

A Watershed Approach to Fish Passage Feasibility (Calaveras Dam Case Study)



URS

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Jonathan Stead¹, Craig Freeman², Steve Leach¹, Susan Hou²

¹URS Corporation, ²San Francisco Public Utilities Commission

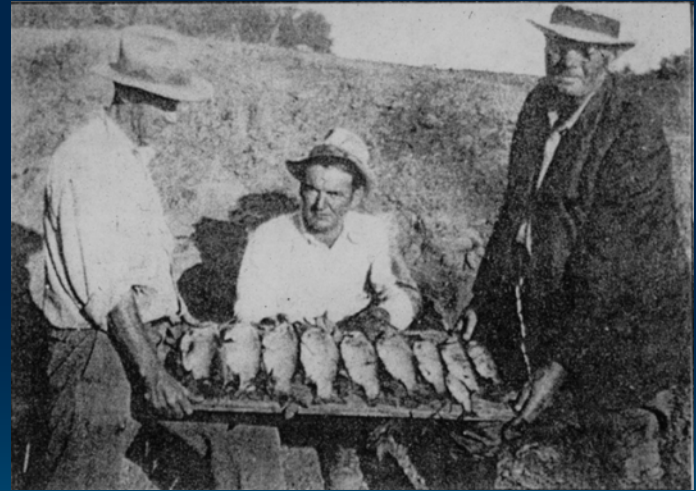
Agenda

- Introduction
- Setting
- Fish Passage Studies
 - Calaveras Dam
 - Natural Barriers
 - Alameda Creek Diversion Dam
- Project Permits
- Conclusions



Introduction

- Evaluation of need for fish passage can be triggered by project CDFW Stream Alteration Agreement (F&G Code) and Federal ESA consultation
- Much water infrastructure developed prior to implementation of environmental laws
- Modifications or repairs may trigger need for environmental permits



Introduction

- Several interrelated steelhead passage studies
- Studies would support Calaveras Dam permitting and public review
- Ongoing, watershed-wide restoration effort would benefit from information from feasibility analyses

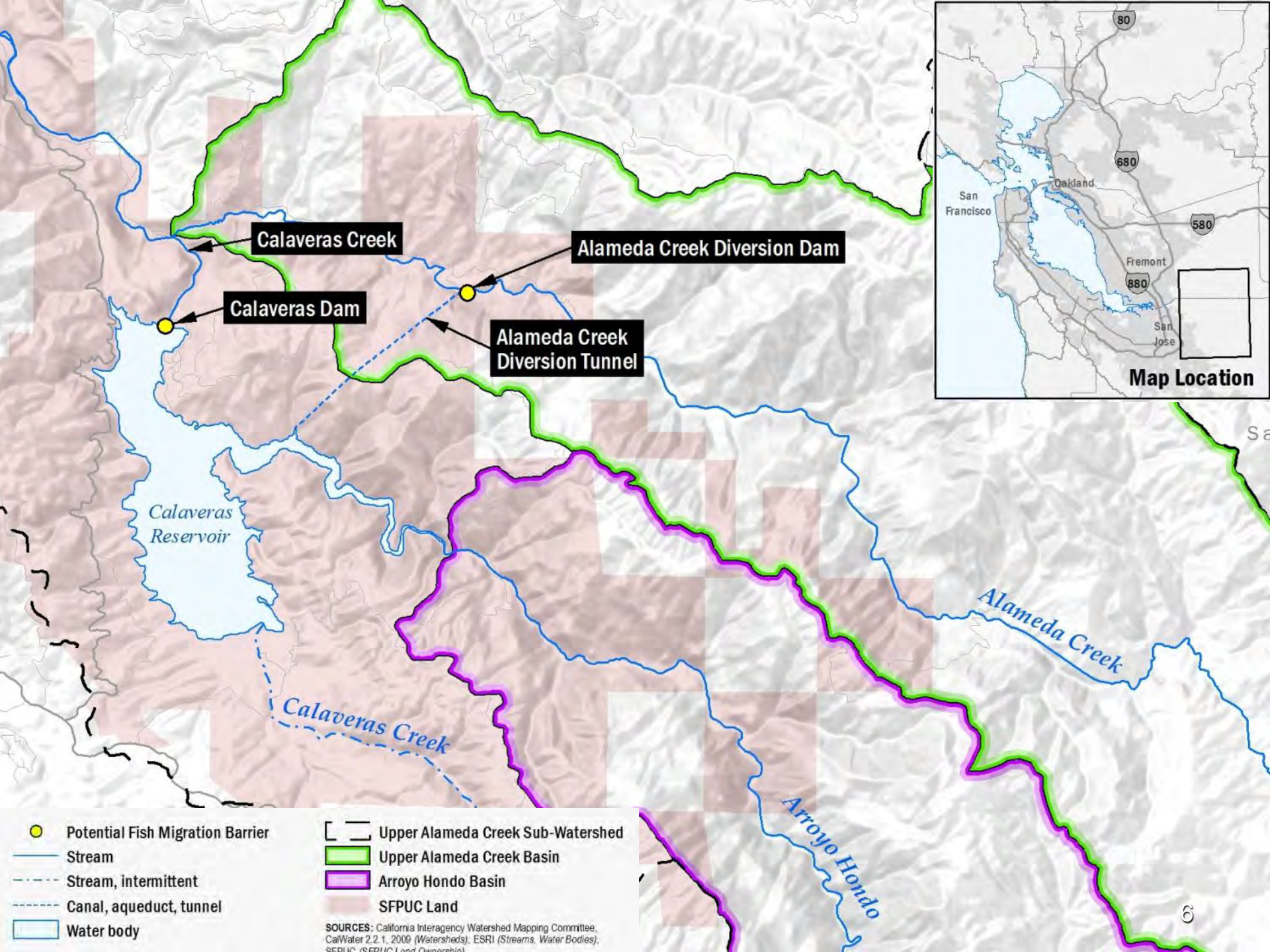


Calaveras Dam

- 220-foot-tall earthen dam
- Alameda and Calaveras Creeks, and Arroyo Hondo
- Arroyo Hondo Basin is 50,000 acres



Old Calaveras Dam

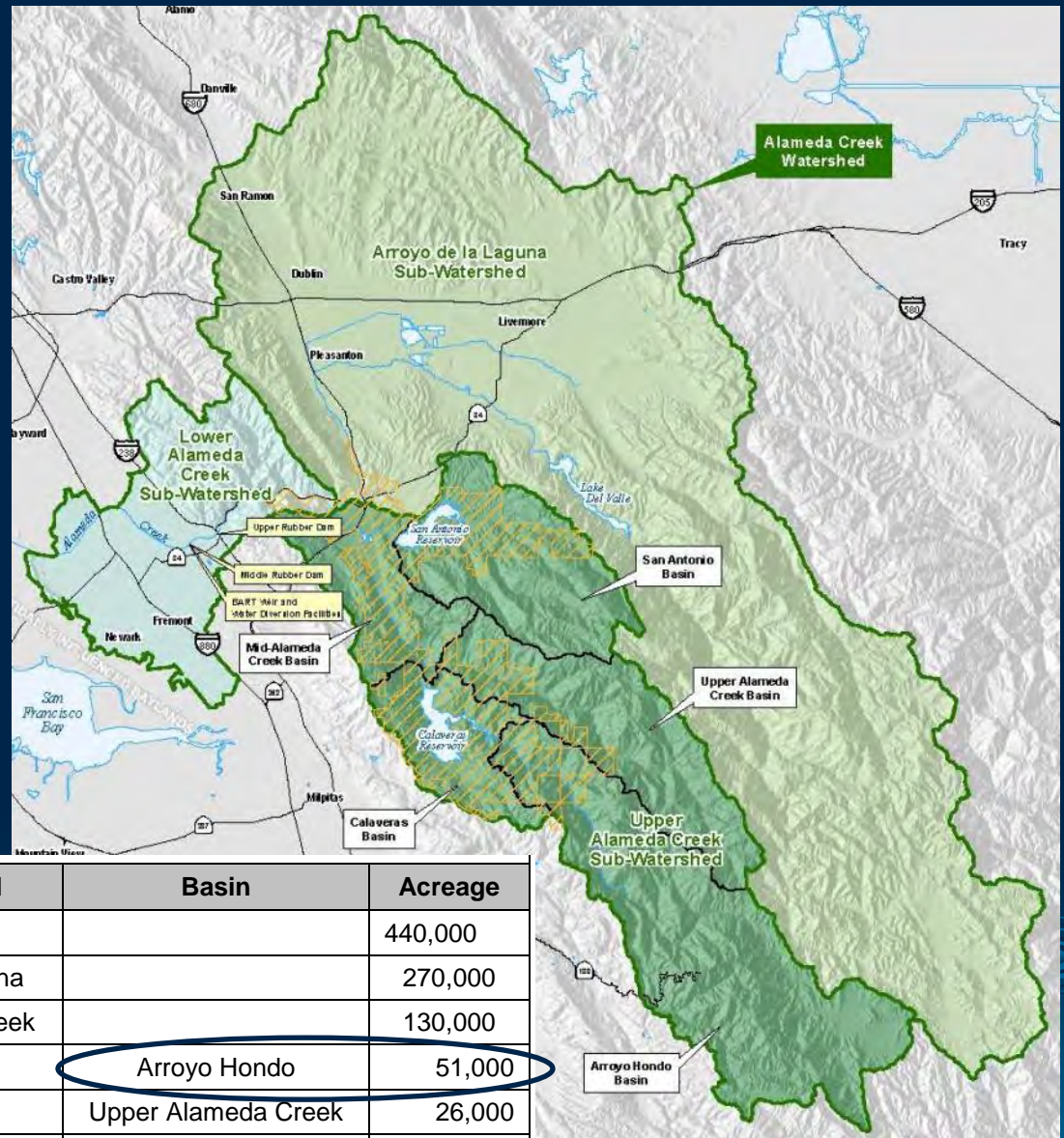


Central California Coast Steelhead DPS



- Alameda Creek Watershed is 10% of DPS
- Steelhead anadromous life history
- Watershed-wide efforts to restore run of steelhead underway

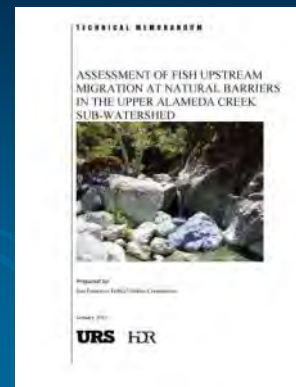
Habitat Upstream of Calaveras Dam



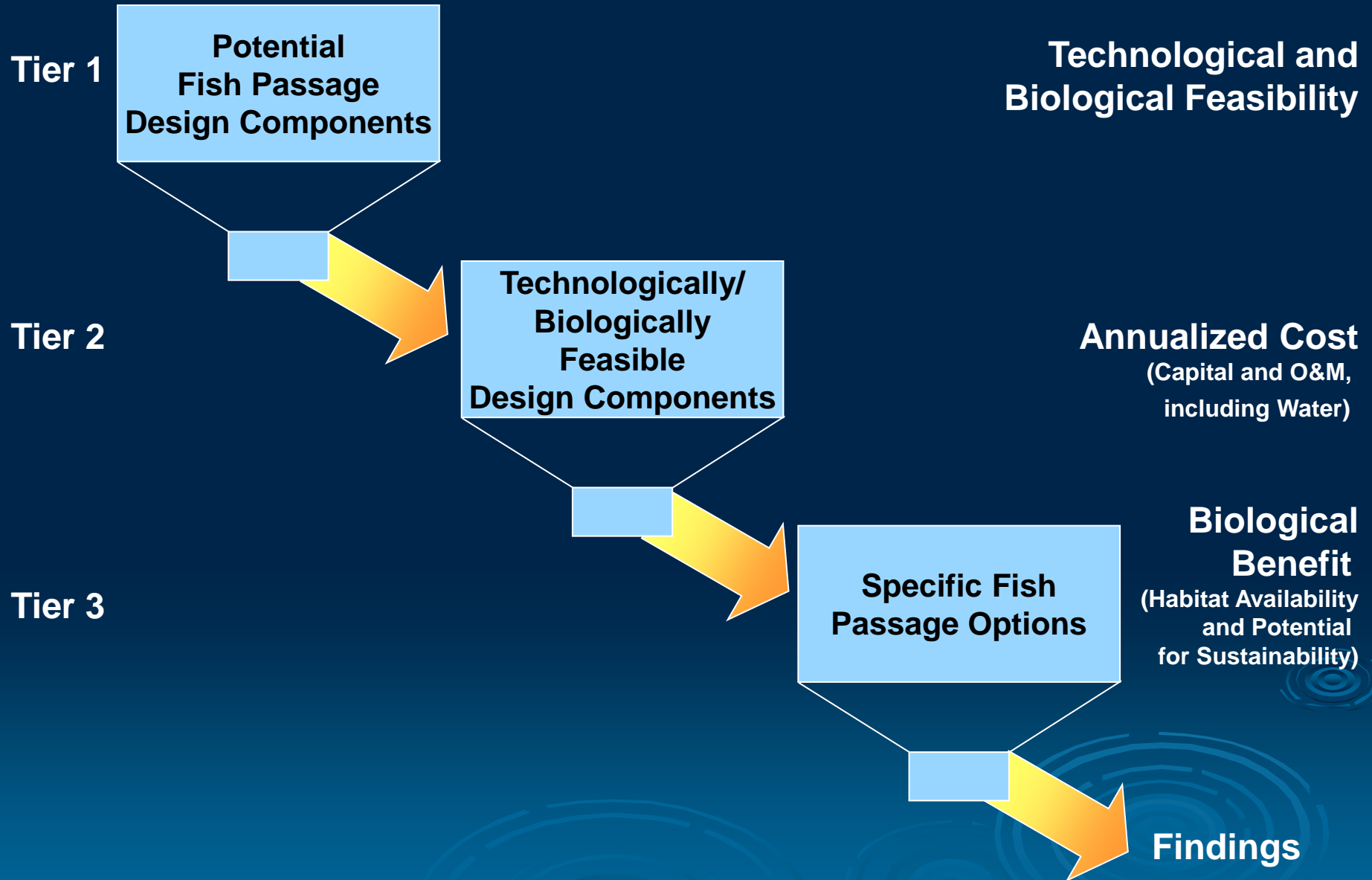
Watershed	Sub-Watershed	Basin	Acreage
Alameda Creek			440,000
	Arroyo de la Laguna		270,000
	Upper Alameda Creek		130,000
		Arroyo Hondo	51,000
		Upper Alameda Creek	26,000
		San Antonio	25,000
		Mid-Alameda Creek	15,000
		Calaveras	13,000
	Lower Alameda Creek		40,000

Fish Passage Studies

- Feasibility of Fish Passage at Calaveras Dam
- Feasibility of Fish Passage at Alameda Creek Diversion Dam
- Assessment of Fish Upstream Migration at Natural Barriers in the Upper Alameda Creek Sub-Watershed
- Assessment of Fish Migration at Riffles in the Sunol Valley Quarry Reach of Alameda Creek



Focus Of Analysis



Evaluation Factors

Tier 1 Focus

- Biological Feasibility
 - Migratory needs
 - Avoiding injury
- Technological Feasibility
 - Engineering solutions available



Tier 2 Focus

- Annualized cost
 - Capital Cost
 - Water Cost
 - O&M Cost

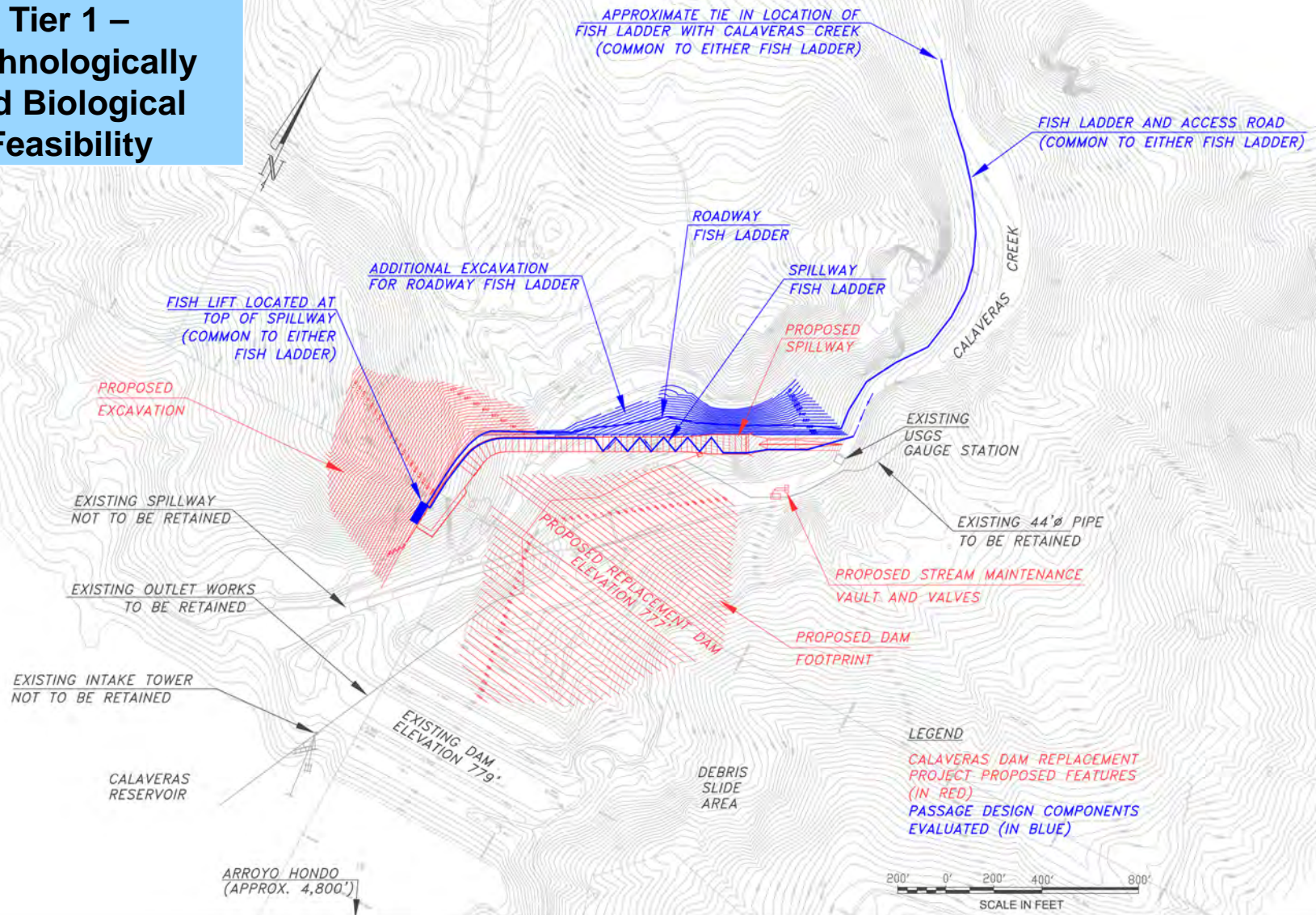


Tier 3 Focus

- Biological benefit
 - Habitat availability
 - Potential for sustainability
 - Typical goals of fish passage

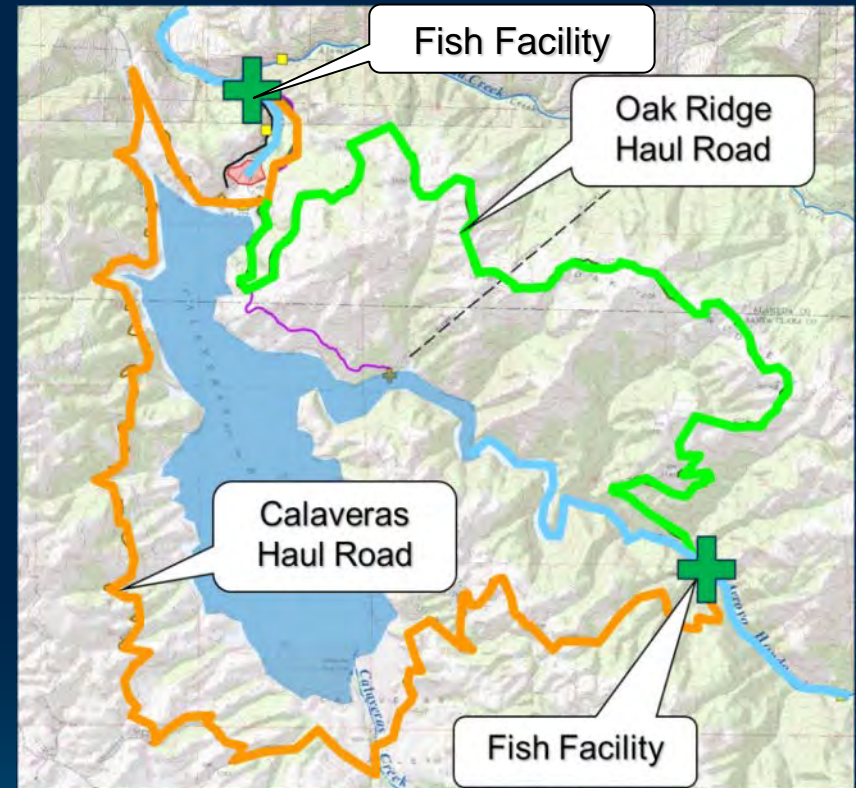
Fish Ladder at Calaveras Dam

Tier 1 – Technologically and Biological Feasibility



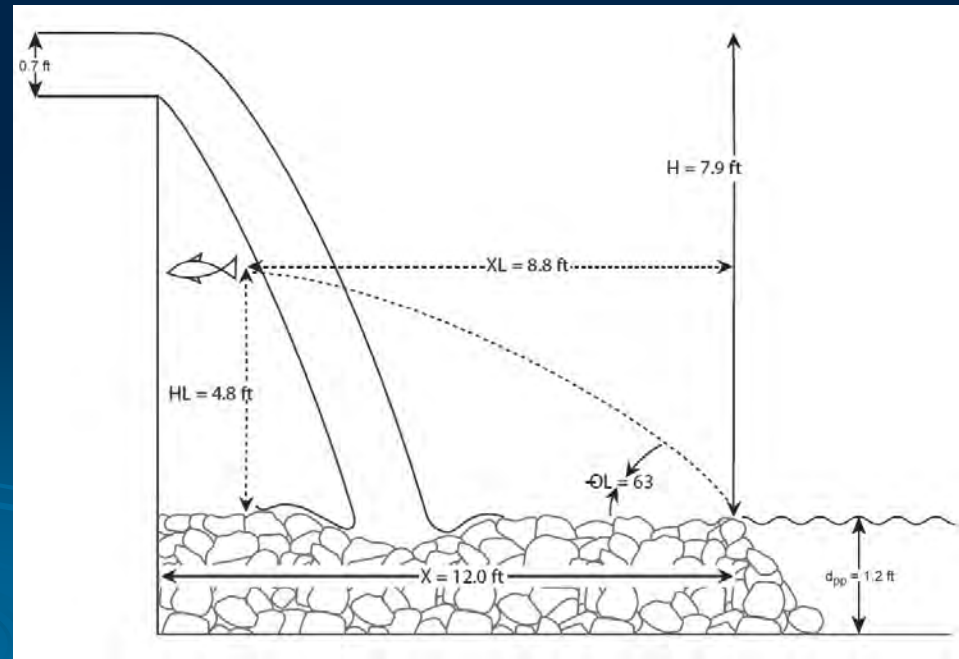
Preliminary Findings

- Fish ladder
 - 290 vertical feet
 - 70 feet of reservoir forebay fluctuation
- No volitional upstream or downstream passage options identified
- Trap and haul only feasible option for passage at Calaveras



Natural Barriers Study

- Evaluated in-stream features considered potential barriers
- Methods from Powers and Orsborn (1985)
- Provides context for Calaveras Dam
 - 12-foot waterfall 200 feet downstream
 - 17-foot waterfall 1.8 miles upstream



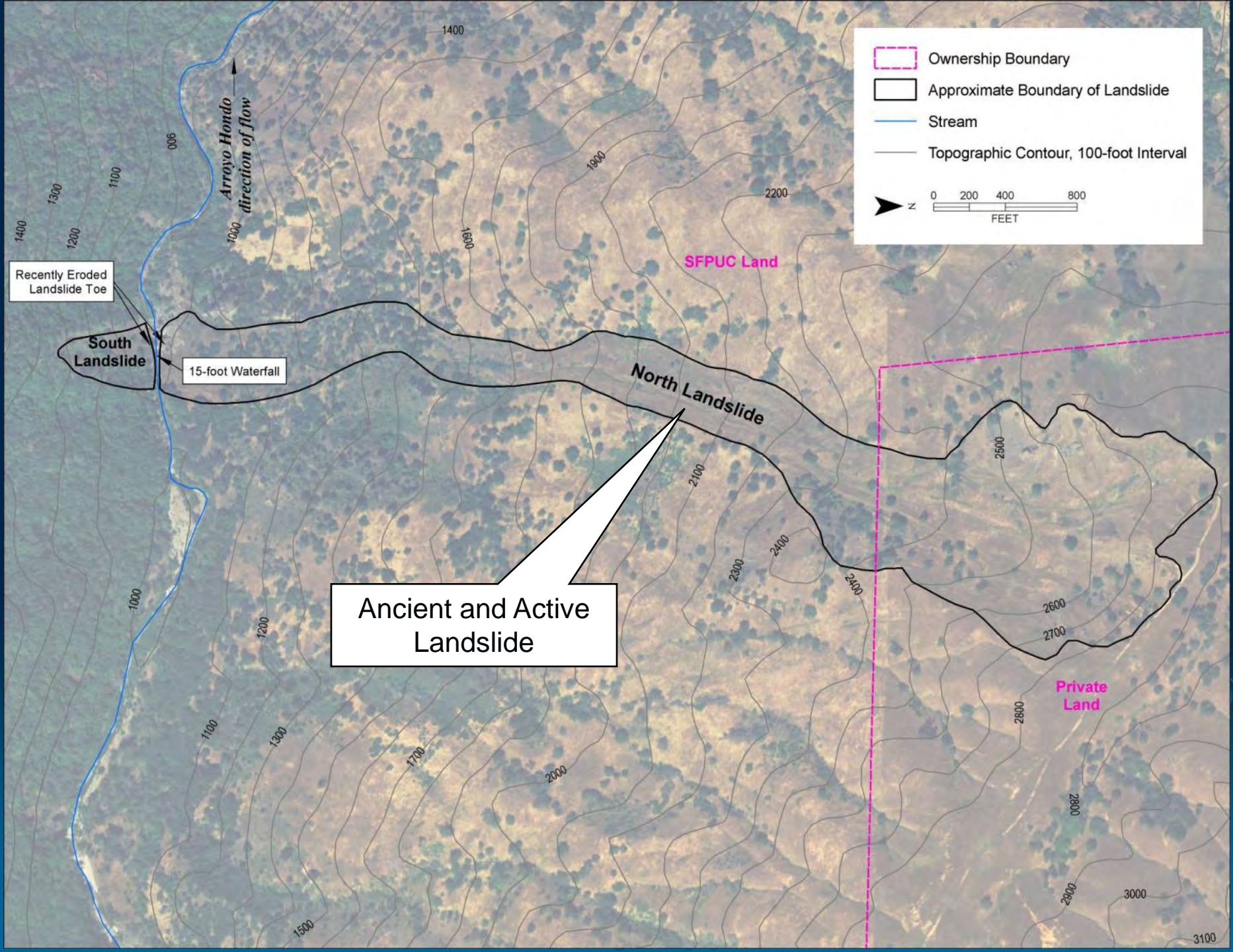
Arroyo Hondo Landslide – 17-foot Waterfall

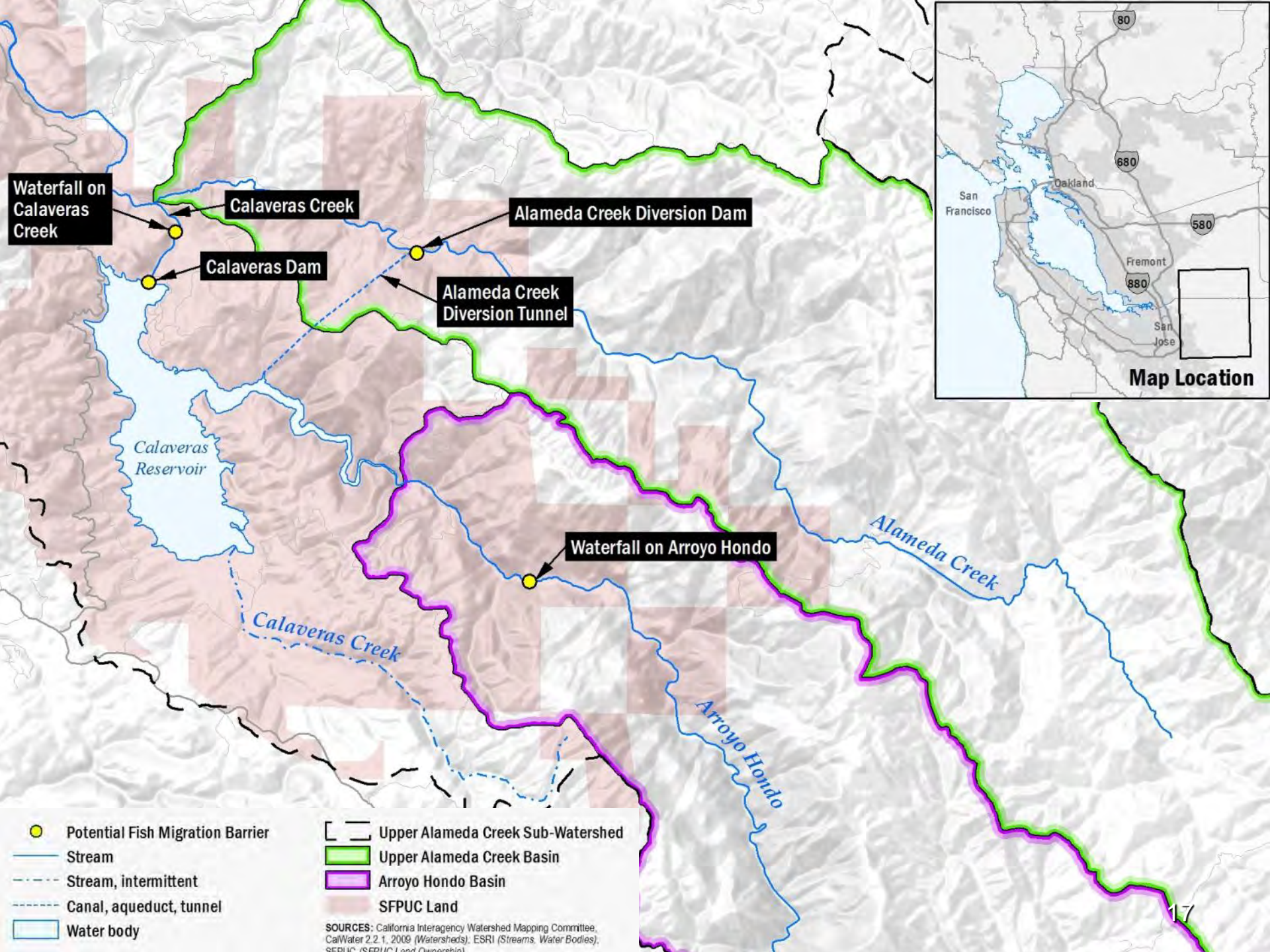
February 23, 2006 (17 cfs)



March 3, 2009 (590 cfs)

Blocks upstream migration
to majority of habitat above
Calaveras Reservoir





Findings

- Alternative measures for steelhead recovery with greater benefit-to-cost ratio should be investigated
 - Trap and haul would provide access to limited amount of habitat
 - Passage would be non-volitional
 - Cost would be relatively high





Alameda Creek Diversion Dam and Tunnel

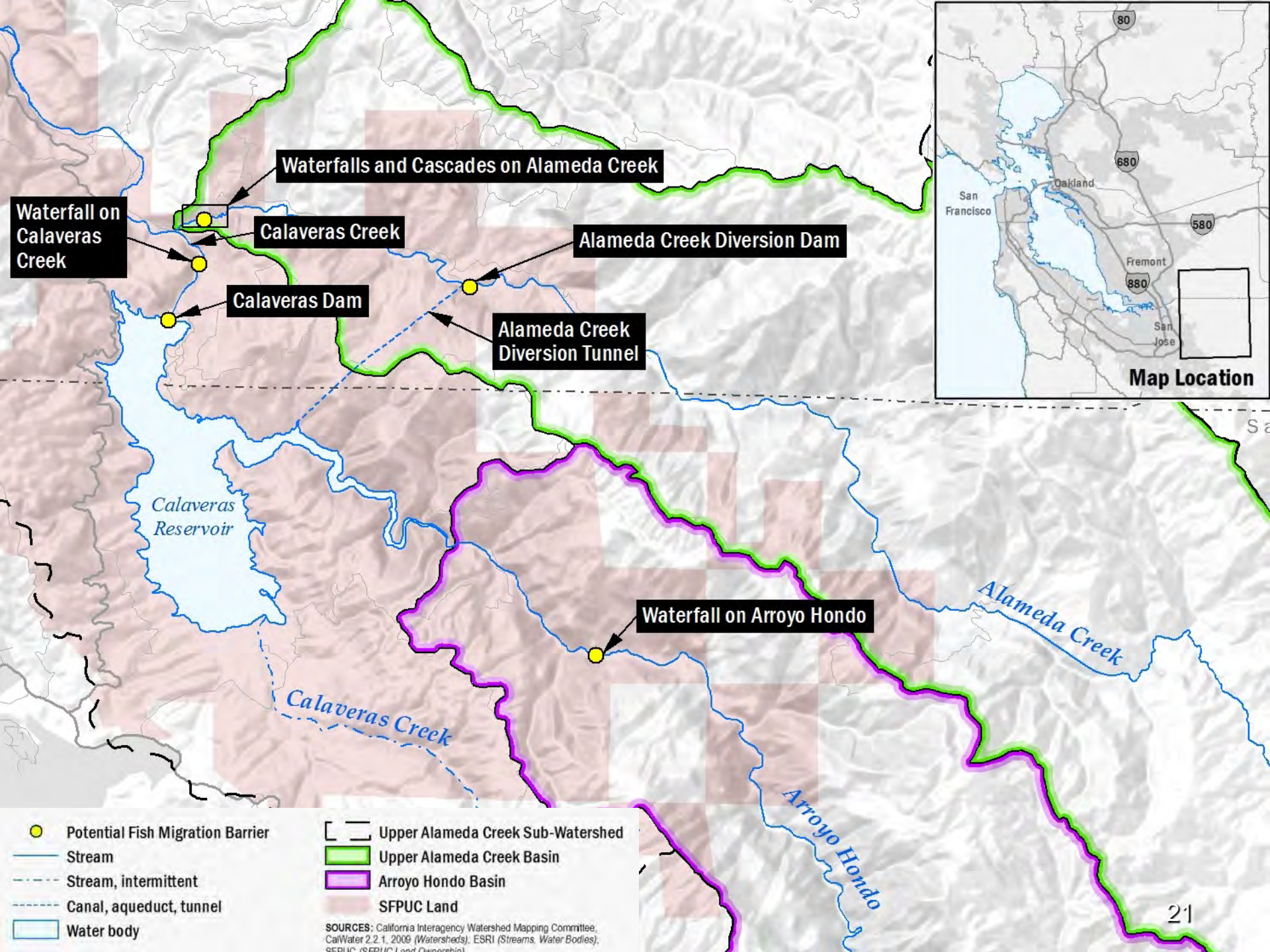
- 31 foot high dam
- 650 cfs capacity diversion
- 1.8 mile tunnel to Calaveras Reservoir



Complete Barrier to Upstream Migration

- Unscreened diversion may take fish from Alameda Creek to Calaveras Reservoir
- Suitable steelhead habitat present upstream
- SFPUC studied feasibility of passage and screens concurrent with Calaveras Dam





Feasibility Cost Estimation

➤ Capital Investment

- Design Fees
- Materials and Labor
- Construction Management

Tier 2 – Annualized
Cost

➤ Other Annual Costs

- Operation and Maintenance
- Annual Equipment/Repair/Replacement

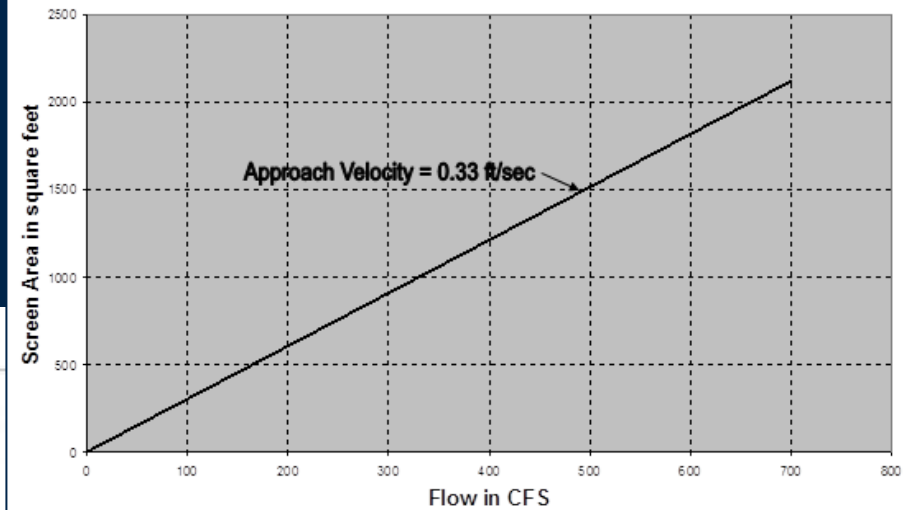
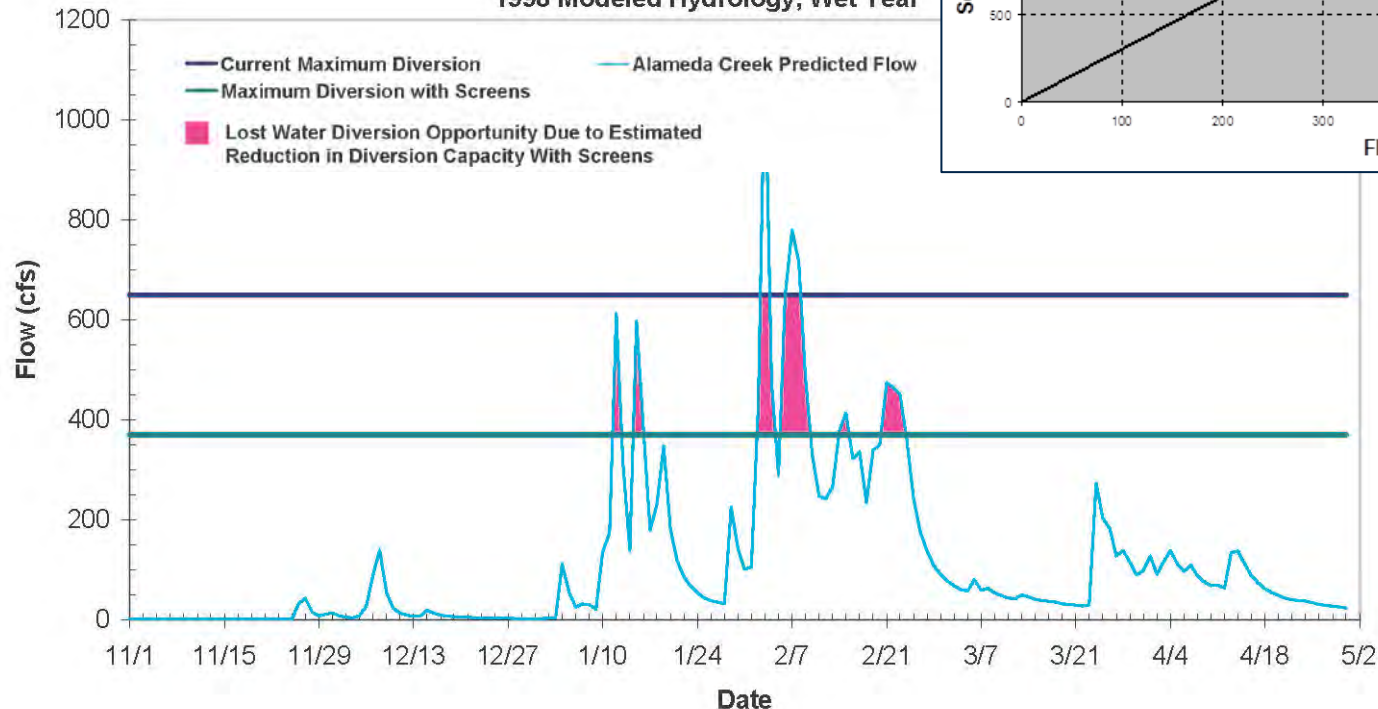
➤ Lost Water Opportunity

- Replacement of water not diverted

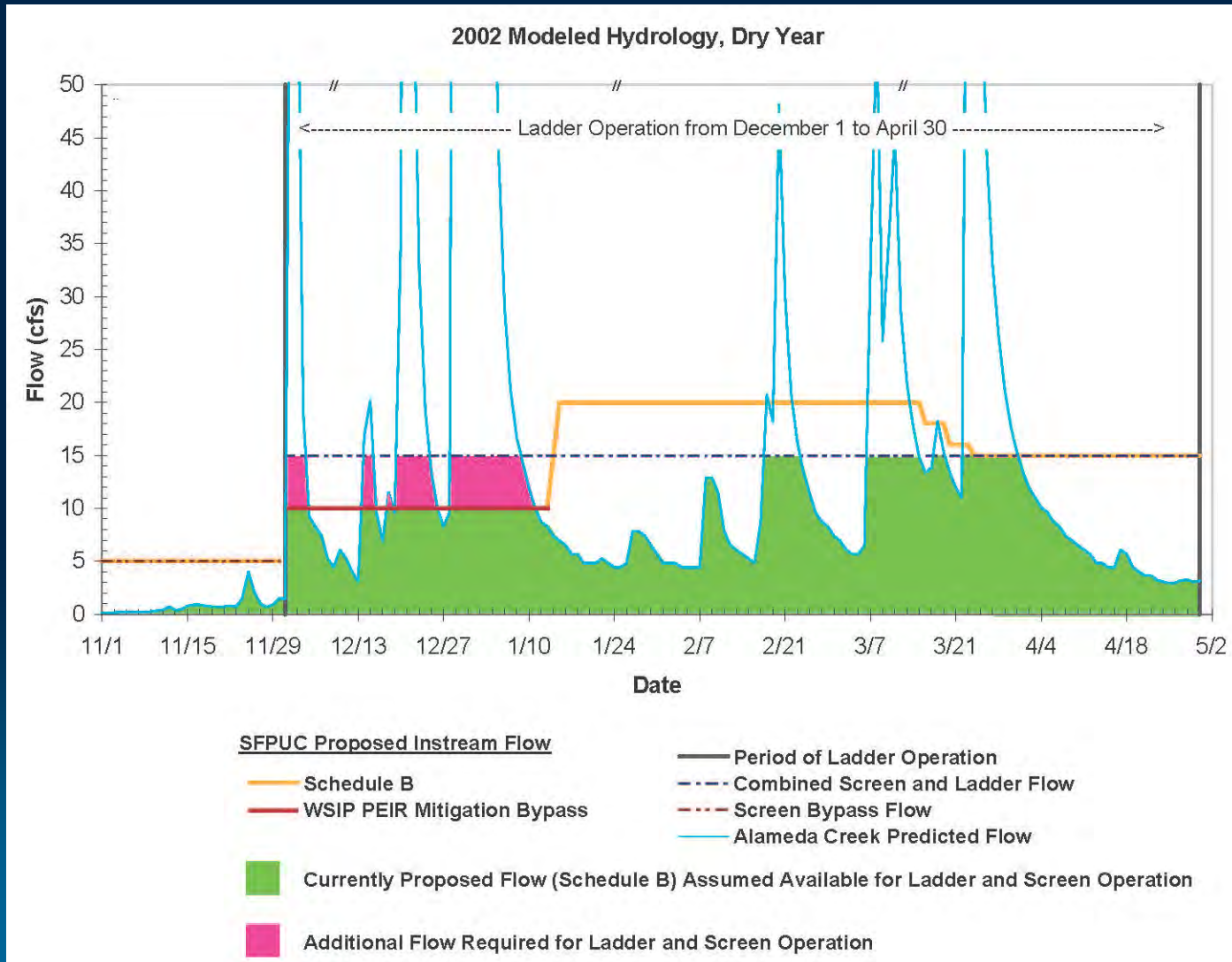
➤ Presented as Annualized Cost Over an Assumed 30-Year Project Life

Water Cost due to Reduced Diversion Capacity

1998 Modeled Hydrology, Wet Year

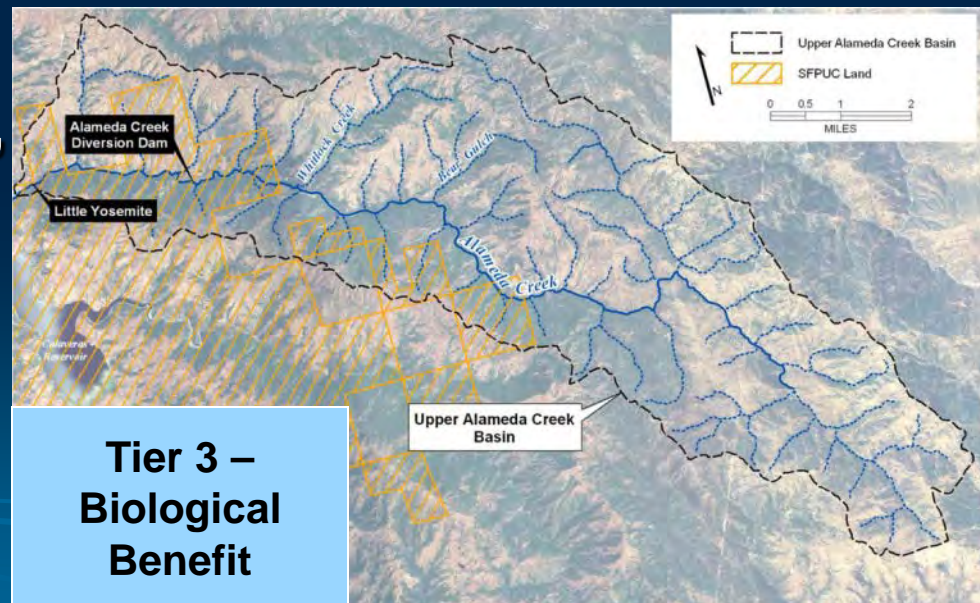


Water Cost due to Screen and Ladder Operations



Findings

- Effort to establish steelhead above the diversion dam would have reasonable probability of success
- Fish ladder technologically feasible
- If Little Yosemite limits immigration to a ladder, trap and haul could provide passage



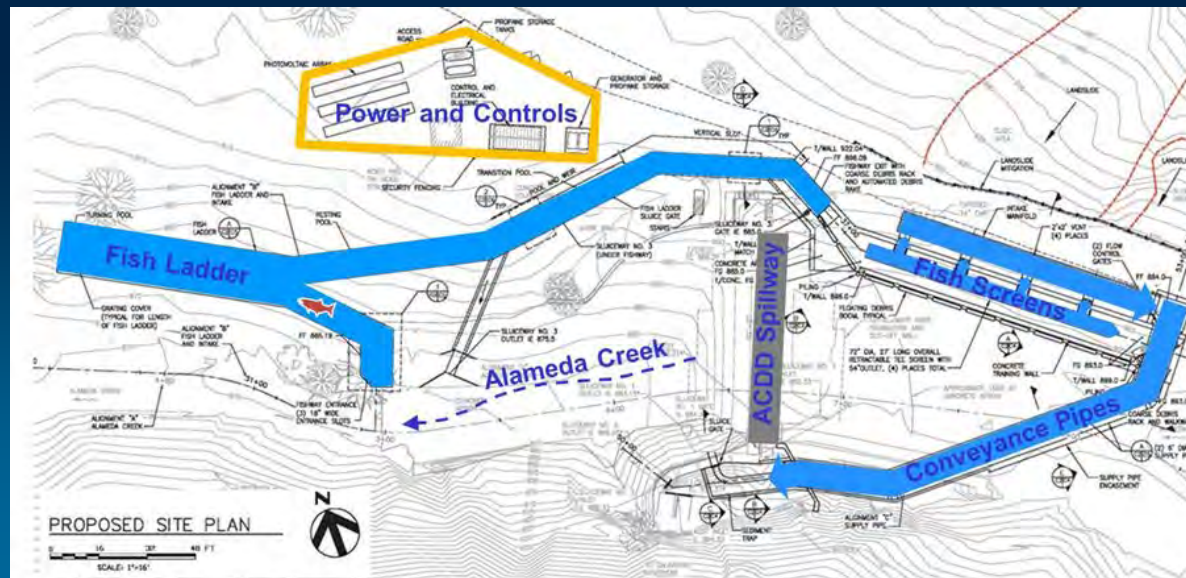
Project Permits

- Passage studies provided essential information needed for completion of permitting by answering key questions
 - Findings helped focus attention on feasible solutions
 - Facilitated approval of key environmental permits



Project Permits

- Included passage at the Diversion Dam and not at Calaveras Dam, & minor passage improvements downstream
- Decision based on:
 - Non-volitional, high cost/benefit of passage at Calaveras
 - Likelihood of greater success at Diversion Dam



Conclusions

- Early initiation of focused and coordinated fish passage studies provided several benefits:
 - Provided rational, technical foundation for decisions
 - Removed from consideration costly recommendations to modify dam replacement project
 - Results incorporated into final CEQA document and permit applications
 - Reduced potential permit delays
 - Resulted in feasible permit terms and conditions

Acknowledgements

- SFPUC
- HDR
- Resource Agencies
 - CDFW
 - NMFS
 - USFWS



Questions?



Friant Power Authority, Friant Dam Hydroelectric Facility Expansion Investigation, Design, FERC Licensing, and Permitting



El Dorado Irrigation District, Weber Dam Seismic Strengthening Design, Plans/Specs and Construction Management



Nevada City, Deer Creek Environs Wildfire Mitigation Project, Federal Environmental Compliance

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