Enhancing Channel and Floodplain Connectivity: Improving Salmonid Winter Habitat on Lagunitas Creek, Marin County

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Beyond the Thin Blue Line: Floodplain Processes, Habitat, and Importance to Salmonids: Part II

33rd Annual Salmonid Restoration Conference

Fisheries Restoration: Planning for Resilience

March 11-14, 2015

Santa Rosa, California

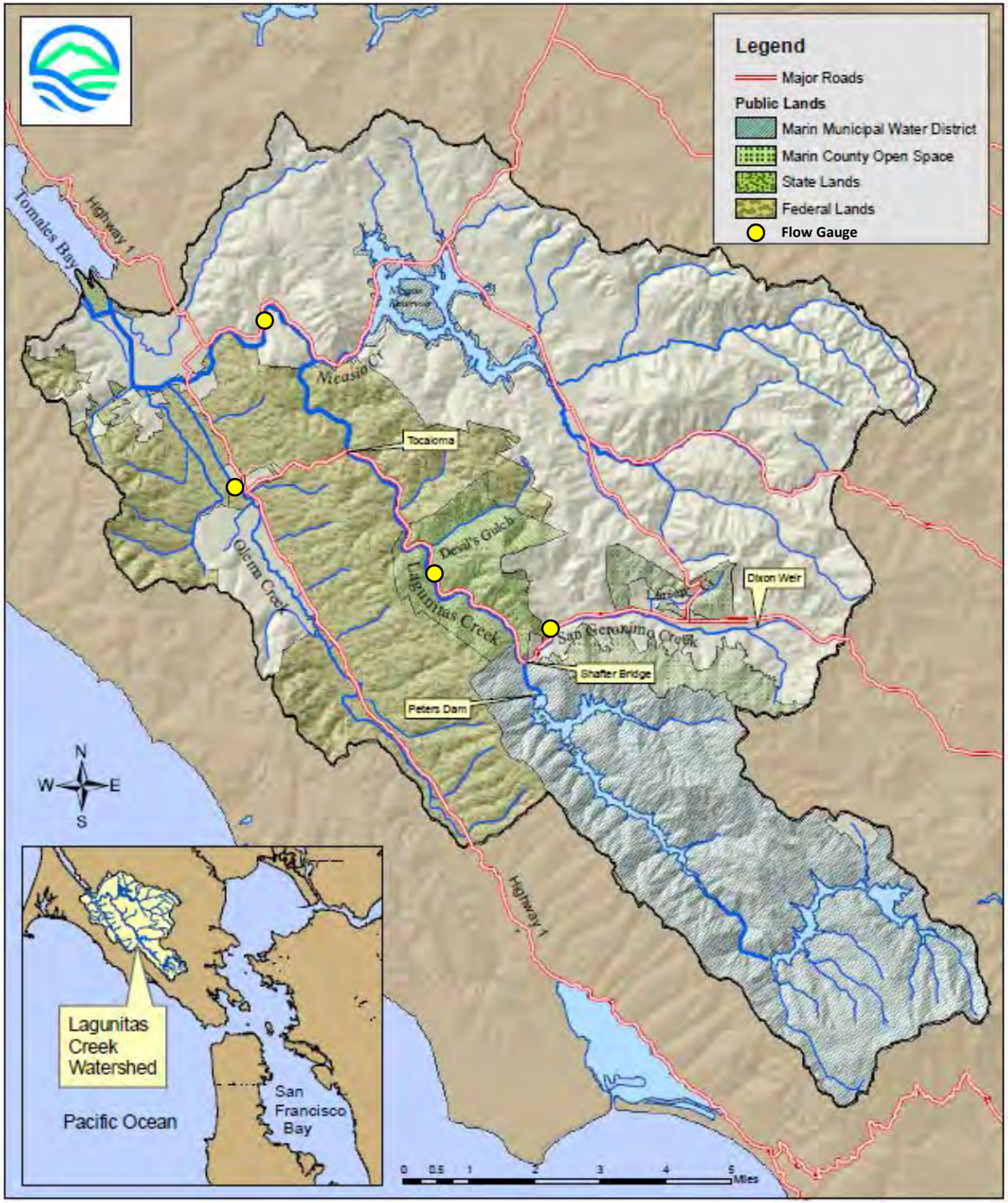
Kamman Hydrology & Engineering, Inc.

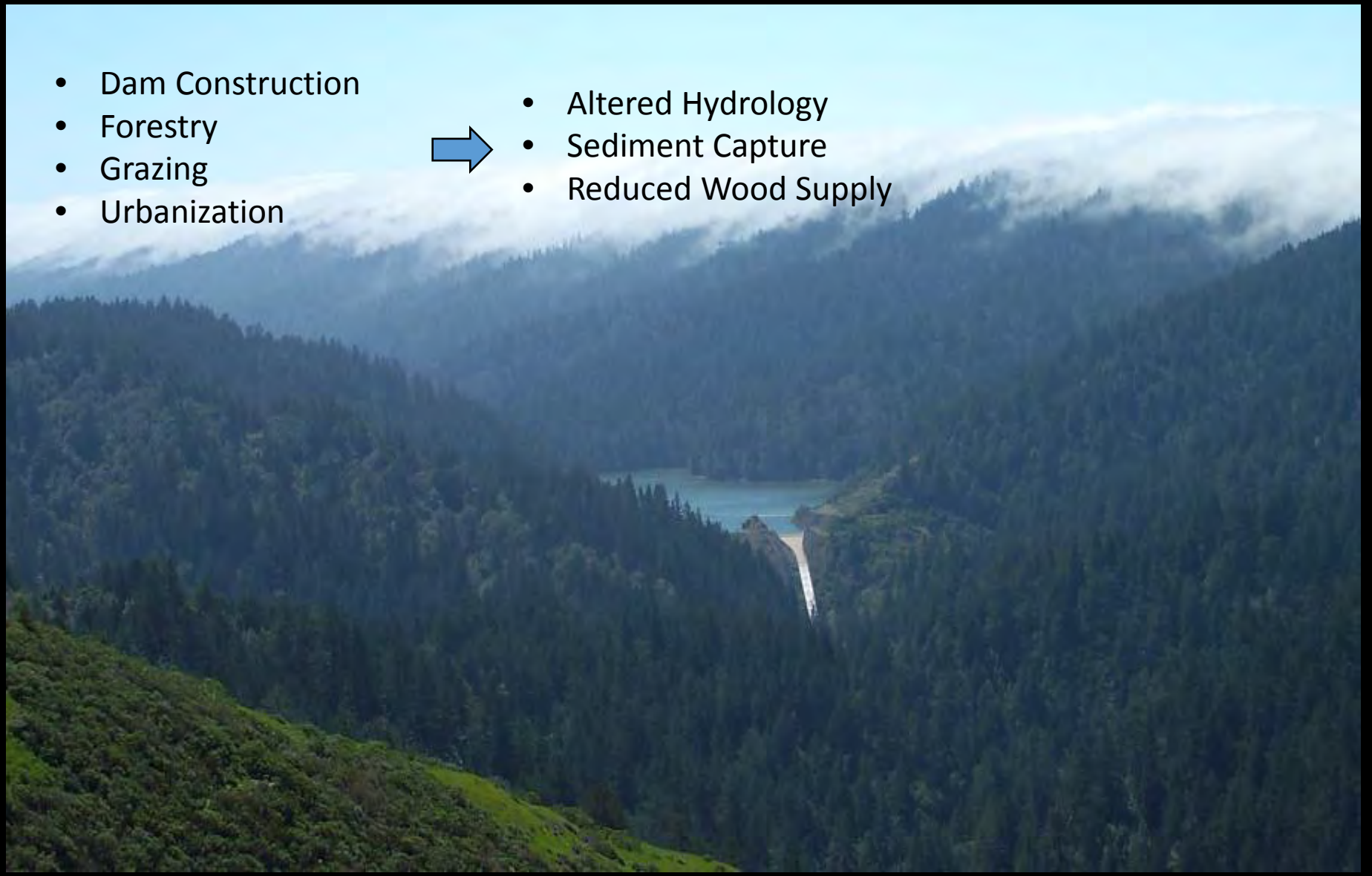
PRESENTATION OUTLINE

1. Introduction to Lagunitas Creek
2. Winter Habitat Assessment Studies
3. Goals-Objectives of Enhancement Projects
4. Proposed Project Approach & Methods
5. Examples of Project Designs

INTRODUCTION

- 109 square mile watershed
- Dam construction (1872-1982)
- Coho (LE) and steelhead (LT)
- CA freshwater shrimp (LE)




• Dam Construction
• Forestry
• Grazing
• Urbanization
• Altered Hydrology
• Sediment Capture
• Reduced Wood Supply

Lagunitas Creek Limiting Factors Analysis

(Stillwater Sciences, 2008)

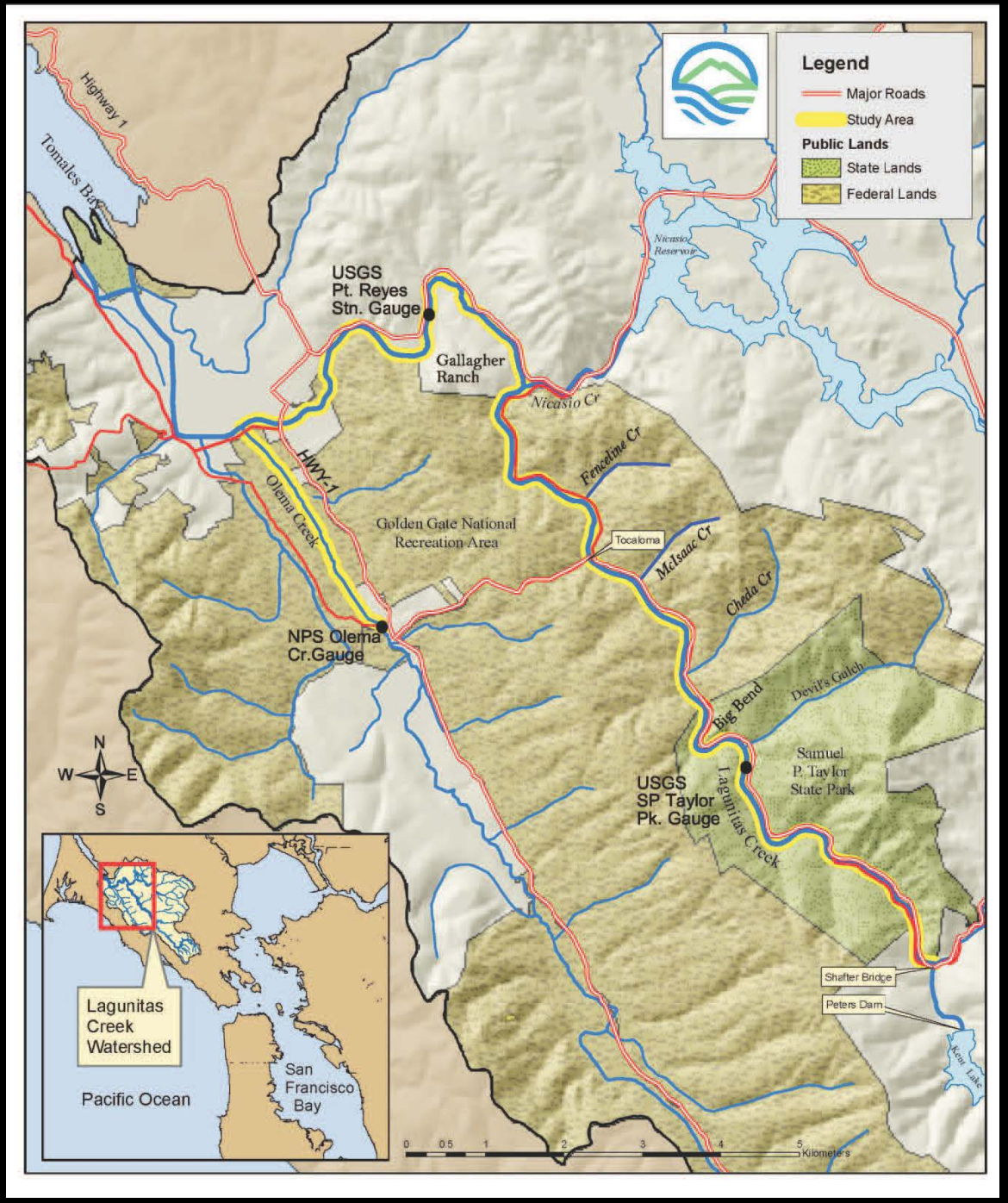
- Winter habitat is the limiting factor for both coho and steelhead.
- Winter habitat is limited during base flow to bank-full periods.
- Estimated winter carrying capacity of 7,000 juvenile coho and <5,000 steelhead.

Lagunitas Creek Salmonid Winter Habitat Enhancement Assessment & Plan

- FRGP grant to MMWD
- Phase 1 (2012-2013) Assessment: Evaluate existing winter habitat; identify opportunities and constraints for enhancement; and select enhancement sites & approaches.
- Phase 2 (2013-2014) Project Plan: Develop site specific designs for permitting and construction.

Study Area

California freshwater shrimp



Phase 1 Assessments

- Analysis of daily & peak flow records.
- Compare existing flow conditions to historic unimpaired (natural) flows.
- Synthesis of available LiDAR & survey data.
- Site reconnaissance of corridor morphology and associated salmonid habitat attributes.
- High flow monitoring and photographs – at what flows do we see overbank flooding?

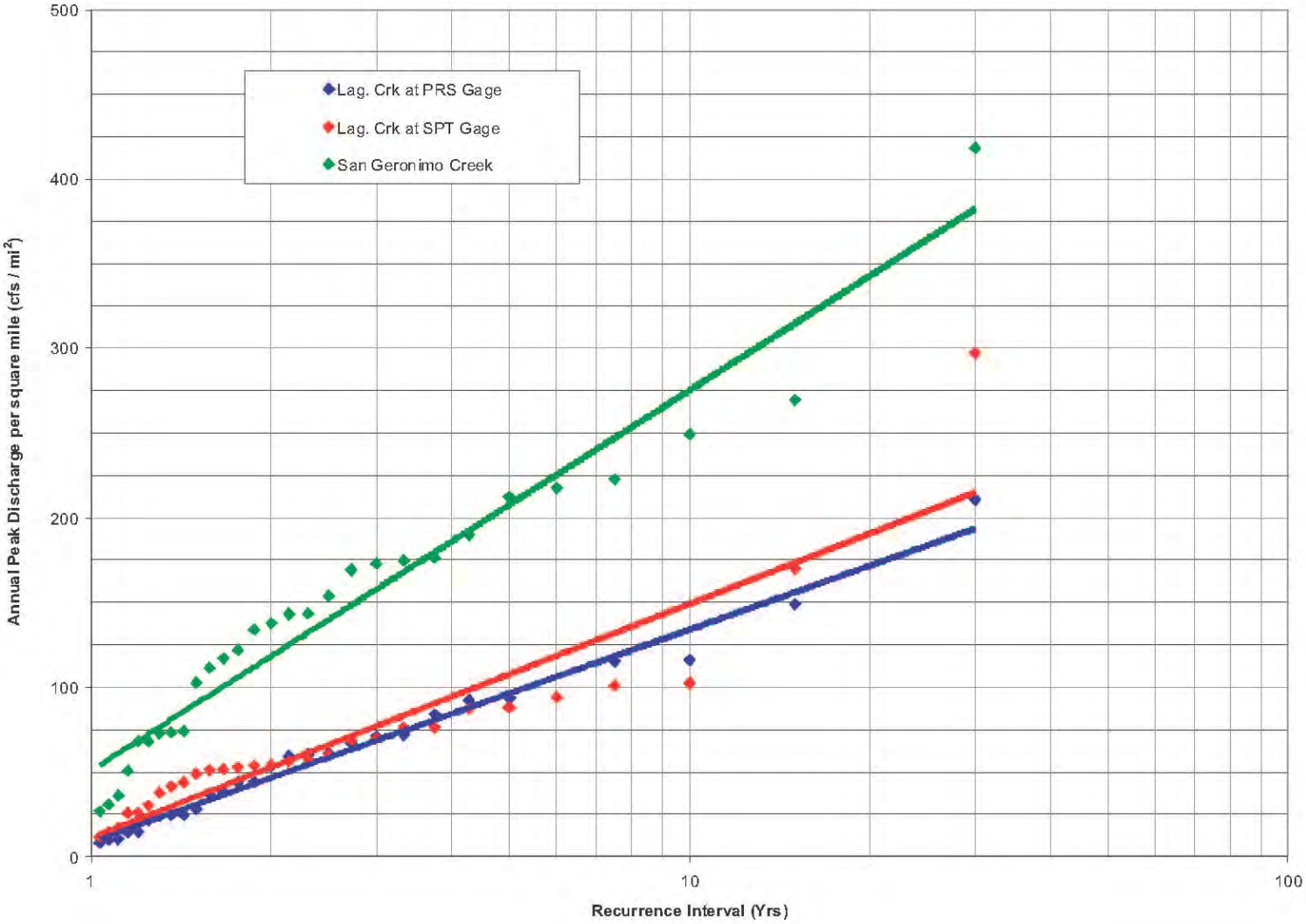
Phase 1 Findings

Two primary hypotheses that limit winter habitat in majority of creek.

1. Above average percentage of channels are incised with elevated velocity during winter flows.

2. The lower frequency, duration and magnitude of “bankfull” flow has reduced the amount of inundated floodplain and side channels available for winter habitat.

Examples of Incised Channels



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FLOOD FREQUENCY BY UNIT AREA RUNOFF

Lagunitas Creek Salmonid Winter Habitat Enhancement Assessment

FIGURE 9

Enhancement Goals and Objectives

<u>Goal: Increase the winter carrying capacity for coho and steelhead.</u>

- Enhance/restore natural hydrologic processes to promote geomorphic evolution of more active high flow (side) channels and floodplain;
- Do not strand juvenile salmonids;
- Do not allow invasive predators (bass and bullfrogs);
- Do not create stagnant water – (temp., DO, mosquito);
- Do not degrade habitat for freshwater shrimp; and
- Limit disturbance, maintenance and cost.

Phase 2 Enhancement Design Approach

- Primary design elements include construction of log structures to raise creek water elevations in order to backwater/deflect flow into existing floodplain channels on a more frequent basis.

- Work with the existing landscape (enhance vs. create).

Reference Sites with Desirable Traits

Lagunitas Creek

Olema Creek

Restore this…

…to this.

Bar Apex Jam Examples

Large Log Jam - Big Bend

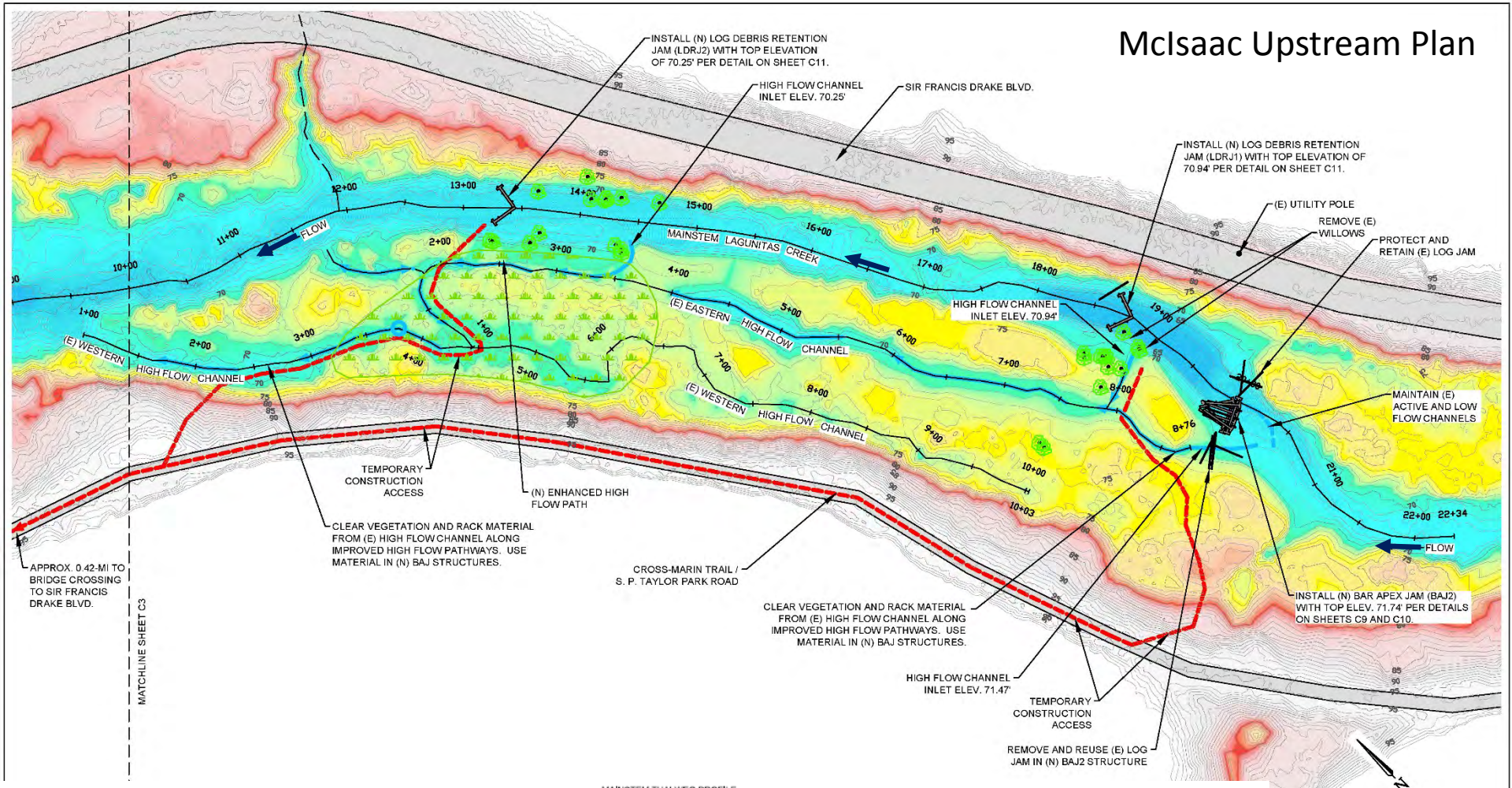
Channel-Spanning
Debris Jams

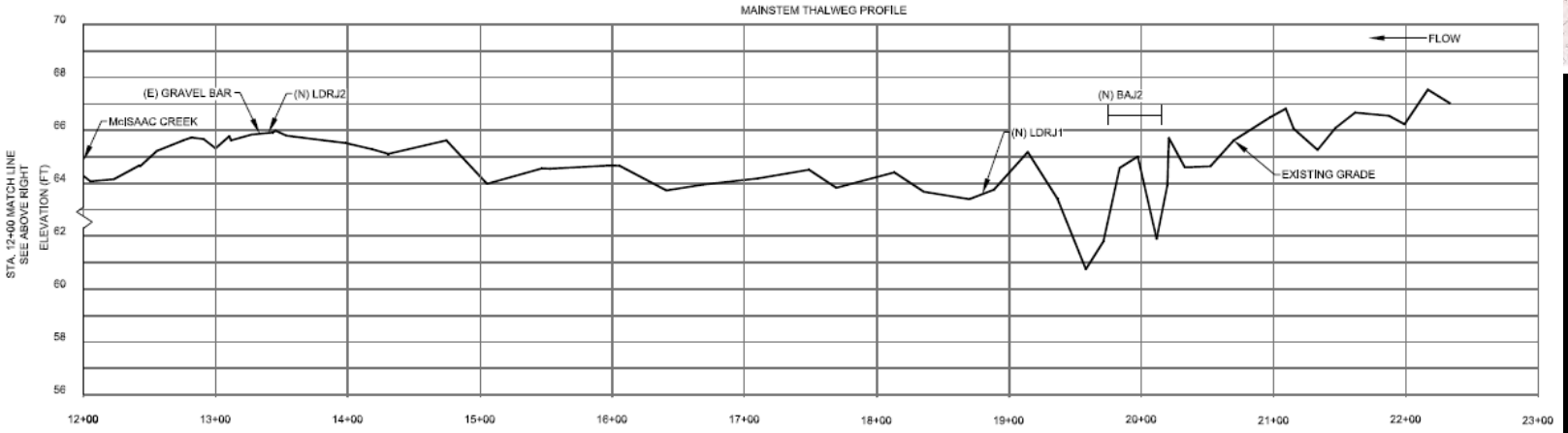
McIsaac Upstream Floodplain

McIsaac Upstream Floodplain

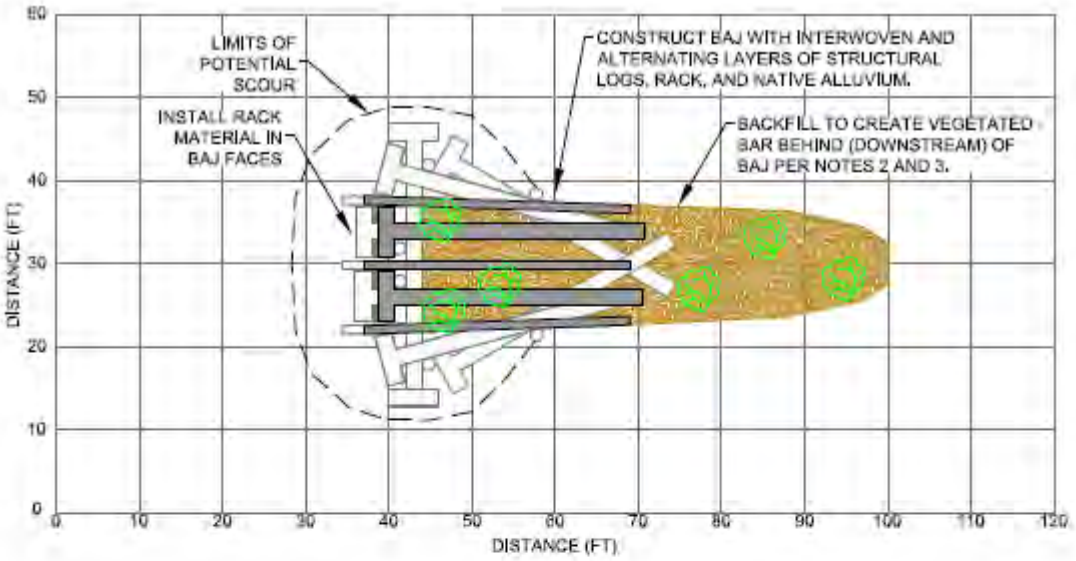
McIsaac Upstream Floodplain

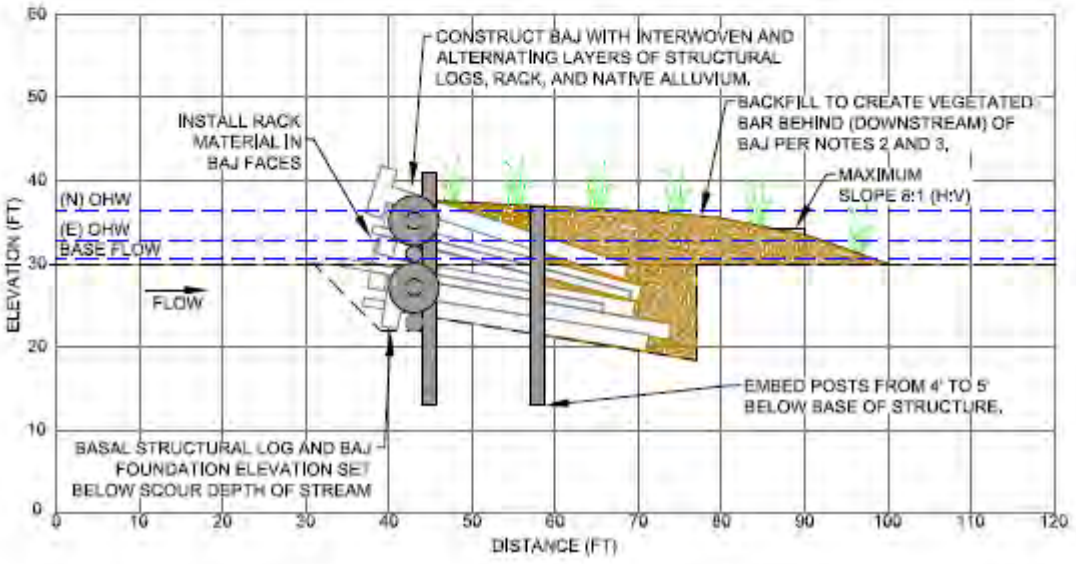
McIsaac Upstream Plan

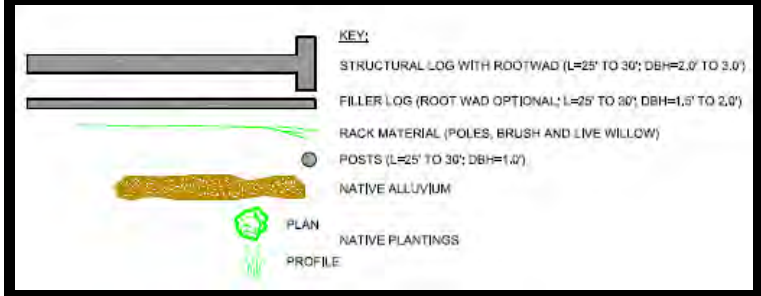




Bar Apex Jam (BAJ) – Design Detail

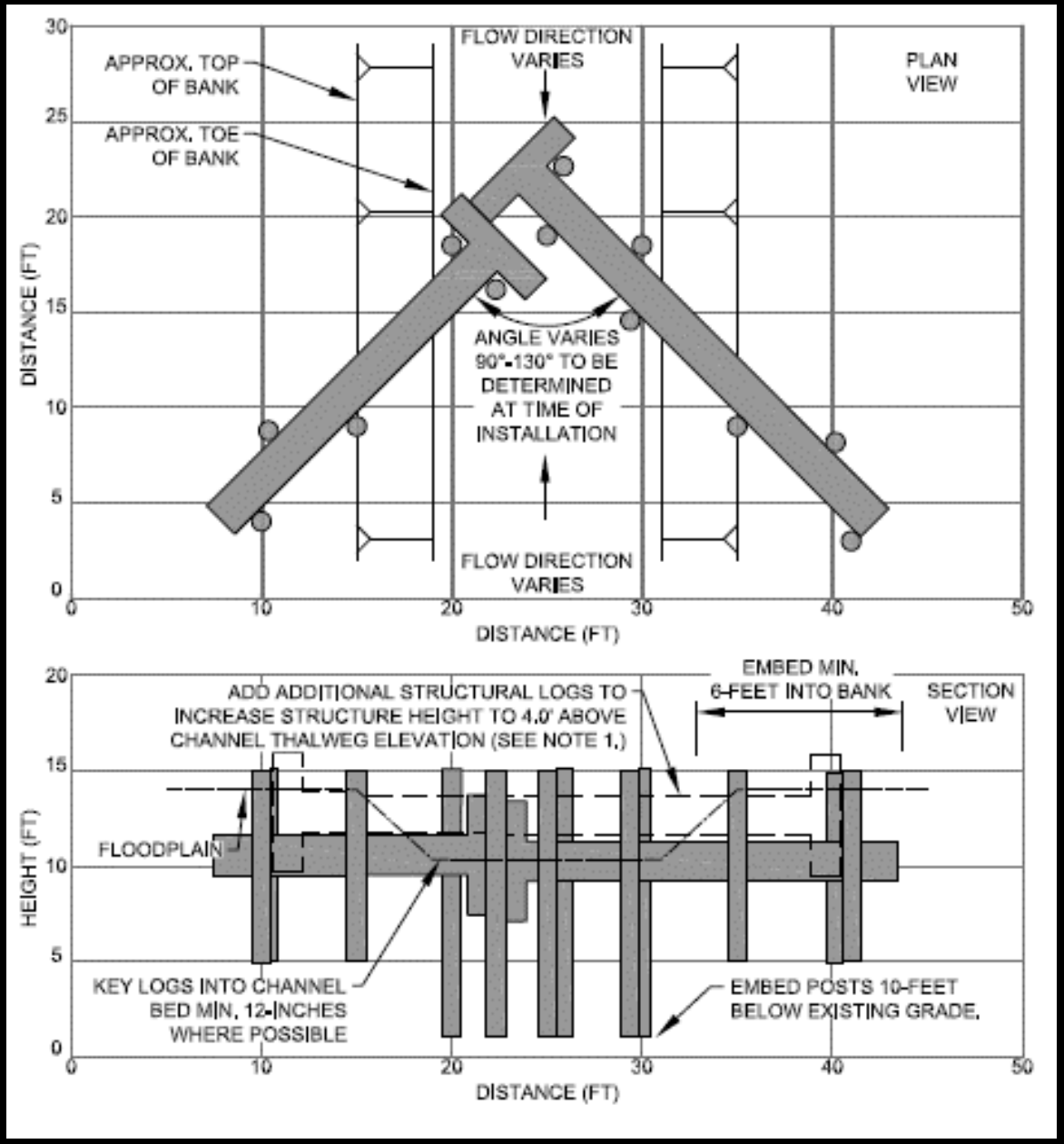






Bar Apex Jam
Hunter Creek
Installation
Rocco Fiori

Log Debris Retention Jam - LDRJ (Post Assisted Debris Jam, a.k.a. “Trash Rack”)



Log Debris Retention Jam – The Inspirations

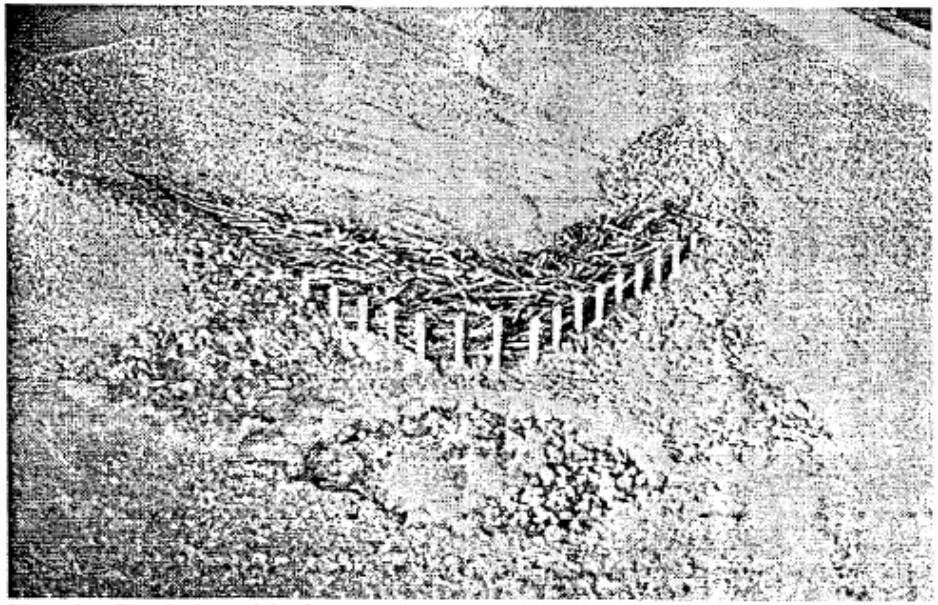


Plate 2 : Physical model of the Arzbach "Treibholzfang". Note the central low flow channel and stilling basin. View upstream.

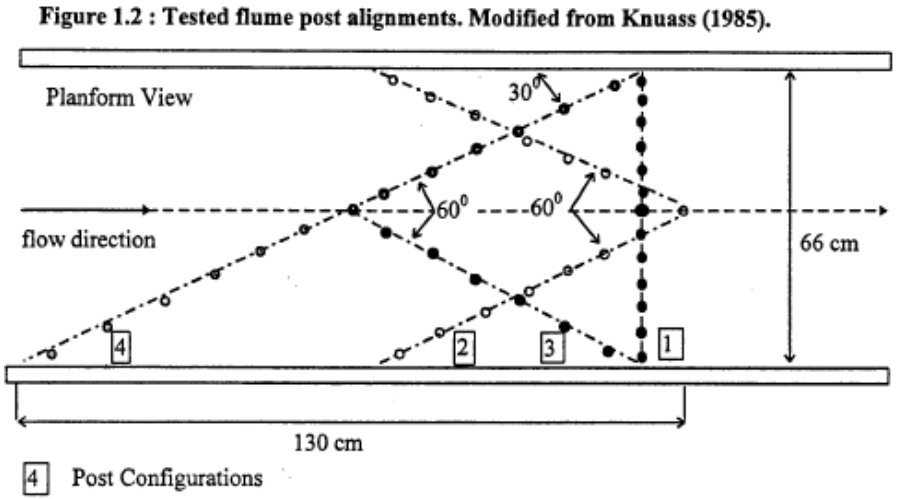


Figure 1.2 : Tested flume post alignments. Modified from Knuass (1985).

Debris Retention Device by Knauss, Bavarian Alps
(Source: Wallerstein, Thorne and Abt, 1996)

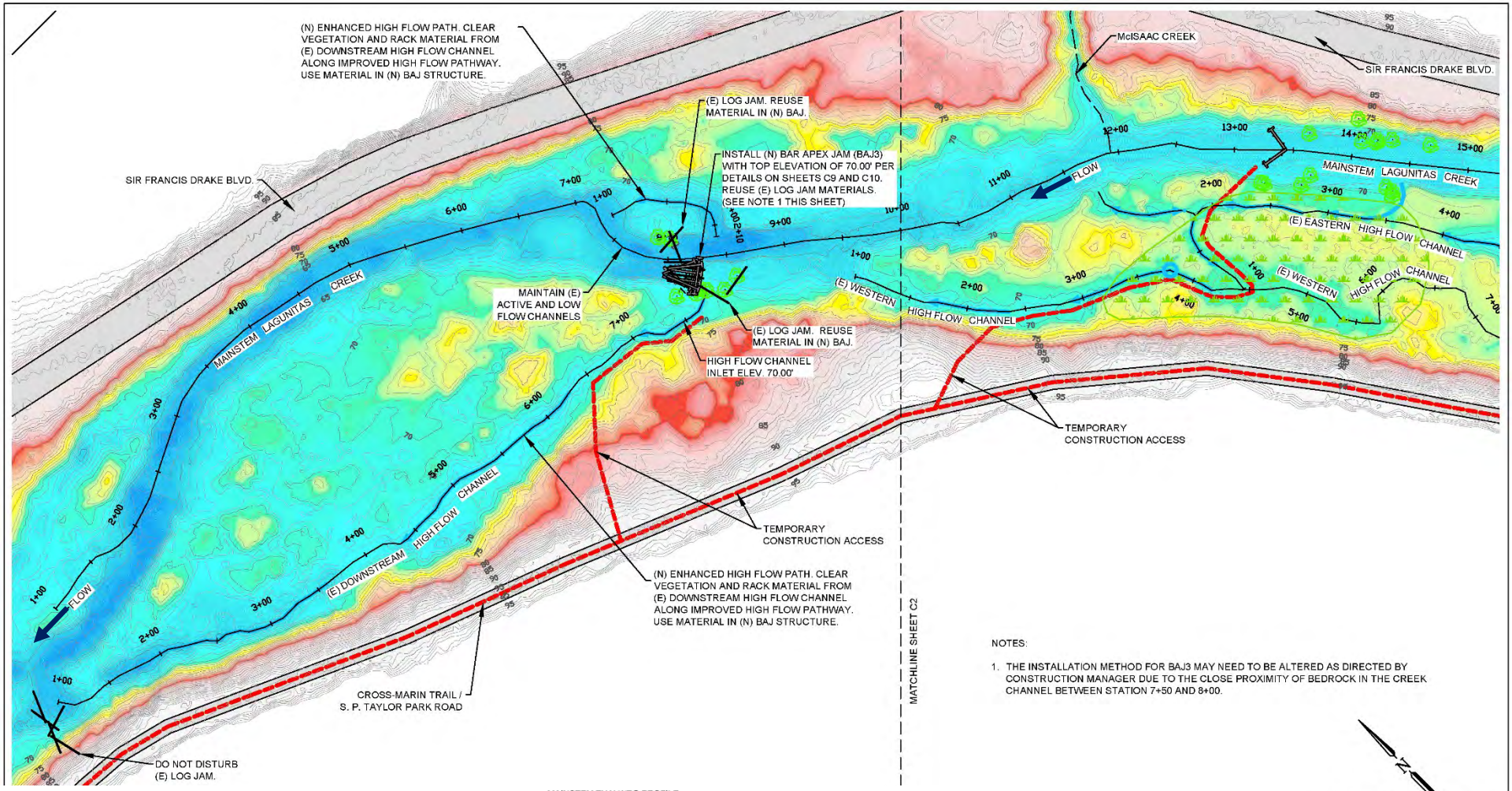
Incised Channel Restoration, Bridge Creek, Oregon (Source: Pollack et al., 2012)

Log Debris
Retention Jam

Hunter Creek Installation
Rocco Fiori

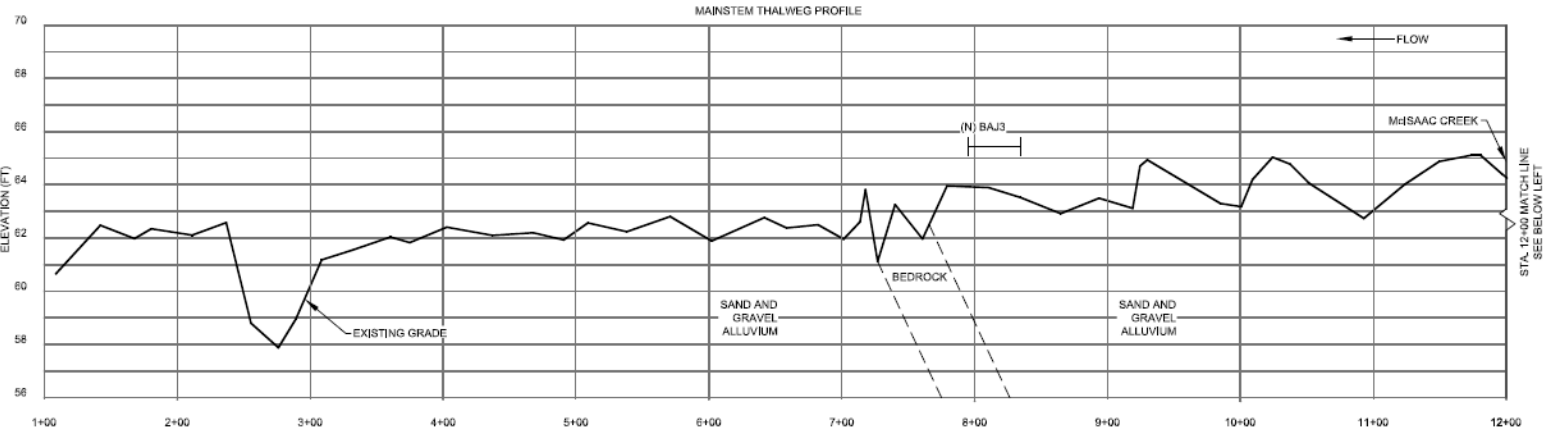
Log Debris
Retention Jam

- Deep Pools
- Cover



NOTES:

1. THE INSTALLATION METHOD FOR BAJ3 MAY NEED TO BE ALTERED AS DIRECTED BY CONSTRUCTION MANAGER DUE TO THE CLOSE PROXIMITY OF BEDROCK IN THE CREEK CHANNEL BETWEEN STATION 7+50 AND 8+00.



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CREEK SALMONID WINTER ENHANCEMENT PLANS
DOWNSTREAM PLAN

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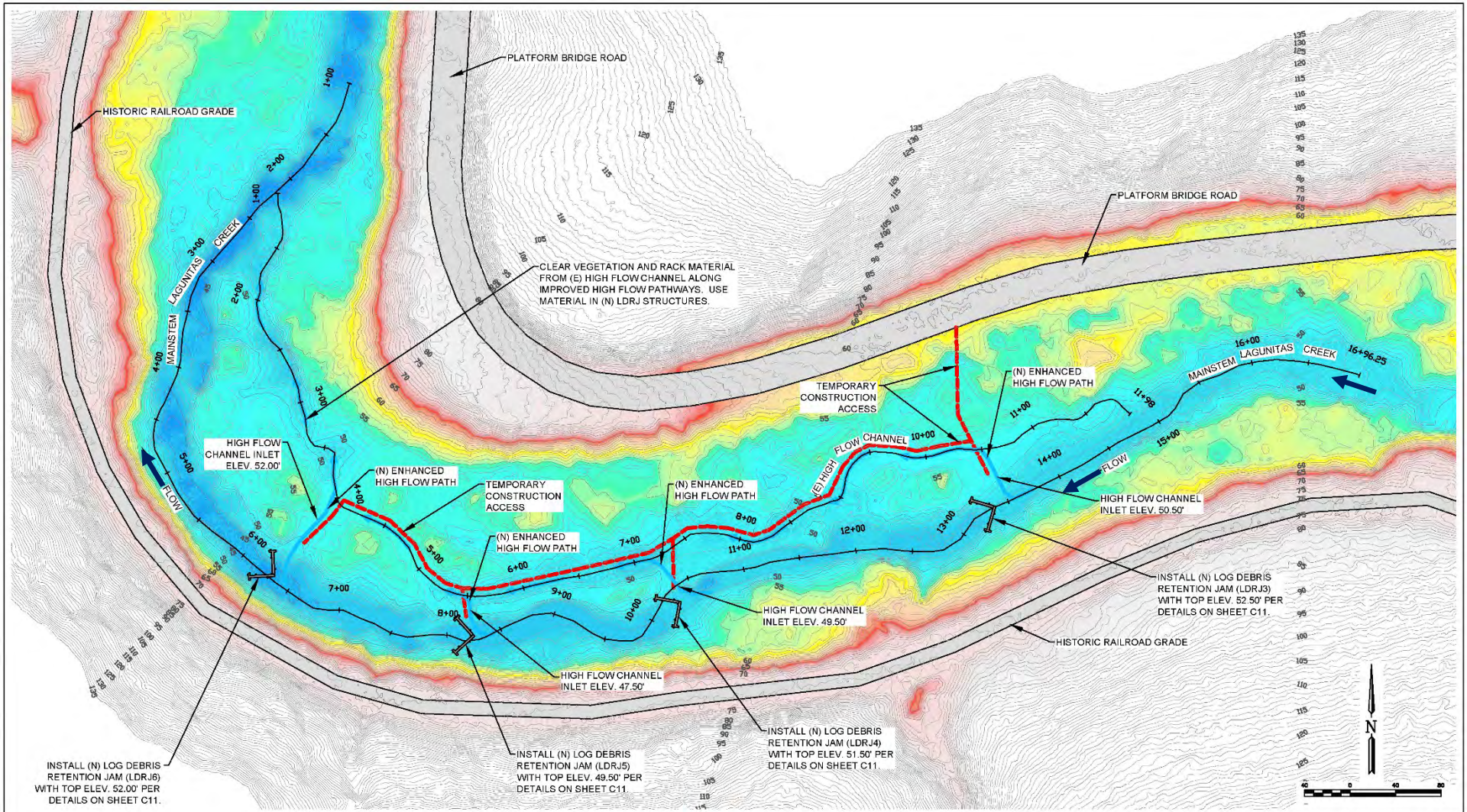
SHEET NO.
JOB NO.

McIsaac Downstream Plan

McIsaac Downstream

Fern Rock



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LAGUNITAS CREEK SALMONID WINTER HABITAT ENHANCEMENT PLANS
FERN ROCK PLAN

C5
7 13
SHEET NO.
JOB NO.

Fern Rock

Fern Rock High Flow Channels

Desired Condition during Winter Flows

Acknowledgements

- Funding from CDFW FRGP, in partnership with NOAA Pacific Coast Salmon Restoration Fund and Marin Municipal Water District (MMWD)
- Project Partners: MMWD, the Pt. Reyes National Shore (NPS), and California State Parks.
- USFWS, Coastal Program Fund
- Private landowners in the watershed.
- Lagunitas TAC members for input and review.

Lagunitas Creek Recent Chronology

1982: Peters Dam Raised

1995: State Water Board (SWRCB) Order Issued (Minimum Instream Flow Requirements)

1997: Lagunitas Creek Management Plan Approved

2008: Limiting Factors Analysis; Giacomini Wetland Restoration Project

2011: Lagunitas Stewardship Plan Completed

2013: Roads Assessment

2014: Winter Habitat Enhancement Assessment & Plan

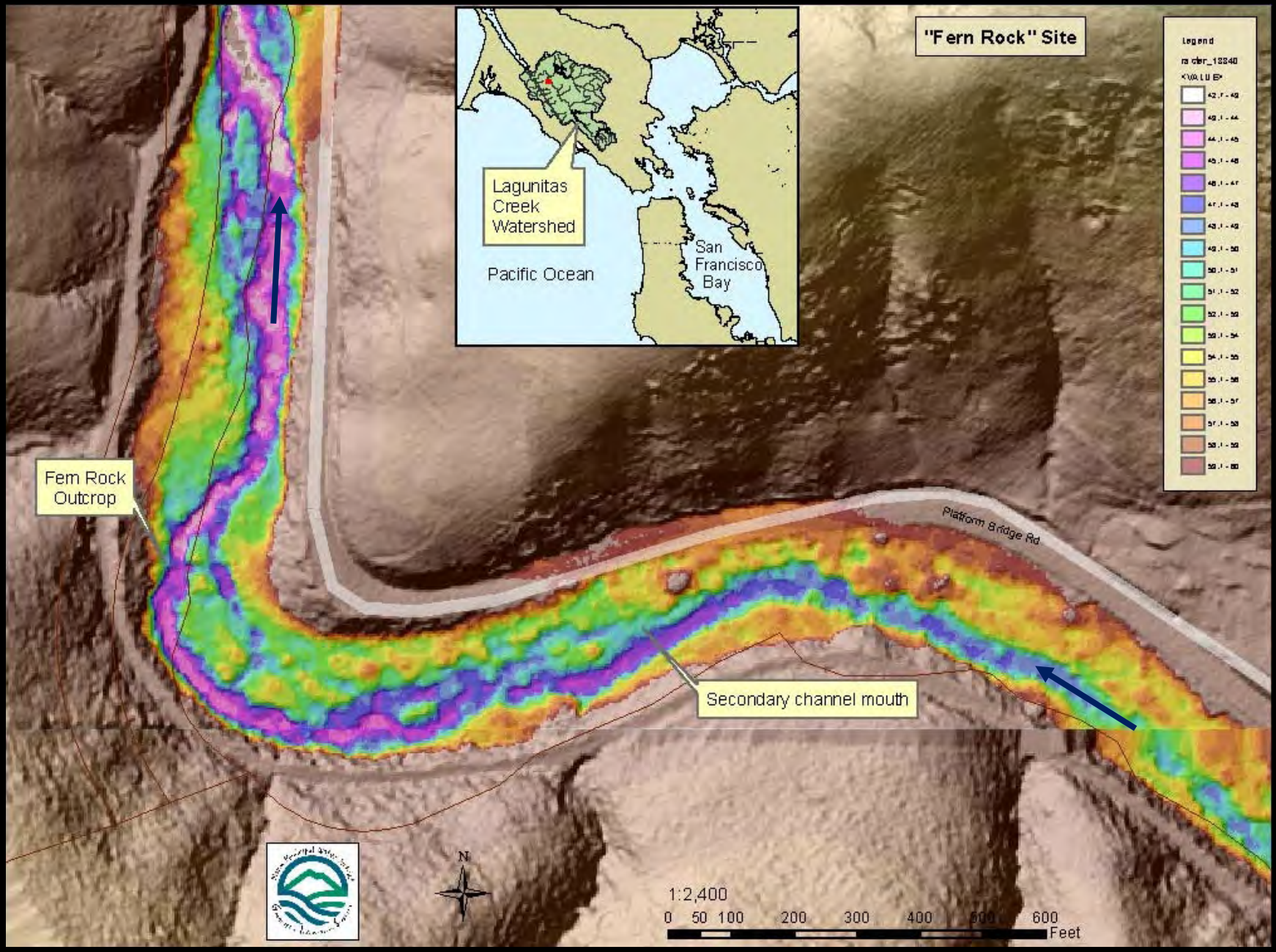
2014: Lagunitas Creek TMDL (sediment) Issued

2016: Winter Habitat Project Implementation

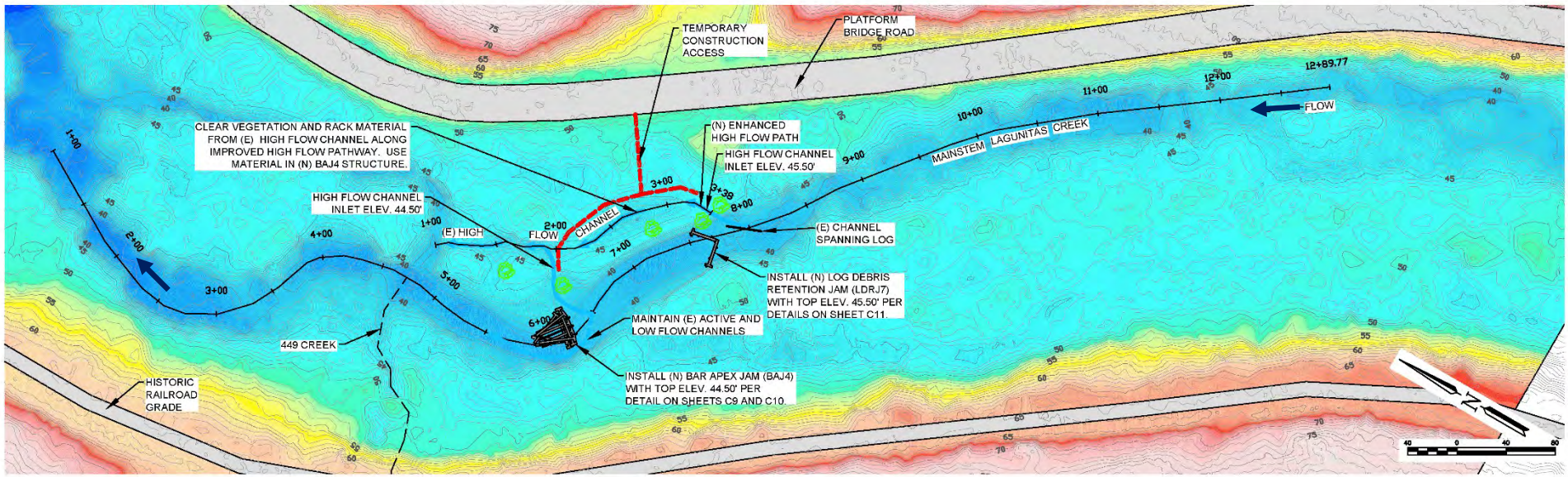
Design Elements Considered but Rejected

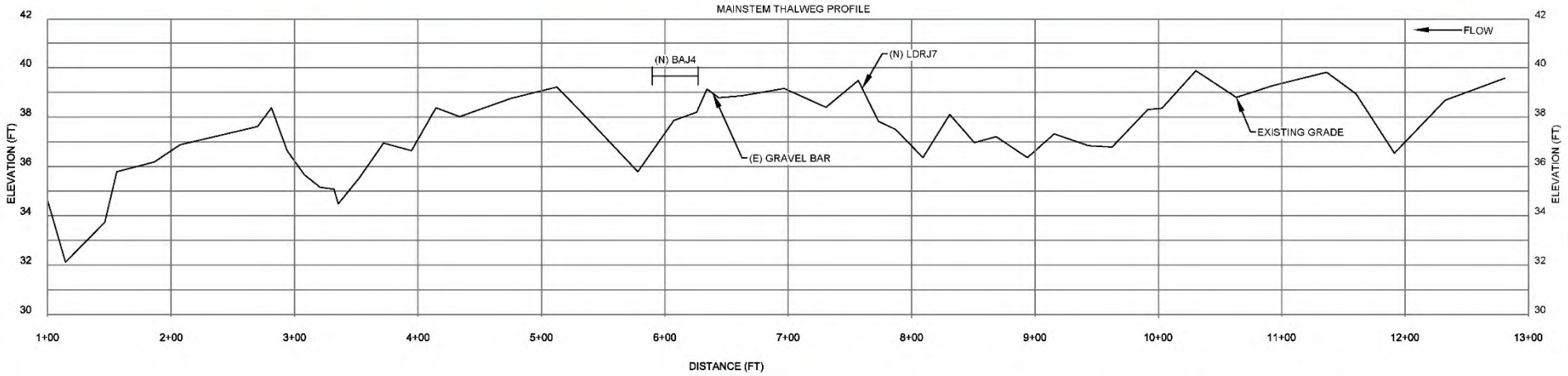
- Floodplain excavation (lowering);
- Off-channel pond creation;
- Alcove creation via mechanical excavation;
- Upland sediment disposal;
- Work that significantly impacts wetland and riparian areas;
- Excavation of existing or new high flow channels; and
- Work in reaches on a trajectory of geomorphic and habitat recovery from historic disturbance (e.g. Lower Olema Creek and Below Tocaloma Reach).

Fern Rock LiDAR



449 Creek Plan





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LAGUNITAS CREEK SALMONID WINTER HABITAT ENHANCEMENT PLANS
449 CREEK PLAN AND PROFILE

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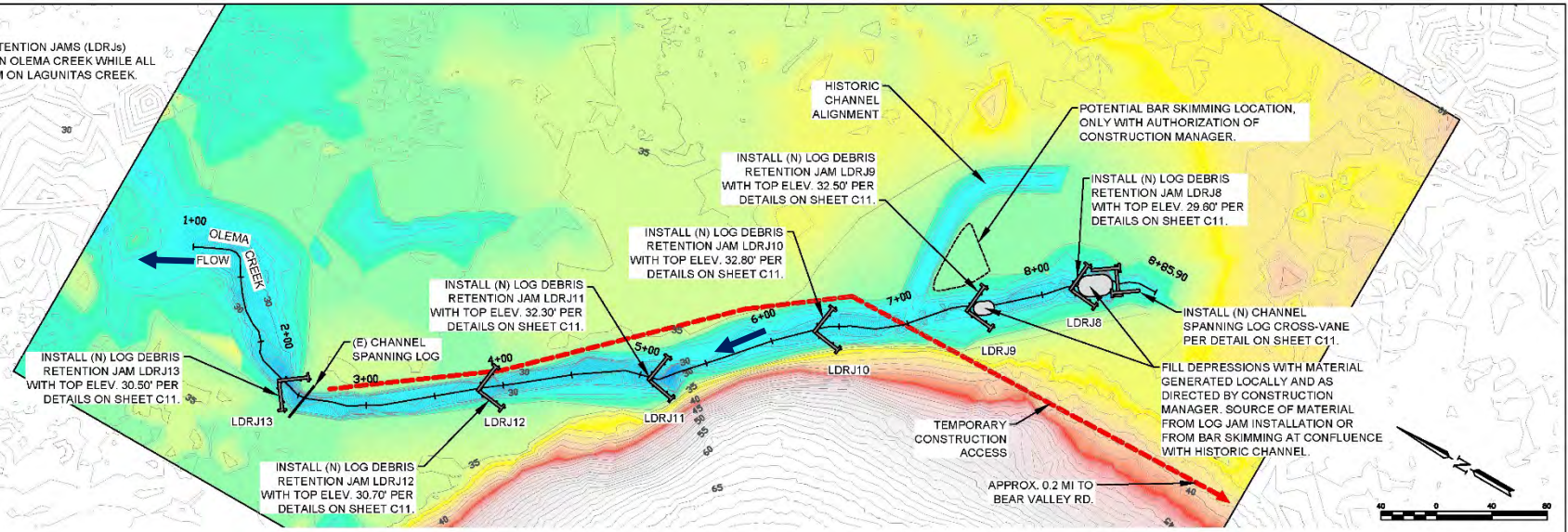
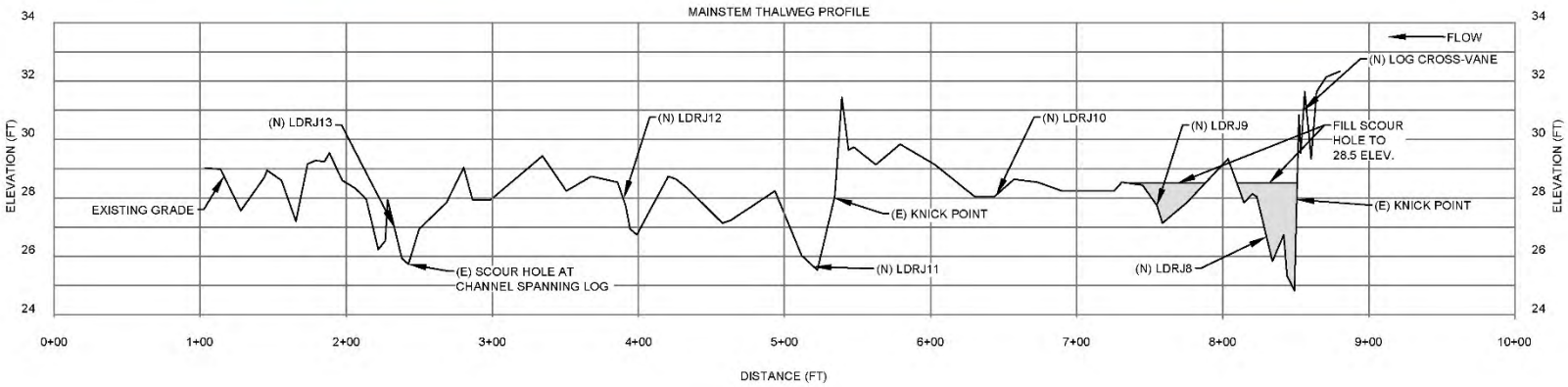
449 Creek

449 Cr. Site High Flow Channels

Olema Creek Plan





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LAGUNITAS CREEK SALMONID WINTER HABITAT ENHANCEMENT PLANS
OLEMA PLAN AND PROFILE

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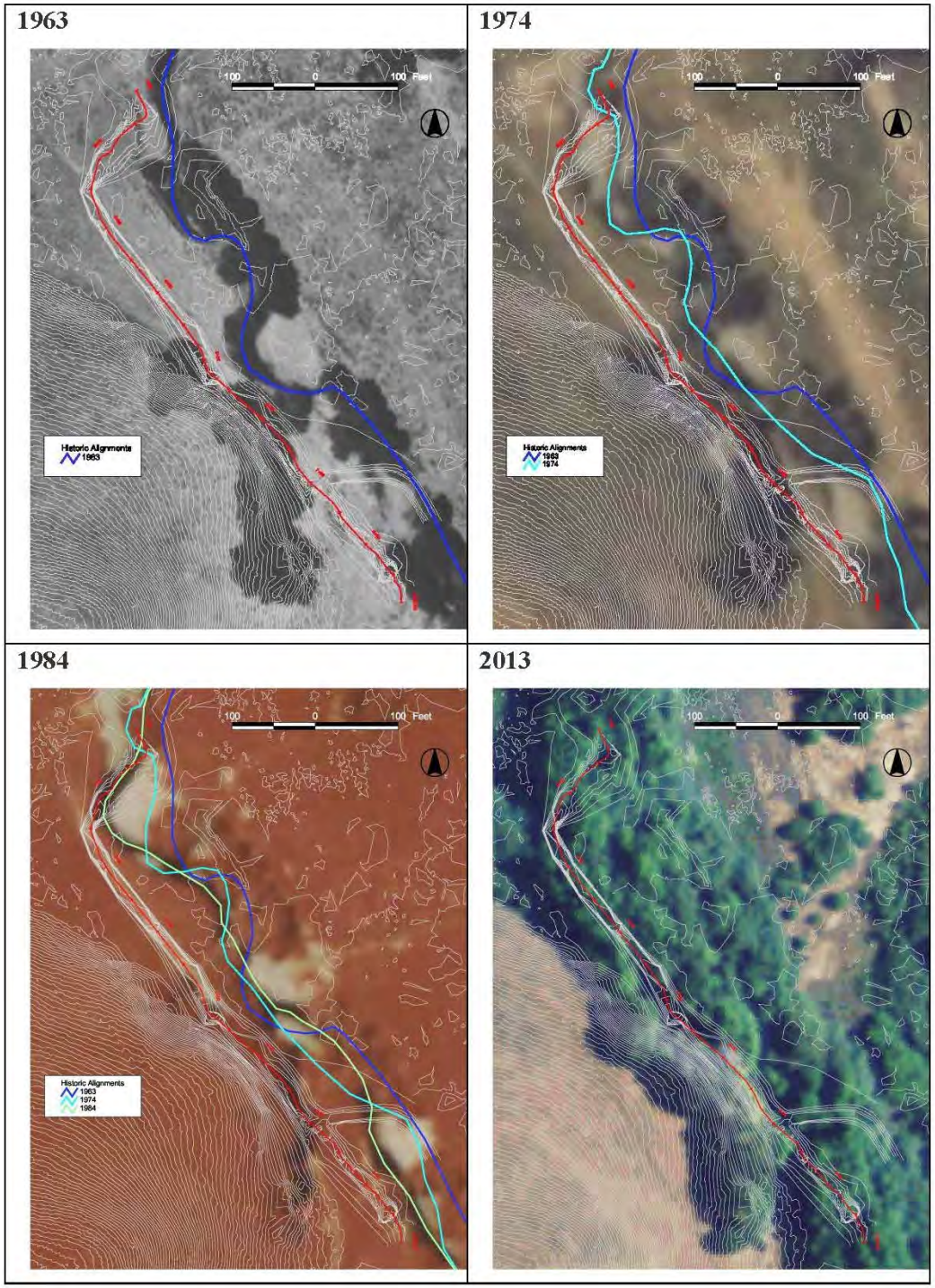
Olema Creek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Olema Creek

Olema Creek

Olema Creek

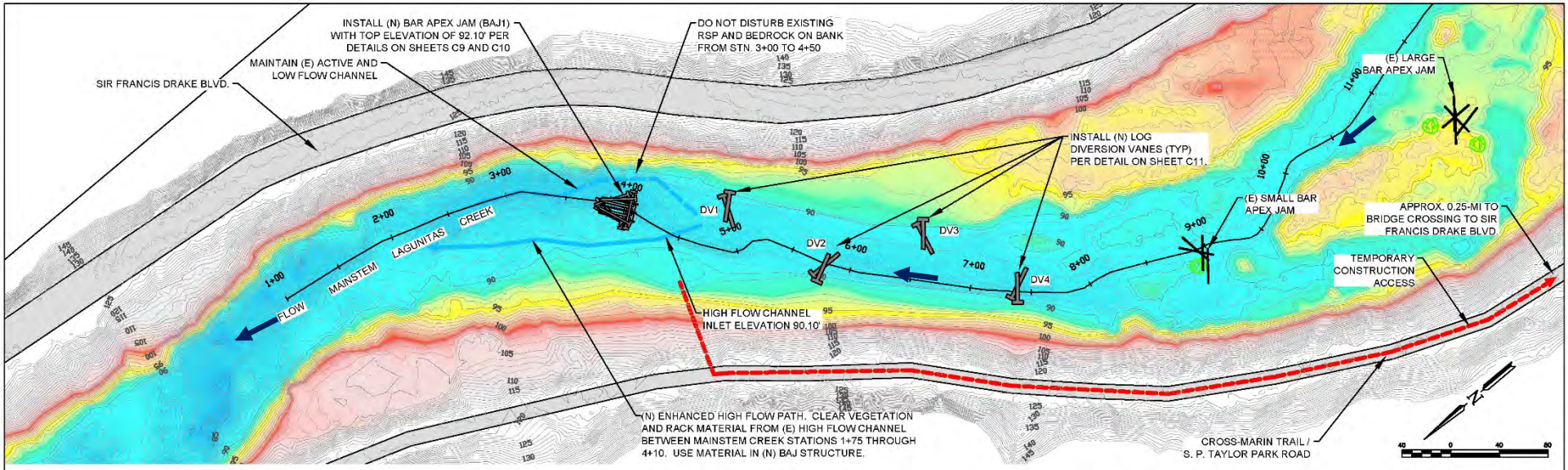
Lagunitas Creek Winter Habitat Enhancement Implementation
Construction Cost Summary

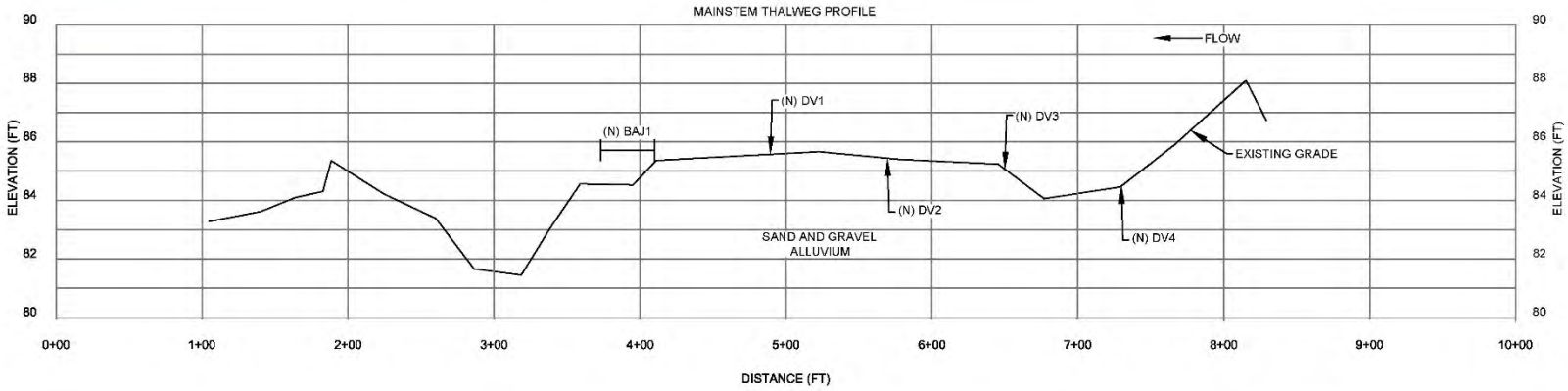
SITE	100% Design Construction Cost Estimate
SITE: TOCALOMA FLOODPLAIN ENHANCEMENT	$153,290
SITE 1: BIG BEND LOG DEFLECTOR VANES (8)	$112,010
SITE 2: BIG BEND BAR APEX JAM	$90,065
SITE 3: McISAAC UPSTREAM BAR APEX JAM	$89,493
SITE 4: McISAAC UPSTREAM LOG DEBRIS RETENTION JAM 1	$52,207
SITE 5: McISAAC UPSTREAM LOG DEBRIS RETENTION JAM 2	$51,276
SITE 6: McISAAC DOWNSTREAM BAR APEX JAM	$89,485
SITE 7: FERN ROCK LOG DEBRIS RETENTION JAMS (4)	$143,381
SITE 8: 449 CREEK LOG DEBRIS RETENTION JAM AND BAR APEX JAM	$118,356
SITE 9: OLEMA CREEK LOG CROSS-VANE AND LOG DEBRIS RETENTION JAMS (6)	$219,446
TOTAL	$1,119,009

Lagunitas Creek Winter Habitat Enhancement Implementation - Phase I
Construction Cost Summary

SITE	100% Cost Estimate
SITE: TOCALOMA FLOODPLAIN ENHANCEMENT	$153,290
SITE 3: McISAAC UPSTREAM BAR APEX JAM	$89,493
SITE 4: McISAAC UPSTREAM LOG DEBRIS RETENTION JAM - 1	$52,207
SITE 5: McISAAC UPSTREAM LOG DEBRIS RETENTION JAM - 2	$51,276
SITE 6: McISAAC DOWNSTREAM BAR APEX JAM	$89,485
TOTAL	$435,751

Big Bend Plan





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LAGUNITAS CREEK SALMONID WINTER HABITAT ENHANCEMENT PLANS
BIG BEND PLAN AND PROFILE

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JOB NO.

Big Bend

Diversion Vane Design Detail