

Redwood Creek Restoration at Muir Beach

Multiple Objectives for Landscape Scale Restoration



Chris Friedel

Redwood Creek Vegetation Ecologist
Golden Gate National Recreation Area

chris_friedel@nps.gov

Loss of the Big Lagoon

Landscape Evolution: 1850s to 1960s



1852

SOURCE: US Coast & Geodetic Survey



1952



1965





Redwood Creek at Muir Beach

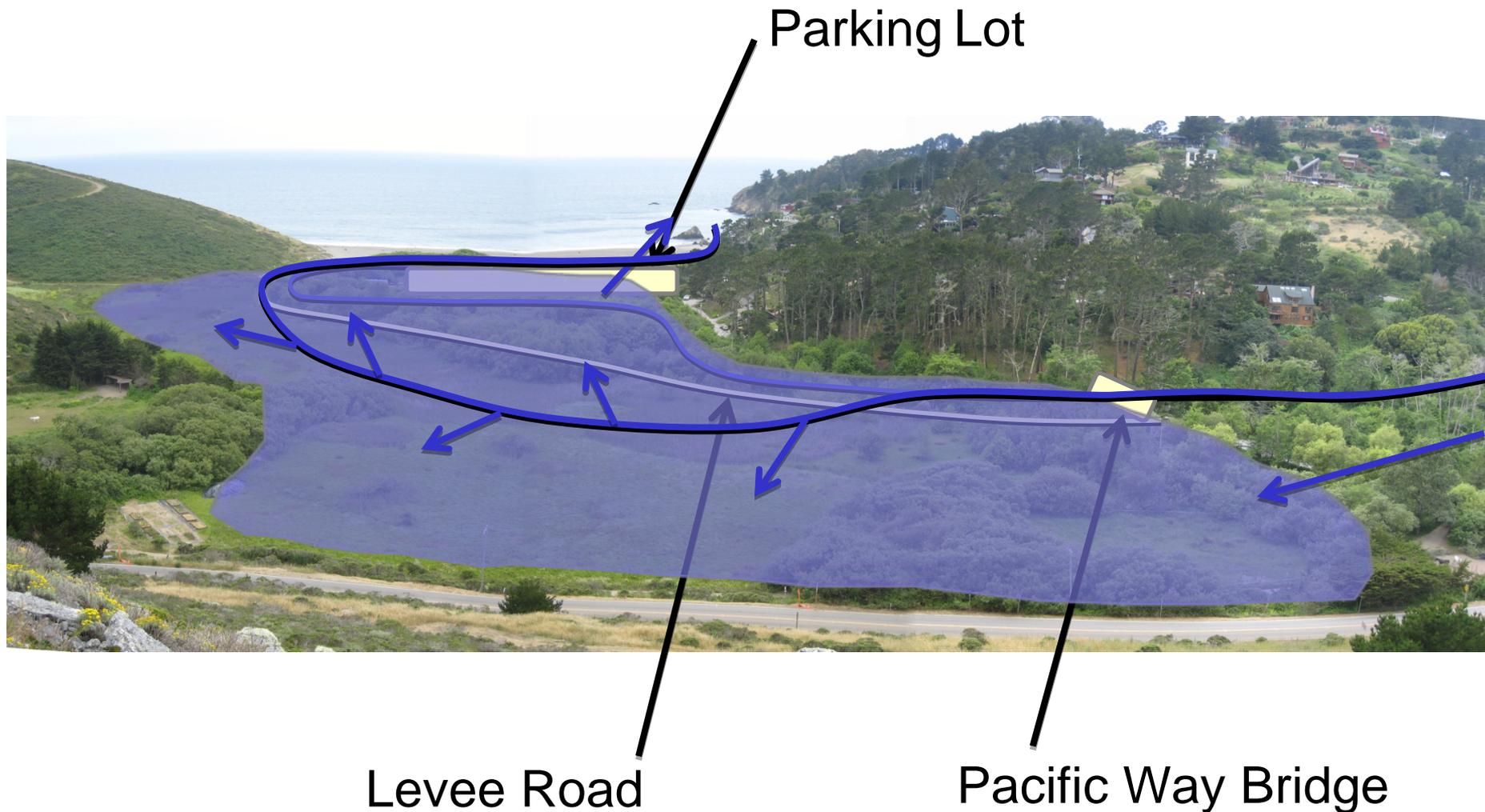
Early 1960s





Redwood Creek at Muir Beach

Existing Conditions



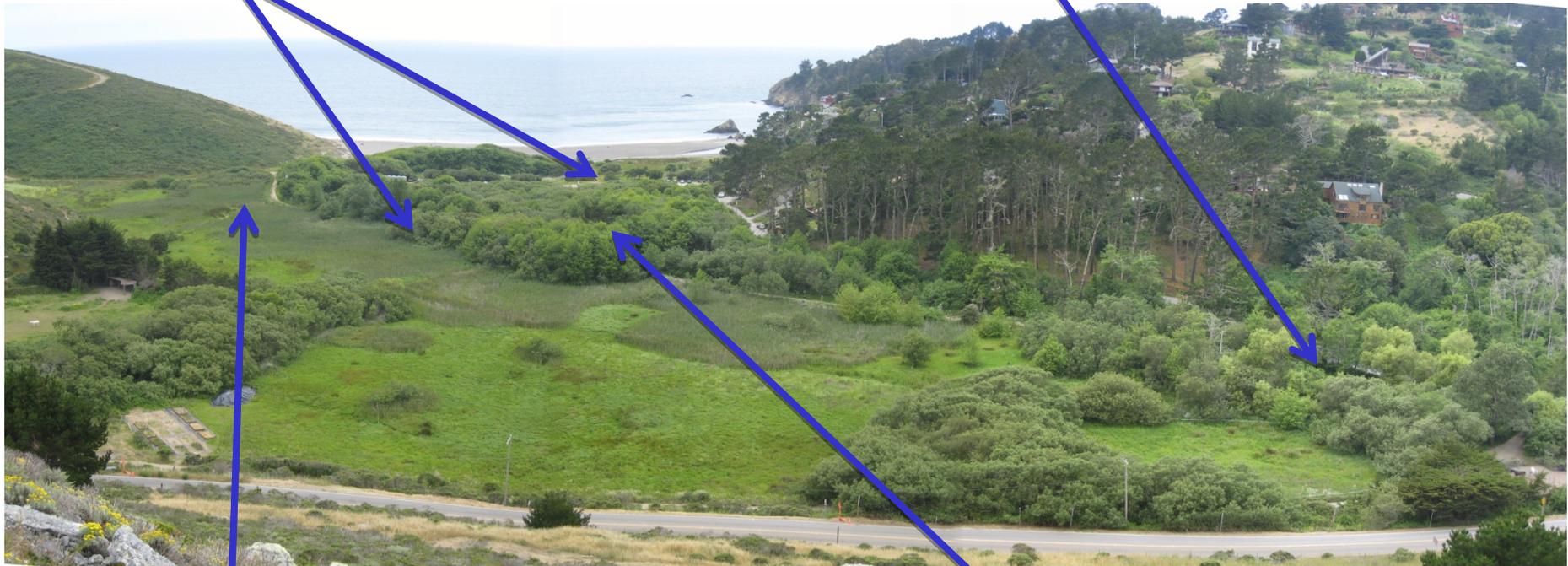
Redwood Creek at Muir Beach

Project Needs



Hydraulic Obstruction from Parking Lot and Levee

Flooding on Pacific Way



Unsustainable Frog Habitat

**Loss of Natural Creek Function
Diminished Habitat for Salmonids**



Project Objectives

Hydrology / Geomorphology



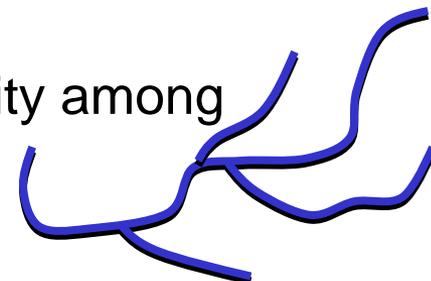
1. Remove constraints to natural geomorphic processes, such as sediment transport, channel migration, channel-floodplain interaction, and seasonal and long-term beach change.
2. Rely on geomorphic processes to maintain and support the restoration.
3. Accommodate future watershed sediment delivery.
4. Restore natural beach processes.
5. Accommodate physical disturbance (i.e., extreme hydrologic event, storm surge, sediment pulse, fires, earthquakes, etc.).
6. Restore physical complexity of creek channel.

Project Objectives

Ecology



1. Improve coho salmon and steelhead winter rearing habitat.
2. Provide a migration corridor for steelhead and coho salmon.
3. Maintain or improve breeding and rearing habitat for CRLF (*Rana aurora draytonii*).
4. Re-establish natural lateral and longitudinal connectivity among channel, floodplain, riparian, and upland habitats.
5. Enhance bird diversity.
6. Provide quality (e.g., high reproductive success) habitat for riparian/wetland-associated birds (particularly neotropical migrants).
7. Enhance native dune processes and increase diversity of native dune communities.
8. Enhance native wetland and riparian plant assemblages.
9. Provide a diversity of estuarine habitats.

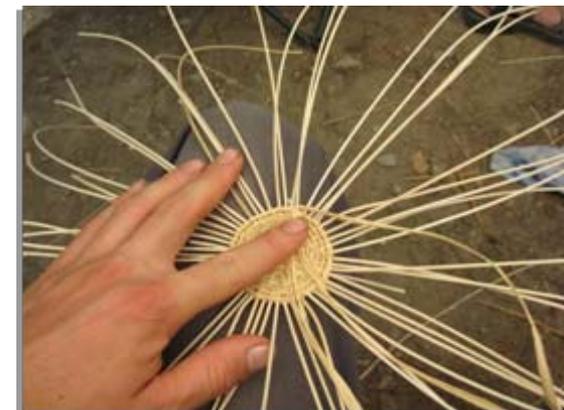


Project Objectives

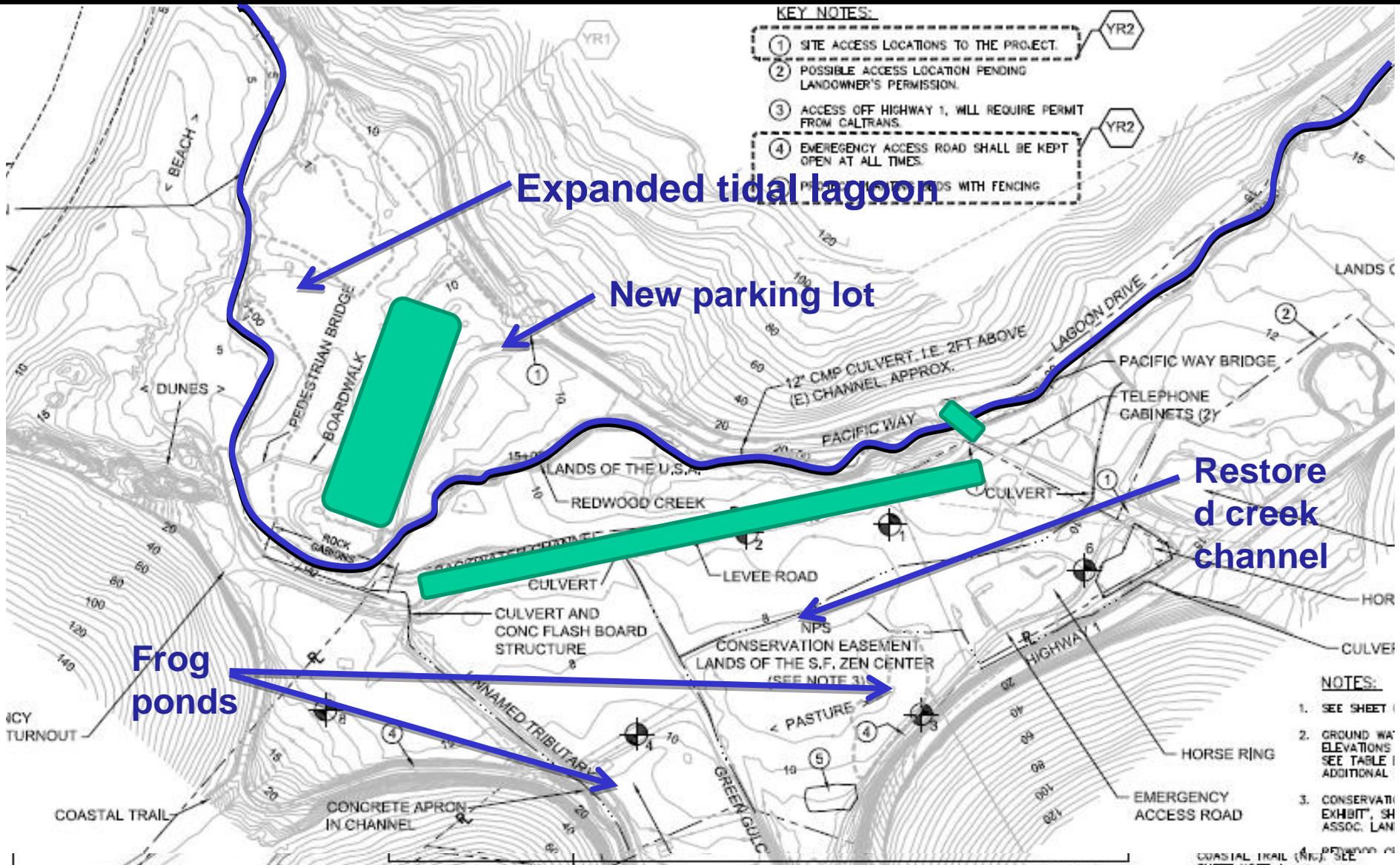
Cultural Resources



1. In addition to the principle of ecological restoration, the landscape design will be informed by the traditional ecological knowledge of the indigenous peoples of the Central California Culture Area.
2. Make the project area an important focal point of interpretation of history and culture of the Coast Miwok.



Project Design (2010)



Winter Juvenile Coho Salmon Suitable Habitat

Existing vs. Design Conditions

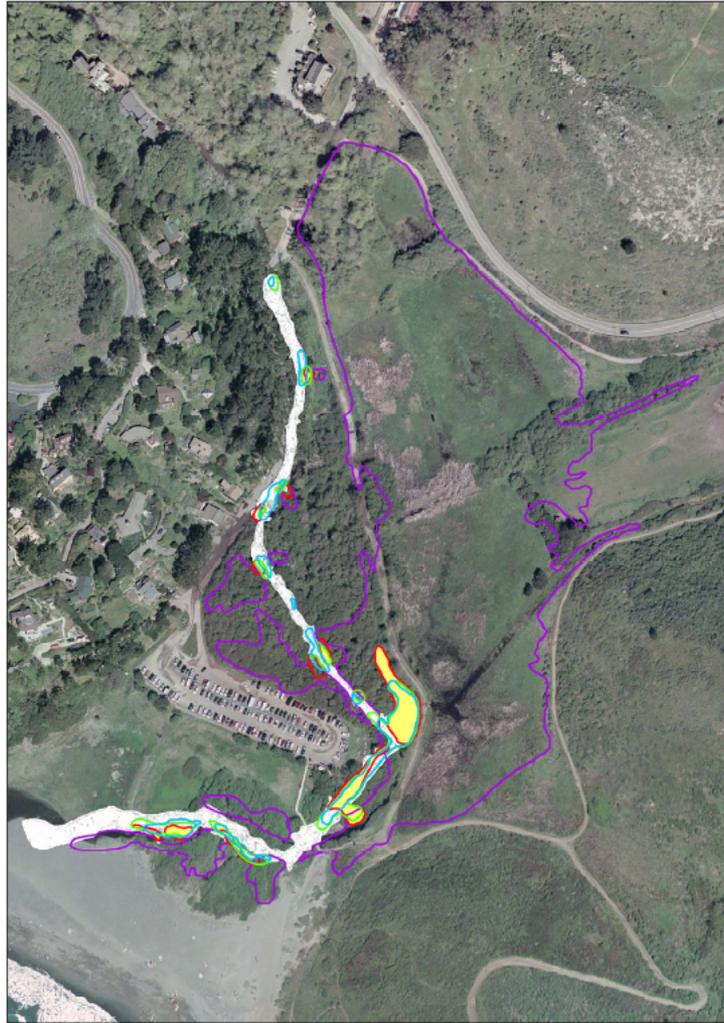


Figure 3. Lower Redwood Creek Existing Winter Juvenile Coho Salmon Habitat

Legend

- Habitat at 10 cfs
- Habitat at 50 cfs
- Habitat at 110 cfs
- Habitat at 570 cfs
- Suitable habitat

Data sources: Depth, velocity, and inundation from Moffatt and Nichol Channel sketch from Forgy and Sunshine (2008)

Scale: 0 110 220 330 Feet / 0 30 60 90 Meters

Logos: Moffatt & Nichol, Silwater Sciences

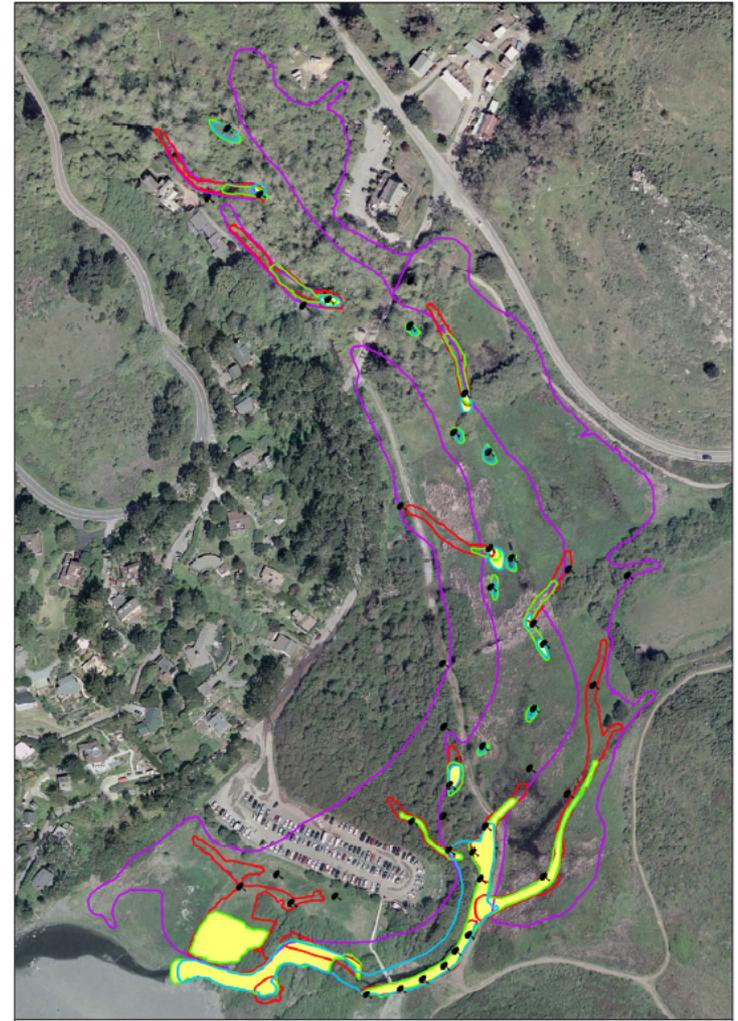


Figure 7. Lower Redwood Creek Winter Juvenile Coho Salmon Habitat at the 30% Design

Legend

- 10 cfs
- 50 cfs
- 110 cfs
- 570 cfs
- Suitable
- LWD

Data sources: Depth, velocity, and inundation from Moffatt and Nichol Channel sketch from Forgy and Sunshine (2008)

Scale: 0 100 200 300 Feet / 0 20 40 60 Meters

Logos: Moffatt & Nichol, Silwater Sciences

Construction 2010



Construction 2010



Construction 2010



Construction 2010

GOLDEN GATE
NATIONAL
PARKS
CONSERVANCY



Construction 2010



Construction 2010



Construction 2010



Construction 2010



Construction 2010



Construction 2010



Construction 2010



Construction 2010



600 ft. of new creek channel
completed in 2010

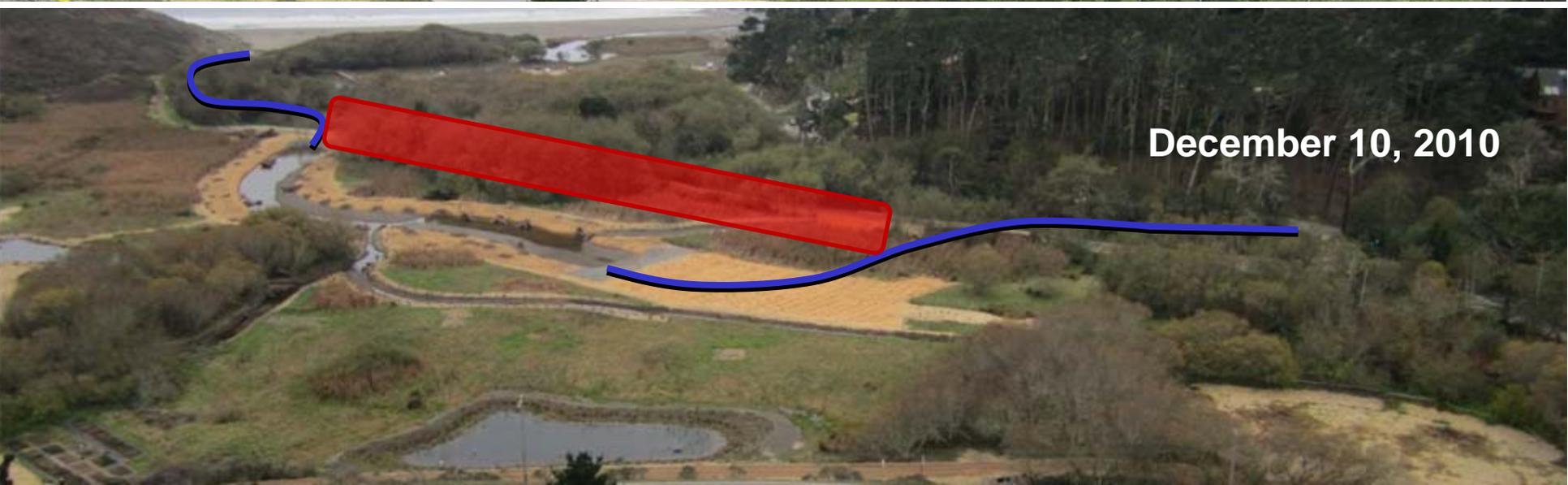




Before and After

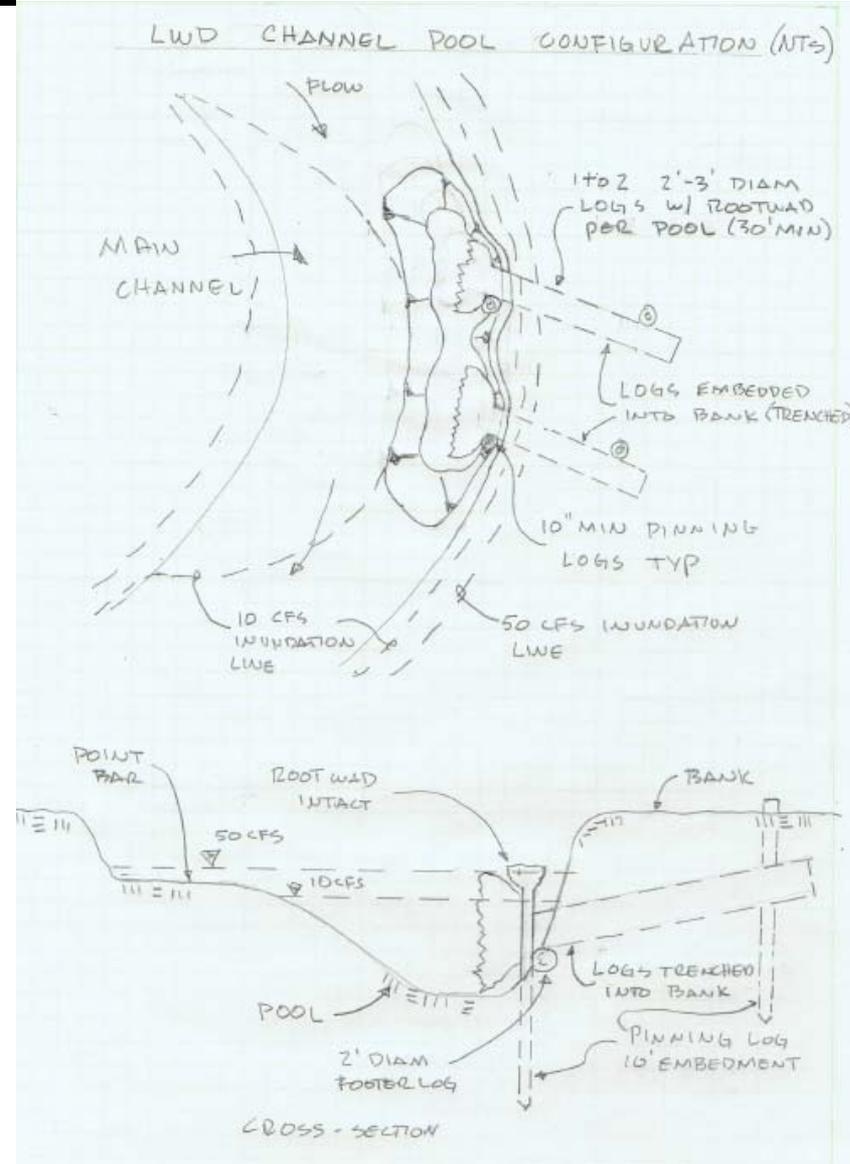
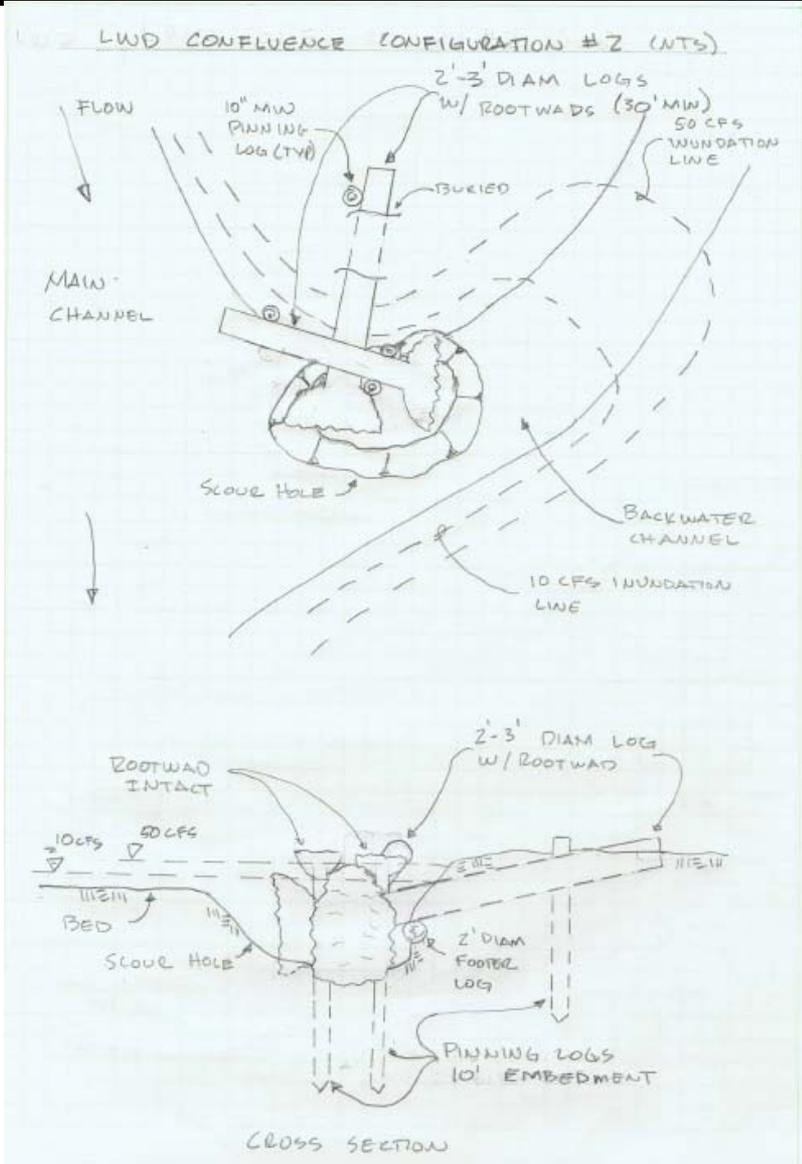


August 11, 2009



December 10, 2010

Large woody debris configurations





Large woody debris configurations



Revegetation Strategies

Plant Palettes



Revegetation Strategies



1500 willow stakes



Container plants



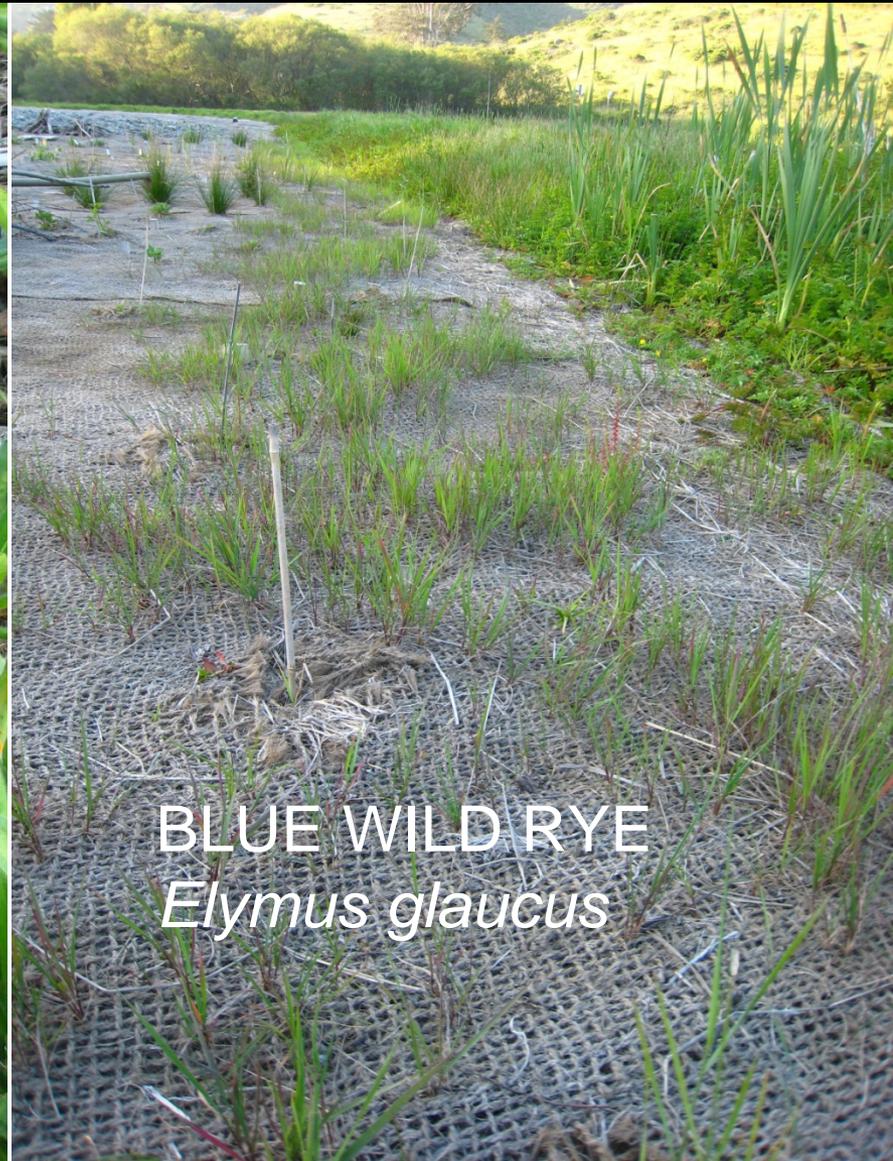
Revegetation Strategies

Cover cropping



TOAD RUSH
Juncus bufonius

COAST TARWEED
Madia sativa



BLUE WILD RYE
Elymus glaucus

Revegetation Strategies

Native plant propagation



Redwood Creek Native
Plant Nursery



On-site propagation of
bare-root divisions



Revegetation Strategies

Understory Species



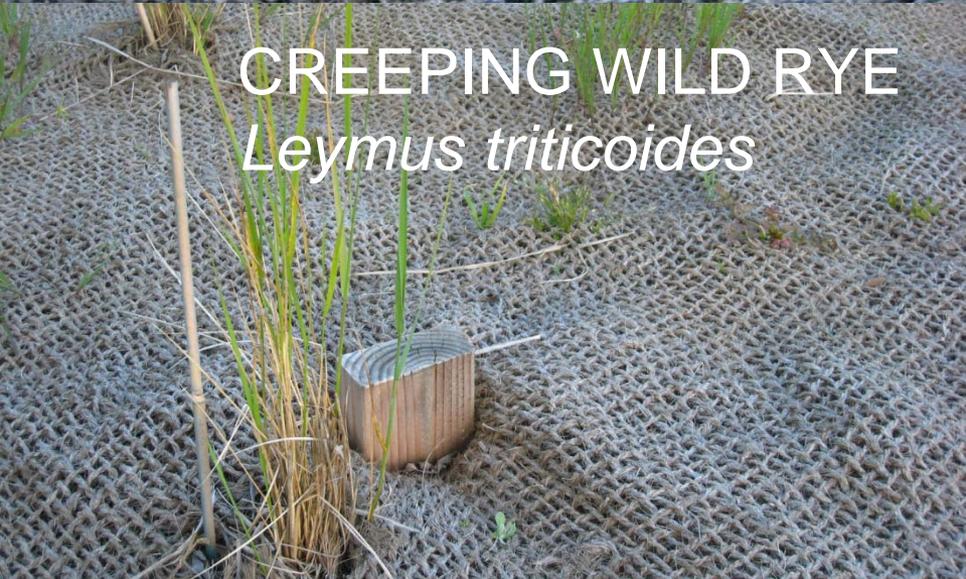
SMALL-FRUITED BULRUSH
Scirpus microcarpus



CHAMISSO'S HEDGE NETTLE
Stachys chamissonis



CALIFORNIA BLACKBERRY
Rubus ursinus



CREEPING WILD RYE
Leymus triticoides



Revegetation Strategies

Plant Protection



Acknowledgements



PARTNERS

Golden Gate National Parks Conservancy
National Park Service
Conservation Corps North Bay

CONSULTANTS

PWA
Stillwater Sciences
Jeff Anderson and Bonnie Pryor (Northern Hydrology)
Peter Baye
Kamman Hydrology

CONTRACTORS

Campbell Grading
Hanford ARC
Go Native
Cameron Colson
Great Tree Tenders

FUNDERS

California Coastal Conservancy
Wildlife Conservation Board
National Fish and Wildlife Federation
US Fish and Wildlife Service
California Dept. of Fish and Game
National Park Service