California Fish Passage Advisory Committee

Connectivity Case Studies

June 17, 2020
www.cafishpac.org

Presenters

Cedar Creek	Kristine Pepper, P.E. – Caltrans – North Region District 1 – Eureka

Quiota Creek Restoration and Refugia Road	Tim Robinson, Fisheries Division Manager – Cachuma Operation and Maintenance Board

Twin and Ditch Gulches	Eric Rulison Biologist – Caltrans – North Region District 2

Cedar Creek

Kris Pepper, P.E.
Department of Transportation
North Region-District 1-Eureka

Topics

- Project Location
- Purpose and Need
- Science and Data to Inform Project Goals
- Existing Facility
- Design
- Project Collaboration
- Permits and Approvals Required
- Construction
- Post Project Monitoring
- Lessons Learned
- Questions

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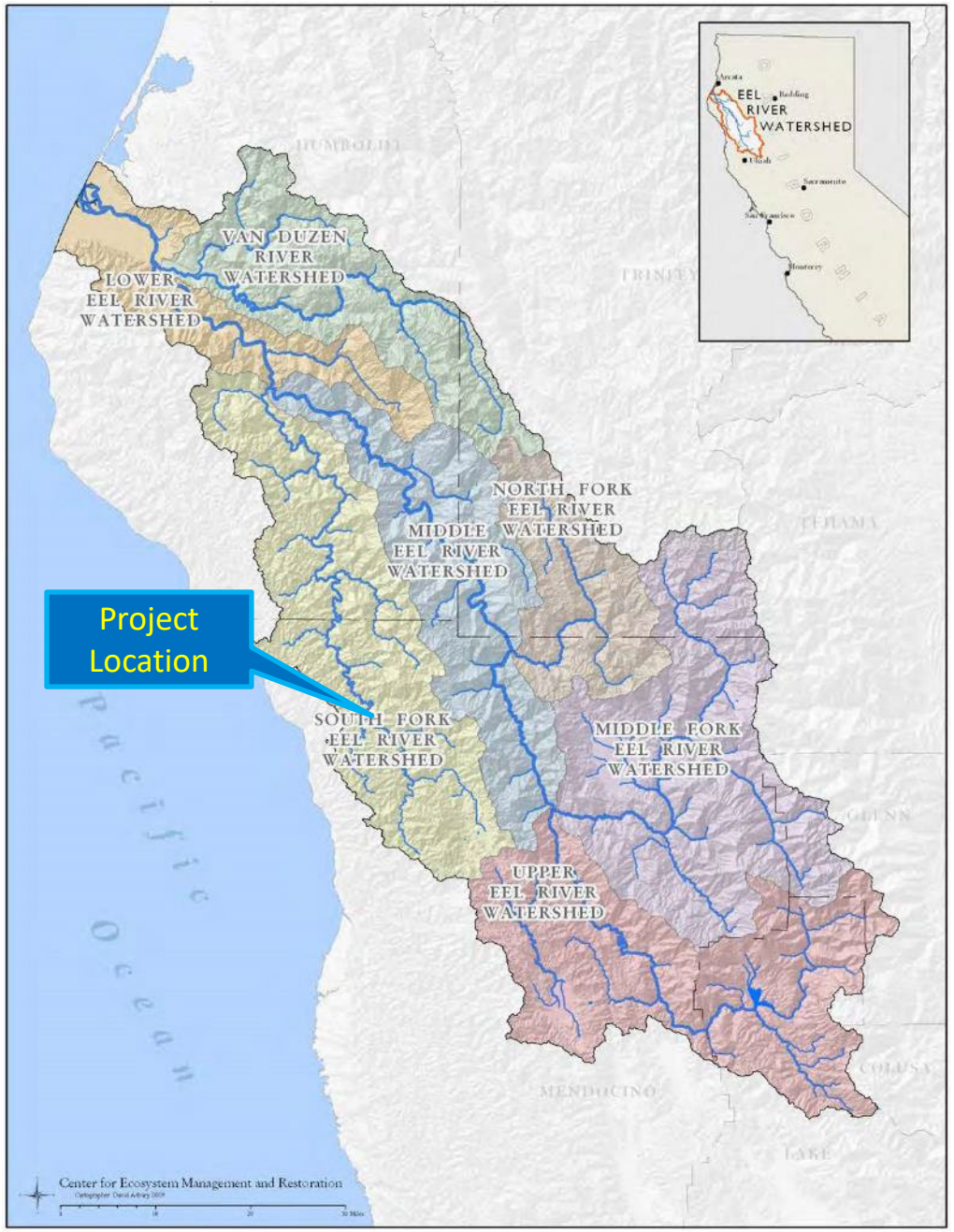
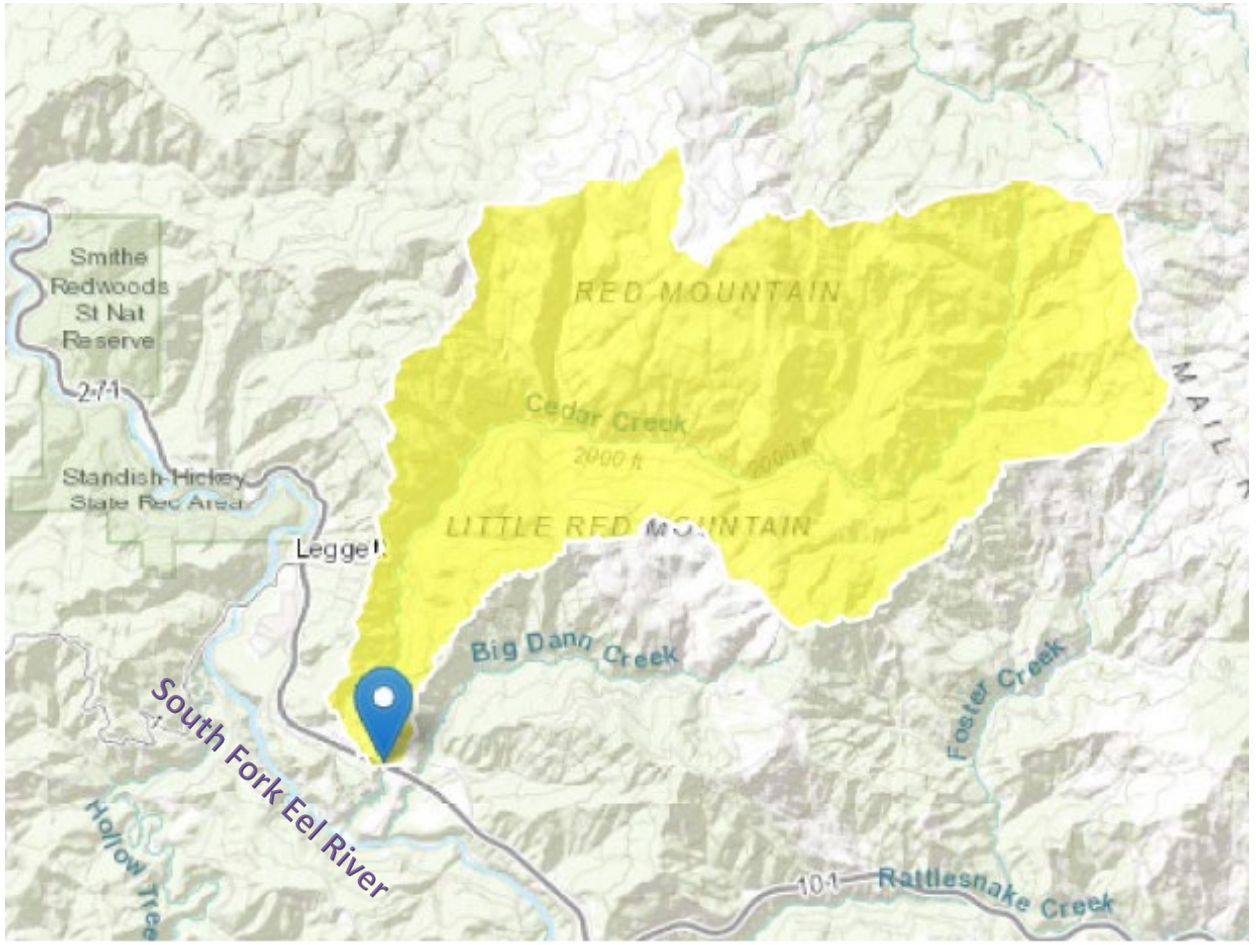
Project Location

Mendocino County @ Highway 101
Cedar Creek tributary to South Fork Eel River



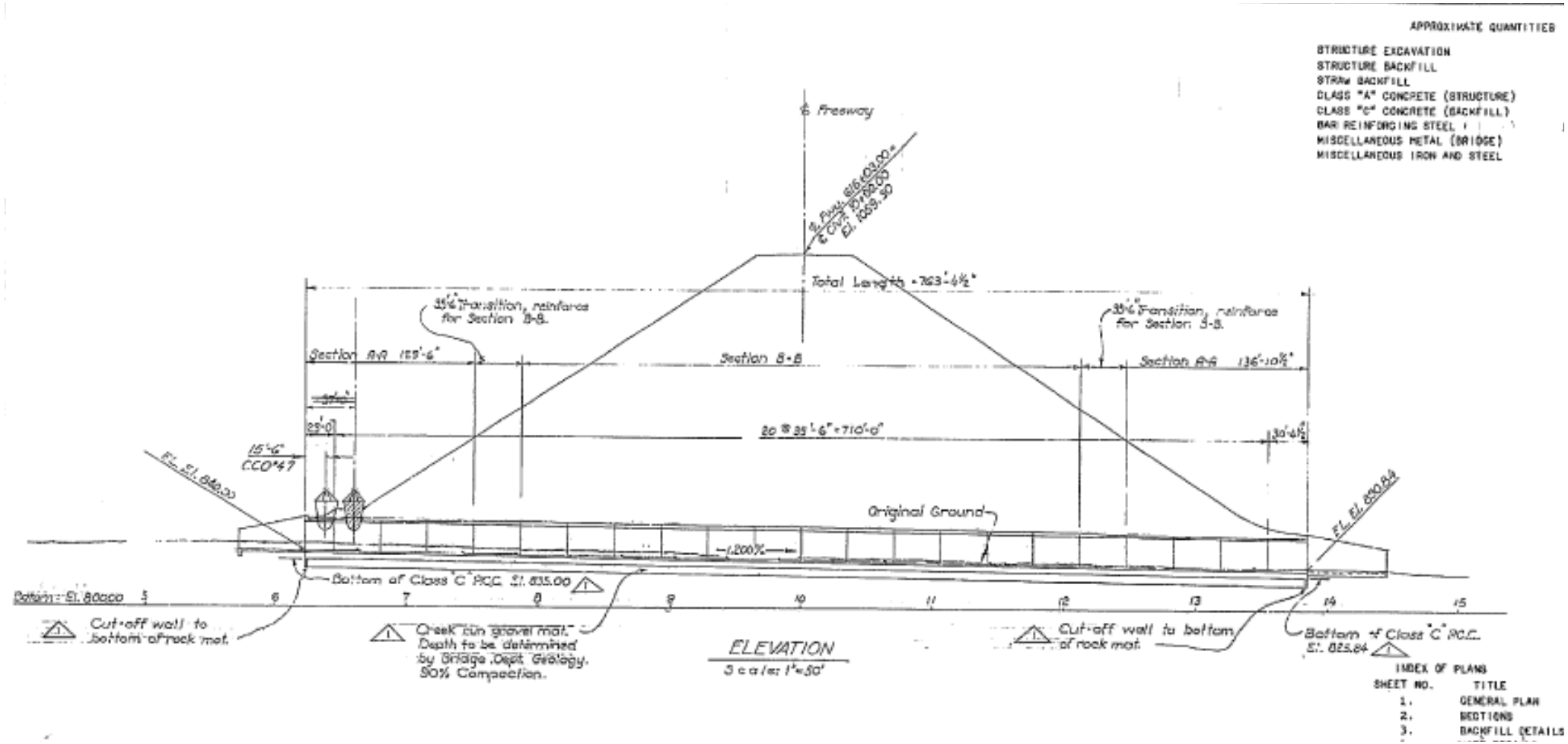


Cedar Creek Bridge – SR 271

Existing Facility

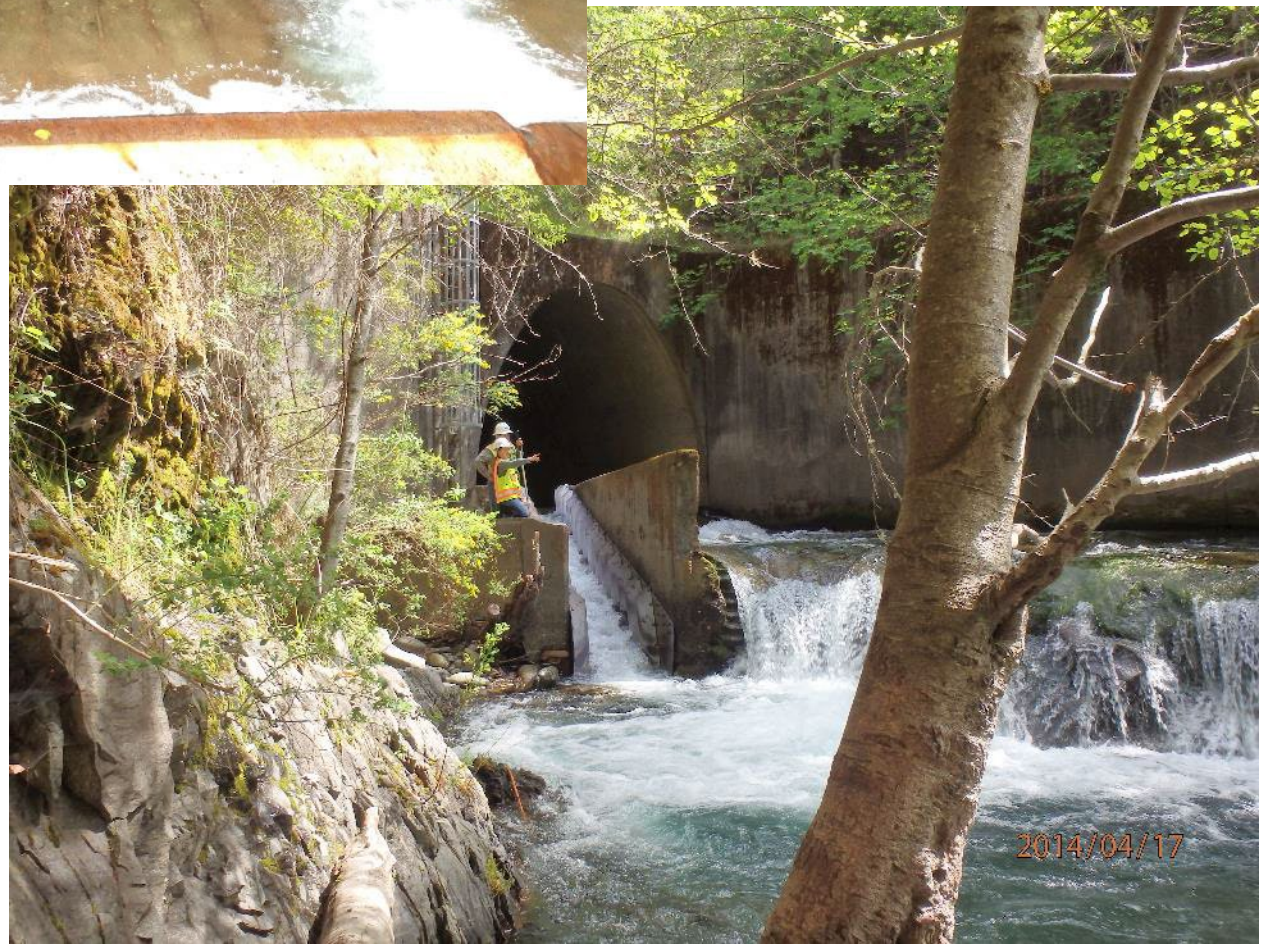
- Constructed 1969
- 22’ Concrete Arch Culvert
- 763’ long
- 1.2% slope
- 24 steel armored concrete weirs
- Concreted RSP apron
- Denil Fish Ladder

Construction 1969



Purpose and Need Funding Source

- Purpose and Need
  - Preserve the integrity of the culvert invert
  - Remove barriers to the migration of fish – SB 857
- Funding
  - Initiated by Structure Maintenance and Investigations (SMI),
  - Funded through the State Highway Operations and Protection Program



Science and Data Used to Inform Project Goals

- CDFW PAD – Barrier Status/Species
- California Department of Transportation (Caltrans) District 1 Pilot Fish Passage Assessment Study: Volume 1 – Overall Results (2005)- AKA 'Lang' Study
- Topographic survey
- Geologic information
- Hydrologic
  - Basin transfer technique
  - Recurrence interval-Fish passage design flows
- District 1 Hydraulics Historic Files
  - Correspondence with CDFG
  - Correspondence internally
  - Past project design records/as-built plans
  - Construction photographs
  - Institutional knowledge-staff
- Collaboration with resource agency staff
- Fish Passage Design guidance:
  - CDFW
  - Caltrans
  - NMFS
  - US Army Corps
  - USFWS
- Caltrans commissioned study: Influence of Fish Passage Retrofits on Culvert Capacity (2008)
- Various other hydraulic engineering trainings, reports and circulars

Species of interest

- Federally and State listed species:
  - coho salmon (*Oncorhynchus kisutch*),
  - Chinook salmon (*Oncorhynchus tshawytscha*) and
  - steelhead trout (*Oncorhynchus mykiss*)
- Foothill Yellow-Legged Frog candidate for listing in July 2017
- California Species of Special Concern/interest:
  - Pacific lamprey (*Entosphenus tridentatus*)

Fish Passage Design Flows

Target Species	***Fish Passage Design Flows***	
	Low	High
Juvenile Salmonid	6.9	162
Adult Resident	8.6	274
Adult Salmonid	13.59	643

Table 1-Fish Passage Design Flows

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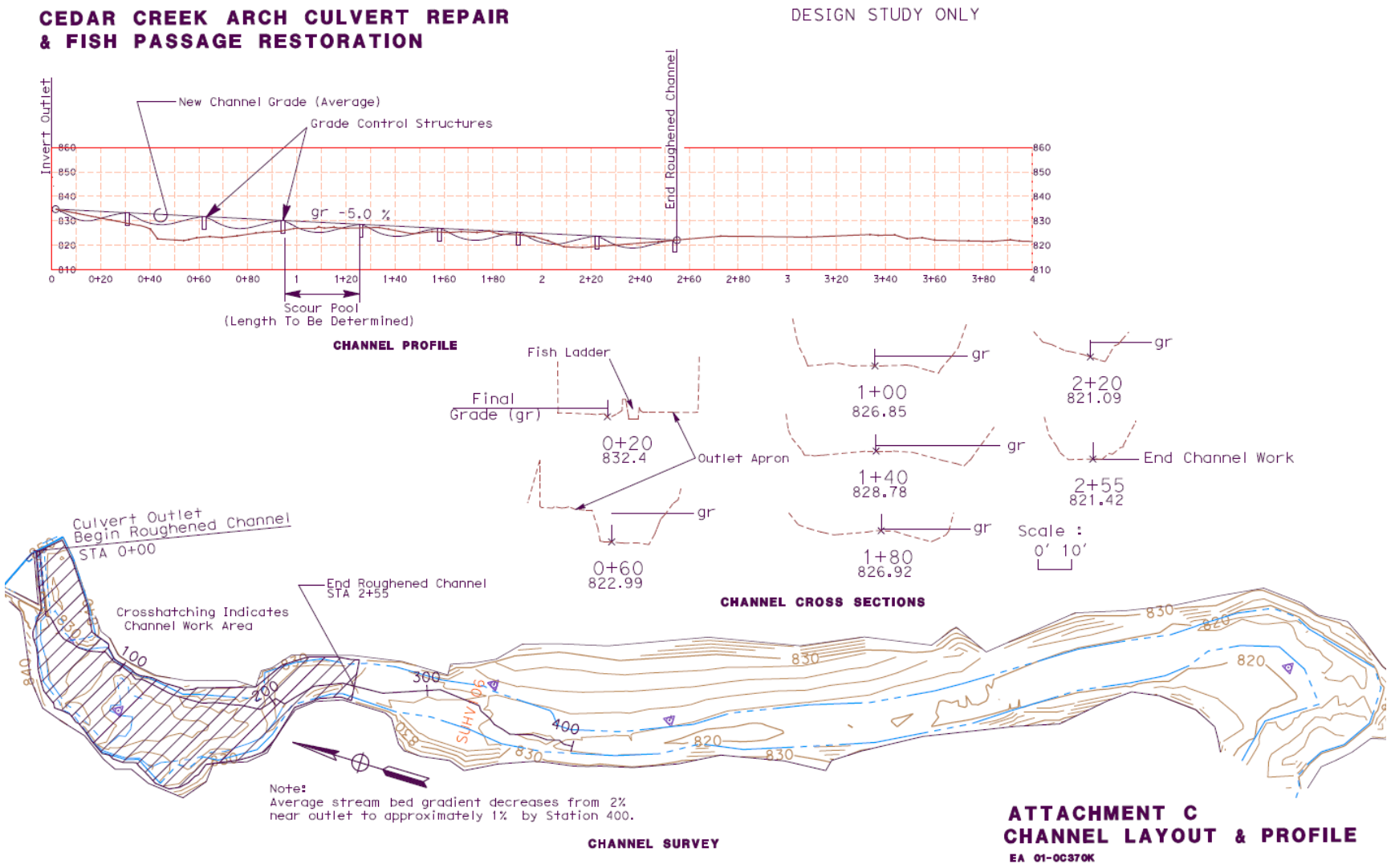
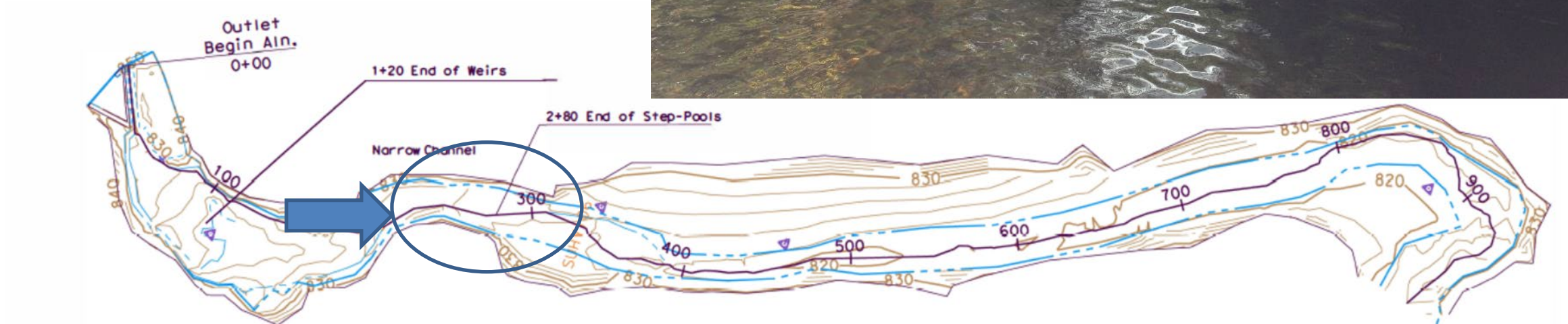
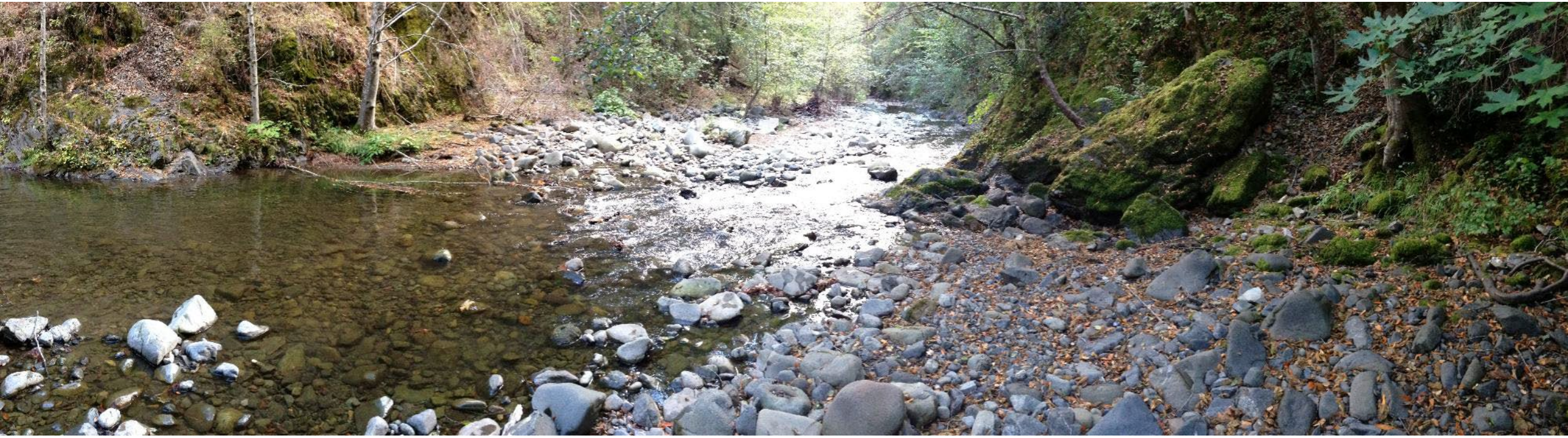
K- Phase Design – Project Initiation Document

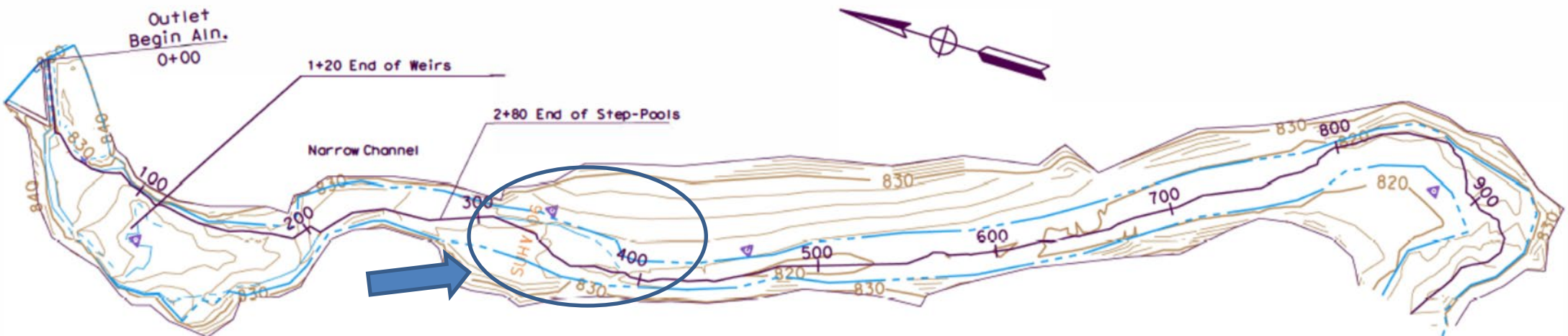



2014/04/17

The Narrow

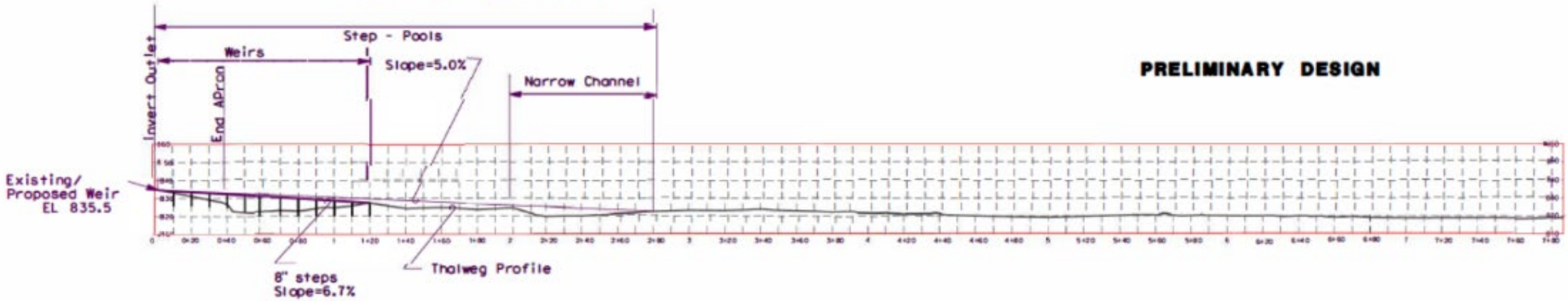

Outlet
Begin Aln.
0+00
1+20 End of Weirs
2+80 End of Step-Pools
Narrow Channel
100
300
400
500
600
700
800
900
820
830
840



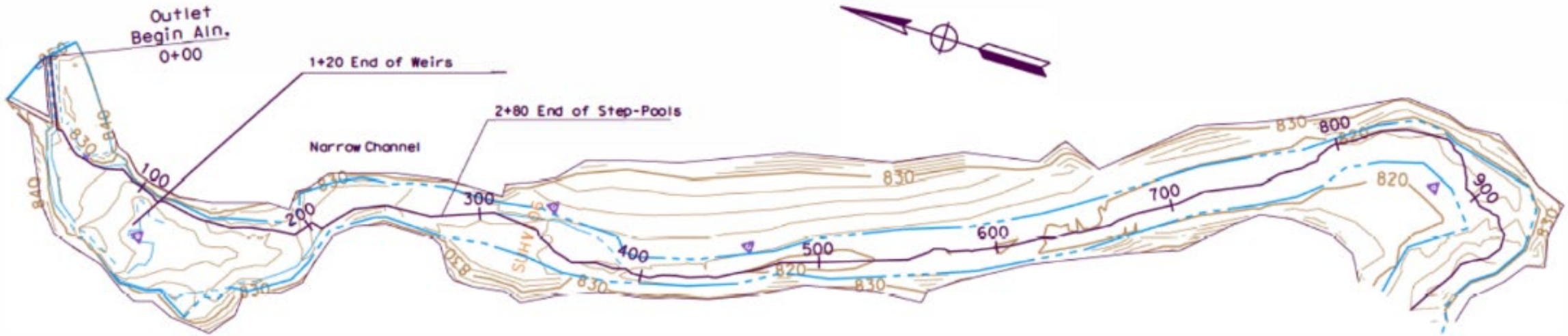

Outlet
Begin Aln.
0+00
1+20 End of Weirs
2+80 End of Step-Pools
Narrow Channel
100
200
300
400
500
600
700
800
900
820
830
840
SHAHS

California Salmonid Stream
Habitat Restoration Manual

STEP - POOLS
Overall channel slope 3.0-5%
Maximum elevation drop 5ft/sequence
Figure XII-24
Step spacing 0.4 - 0.8 channel widths
Pool spacing 2 - 4 channel width

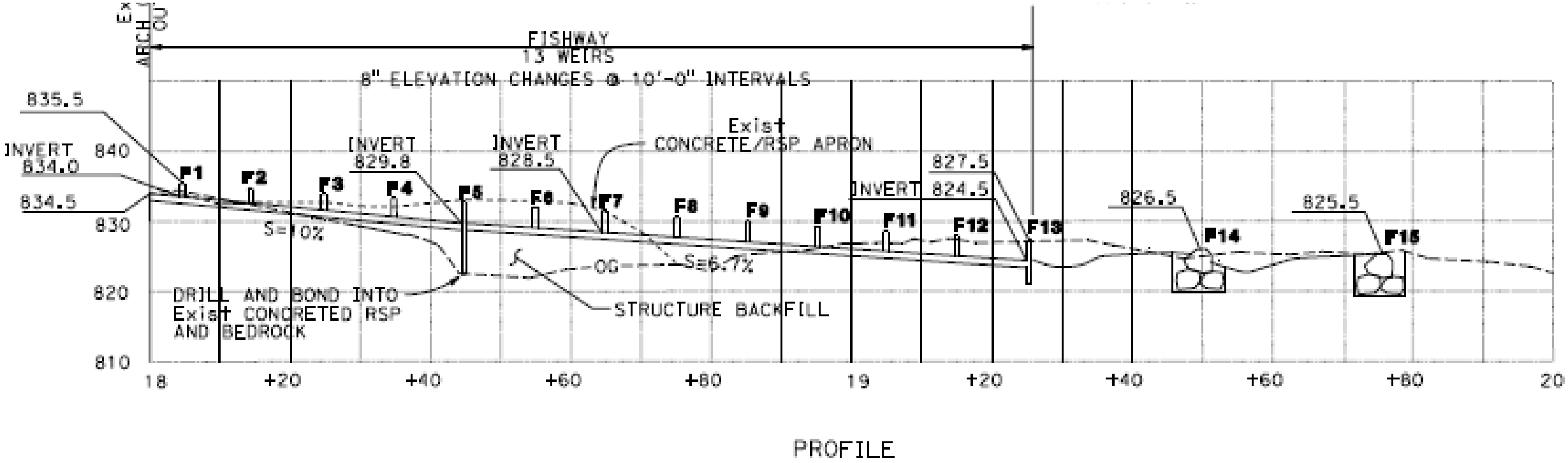


PRELIMINARY DESIGN



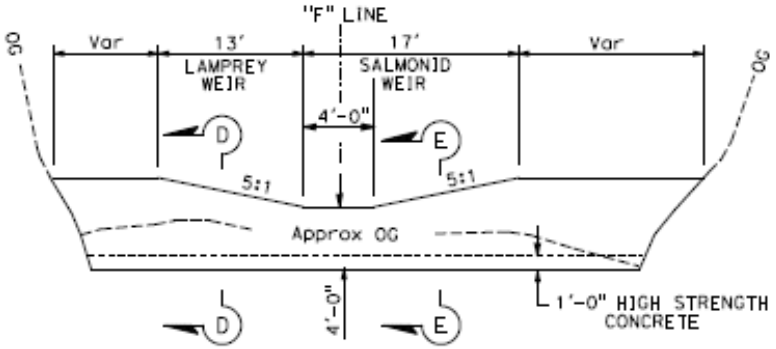
CEDAR CREEK ARCH CULVERT
EA 01-0C3700
STUDY OF WEIR DESIGN AND LENGTH

Downstream Channel Weirs –Stage 1



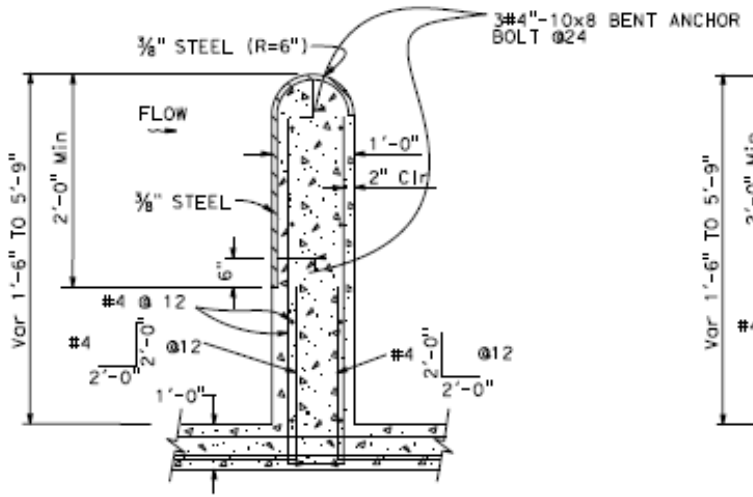
PROFILE

Typical Lamprey and Salmonid Weirs

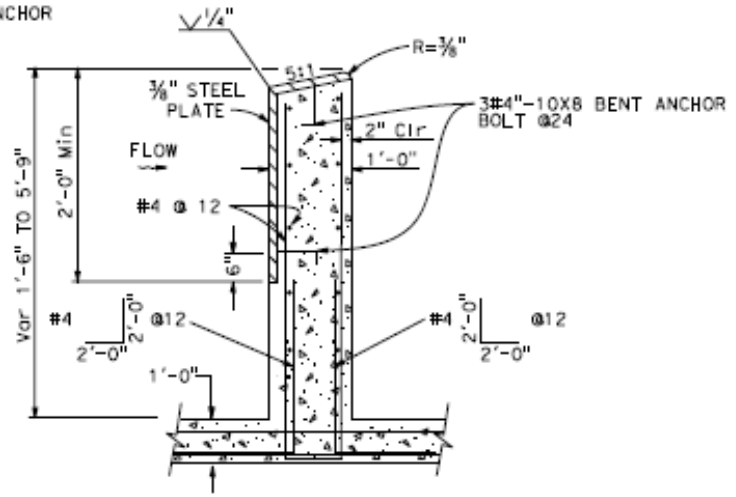


WEIRS F5-F12

FISHWAY CONCRETE WEIRS
TYPICAL SECTIONS



SECTION D-D
LAMPREY WEIR DETAIL



SECTION E-E
SALMONID WEIR DETAIL

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Project Collaboration

- Initiated by CT District 1 Bridge Preventative Maintenance Coordinator,
- CT Project Manager, Steven Blair, P.E.
- CT Project/Hydraulic Engineer, Kristine D. Pepper, P.E.
- CT Biologist, Gail Popham
- CT Environmental Coordinator, Jason Meyer
- NMFS Hydraulic Engineer, Margret Tauzer
- CDFW Biologist, JoAnn Dunn
- CDFW Hydraulic Engineer, Jonathan Mann, P.E.
- NMFS Biologist, Rebecca Bernard
- USFWS Biologist, Damon Goodman
- Bugler Construction, Glenn Bugler
- CT Construction Resident Engineer, Sheri Rodriguez, P.E.
- CT Environmental Construction Liaison, Jim Mcintosh
- CT Construction Inspector, Jack Naylor

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Permits and Approvals Required

- U.S. Fish and Wildlife Service (USFWS)
  - Section 7 consultation for threatened and endangered species using a Programmatic Letter of Concurrence
- National Marine Fisheries Service (NMFS)
  - Section 7 consultation for threatened and endangered species
- US Army Corps of Engineers (USACE)
  - Section 404 of the Clean Water Act (CWA)
  - Project in compliance with Department of the Army Nationwide Permit (NWP) 27-Aquatic Habitat Restoration, Establishment and Enhancement Activities
- California Department of Fish and Wildlife (CDFW)
  - Section 1602 - Streambed Alteration Agreement and consistency determination with biological opinion prepared by NMFS
- North Coast Regional Water Quality Control Board
  - Federal Clean Water Act (CWA), section 401, Water Quality Certification

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Contractor Proposed Access

Contractor Proposed Access

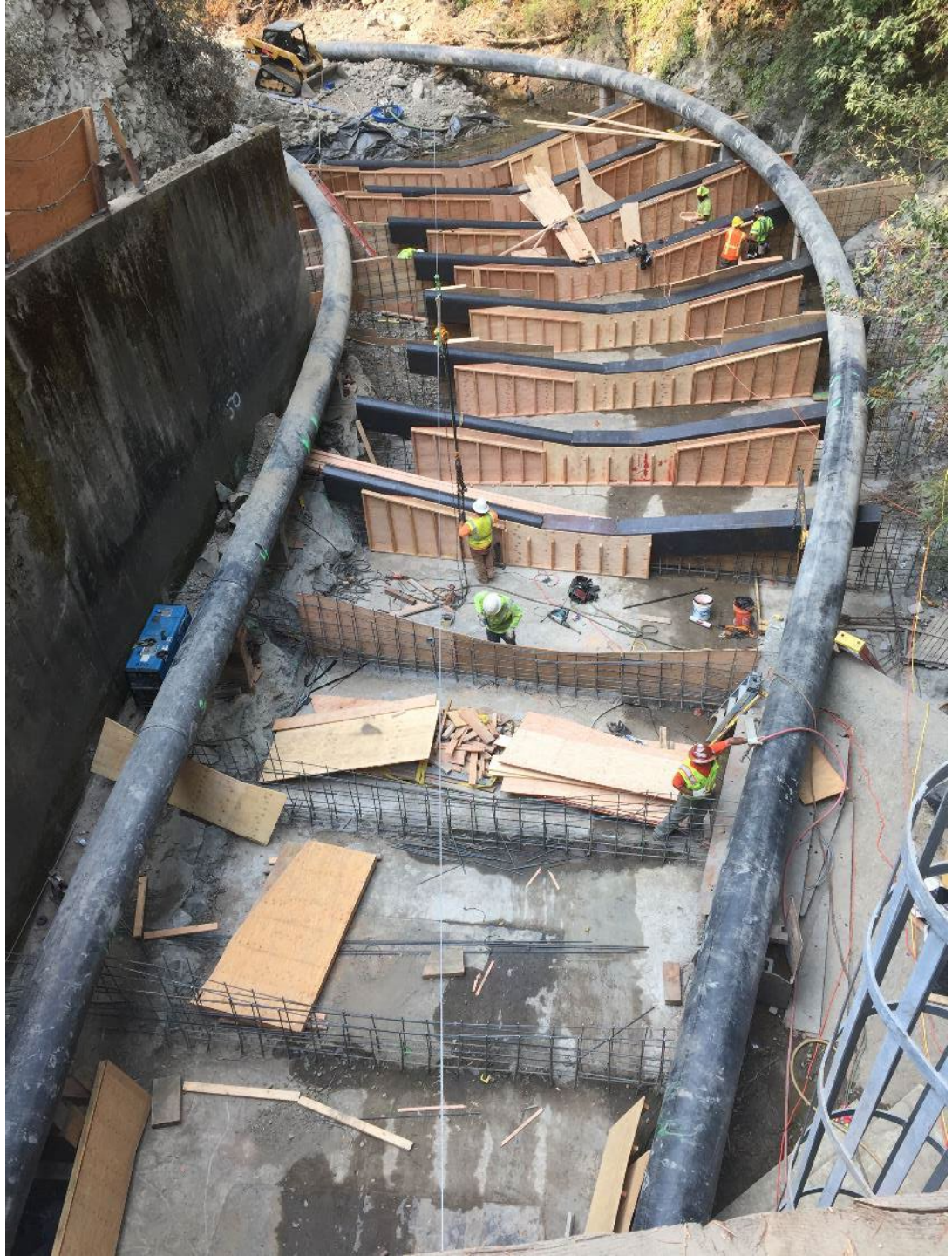
Contractor Proposed Access

Contractor Proposed Access

Clearwater Diversion

Clearwater Diversion

October 2017 Downstream Fishway



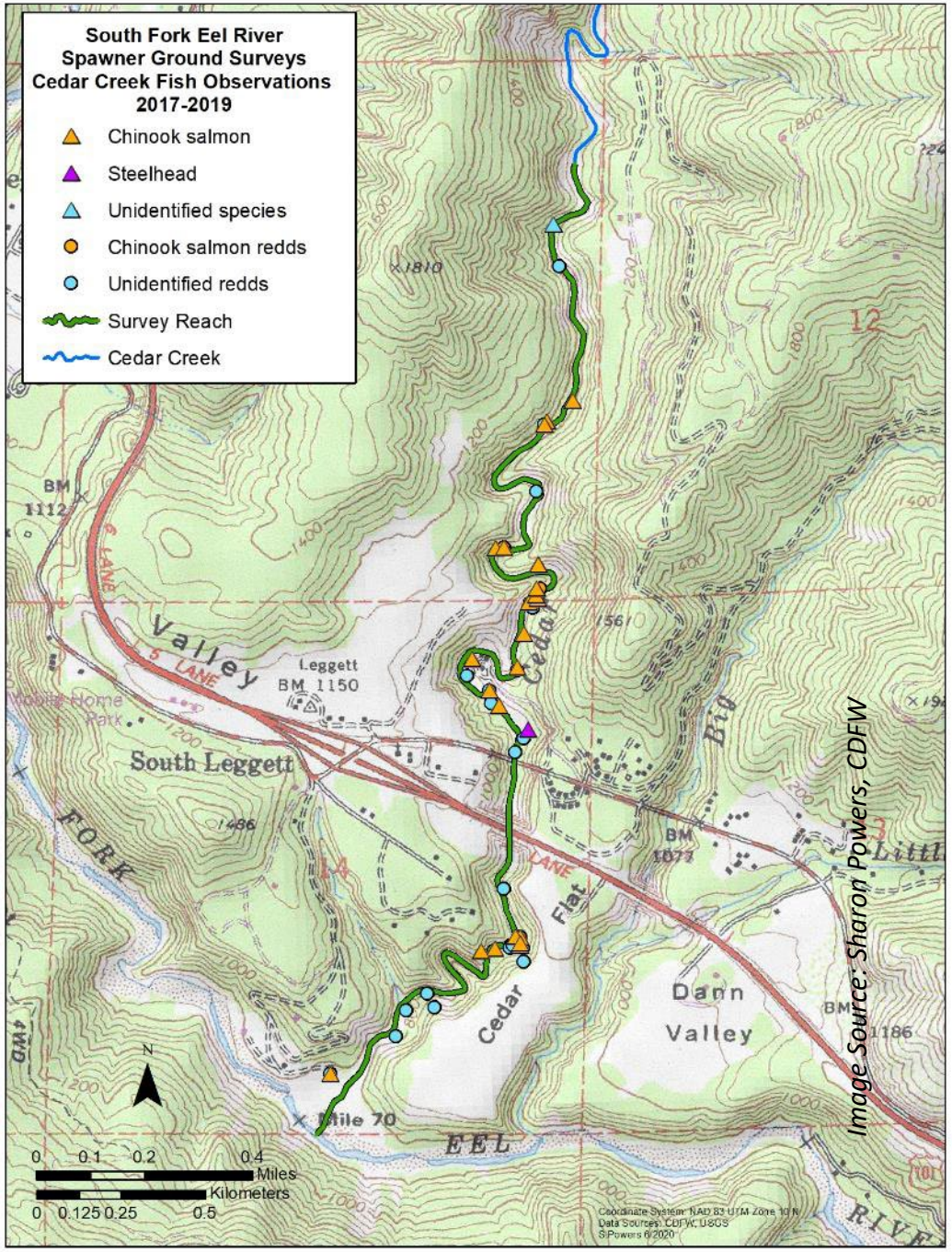
Fishway Weirs Concrete Pour


October 2017
Downstream Fishway

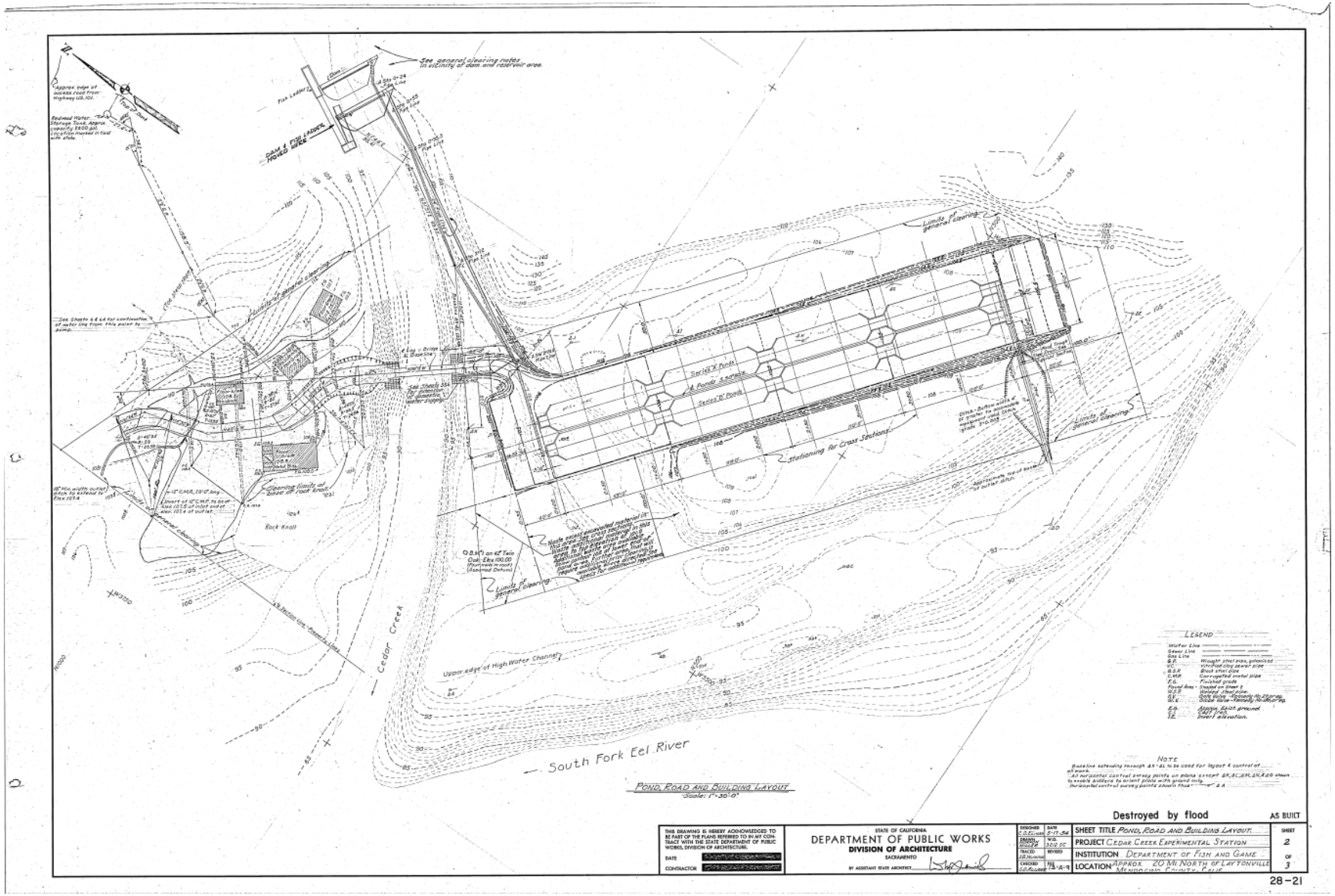

Lamprey
Weir
Salmonid
Weir

Post Project

- Fishway completed October 2017
- Culvert weirs completed October 2018



Downstream


Cedar Creek
South Fork Eel River
Rock Knoll
Upper edge of High Water Channel
Limits of general clearing
Stationing for Cross Sections
Series 'A' Ponds
Series 'B' Ponds
Series 'C' Ponds
POND, ROAD AND BUILDING LAYOUT
Scale: 1"=30'-0"
LEGEND
NOTE
Destroyed by flood
AS BUILT
DEPARTMENT OF PUBLIC WORKS
DIVISION OF ARCHITECTURE
SACRAMENTO
SHEET TITLE POND, ROAD AND BUILDING LAYOUT
PROJECT CEDAR CREEK EXPERIMENTAL STATION
INSTITUTION DEPARTMENT OF FISH AND GAME
LOCATION APPROX. 20 MI. NORTH OF LAYTONVILLE
28-21


Estimated
Completion
2021-2020

Lessons Learned

- Engage with agencies early and often
- Important to have both environmental coordinator and the project engineer attend project design/construction discussions with agencies, especially site visits
- Historic site information is important- preserve photos
- Be open to proposed changes
- Hind sight is 20/20

Photos curtesy of Scott Monday, CDFW

Quiota Creek Restoration and Refugio Road Improvements

Timothy H. Robinson

Cachuma Operation and Maintenance Board

July 17, 2020

The Cachuma Project

Bureau of Reclamation and Cachuma Member Agencies

(Cachuma Operation and Maintenance Board)

Objectives:

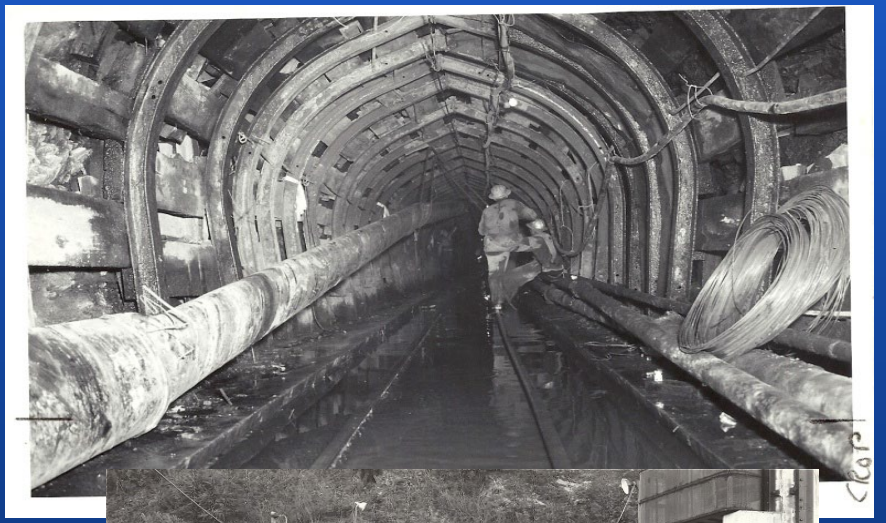
- Water delivery (reservoirs, tunnels, conduit, etc.)
- Resource management (water and biological species/habitat)

Watershed:

- ~ 900 sq. mi.
- ~ 90 mi. in length
- 3 reservoirs

Cachuma Project Elements

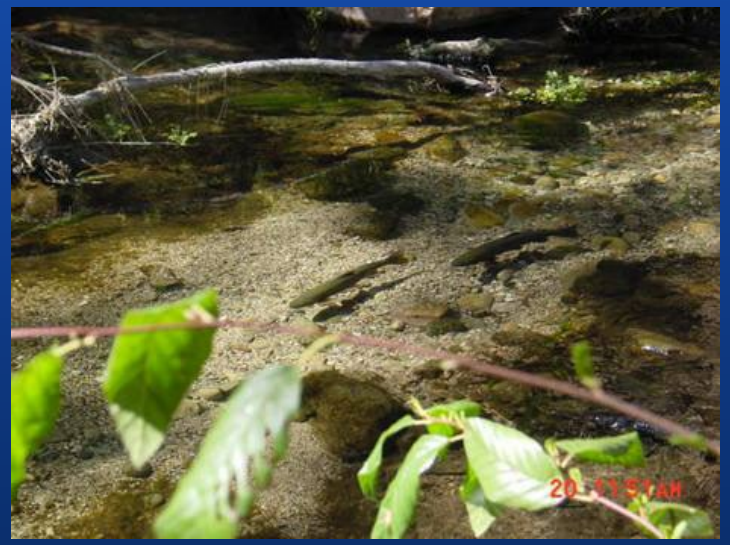
- Earthen fill dam with 4 radial gates
- Water supply reservoir only
- Tecolote Tunnel
  - 6.4 miles to transports water through the Santa Ynez Mountains to the South Coast Conduit
- South Coast Conduit
  - 26 miles gravity feed to all South Coast cities (Goleta to Carpinteria



Southern Steelhead

Oncorhynchus mykiss

Listed as endangered in 1997



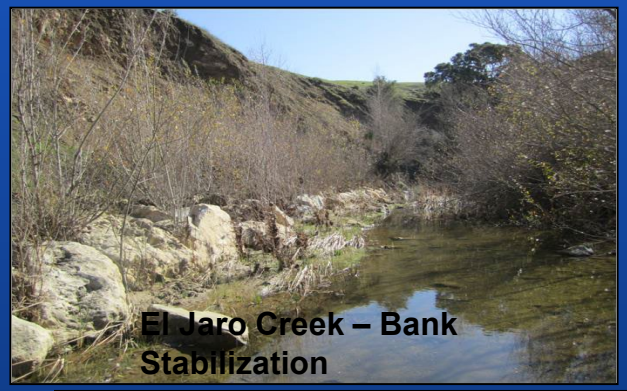
Southern California Steelhead – Endangered Species List (1997)

Cachuma Project Biological Opinion (NMFS, 2000): NMFS to USBR

15 Reasonable and Prudent Measures (RPMs):

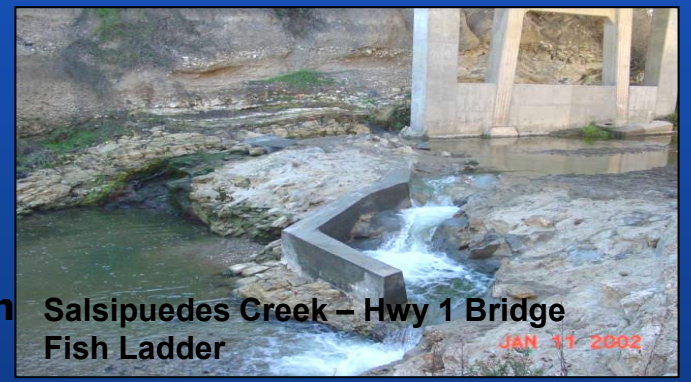
- Monitoring of the population
- River target flows
- Passage supplementation
- Habitat quality improvement
- Migration barrier fixes
- Reporting
- Outreach
- Adaptive management

Habitat Restoration Projects


El Jaro Creek – Bank Stabilization


El Jaro Creek – Culvert Replacement

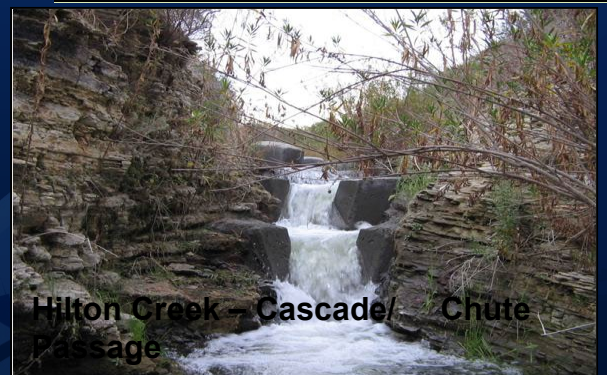

El Jaro Creek – Cross Creek Ran

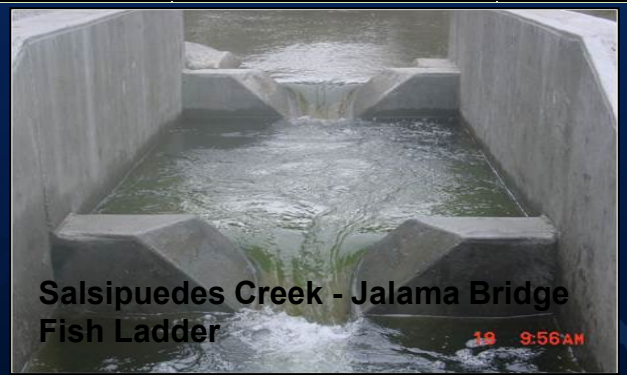


Salsipuedes Creek – Hwy 1 Bridge Fish Ladder

Project	Drainage	Timeline
Hilton Creek Watering System	Hilton	2000
Hwy 1 Bridge Fish Ladder	Salsipuedes	2002
Streambank and Side Channel Restoration	El Jaro	2003
Jalama Bridge Fish Ladder	Salsipuedes	2004
Bradbury Dam Flashboard Installation (Surcharge)	Santa Ynez River	2004
Cascade Chute	Hilton	2005
Crossing 6 60-ft Bottomless Arched Culvert	Quiota	2008
San Julian Ranch Fish Ladder	El Jaro	2008
Cross Creek Ranch Fish Passage Improvement	El Jaro	2009
Crossing 2 60-ft Bottomless Arched Culvert	Quiota	2011
Crossing 7 60-ft Bottomless Arched Culvert	Quiota	2012
Crossing 1 60-ft Bottomless Arched Culvert	Quiota	2013
Crossing 3 53-ft Bottomless Arched Culvert	Quiota	2015
Crossing 0A 55-ft Bottomless Arched Culvert	Quiota	2015
Crossing 4 54-ft Bottomless Arched Culvert	Quiota	2016
Crossing 5 58-ft Bottomless Arched Culvert	Quiota	2018
Crossing 9 60-ft Bottomless Arched Culvert	Quiota	2018
Crossing 8 54-ft Bottomless Arched Culvert	Quiota	2019

Bradbury Dam Flashboard Installation


Hilton Creek – Cascade/ Chute Passage

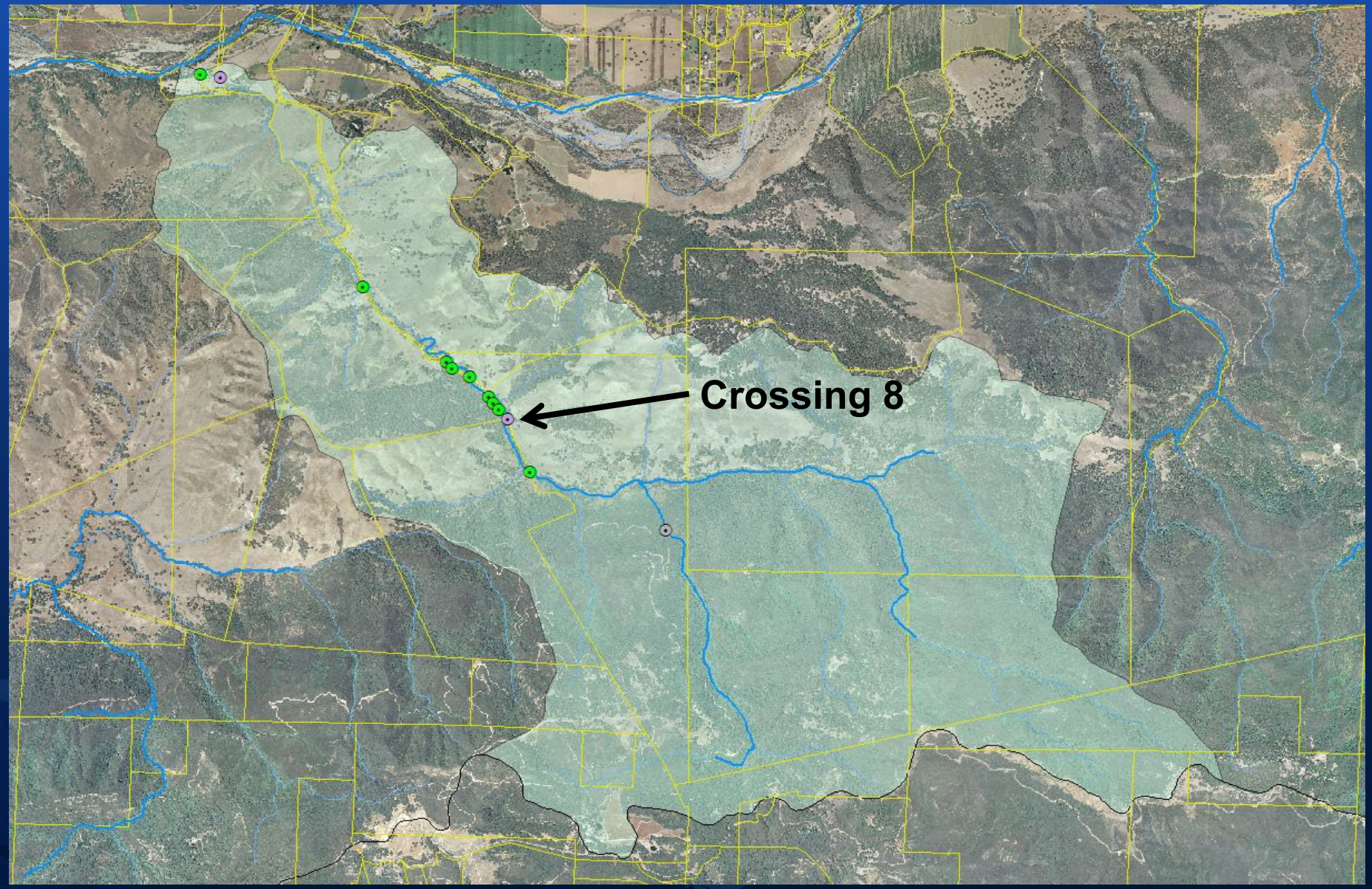


Salsipuedes Creek - Jalama Bridge Fish Ladder


El Jaro Creek – San Julian Ranch Fish Ladder


Quiota Creek - Crossing 6

Quiota Creek Watershed
Overview and Plan (2006 – present)



Summary of all Quiota Creek Projects

#	Projects	Location	Treatment	Designer*	Bridge	Fabricator	Funding	Cost	Year Completed
A	Watershed Plan	-	Road Map	HDR	Contech	COMB + HDR	CDFW + COMB	$80,459	2000
1	Crossing 6	Refugio Rd	48-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	Coastal Conservancy + COMB	$877,627	2008
2	Crossing 2	Refugio Rd	60-ft Bottomless Arched Culvert	HDR	Contech	Jensen	CDFW-FRGP + COMB	$818,182	2011
3	Crossing 7	Refugio Rd	60-ft Bottomless Arched Culvert	HDR	Contech	Jensen	CDFW-FRGP, WCB + COMB	$895,102	2012
4	Crossing 1	Refugio Rd	60-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP, WCB + COMB	$898,822	2013
5	Crossing 3	Refugio Rd	53-ft Bottomless Arched Culvert	HDR	Contech	PreCon	CDFW-FRGP + COMB	$922,068	2015
6	Crossing 0A	Ranch Rd	55-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP, Landowner + COMB	$788,438	2016
7	Crossing 4	Refugio Rd	54-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP + COMB	$1,118,872	2016
8	Crossing 5	Refugio Rd	58-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP + COMB	$1,127,737	2018
9	Crossing 9	Refugio Rd	60-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP + COMB	$1,210,973	2018
10	Crossing 8	Refugio Rd	54-ft Bottomless Arched Culvert	HDR	Contech	Bethlehem	CDFW-FRGP + COMB	$1,307,187	2019
11	Crossing 0B	Ranch Rd	?	-	-	-	-	-	?
							Total:	**$10,045,467**	
* HDR - Fisheries Design Center									







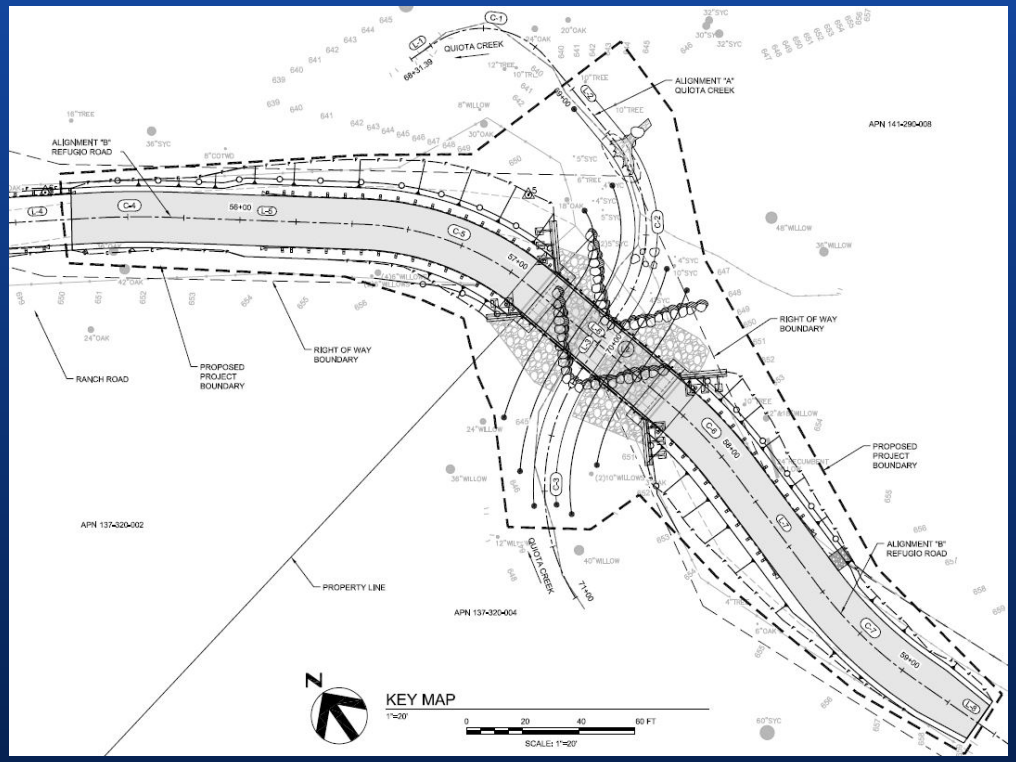

Quiota Creek Crossing 8 – Project Specifics

- Project Lead: Cachuma Operation and Maintenance Board (COMB), Tim Robinson
- Stakeholders: COMB, 2 landowners, SB County, CDFW-NMFS, and the public
- Project objective: Remove a fish passage barrier for the endangered southern California steelhead on a NMFS designated critical habitat stream (Quiota Creek, a tributary to the Santa Ynez River)
- Project location: 5 miles south of the town of Santa Ynez, CA (Santa Barbara County)
- Design approval (Santa Barbara County, NMFS, CDFW): 3 years
- Design engineers: HDR Fisheries Design Center
- Bridge design and manufacturer: Contech (O-Series)
- Bridge fabricator: Bethlehem Construction (Wasco, CA) (180 miles from project site)
- Permit acquisition: 8 months
- Contractor: Peter Lapidus Construction
- Biological monitoring: COMB Fisheries Division
- Start date: 9/18/19
- Completion date: 1/8/20
- Instream work completed: 11/15/19
- Total cost: $1,307,187
- Funding: $1,010,700 CDFW-FRGP and $296,457 COMB

Construction Process

- Survey
- Close the road
- Environmental containment and relocation
- Dewatering
- Clearing, grubbing and
- Concrete crossing removal
- Foundation excavation and pouring
- Bridge fabrication at a pre-fabricator
- Bridge transport and installation
- Backfilling the arches
- Installation of instream elements
- Install anti-graffiti coating
- Road and shoulder work
- Pave road
- Guardrail and bridge rail installation
- Revegetate (plant mitigation trees and hydro-mulch/seed)
- Final inspection

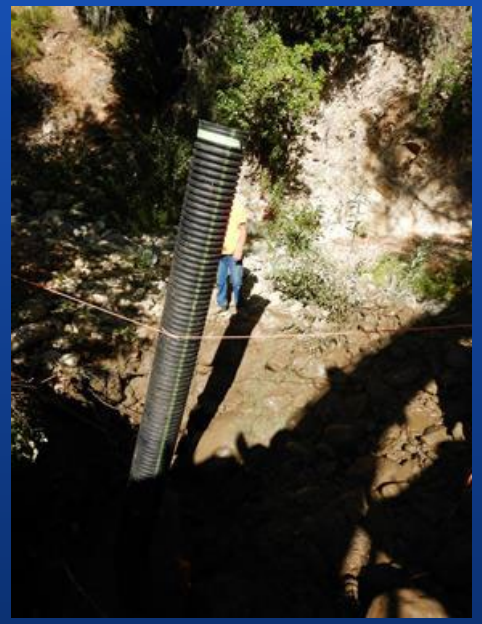
Biological Monitoring
Pre-, During-, and Post-Construction



Reporting:

- **Progress Reports**
- **Final Report**
- **Annual Performance Evaluation Reports**

Species Relocation, Dewatering, Clearing/Grubbing and Excavation for Foundations

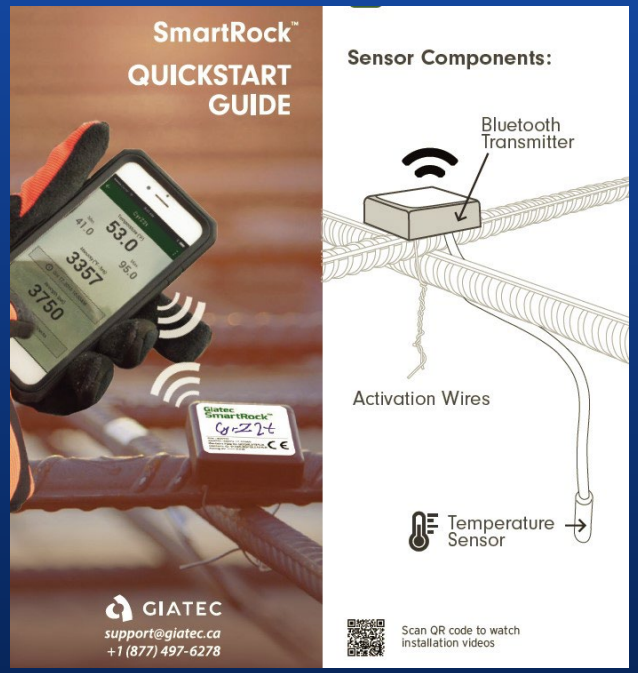


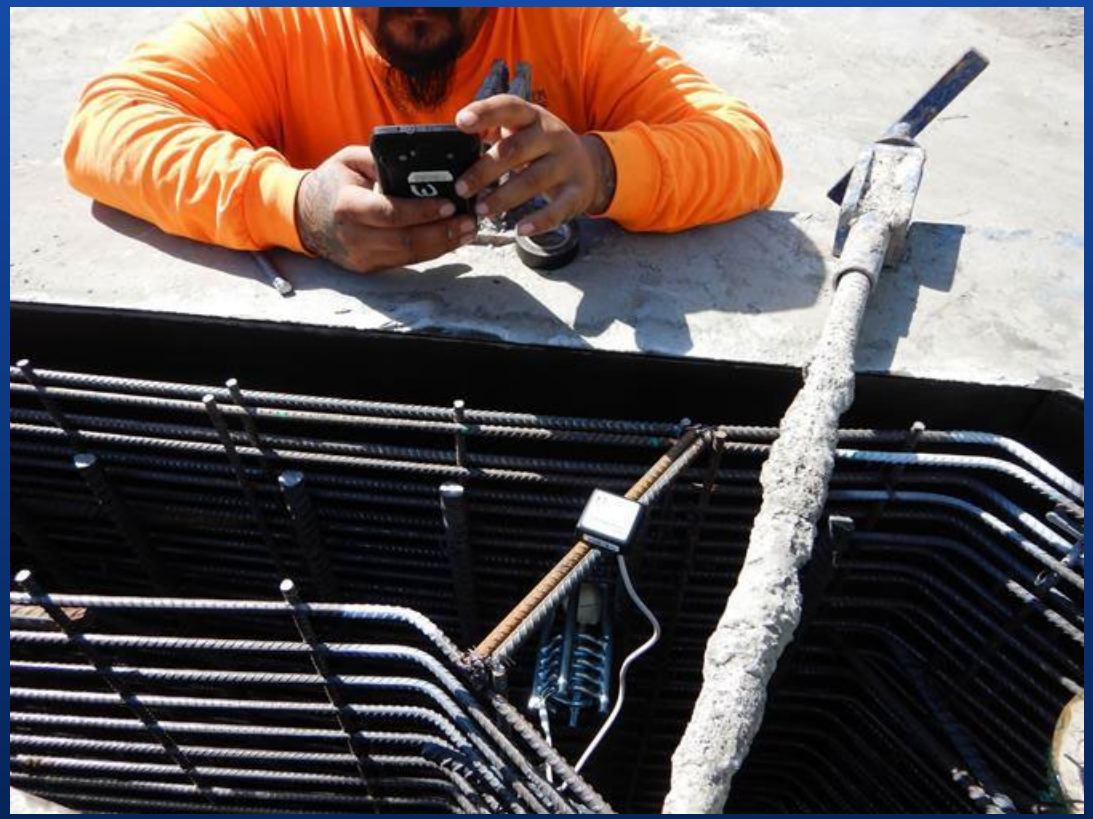
Bridge Foundation Construction

Instream Elements

Bottomless Arched Bridge – Fabrication

Concrete Curing Temperature Monitoring (Section 90-4.01D(2)(d)





1. Maximum internal concrete temperature can't exceed 165 degrees F
2. Internal temperature gain can't exceed 40 degrees F per hour

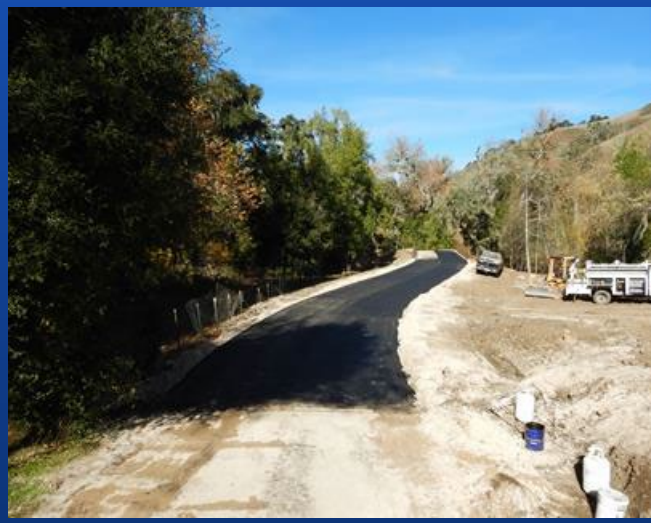
- Measured max temperature: 105 – 115 degrees F
- Smooth curing temperature cures

Bridge – Transport

Bridge Installation

Quiota Creek Crossing 8
Time-elapse Bridge Installation

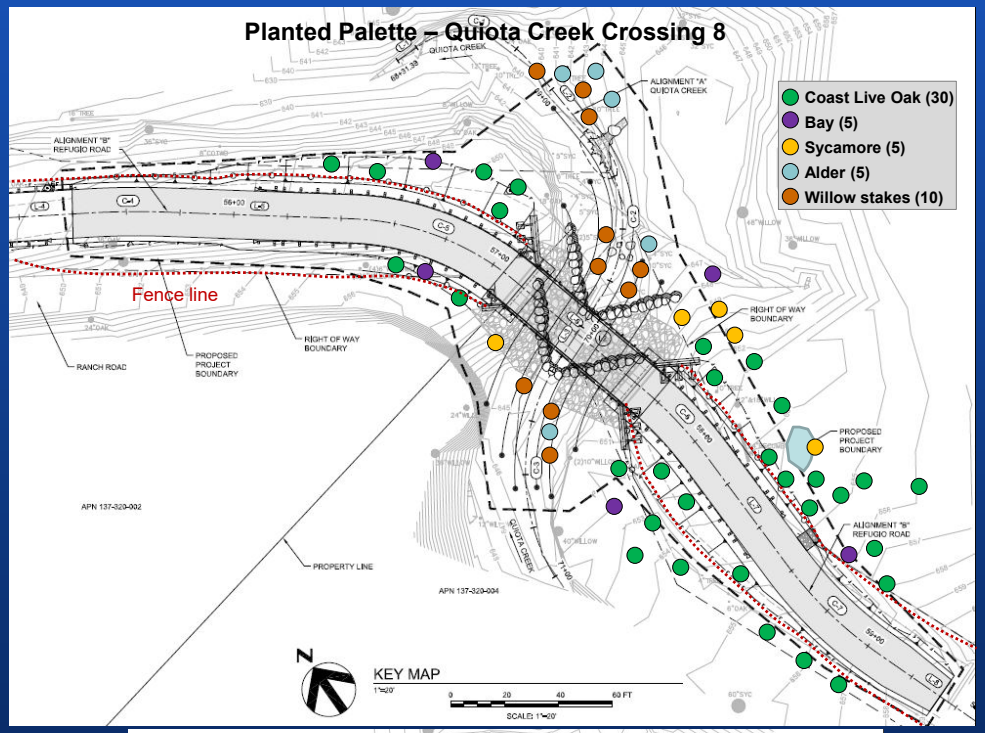
Grout, Backfilling, Road/Shoulders, and Pave

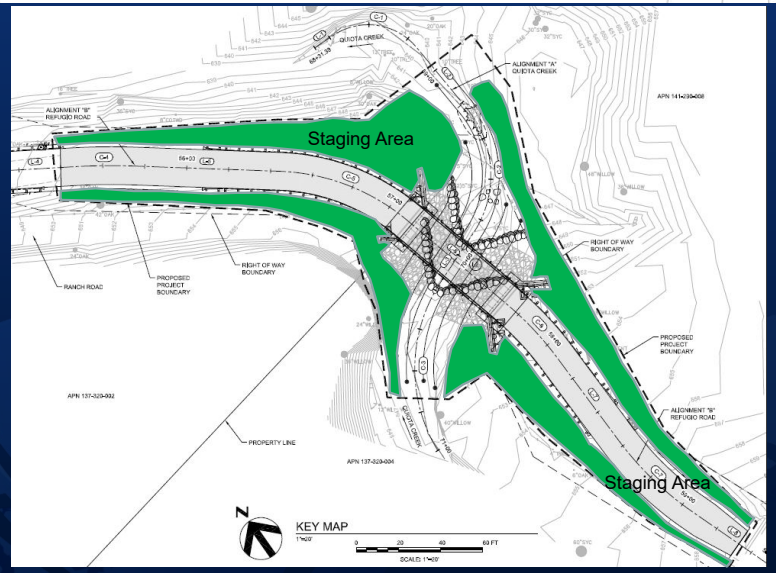


Guardrails and Bridge-Rails

- Standard galvanized Midwest Guardrail System with Caltrans approved inline 31” terminal system and Natina coating
- Modified FHWA California Type 115 bridge rail with single bike rail at 54-inches utilizing corten weathering steel

Revegetation, Site Cleanup and Reporting

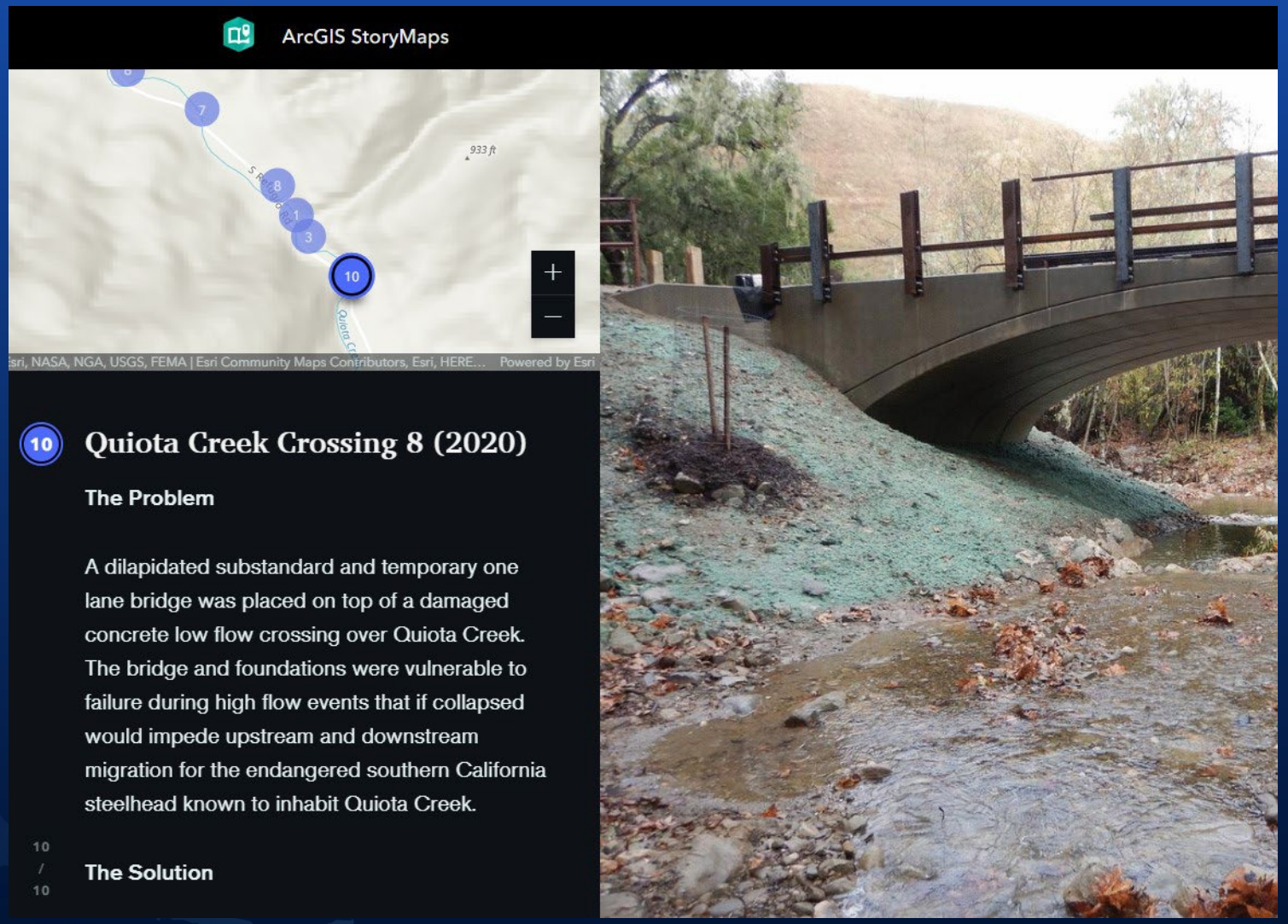




Public Outreach – ESRI StoryMaps

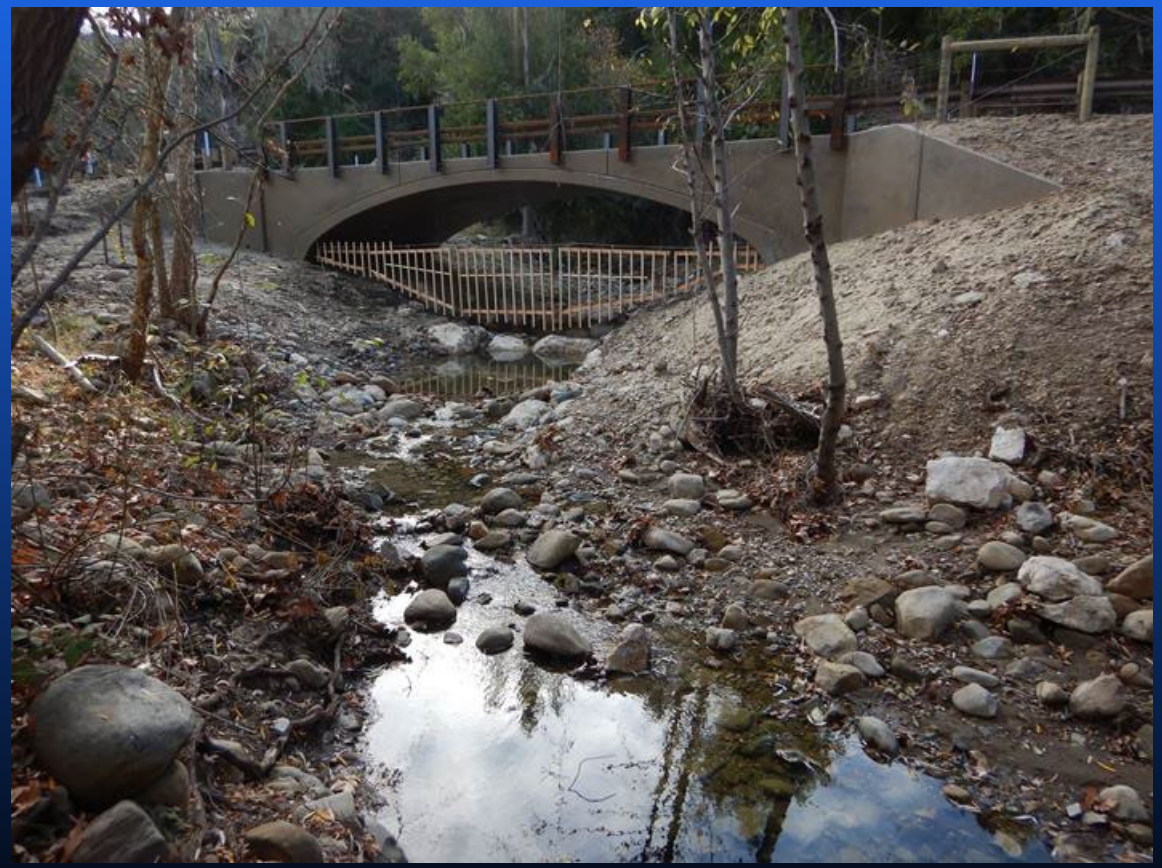
Quiota Creek Fish Passage and Habitat Restoration Projects

- The public can see completed projects via StoryMaps embedded on our website
- “Guided Tour” allows text and media to be related to a specific location on the map
- Supports gif format, for professional looking before and after pictures that auto-fade



Conclusions

- Bottomless arched culvert bridges
- 3-4 month long project
- Good flow conveyance
- Get all permits (Haul) early
- Blend into the background
- Contractor that knows bridge and stream work
- County, landowners and the public
- The fish and aquatic life

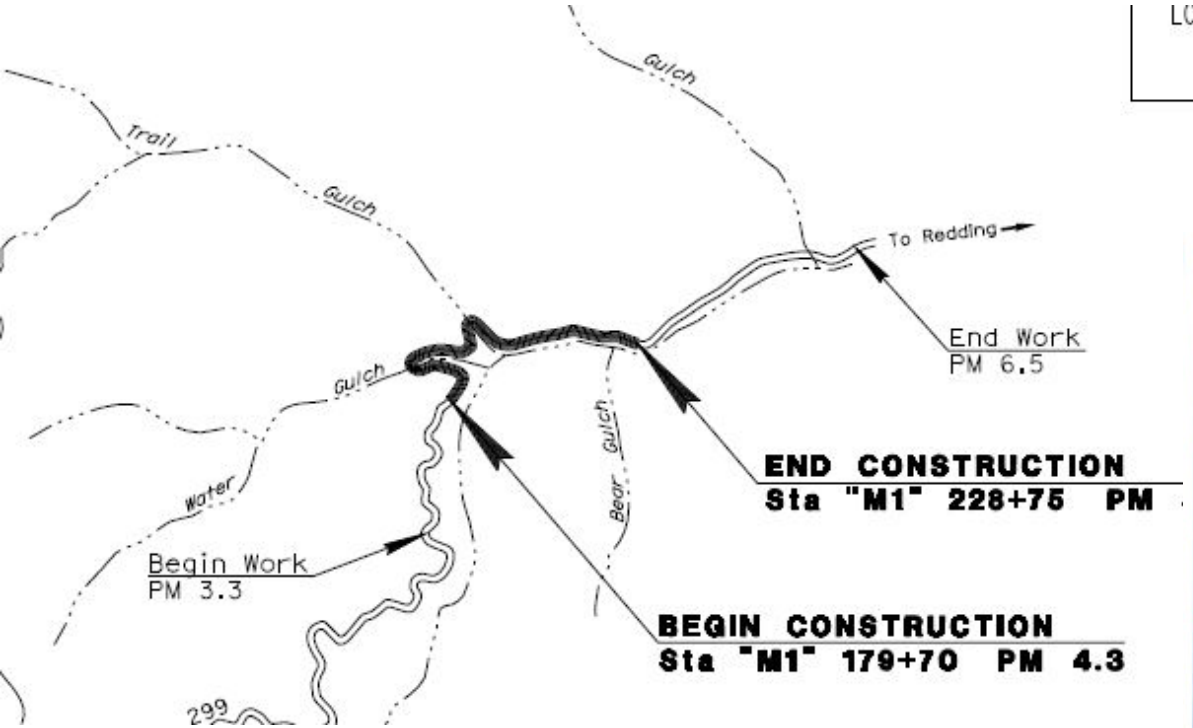


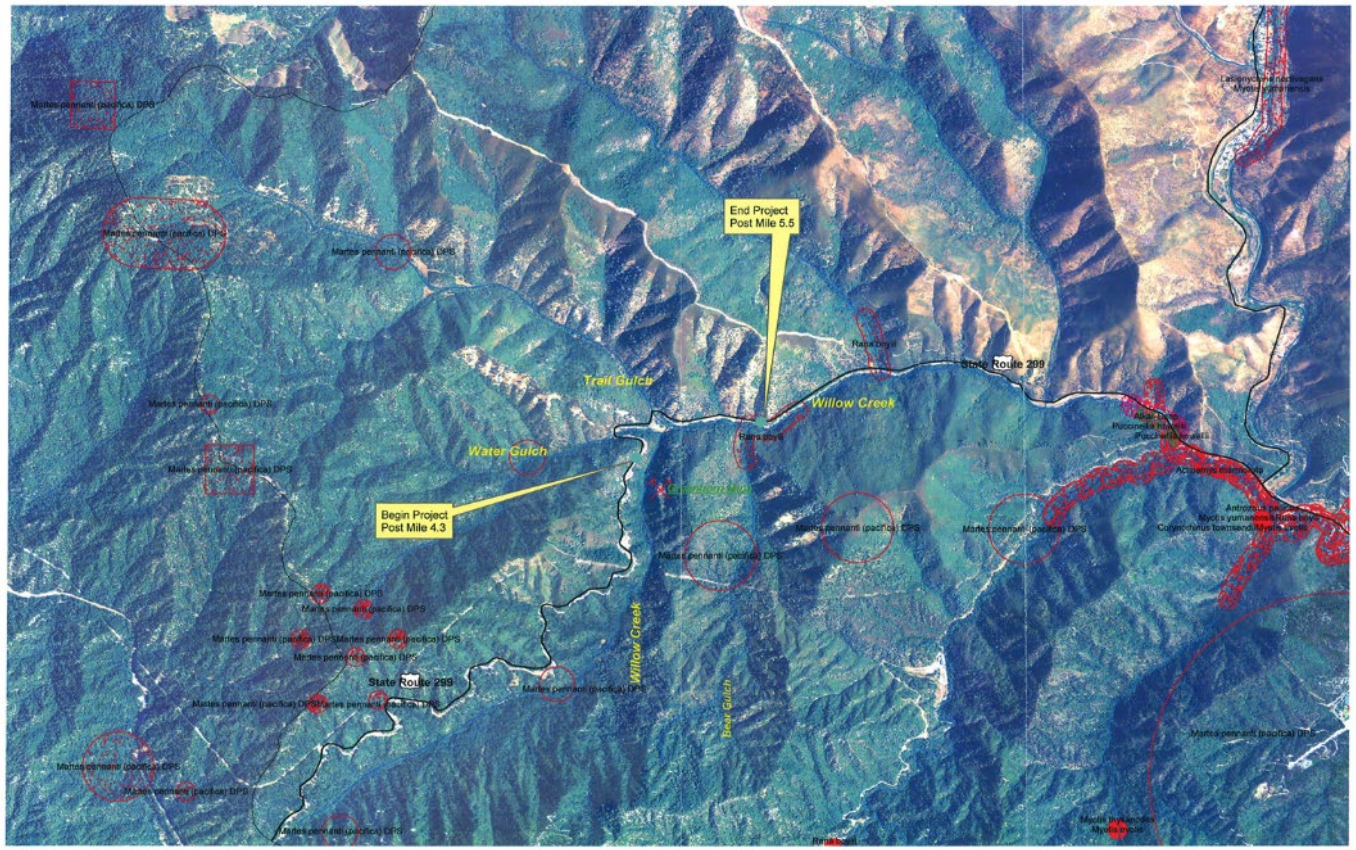
What Can We DO?

Case Studies:
Twin and Ditch Gulches

Eric L. Rulison
California Department of Transportation
North Region-District 2
Office of Environmental Management

Introduction – Twin Gulches Curve Improvement Project





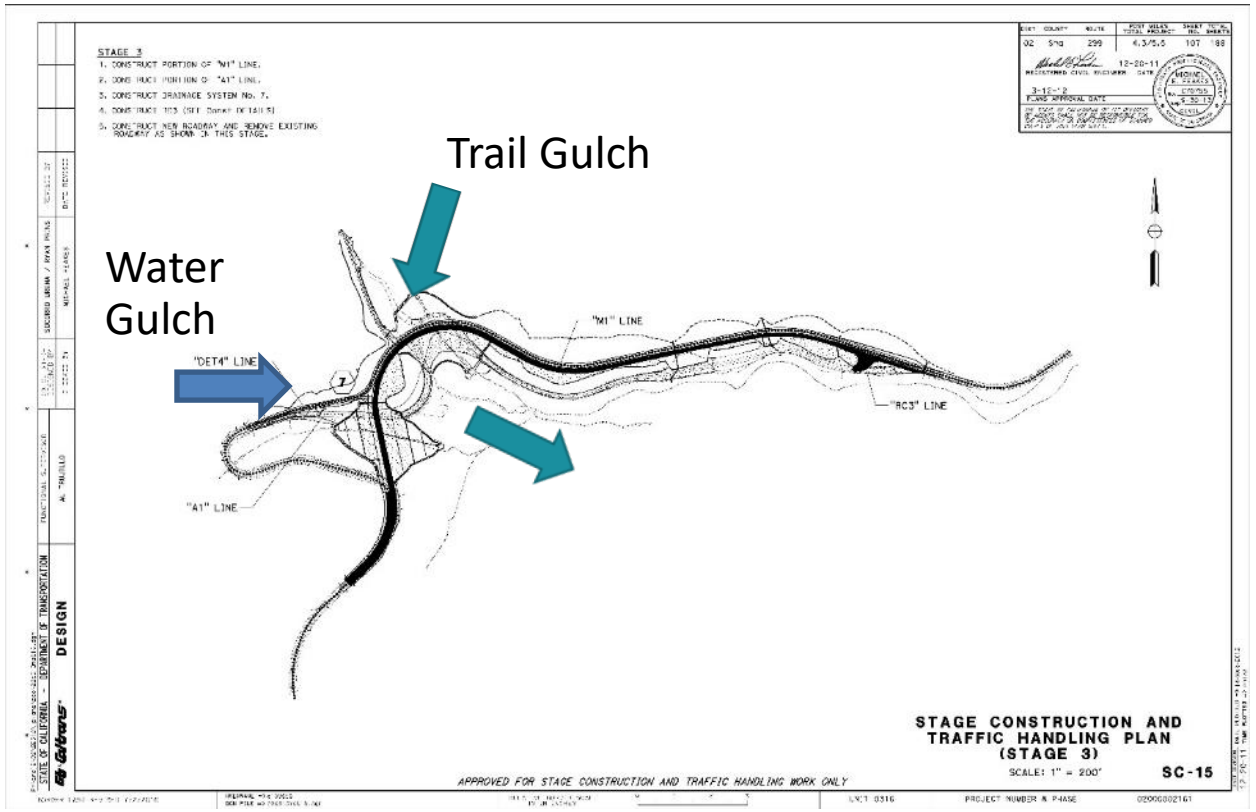
Basics

Curve Correction Project

- To proved safe passage across one of California's busiest highways SR 299

- CDFW Fully Protected Species
  - Fisher and Ringtail

- Long-term Outcomes
  - Connect habitat where a roadway is nearly a complete barrier to wildlife

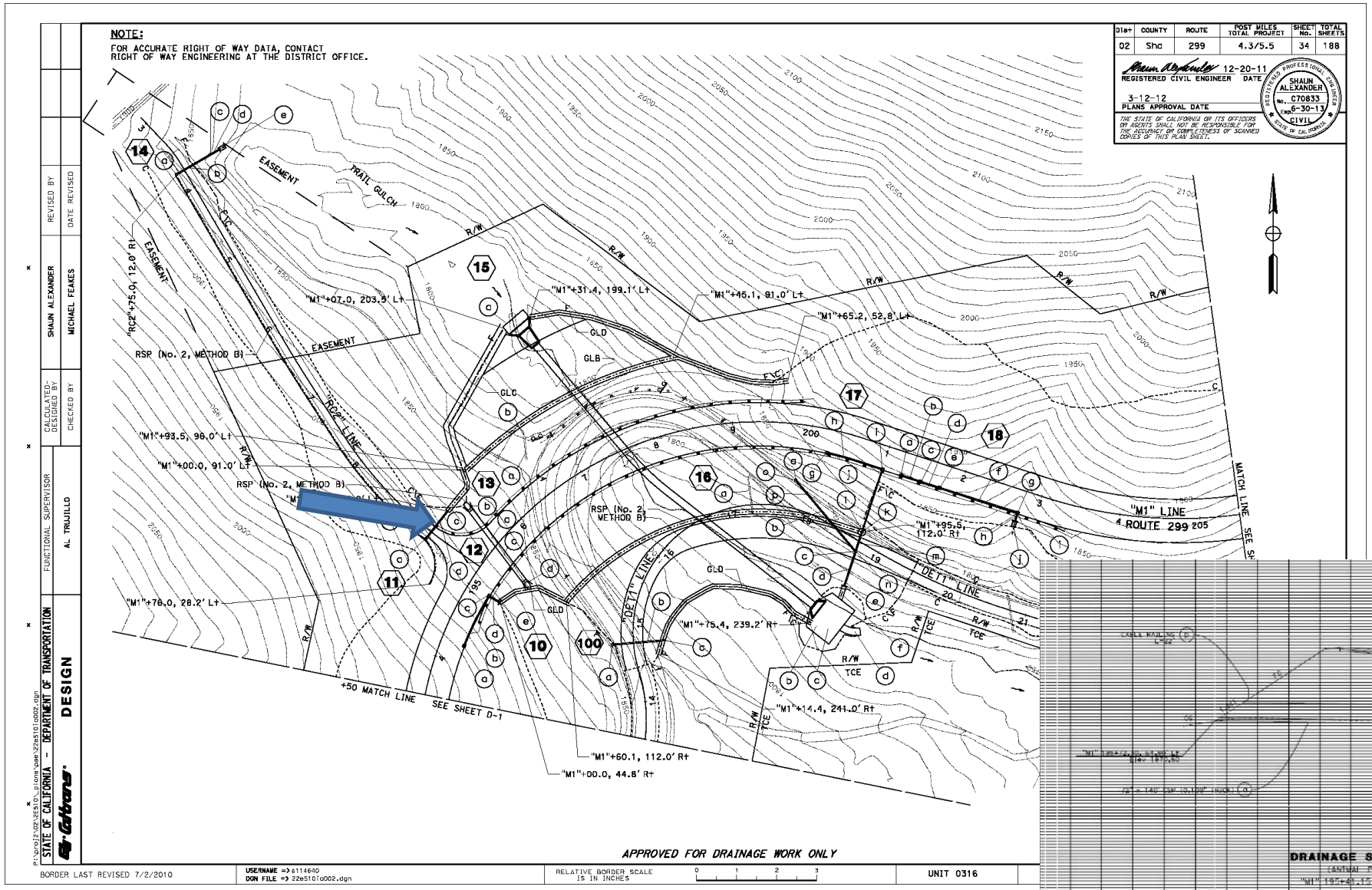


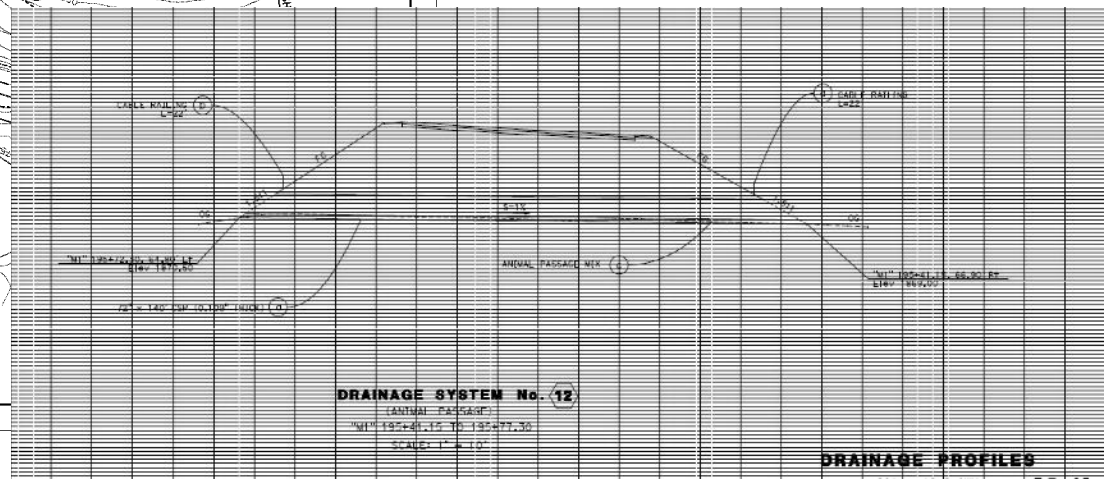
Pre-Work

Water Gulch

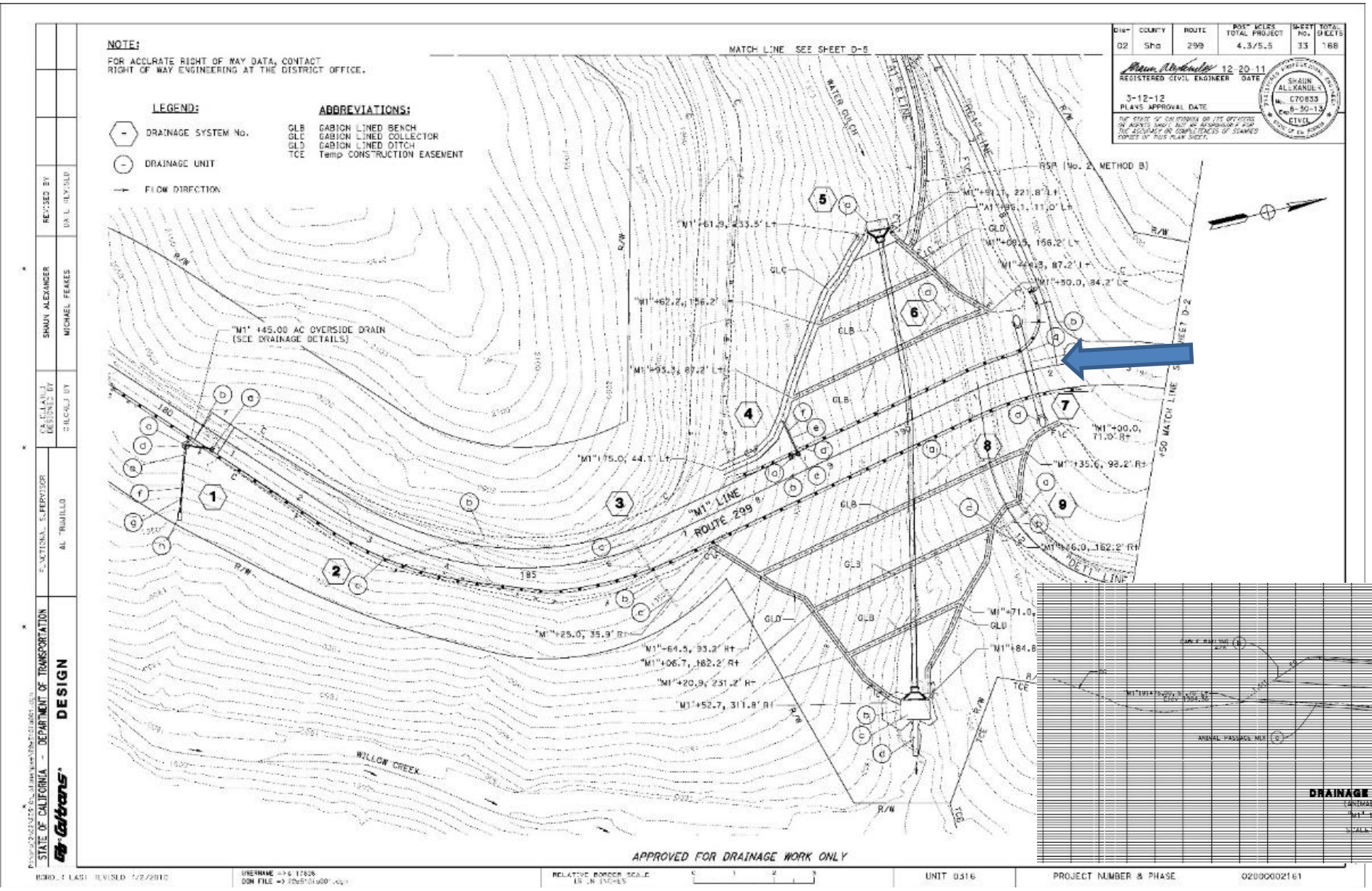
Trail Gulch outlet

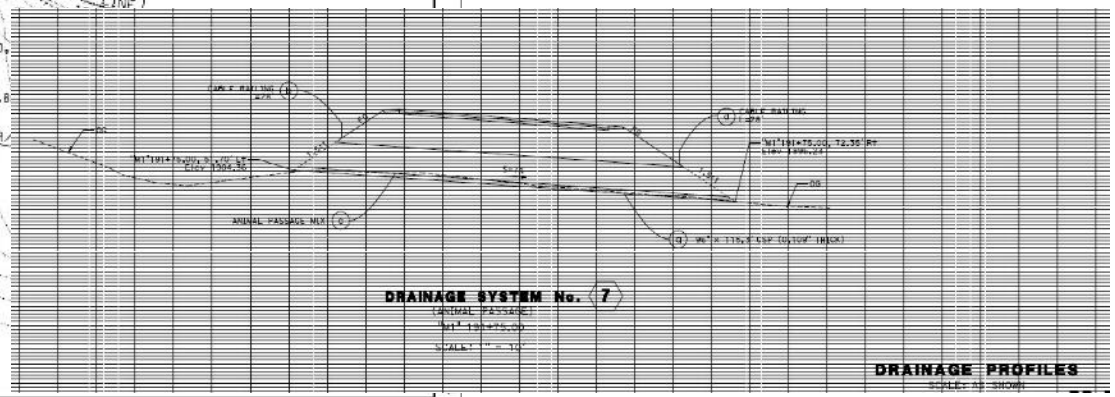
Design – Trail Gulch





Design – Water Gulch





Basic (cont.)

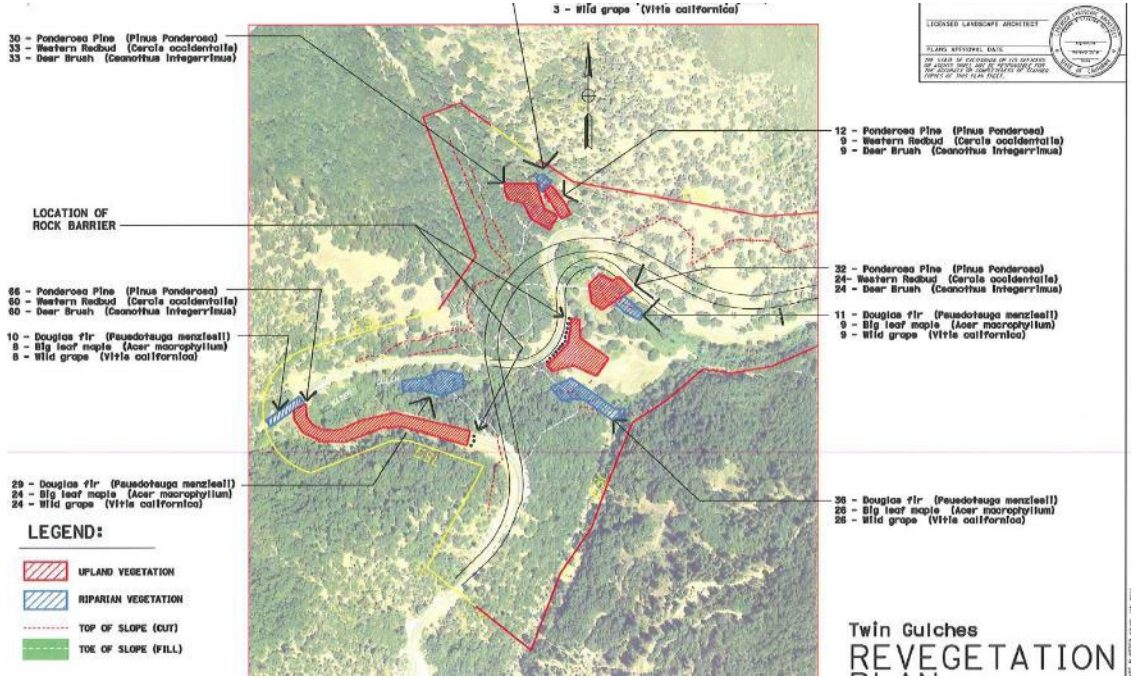
Permits– 401, 404, LSAA, Water Use Permit

Project Lead and involved Organizations: Caltrans, CDFW, ACOE, RWQCB, USFS, UC Davis Road Ecology Center, Nordic Industries

Planning and Project Delivery:

- Caltrans Functional Units
- Environmental m/w/Agencies
- Environmental m/w Scientists

Caltrans PDT made decisions



Water Gulch (96” x 155’)

Water Gulch

Outlet

View from outlet into habitat

Trail Gulch (72”x 204’)

Culvert Enhancements

- Planting
- Mulch

Time

Cameras placed at every entrance

Wildlife Use

Project Cost - $17,858,464.78

But the costs of the culverts were minor

CASE STUDY 2
Ditch Gulch – In Construction (Finished next year)

Trinity County
State Route 36
Post Miles 26.7 to 27.1

Aquatic Organism Passage

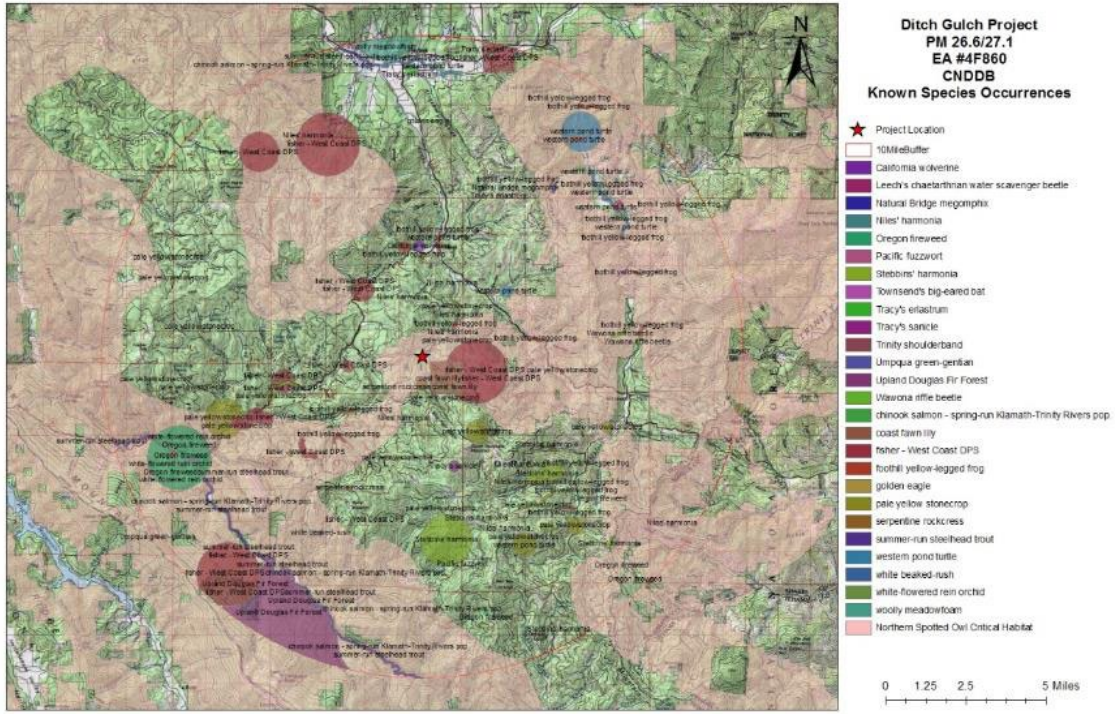
Basics

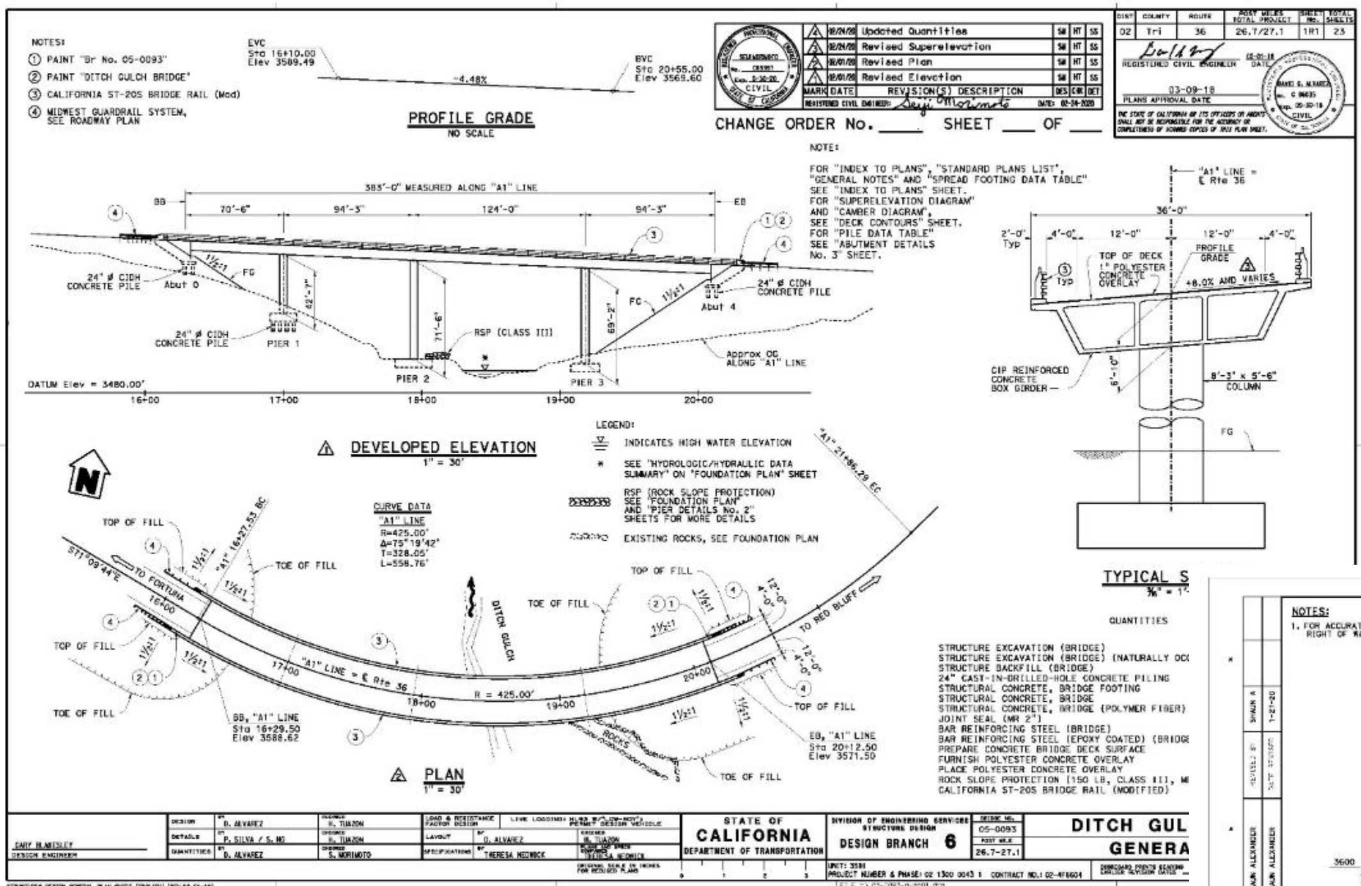
- Permits– 401, 404, LSAA, Letter of Concurrence (USFWS), Special Use permit
- Project Lead and involved Organizations: Caltrans, CDFW, ACOE, RWQCB, USFS, AECOM

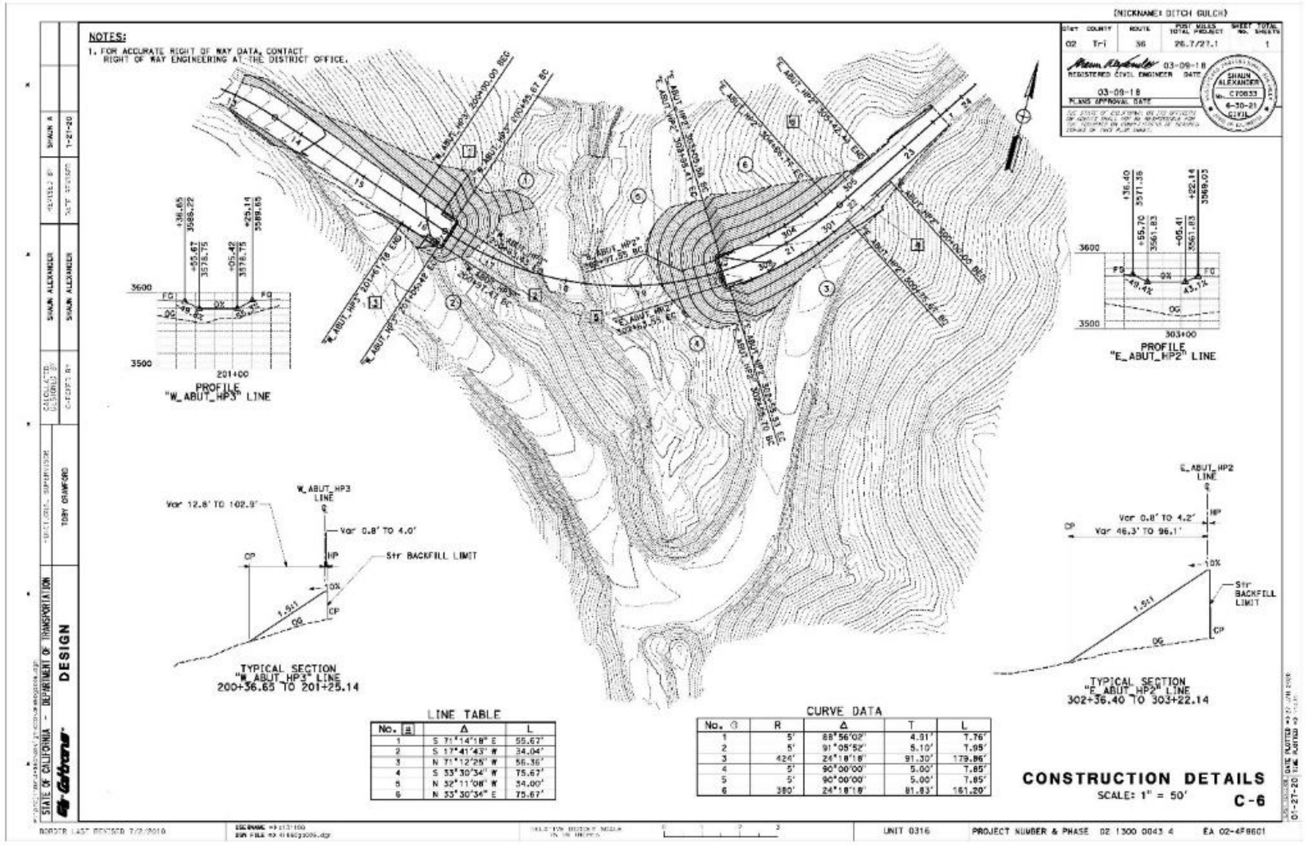
Planning and Project Delivery:

- Caltrans Functional Units
- Environmental m/w/Agencies
- Environmental m/w Scientists

Caltrans PDT made decisions







LINE TABLE

No.	Δ	L
1	S 71°14'18" E	55.67'
2	S 17°41'43" W	34.04'
3	N 71°12'25" W	56.36'
4	S 33°30'34" W	75.67'
5	N 32°11'08" W	34.00'
6	N 33°30'34" E	75.67'

CURVE DATA

No.	R	Δ	T	L
1	5'	88°56'02"	4.91'	7.76'
2	5'	91°05'52"	5.10'	7.95'
3	424'	24°18'18"	91.30'	179.86'
4	5'	90°00'00"	5.00'	7.85'
5	5'	90°00'00"	5.00'	7.85'
6	380'	24°18'18"	81.83'	161.20'

Future work/costs

Cameras will be set to document species use

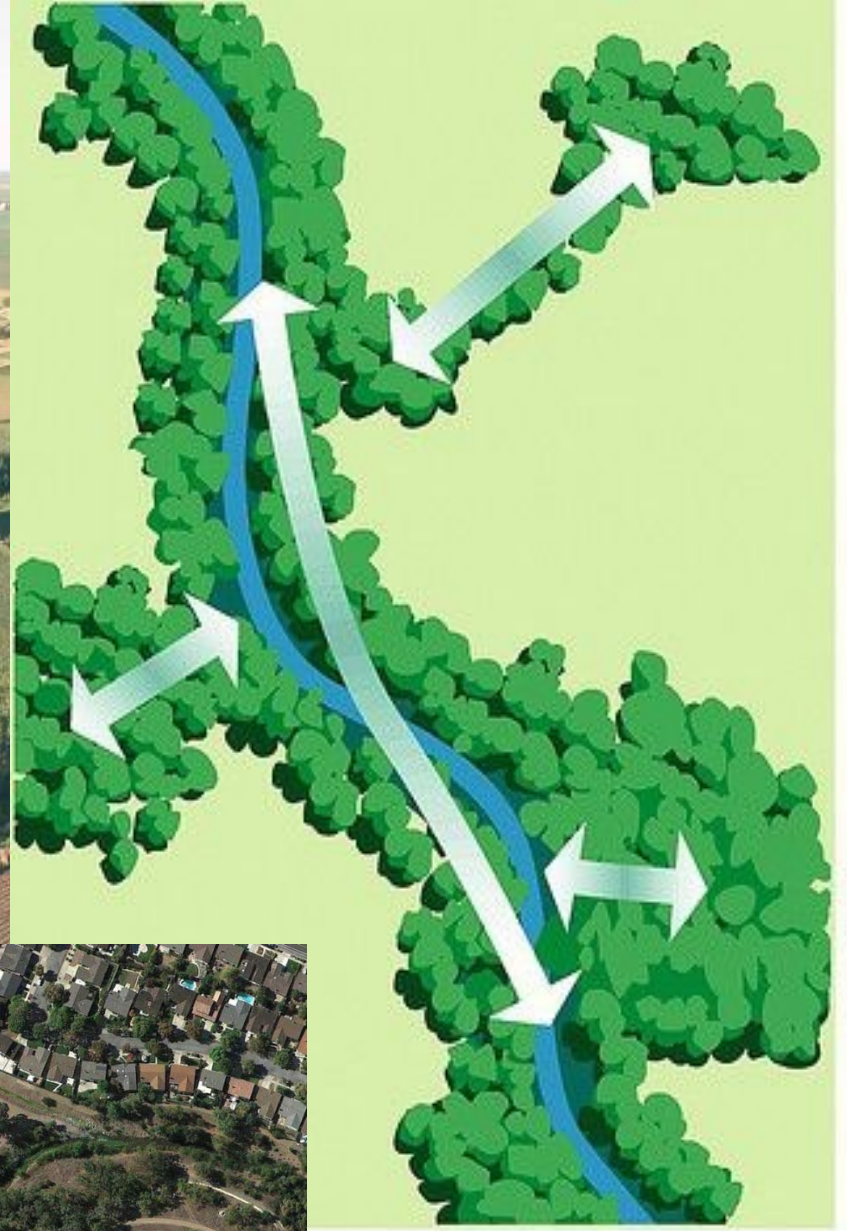
Thus far… $9,161,300.69

Project Benefits, Challenges, and Lessons

- Engage with agencies EARLY and OFTEN
- Engage with the experts
- Conduct site visits
- Pre-project surveys – protocol level (if needed)
- Be adaptable and willing to try different approaches
  - Creating crossings for focal terrestrial species is trial and error
  - Create large viaduct or structure when possible to reduce WVC with LARGE species
- Costs can be inexpensive for CSP culvert in fill slope
- Other design options can optimize and produce a better project

Caltrans

Take Home



38 – Landscapes with (A) high and (B) low degrees of connectivity. A connected landscape structure
lly has higher levels of functions than a fragmented landscape.
am Corridor Restoration: Principles, Processes, and Practices (10/98)
Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the U.S.)

California Fish Passage Advisory Committee

Connectivity Case Studies

www.cafishpac.org