.
Reach 2B		
Columbia Canal	206 to 183	Right bank canal that borders the river, intake from Mendota Pool (typical irrigation season diversion = 200 cfs)
Helm Ditch	204.6 to 197.5	Left bank ditch, intake from Mendota Pool (typical irrigation season diversion = 5 to 10 cfs)
Mendota Dam and Pool	204.6	Headworks for regulating water that is conveyed into the system through the Delta-Mendota Canal. Has no flood storage capacity. Barrier to upstream fish passage with boards in dam. Has fish ladder that is non-functional.
Fresno Slough	204.6	Left bank slough, intake from Mendota Pool (typical irrigation season diversion= 300 cfs)
Delta-Mendota Canal	204.6	Delivers 800 to 2,800 cfs to left bank of Mendota Pool
FCWD Canal	204.6	Left bank canal, intake from Mendota Pool (typical irrigation season diversion = 300 cfs)
Main Canal	194.5	Left bank canal, intake from Mendota Pool (typical irrigation season diversion = 1,500 cfs)
Outside Canal	198.0	Left bank canal, intake from Mendota Pool (typical irrigation season diversion = 300 cfs).
Reach 3		
Sack Dam	182.0	Low-head earth and concrete structure with wooden flap gates that diverts Delta-Mendota Canal flows into the Arroyo Canal.

Element	Location (River Mile)	Description and Comments
Arroyo Canal	182.0	Left bank canal, intake from Sack Dam, diverts Delta-Mendota Canal (typical irrigation season diversion = 500 to 600 cfs, diverts all flows up to 600 cfs)
Reach 4B head-gates	168	<p>Reach 4</p> <p>Earth fill plug of San Joaquin River with headgate culverts controlling flow into Reach 4B of the San Joaquin River.</p>
Flood Control Bypass		
Sand Slough Control Structure	Approx 168	Low head control structure in Sand Slough between San Joaquin River and East Side Bypass. Originally used to back-up water to divert down San Joaquin River Main stem.
Mariposa Bypass Bifurcation Structure	Approx 147	Diverts flood flows from the East Side Bypass / Mariposa bypass confluence back to the San Joaquin River.

Implications of the Fish Passage Conceptual Model Proposed by Dr. Kondolf

Mendota Pool

Under the plan proposed by Dr. Kondolf, adult and juvenile salmonids would be routed through the Mendota Dam and Pool. This would require the construction of one fishway, six screens, and one barrier. Mendota Dam would require the construction of a new single channel vertical-slot controlled fishway to facilitate upstream migration of adult salmonids. The screening facilities will include single wedge-wire vertical plate screens placed in a V-configuration across the entrance to the Columbia Canal, Helm Ditch, Fresno Slough, FCWD Canal, Main Canal, and Outside Canal. Each vertical plate V will be connected to a bypass and bypass channel that will sweep juveniles to the bypass channel, facilitating downstream migration. The screens will be sized for the design flows as proposed by Dr. Kondolf. Other experimental screening techniques such as louvers are unacceptable and Modular Inclined Screens (MIS) are impractical. A single picket type barrier will be required to prevent upstream migration of adult Salmonids up the Delta-Mendota Canal.

Sand Slough

At the Sand Slough control structure, a single fishway facility will be required. The fishway will be required from the San Joaquin River up and through the control gates at the existing hydraulic control structure. Dr. Kondolf feels that juvenile salmonids may be routed through the Mariposa Bypass at this point if necessary. Thus, the use of a screen to keep juveniles out of the Mariposa Bypass may no longer apply. However, the habitat improvements discussed in the supplement report of Dr. Peter Hradilek would apply or, the alternative, 2,500 cfs barrier screen would be required to prevent juvenile fish from entering the bypass. Costs associated with those habitat improvements are included in the supplemental report prepared by Dr. Peter Hradilek. For the purpose of this report the 2,500 cfs screen was not included as Dr. Kondolf has proposed an unscreened bypass.

Table 2 provides a summary of the fish passage and barrier measures I believe are required to mitigate for existing impediments to fish passage located along the San Joaquin River from Friant Dam to the confluence of the Merced River using the plan proposed by Dr. Kondolf. In all other respects the cost estimates would remain the same.

Table 2. Summary of Fish Passage Design Elements and Descriptions

Primary Control Structure	Passage Measure	Description
Mendota Pool	Fishway at Mendota Dam	Single-Channel, vertical-slot control fishway
	Screen Columbia Canal	Vertical Screens, V-configuration.
	Screen Helm Ditch	Picket barrier with cleaning provisions
	Screen Fresno Slough	Provide structures to Agency Guidelines
	Barrier at Delta-Mendota Canal	
	Screen FCWD Canal	
	Screen Main Canal	
	Screen Outside Canal	
Sand Slough	Fishway from San Joaquin	Single channel, vertical-slot control.

Opinion of Probable Cost of Construction

Conceptual level opinions of probable costs were developed for Dr. Kondolf's fish passage strategy. Costs were developed based upon my professional knowledge, experience, and actual construction costs incurred in other similar projects. These costs include a construction contingency of 25%, mobilization cost of 5%, and general conditions cost of 7%. Spreadsheets summarizing cost details are provided in Appendix A.

Table 3 provides a summary of overall comparison between the two plan costs for passage and barrier measures addressing each major infrastructure component. These costs do not include costs associated with acquisition of land.

Table 3. Summary of Probable Costs of Construction for Major Passage Components

Primary Control Structure	Passage Measure	Rounded Cost	
		Hansen Plan	Kondolf Plan
Chowchilla Bifurcation Structure	No Change	\$ 30,166,000	\$ 30,166,000
Mendota Pool ¹	Mendota Pool Bypass Channel	31,530,000	N/A
	Add the following Structures:		
	Mendota Dam Fishway:		398,720
	Columbia Canal: Screen 200 cfs		1,437,600
	Helm Ditch: Screen 10 cfs		150,000
	Fresno Slough: Screen 300 cfs		2,156,400
	Delta-Mendota Canal: Barrier 3,000cfs		1,612,800
	FCWD Canal: Screen 300 cfs		2,156,400
	Main Canal: Screen 1,500 cfs		10,782,000
Outside Canal: Screen 300 cfs		2,156,400	
Sack Dam	No Change	4,521,000	4,521,000
Sand Slough	Screen and Fishway	29,093,000	
	Fishway		407,200
	Bypass Channel Enhancement		44,192,000
Mariposa Bypass	No Change	1,236,000	1,236,000
Pump Diversions	No Change	11,130,000	11,130,000
Total Probable Construction Cost		\$ 107,676,000	\$ 112,502,520



*Supplemental Expert Witness Report by Edward E. Donahue
Fish Passage within the San Joaquin River*

Edward E. Donahue
Edward E. Donahue

Date: September 19, 2005

September 19, 2005

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Received 09-19-05 12:01pm

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Appendix A: Cost Data

**San Joaquin River
Fresno Slough
Opinion of Probable Construction Costs**

300 cfs screen

Use Aurora Bypass Unit Cost
\$3,080,643 / 2 (300 cfs vs 600 cfs)
Total

1,540,322

Construction Costs Subtotal
Contingency (25%)
Subtotal
Mobilization (5%)
General Conditions (7%)
CONSTRUCTION TOTAL

1,540,322

385,000

1,925,322

96,266

134,773

2,156,400

**San Joaquin River
FCWD Canal
Opinion of Probable Construction Costs**

300 cfs screen

Assume similar to Fresno Slough Screen

2,156,400

**San Joaquin River
Outside Canal
Opinion of Probable Construction Costs**

300 cfs screen

Assume similar to Fresno Slough Screen

2,156,400

**San Joaquin River
Delta-Mendota Canal Adult Barrier
Opinion of Probable Construction Costs**

3,000 cfs Barrier

Base of Comparison: Eastside Chowchilla Bypass, Picket Fish Barrier (200 L.F.)

Base Estimate: 384,000

Construction Costs Subtotal	384,000
Contingency (25%)	96,000
Subtotal	480,000
Mobilization (5%)	24,000
General Conditions (7%)	33,600
CONSTRUCTION TOTAL	537,600

Dollars per L.F.	2,688
600 x \$2,688	1,612,800

**San Joaquin River
Sand Slough
Opinion of Probable Construction Costs**

Fishway	290,887
Construction Costs Subtotal	290,887
Contingency (25%)	72,722
Subtotal	363,609
Mobilization (5%)	18,180
General Conditions (7%)	25,453
CONSTRUCTION TOTAL	407,200

**San Joaquin River
Columbia Canal
Opinion of Probable Construction Costs**

200 cfs screen

Comparative Estimate Base: Aurora Diversion (600 cfs)

Base Estimate:	3,228,803
Minus Fishway	<u>-148,160</u>
Total	3,080,643

Construction Costs Subtotal	3,080,643
Contingency (25%)	770,000
Subtotal	<u>3,850,643</u>
Mobilization (5%)	192,532
General Conditions (7%)	<u>269,545</u>
CONSTRUCTION TOTAL	4,312,720

Dollars per cfs	7,188
200 x \$7,188	1,437,600

**San Joaquin River
Main Canal
Opinion of Probable Construction Costs**

1,500 cfs

Assume unit price similar to Aurora Diversion

1,500 x \$7,188	10,782,000
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**San Joaquin River
Fresno Slough
Opinion of Probable Construction Costs**

300 cfs screen

Use Aurora Bypass Unit Cost
\$3,080,643 / 2 (300 cfs vs 600 cfs)
Total

1,540,322

Construction Costs Subtotal
Contingency (25%)
Subtotal
Mobilization (5%)
General Conditions (7%)
CONSTRUCTION TOTAL

1,540,322
385,000
1,925,322

96,266
134,773

2,156,400

**San Joaquin River
FCWD Canal
Opinion of Probable Construction Costs**

300 cfs screen

Assume similar to Fresno Slough Screen

2,156,400

**San Joaquin River
Outside Canal
Opinion of Probable Construction Costs**

300 cfs screen

Assume similar to Fresno Slough Screen

2,156,400

**San Joaquin River
Delta-Mendota Canal Adult Barrier
Opinion of Probable Construction Costs**

3,000 cfs Barrier

Base of Comparison: Eastside Chowchilla Bypass, Picket Fish Barrier (200 L.F.)

Base Estimate: 384,000

Construction Costs Subtotal	384,000
Contingency (25%)	96,000
Subtotal	480,000
Mobilization (5%)	24,000
General Conditions (7%)	33,600
CONSTRUCTION TOTAL	537,600

Dollars per L.F.	2,688
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**San Joaquin River
Sand Slough
Opinion of Probable Construction Costs**

Fishway 290,887

Construction Costs Subtotal	290,887
Contingency (25%)	72,722
Subtotal	363,609
Mobilization (5%)	18,180
General Conditions (7%)	25,453
CONSTRUCTION TOTAL	407,200

		Passage Plan 1	Alternative Plan
Chowchilla Bifurcatio	No Change	30,166,000	30,166,000
Mendota Pool	Mendota Pool Bypass Channel	31,530,000	
	Mendota Dam Fishway		398,720
	Columbia Canal: Screen 200 cfs		1,437,600
	Helm Ditch: Screen 10 cfs		150,000
	Fesno Slough: Screen 300 cfs		2,156,400
	Delta-Mendota Canal: Barrier 3,000 cfs		1,612,800
	FCWD Canal: Screen 300 cfs		2,156,400
	Main Canal: Screen 1,500 cfs		10,782,000
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Sack Dam	No Change	4,521,000	4,521,000
Sand Slough	Screen and Fishway	29,093,000	
	Fishway		407,200
	Bypass Improvements		44,192,000
Mariposa Bypass	No Change	1,236,000	1,236,000
Pump Diversions	No Change	11,130,000	11,130,000
Total OPCC		107,676,000	112,502,520