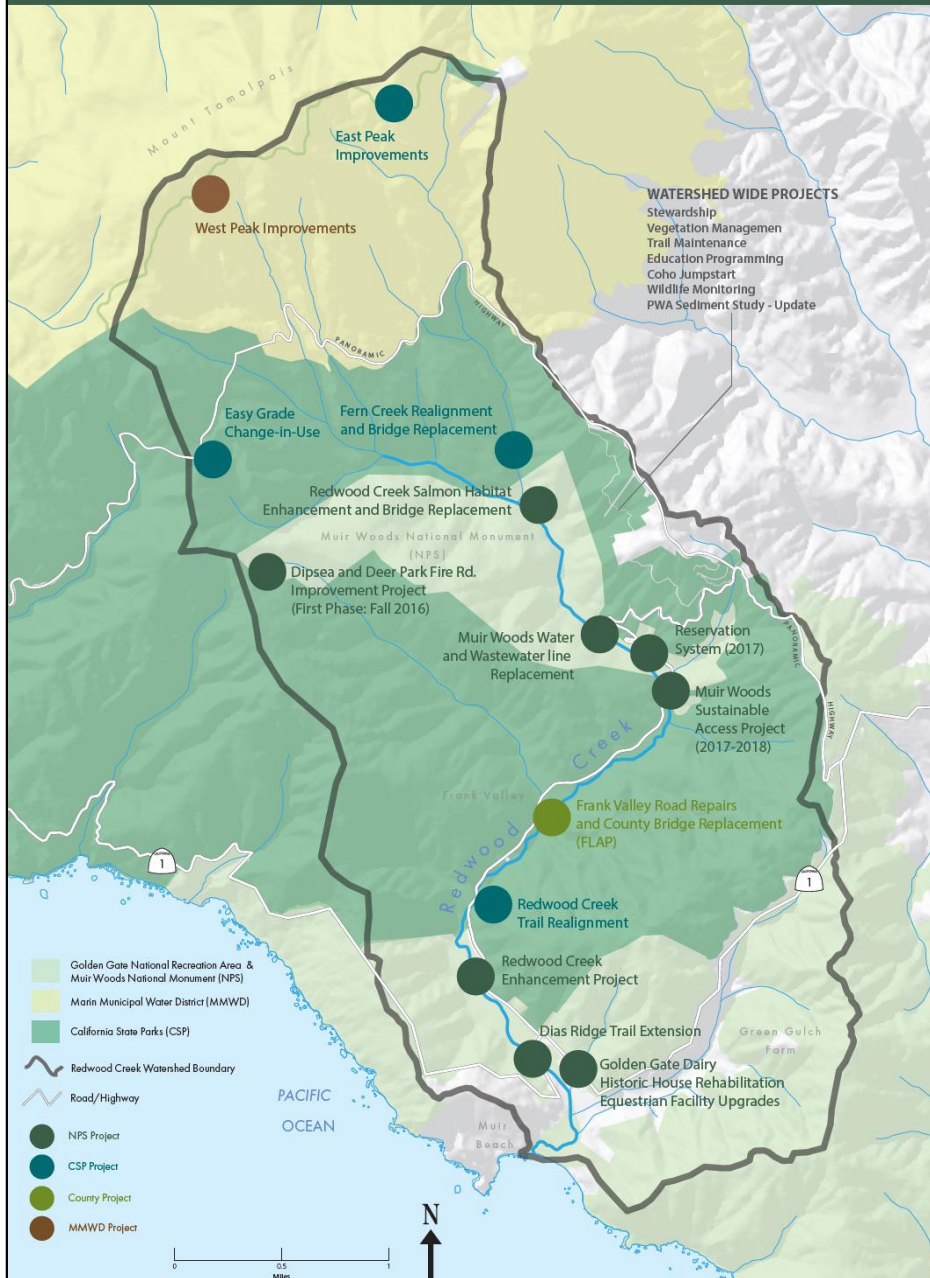
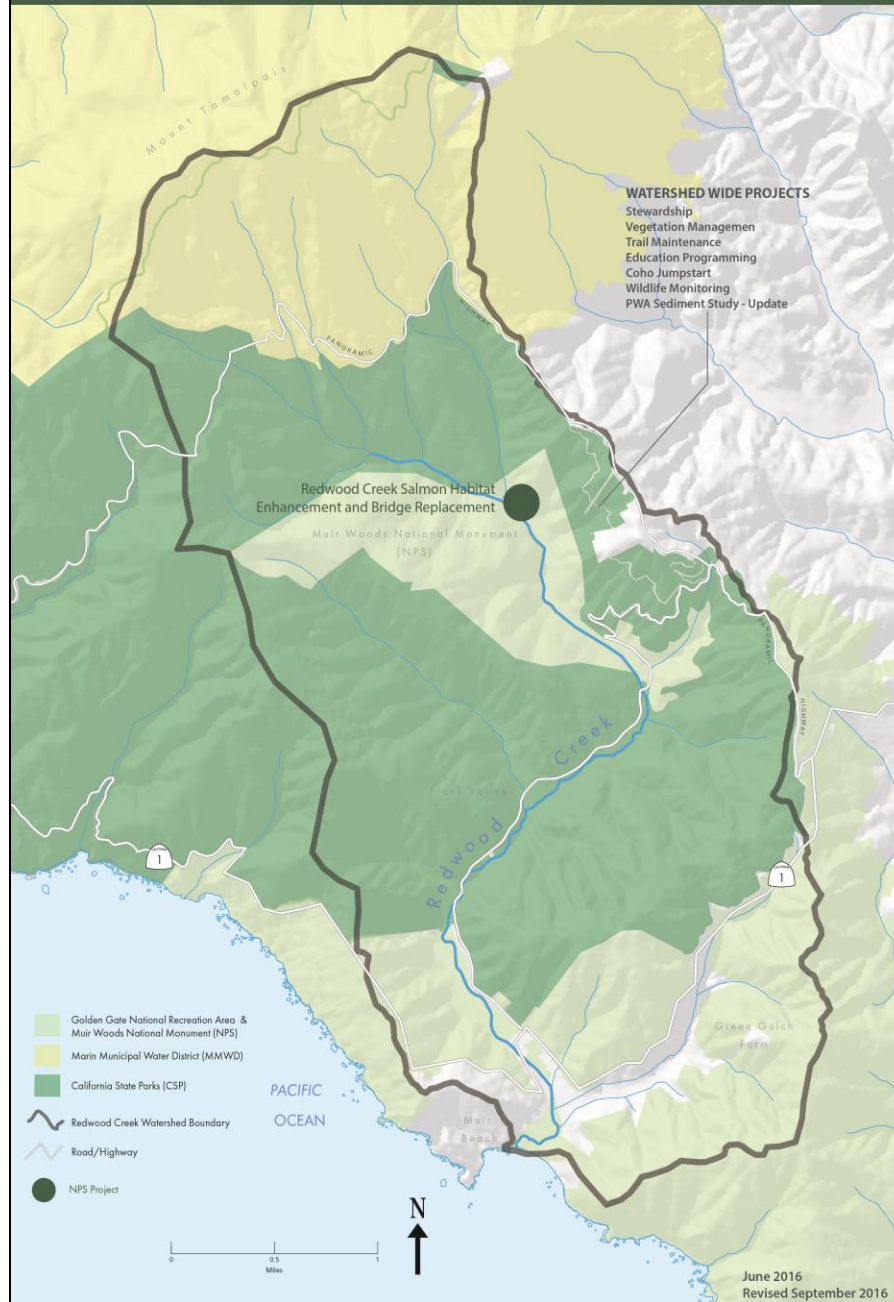


Redwood Creek Watershed Projects 2016 through 2020



Projects in the Redwood Creek Watershed 2016-2020

Sept. 20, 2016



PROJECT SCOPING

Salmon Habitat Enhancement and Bridge Replacement at Muir Woods National Monument

Sept. 20, 2016



Salmon Habitat Enhancement and Bridge Replacement at Muir Woods National Monument

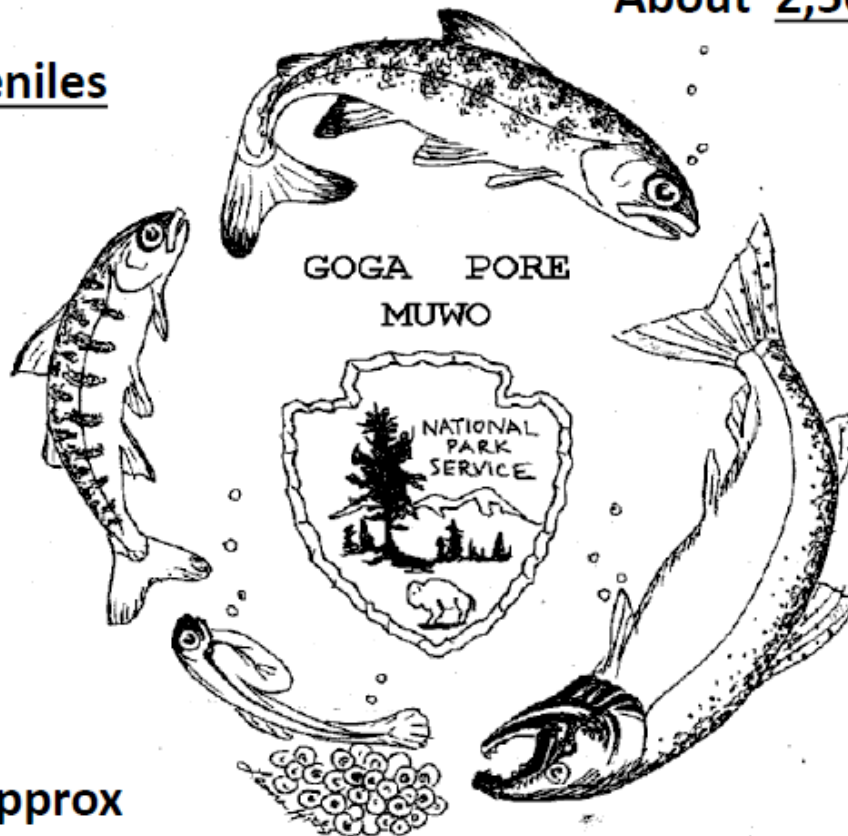
**Project Scoping
Sept. 20, 2016**

Survival Bottlenecks in Coho Lifecycle



About 3,000 juveniles
(Summer 2013)

About 2,500 smolts (Spring 2014)



**FRY: 6%
survival**

**ADULTS: <1%
ocean survival for
Winter 2015-16
(38 adults)**

50,000 eggs @approx
2000 eggs/female redd for
Spawner Year 2012-2013

Data – Fong, Reichmuth

Coho Jumpstart Program by California Dept. of Fish and Wildlife



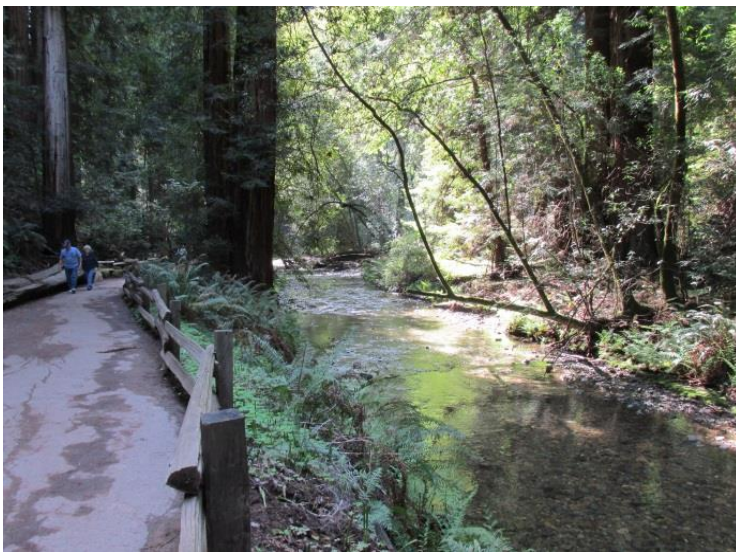
Poor Habitat Conditions at Muir Woods



L12, looking upstream.



From Bridge 2, looking downstream. Jan 2016.



Along Main Trail, between Bridges 1 and 2.



Upstream of Cathedral Grove, where asphalt trail was removed in 1999.

Examples of Pools Providing Juvenile Coho Habitat



Similar Straight Channel Before Restoration at the Banducci Reach, 2003





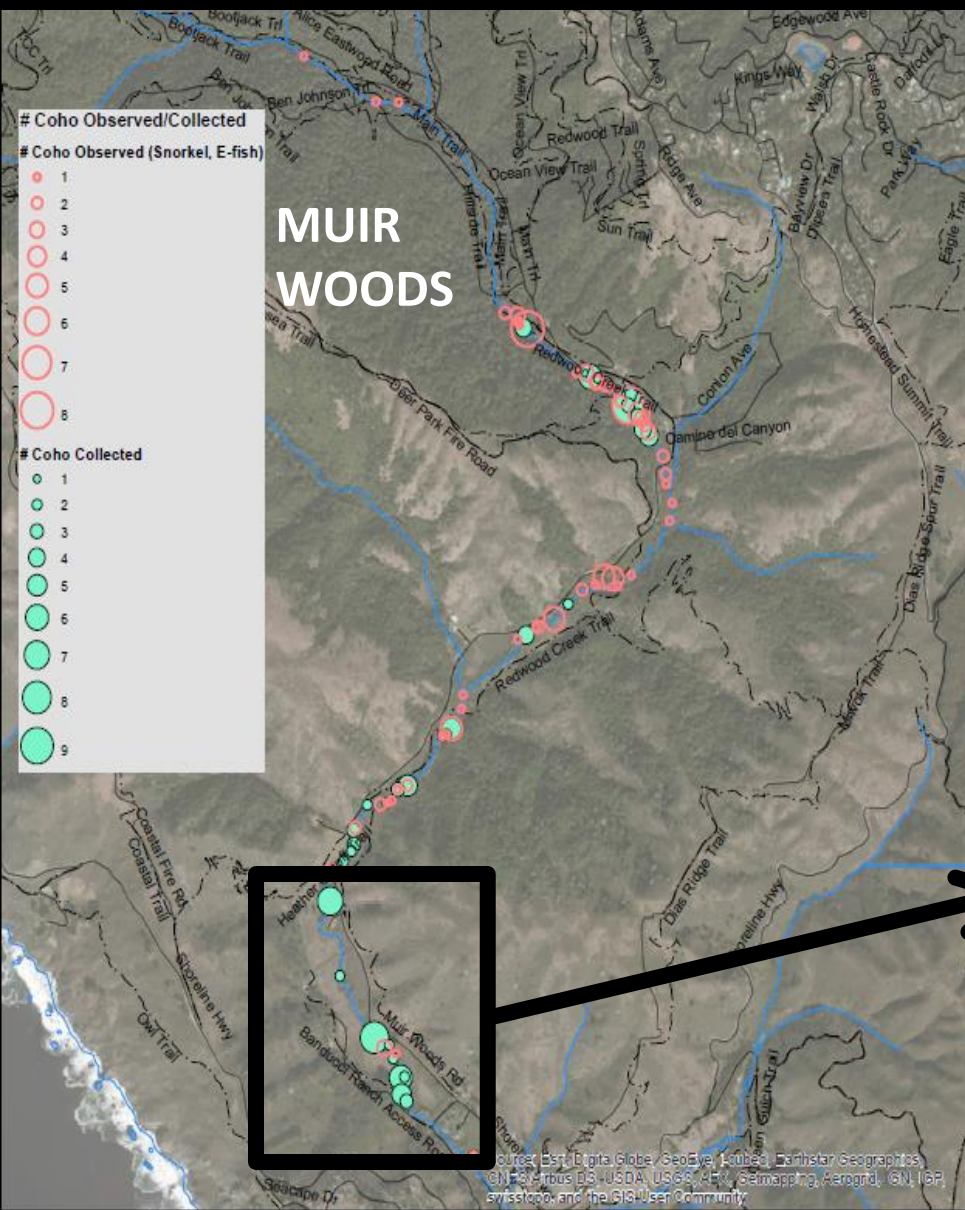
Better Habitat after Restoration, 2005



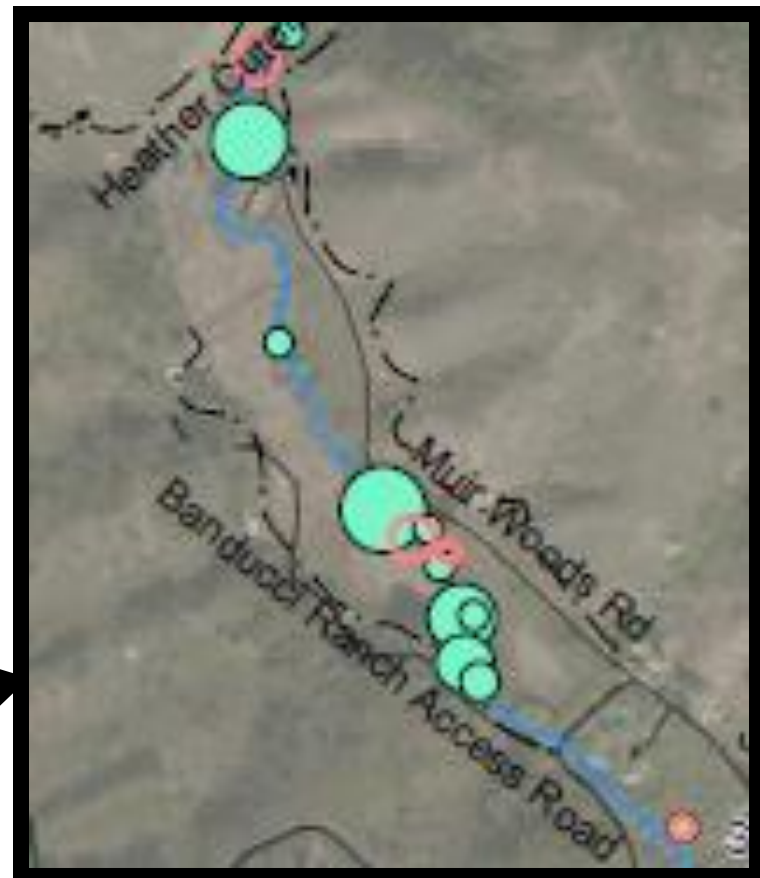
**2016 - Too
Complex to
Photograph:**



Restoration Made a Difference in Juvenile Coho Counts in Banducci Reach

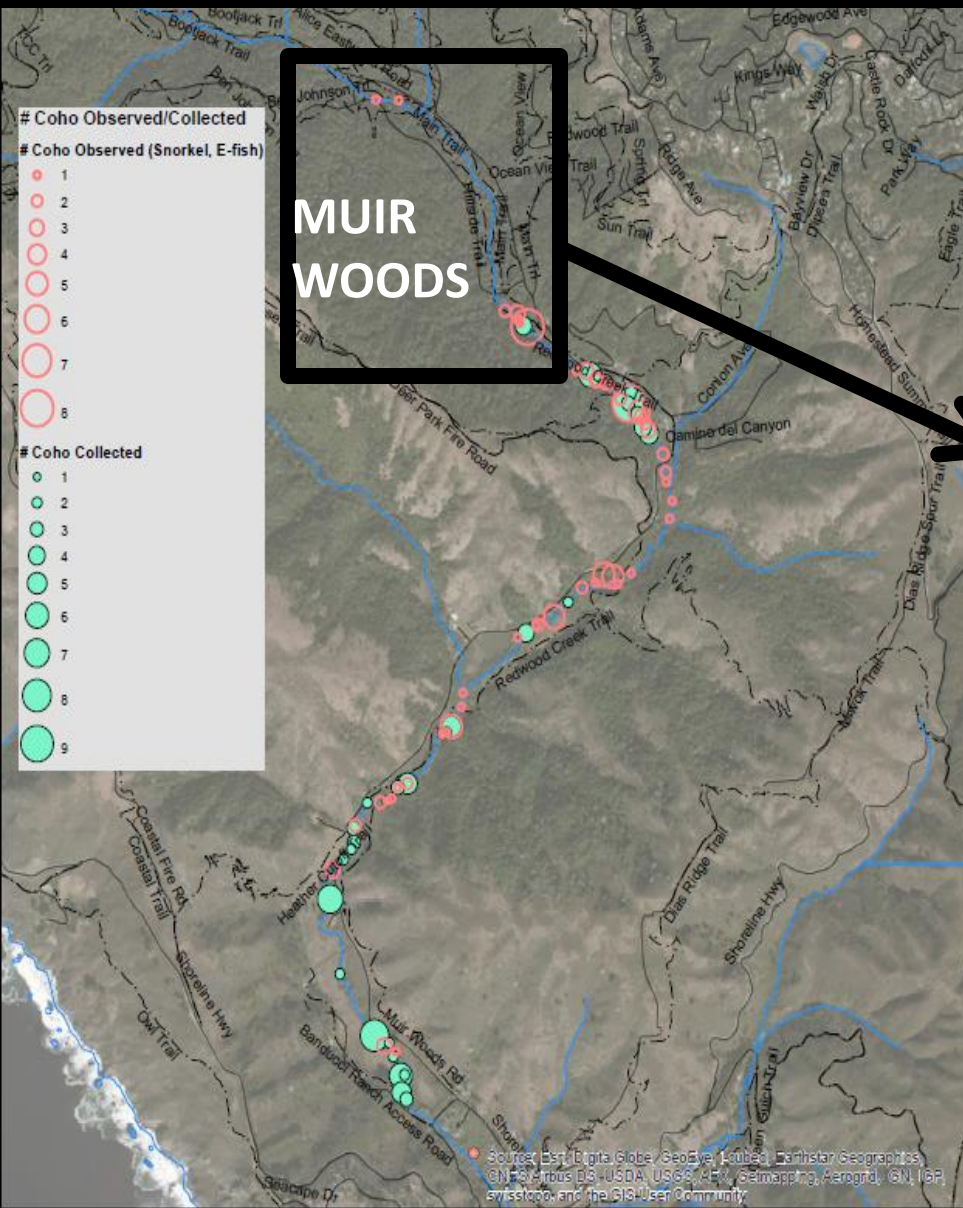


Coho, Spring 2014

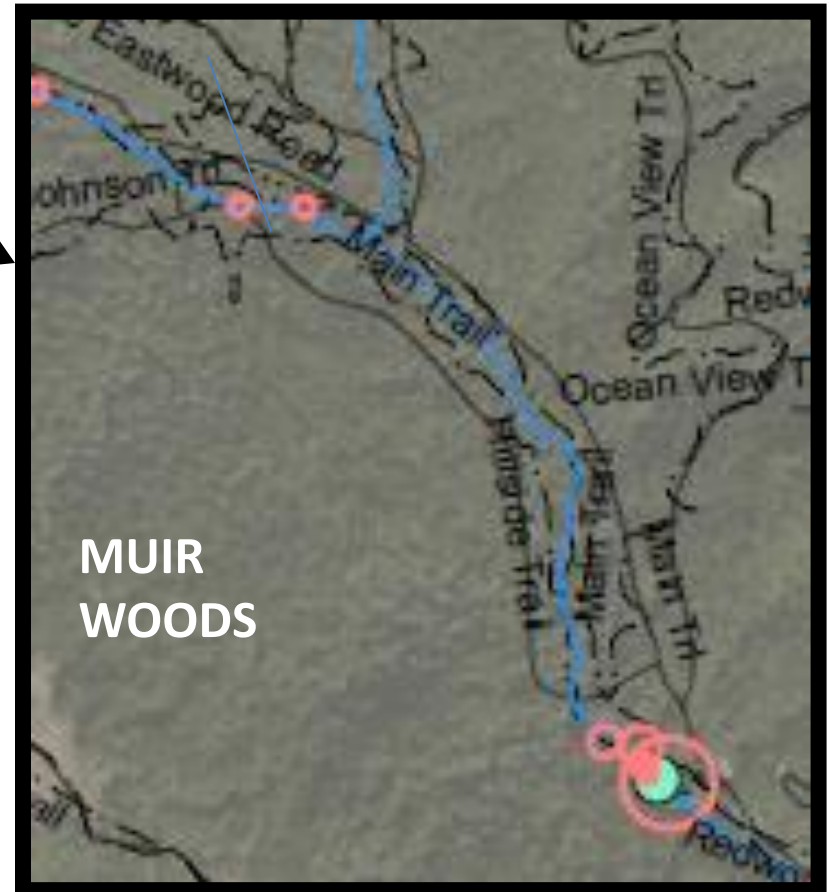


Data – Fong, Reichmuth

Poor Juvenile Coho Numbers in Muir Woods

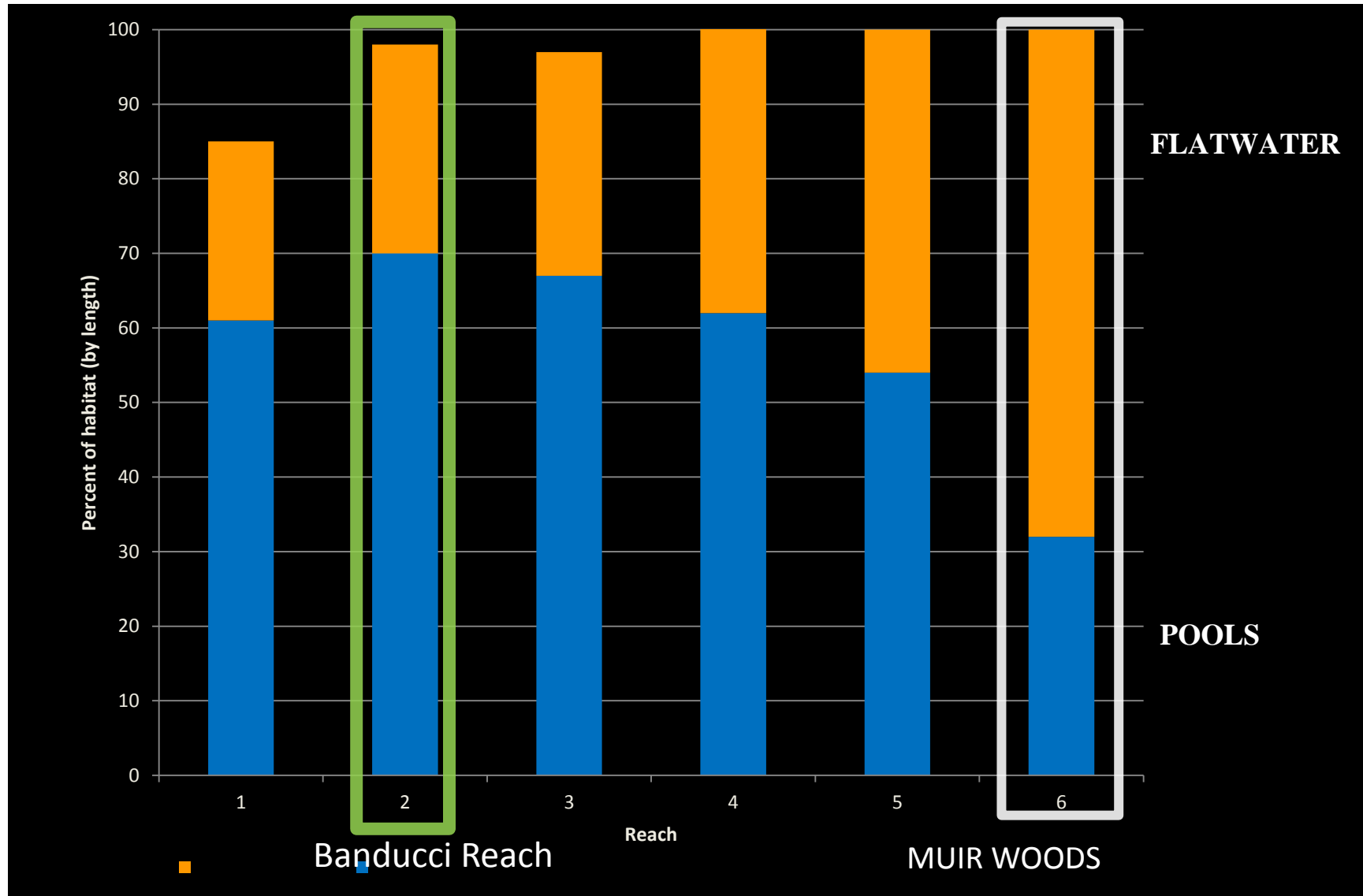


Coho, Spring 2014



Data – Fong, Reichmuth

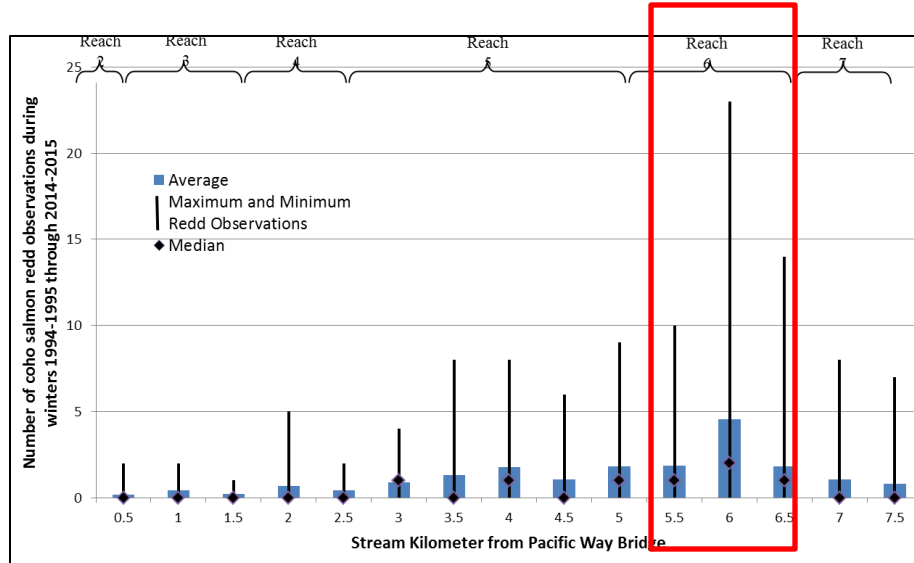
Muir Woods Has Lowest Rate of Pools in 15 Years Of Monitoring



Muir Woods has High Percentage of Spawners but Low Percentage of Juveniles

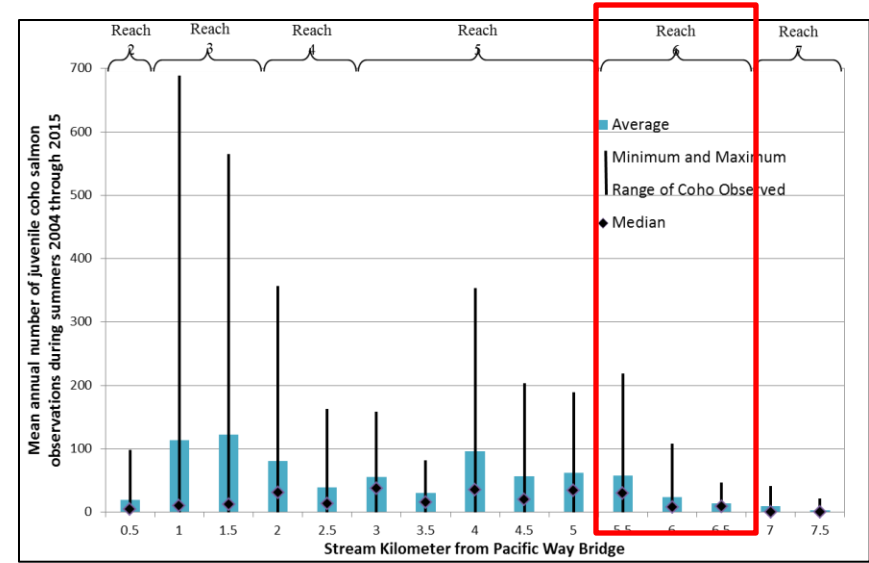


Spawners, 1994-2015



Distribution of coho redds along mainstream Redwood Creek (Marin Co.), Winter 1994-1995 through 2014-2015

Juveniles, 1994-2015



Distribution of juvenile coho along mainstream Redwood Creek (Marin Co.), Winter 1994-1995 through 2014-2015

Data – Fong, Reichmuth

Why Focus on Habitat in Muir Woods?



Near Cathedral Grove

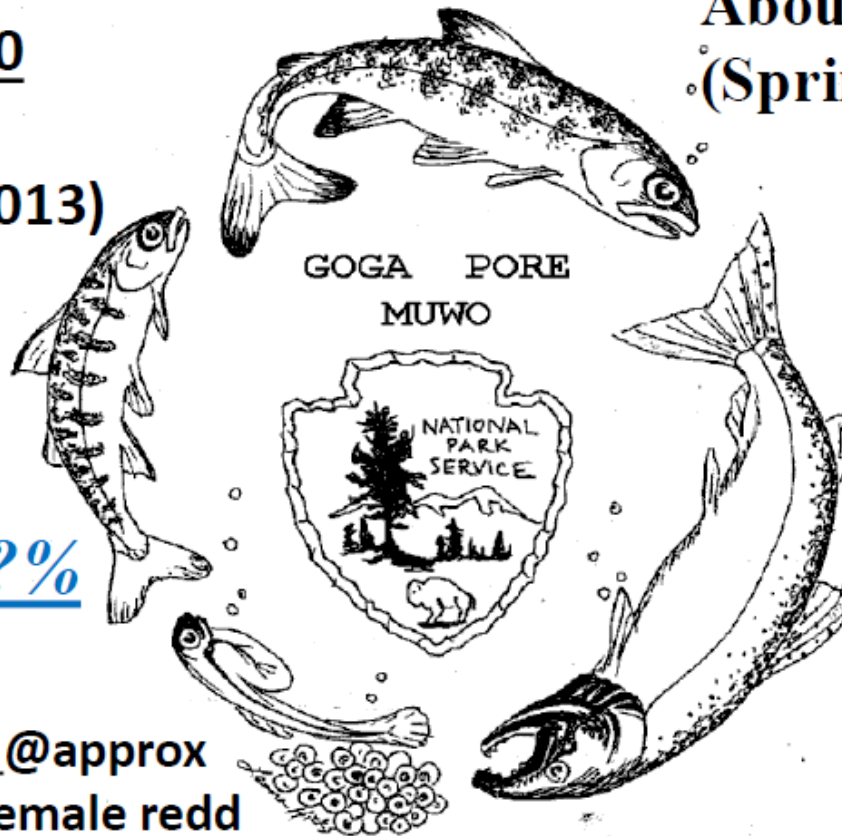
The survival rate of juvenile fish will increase because there will be more juvenile habitat close to the spawning habitat.

Survival Bottlenecks in Coho Lifecycle



About 3,000
juveniles
(Summer 2013)

About 2,500 smolts
(Spring 2014)



ADULTS: <1%
ocean survival for
Winter 2015-16
(38 adults)

FRY: 6%??%
survival?

50,000 eggs @approx
2000 eggs/female redd
for
Spawner Year
2012-2013

Project Purposes



Enhance habitat for juvenile coho salmon, where possible.

Enhance natural stream processes, where possible.

Replace four aging pedestrian bridges spanning Redwood Creek.

Possible Actions: Remove Some Riprap and Add Large Wood



Allow flows
to create
habitat
conditions

Lateral
migration

Undercut
banks

Exposed tree
roots at the
creek

Scour at the
outside

Riprap on Creek Banks



Riprap on Creek Banks at Muir Woods



About 3500 LF total over one mile. 60% of creek banks.

Civilian Conservation Corps

Muir Woods, 1936



Example of CCC Craftsmanship

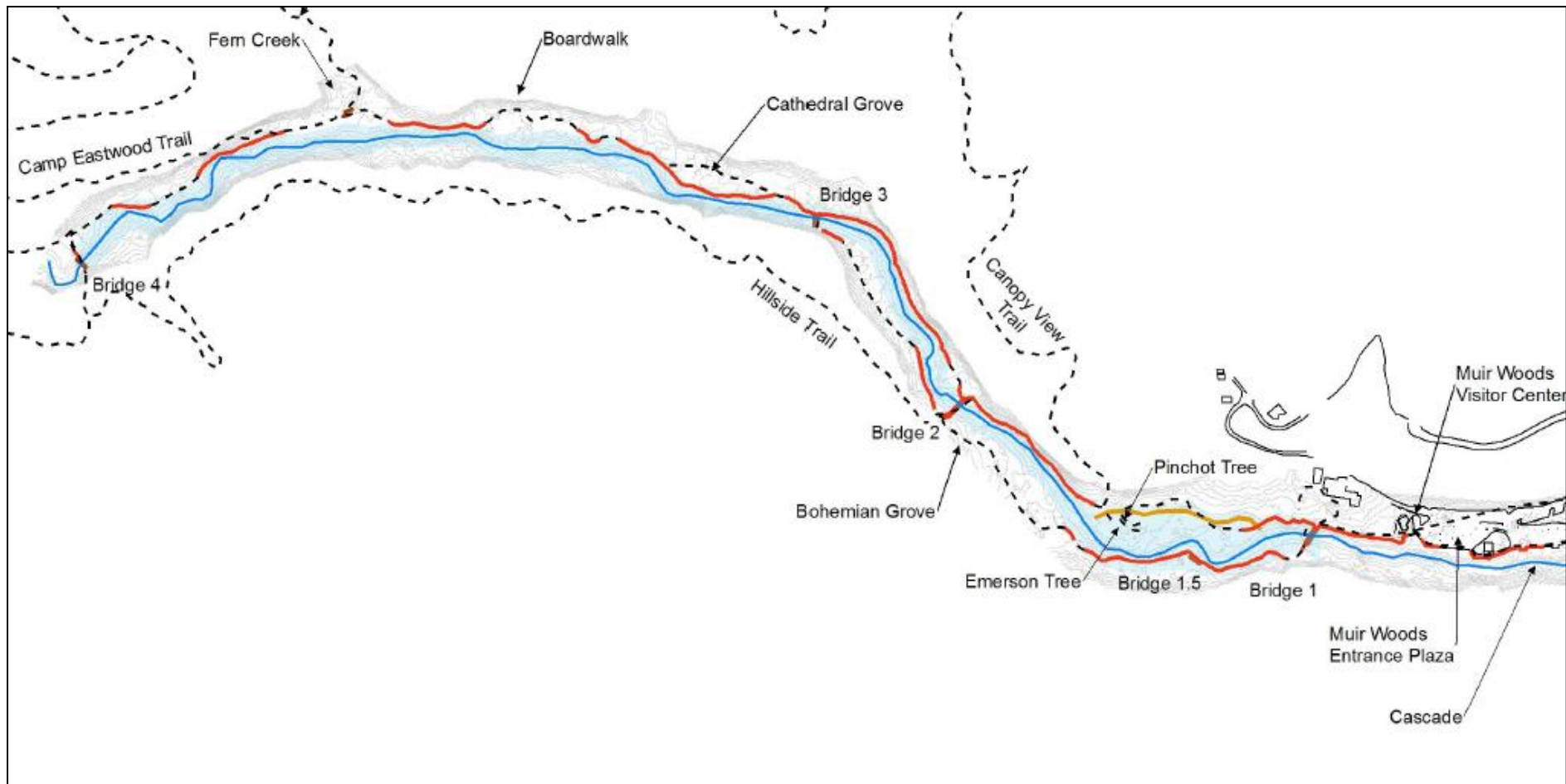


Civilian Conservation Corps

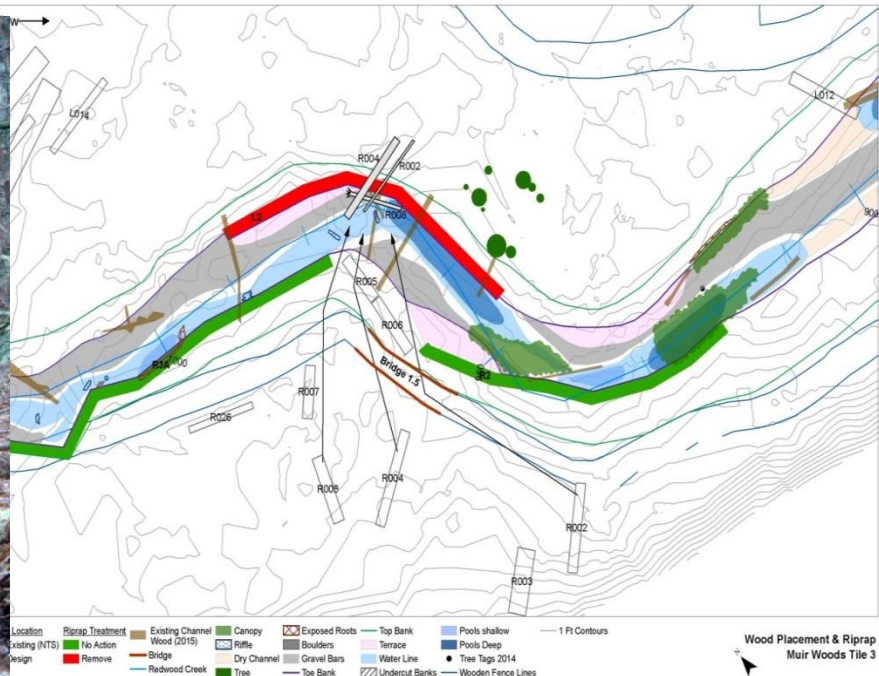
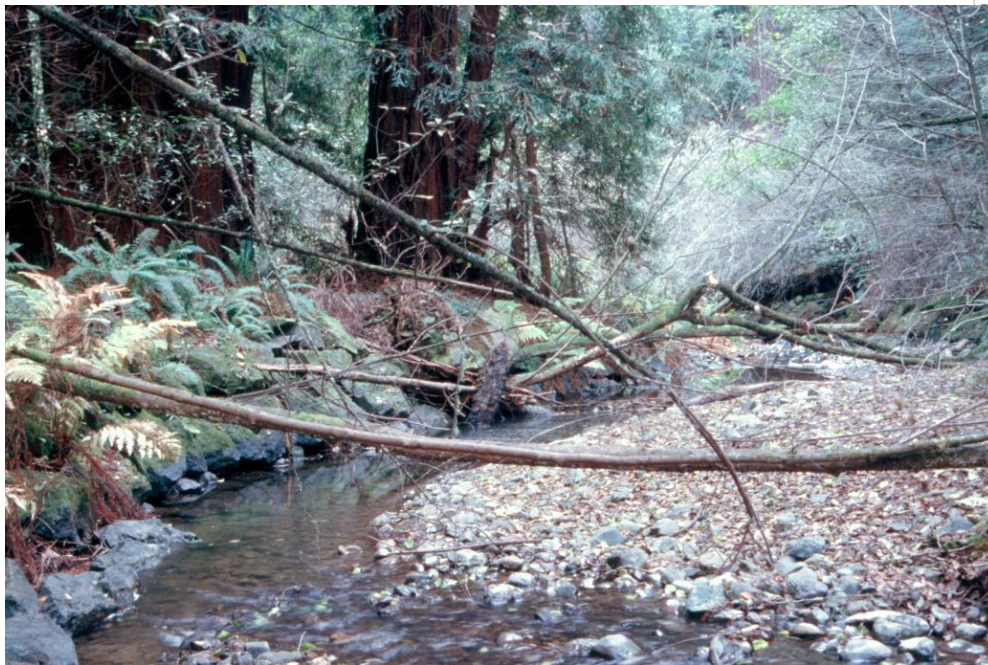
Mountain Theater, 1936



Many Opportunities for Riprap Removal Even with Existing Trails



Example of Opportunity for Riprap Removal



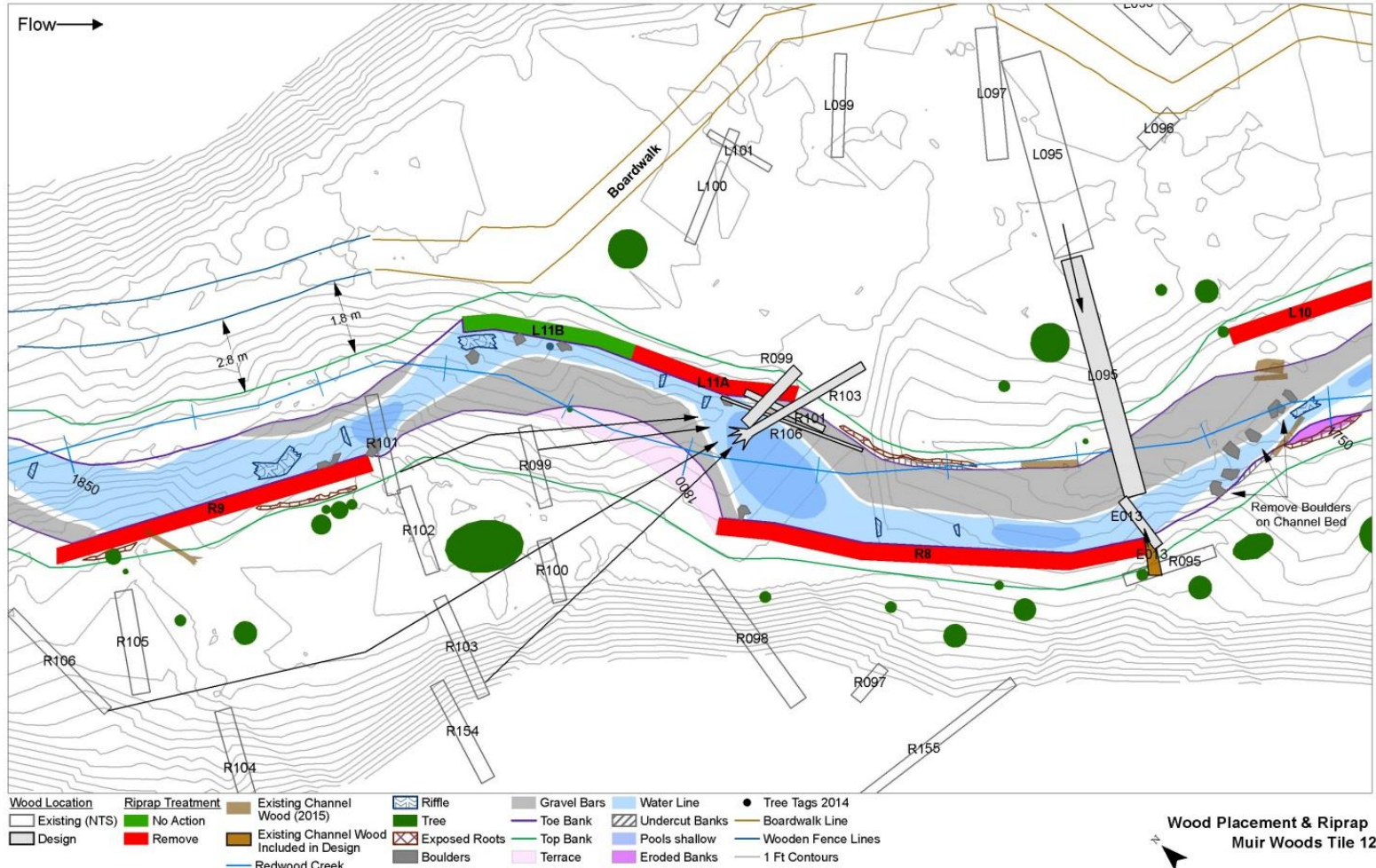
Example of Trail Constraint for Riprap Removal and Beneficial Grade Control Log in Creek



Example of Fallen Trees at Muir Woods that Could be Moved into Creek



Example of Fallen Trees at Muir Woods that Could be Moved into Creek

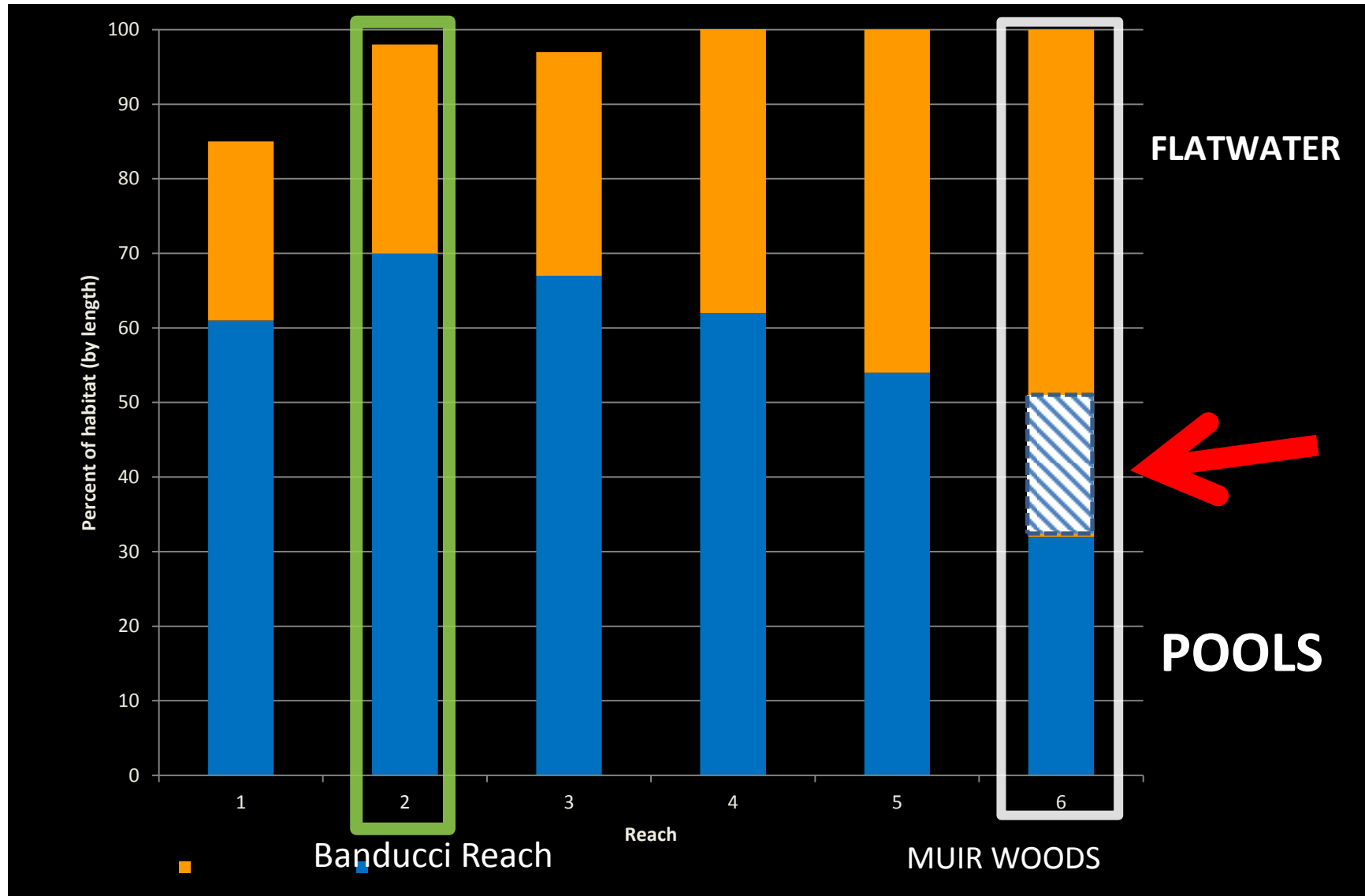


387 Fallen Trees on Floodplain and Nearby Hillslopes

Of these, about 194 are fallen redwoods.

Could move about 46 trees into the creek; about 12%.

MUIR WOODS RATE OF POOLS COULD IMPROVE FROM 32% TO ABOUT 50%



Redwood Tree Fell Upstream of Bridge 3, December 2015



Redwood Trees on Creek Banks

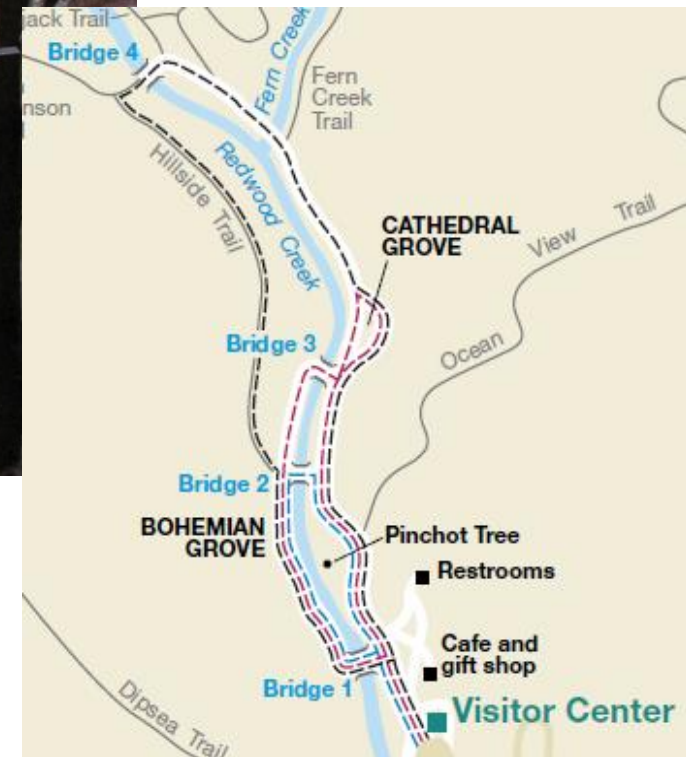


- Extensive inland connected root system
- Undermined roots have not caused imminent tree fall
- Trees develop “buttress roots” where needed
- Trees without riprap have more capacity to develop a supporting root system on the creek side
- Presence of Redwoods shows limited channel migration

Replace Four Pedestrian Bridges



Bridge 2, looking upstream, Jan. 2016



Past Bridges at Muir Woods



Existing Bridge Conditions



- Constructed in 1990s
- Bridges deteriorating and need replacement
- Degrading structural integrity
- Moisture damage
- Damage to Bridges 2 and 3 from floating debris



Existing Conditions



Current spans affects stream hydrology:

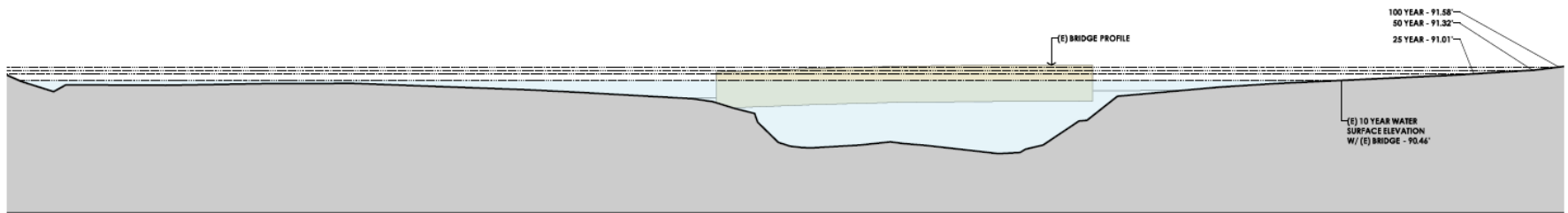
- Bridge 1 is above 25 year storm flow
- Bridges 2 & 3 above only 2 year storm flow
- Bridge 4 is above 50 year storm flow
- Abutments constrain stream channel
- Limited ability to pass large woody debris

Project Opportunities

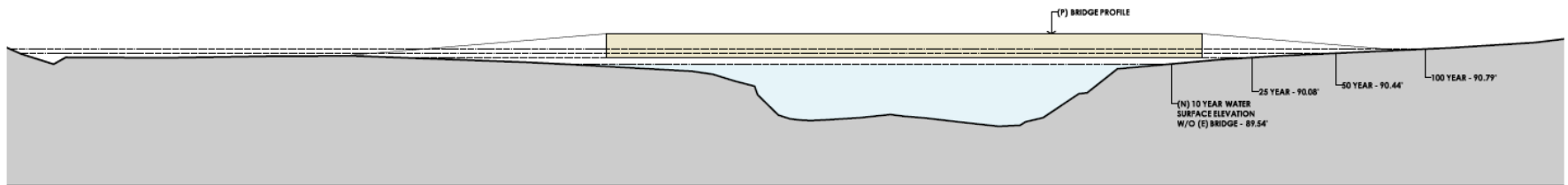


- Enhance and support habitat restoration goals
 - Increase bridge span/height
- Improve visitor safety
- Incorporate accessibility standards for approach and bridges
- Ensure long-term structural integrity
- Enhance rustic character of bridges

Preliminary Conceptual Design

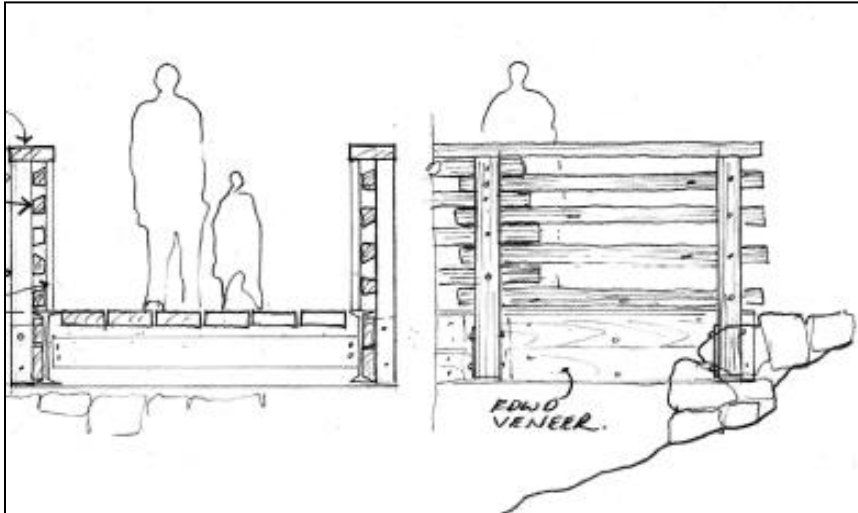


Bridge 2 currently passes 2 year storm flow

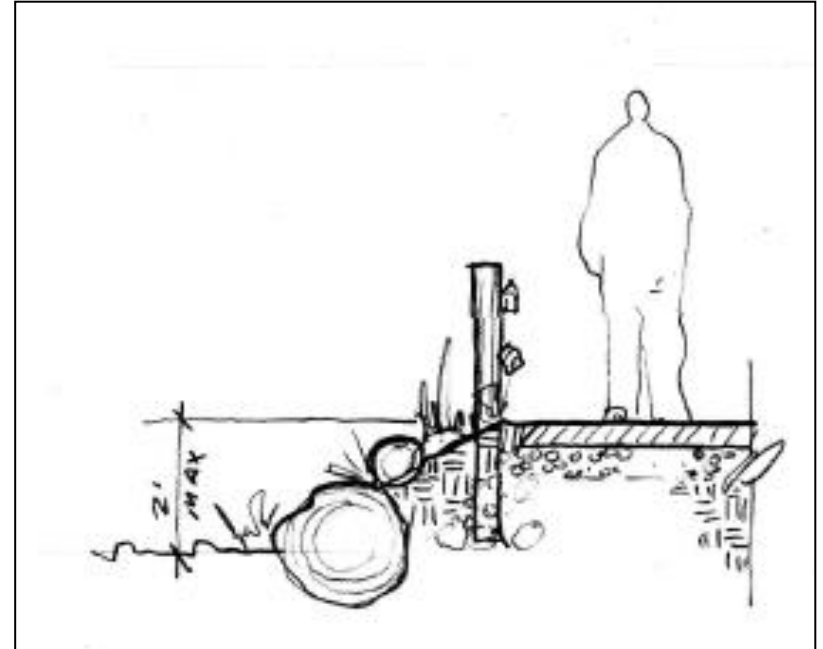


Larger span needed to pass 10 year or larger storm flow

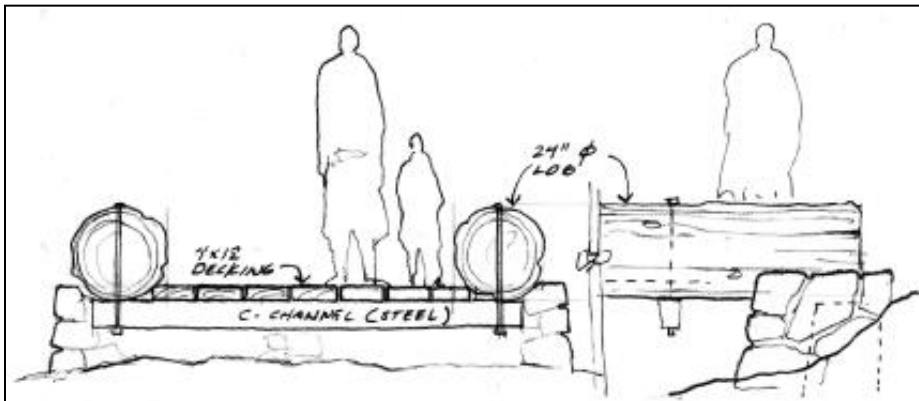
Preliminary Bridge Concepts



Steel Stringer



Earth ramp



Log Stringer

Next Steps

Project Scoping	Through Friday, Oct. 21, 2016
Conceptual Planning and Regulatory Compliance	2016-17
Draft EA and Public Comment	Early 2017
Implement Creek Actions	Fall 2017, 2018, 2019
Bridge construction	2019 and 2021

Scoping Questions?



- Project interests and concerns?
 - Information to inform project design?
 - Potential impacts from project?
 - Specific alternatives?
-

To provide comments:

http://parkplanning.nps.gov/muwo_bridge_salmon

or

GGNRA Superintendent
Attn: MUWO Salmon Habitat Enhancement &
Bridge Replacement Project
Fort Mason Building 201
San Francisco, CA 94123

