

Living shorelines, Stage 0 channels, and other design measures for climate adaptability

*Steigerwald National Wildlife Refuge Restoration
Washougal, WA*

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Wolf Water Resources
Portland, Oregon



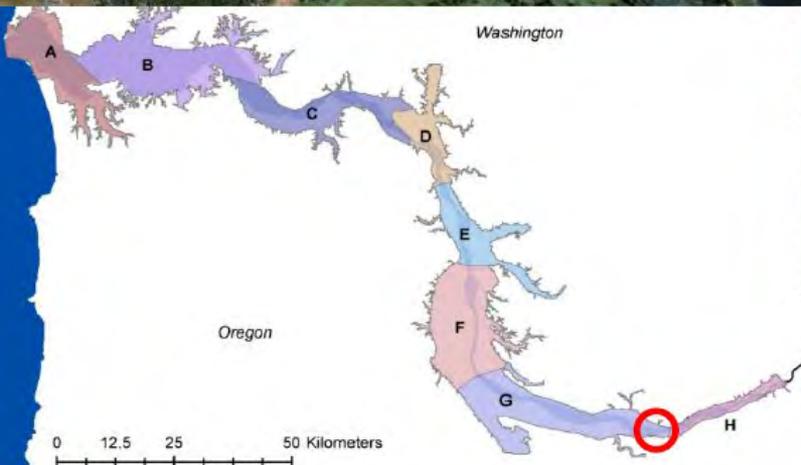
Background

- Lower Columbia River - salmonid species in decline
- 70% loss of historic habitats
- Diking, draining, development
- Effects of climate change exacerbate habitat loss
- Habitat restoration – limit factor
 - Juvenile salmonid rearing
 - Other native fish, wildlife

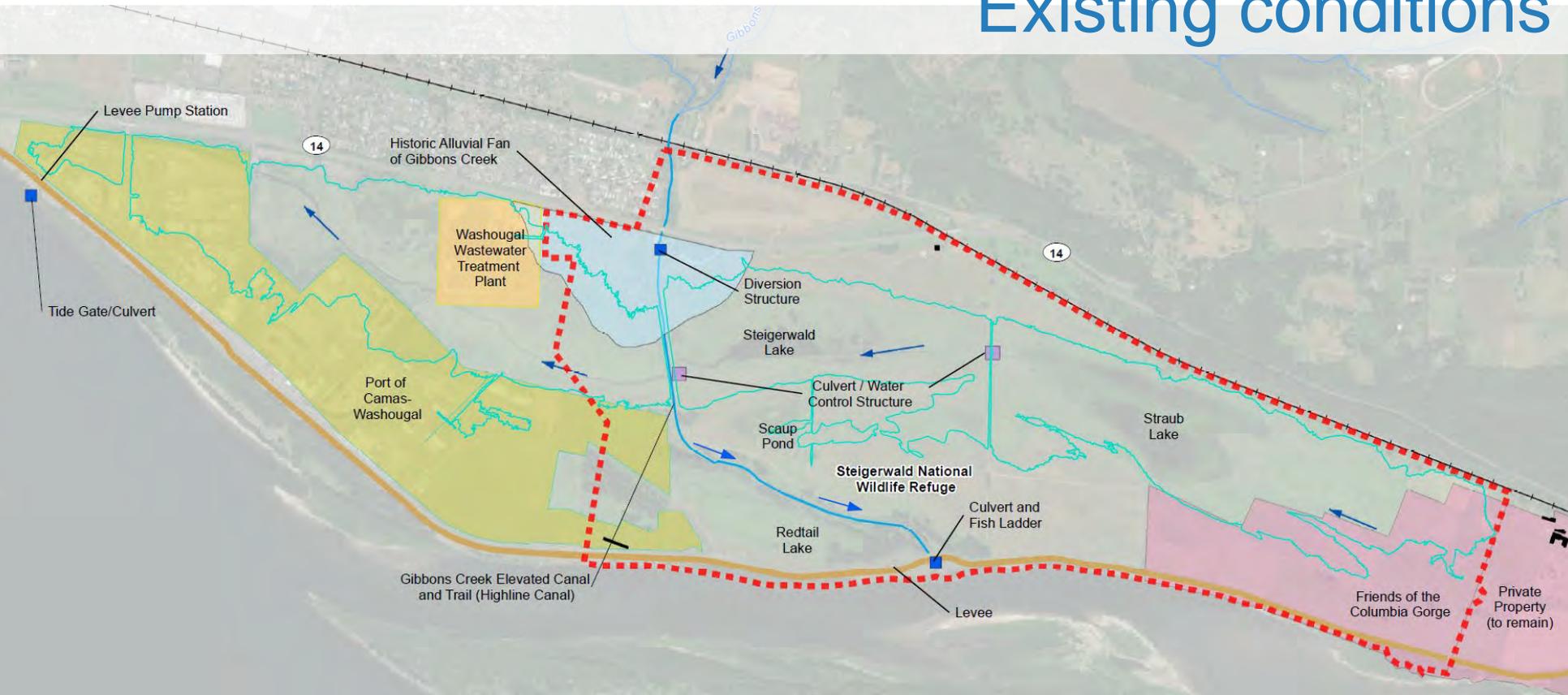
gazzettetimes.com

oregonencyclopedia.org

Estuary position – Steigerwald NWR



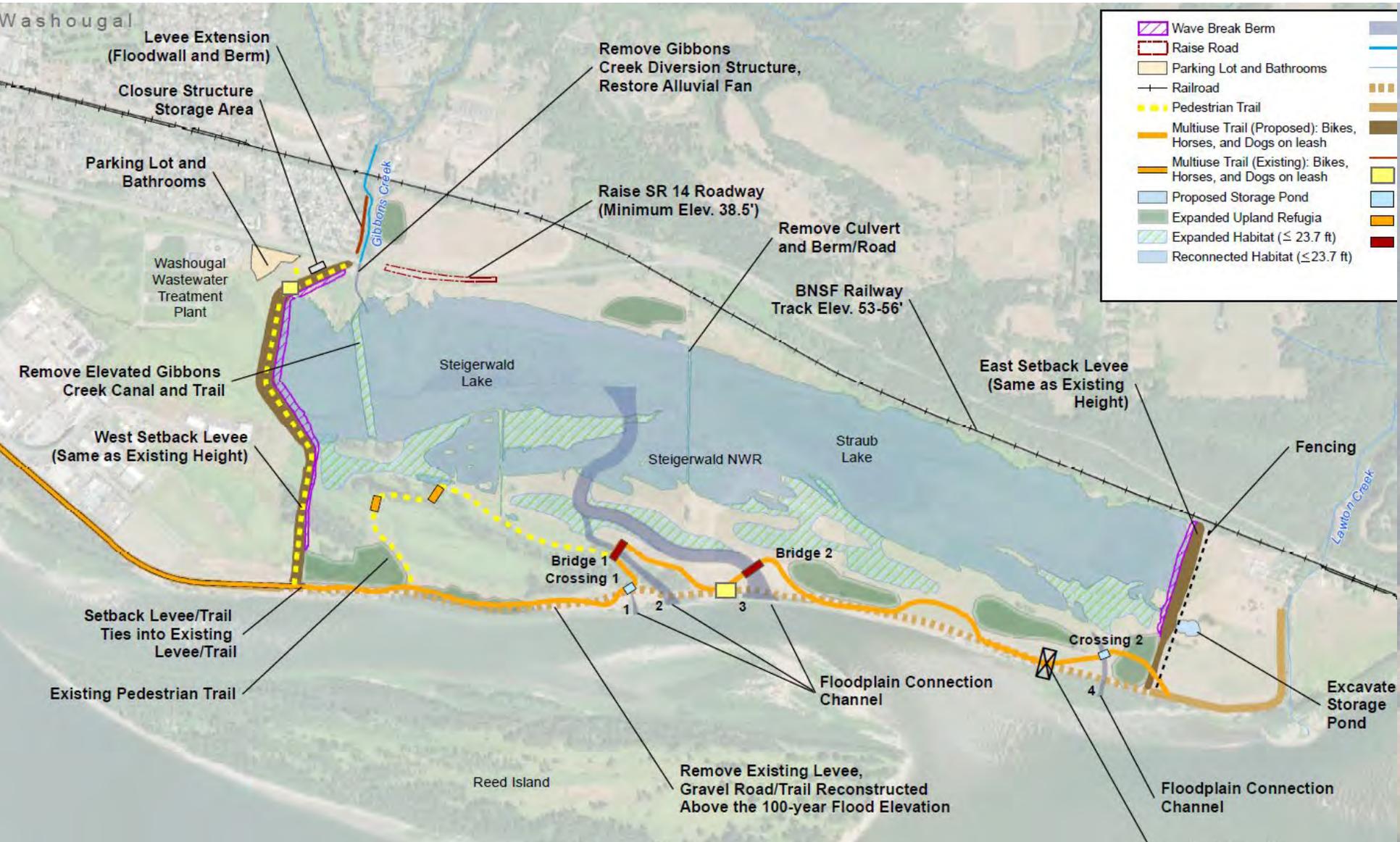
Existing conditions



Impairments – Gibbons Creek



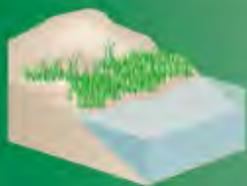
Restoration overview



GREEN - SOFTER TECHNIQUES

GRAY - HARDER TECHNIQUES

Living Shorelines



VEGETATION ONLY -
Provides a buffer to upland areas and breaks small waves. Suitable only for low wave energy environments.

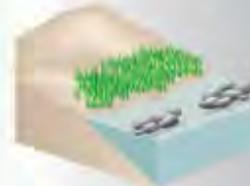


EDGING -
Added structure holds the toe of existing or vegetated slope in place.



SILLS -
Parallel to existing or vegetated shoreline, reduces wave energy, and prevents erosion. Suitable for most areas except high wave energy environments.

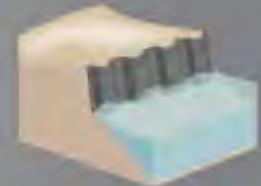
Coastal Structures



BREAKWATER -
(vegetation optional) - Offshore structures intended to break waves, reducing the force of wave action, and encourage sediment accretion. Suitable for most areas.



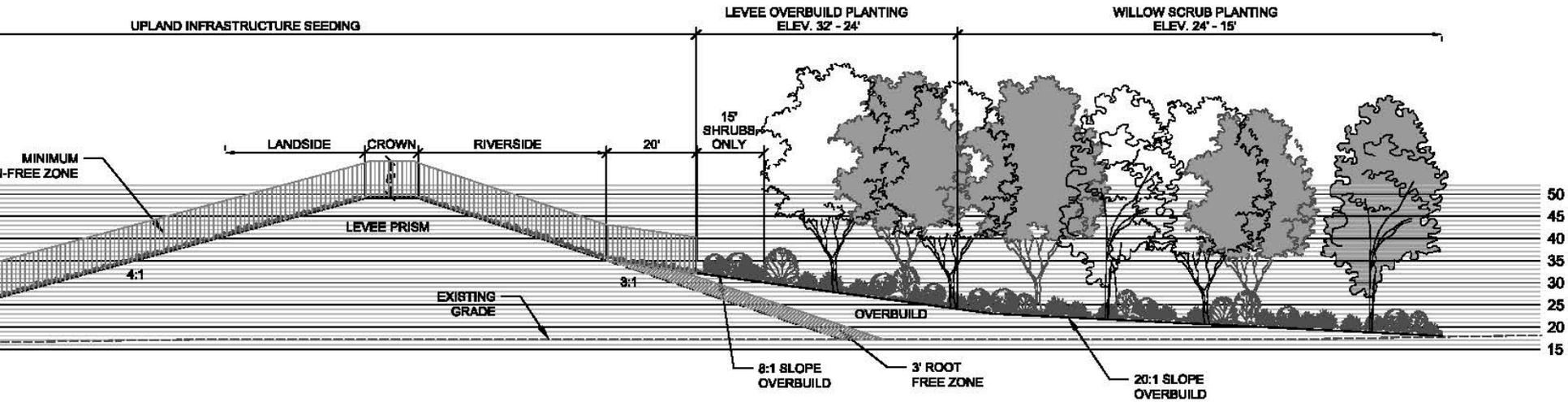
REVETMENT -
Lays over the slope of the shoreline and protects it from erosion and waves. Suitable for sites with pre-existing hardened shoreline structures.



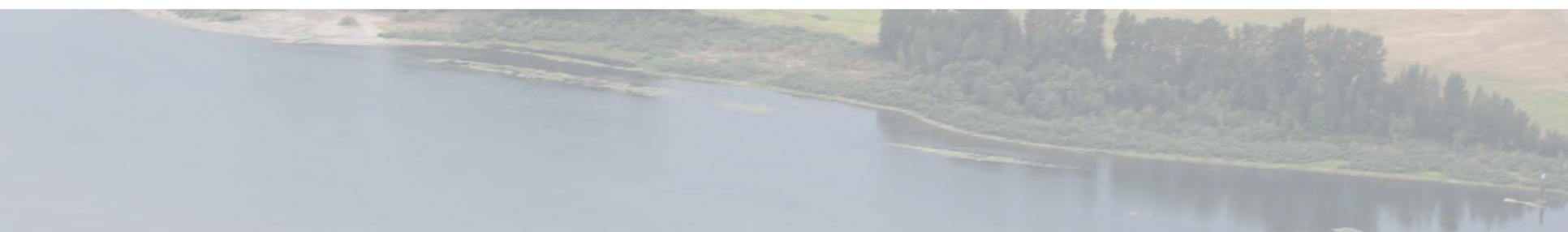
BULKHEAD -
Vertical wall parallel to the shoreline intended to hold soil in place. Suitable for areas highly vulnerable to storm surge and wave forces.

DESIGN MEASURE 1

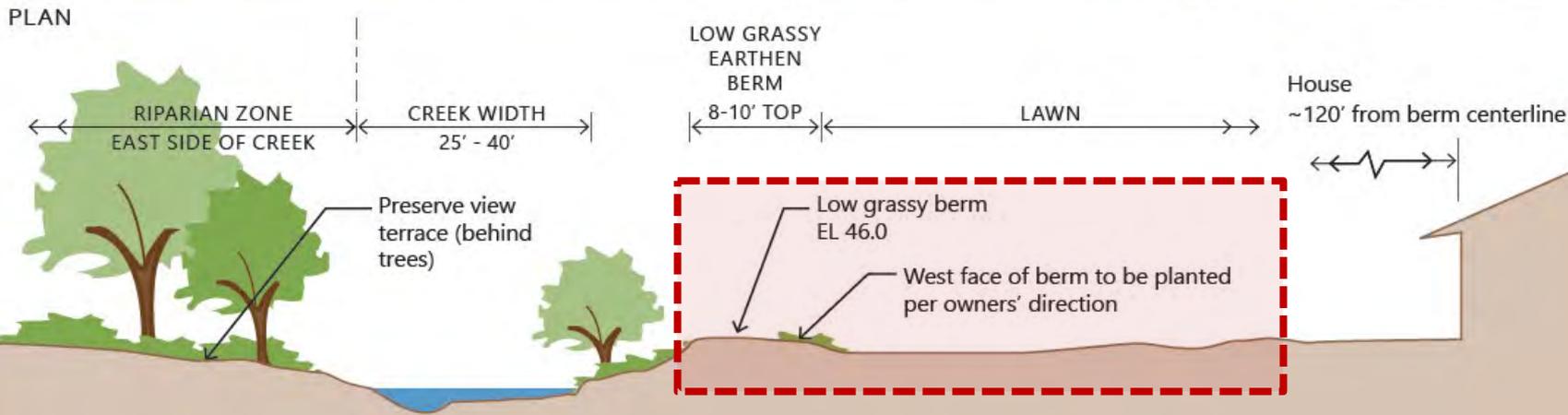
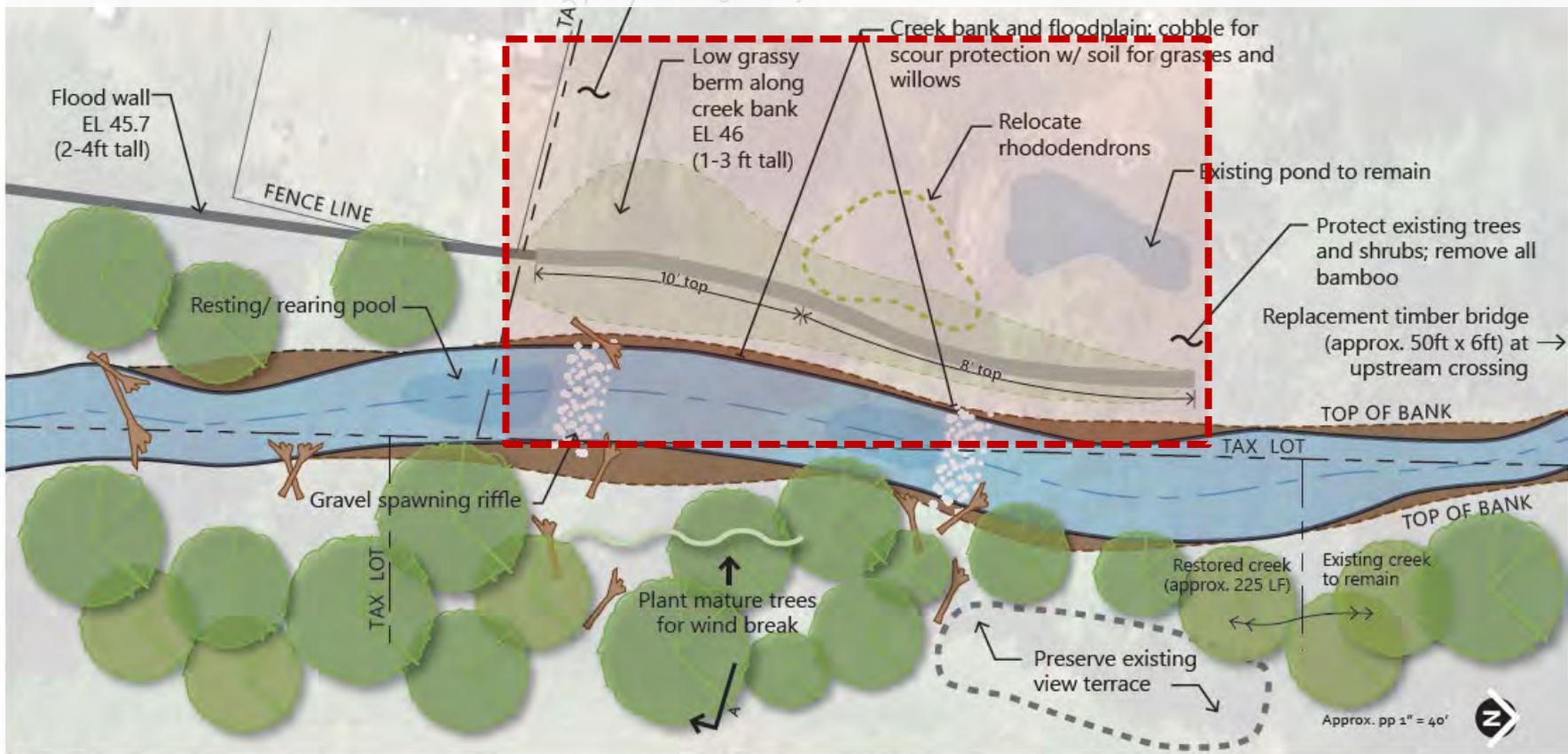
Living shoreline – vegetated overbuilds



PLANTING LAYOUT ON WEST SETBACK LEVEE OVERBUILD



Gibbons Cr – living berm (east levee)

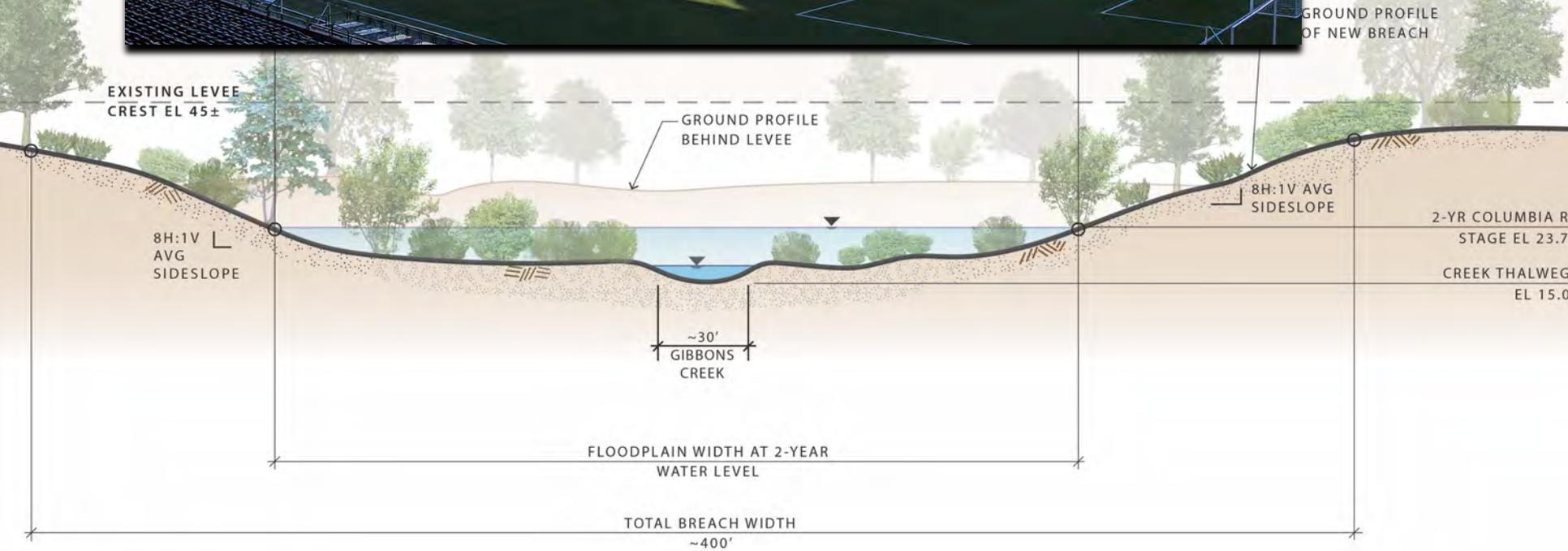


DESIGN MEASURE 2

Hydrologic variability



STEIGERWALD NWR RESTORATION
GIBBONS CREEK CONFLUENCE
CONCEPTUAL DESIGN



GROUND PROFILE
OF NEW BREACH

0 40' 80'

2X Vertical Exaggeration

DESIGN MEASURE 2

Hydrologic variability

Franz Lake Wetland Complex - July 2006



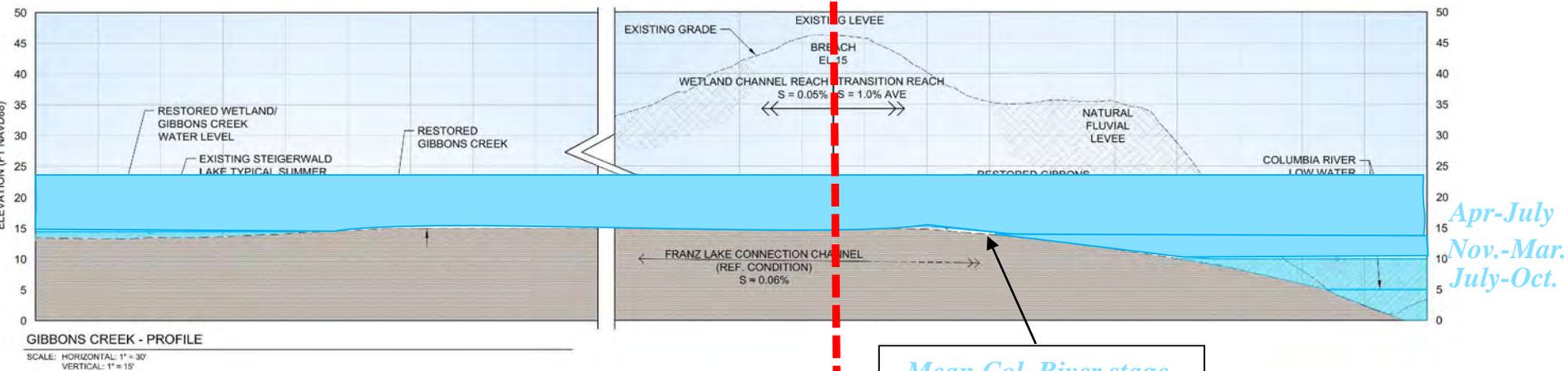
Floodplain Wetlands/Channel - April 2008



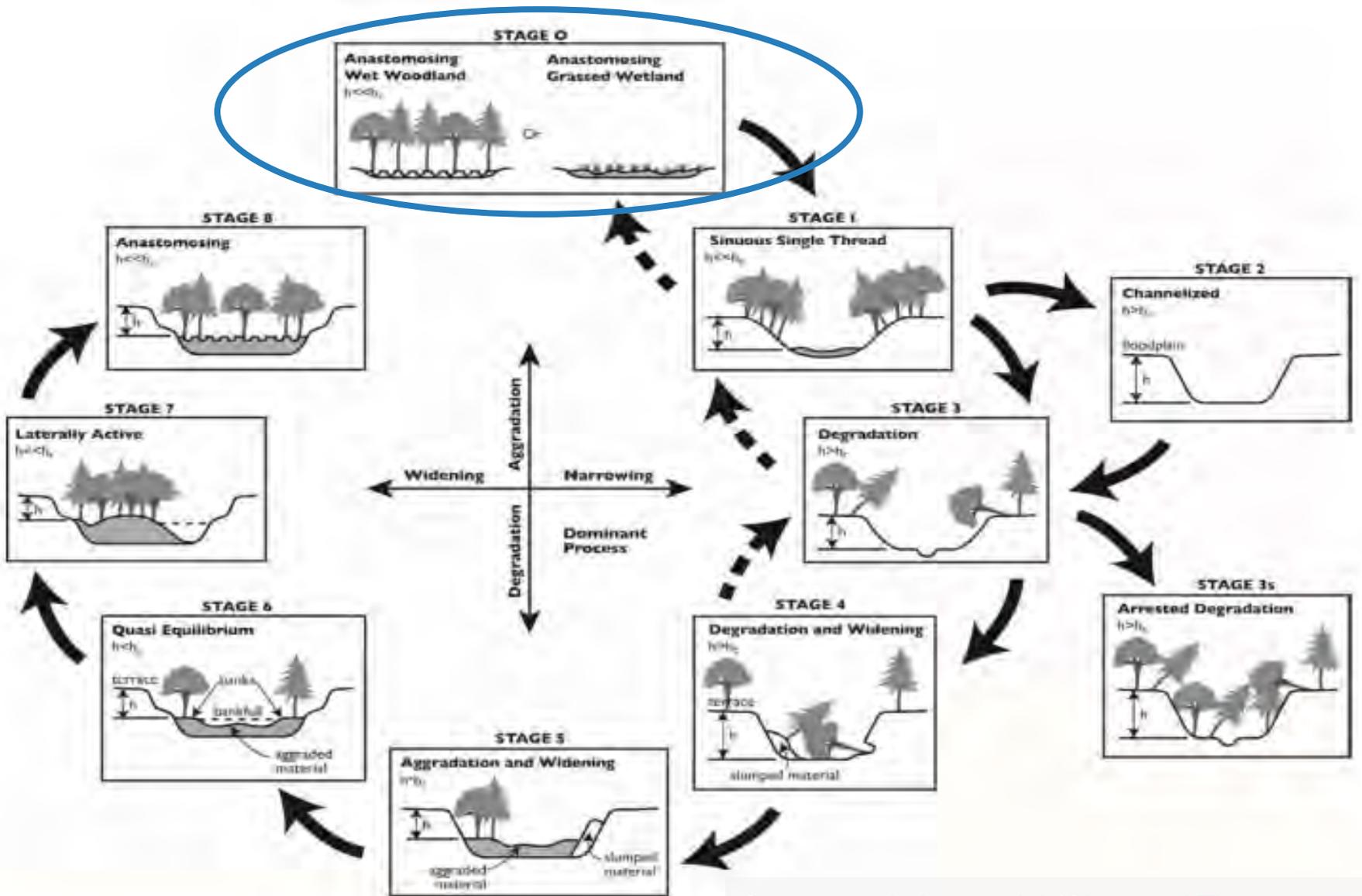
Beaver Dam - April 2015

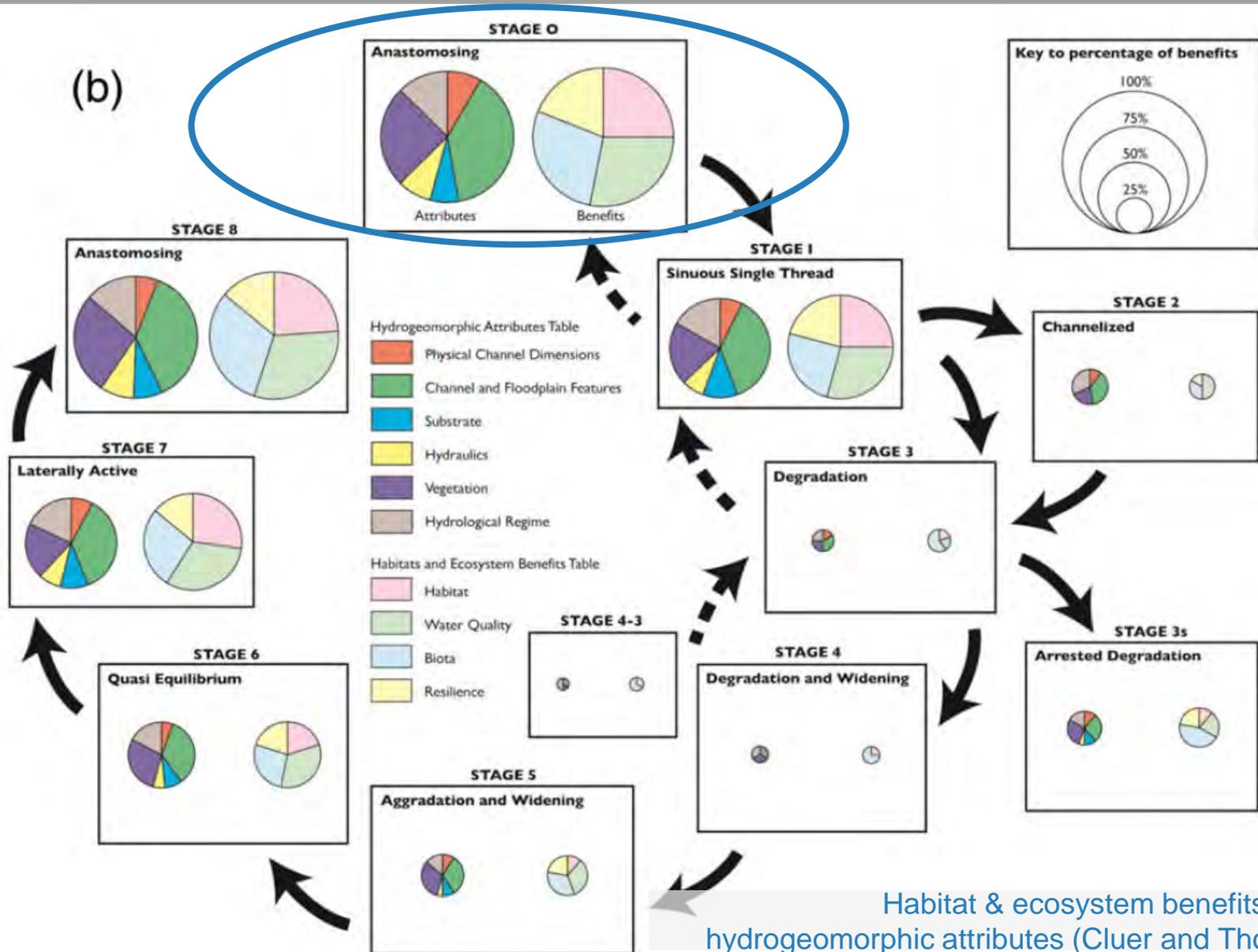
DESIGN MEASURE 2

Hydrologic variability



Mean Col. River stage
Nov-Mar is 6" below
floodplain invert.





Habitat & ecosystem benefits based on hydrogeomorphic attributes (Cluer and Thorne 2013)

DESIGN
MEASURE 3

Floodplain - focused

Staley Creek, Upper Willamette River



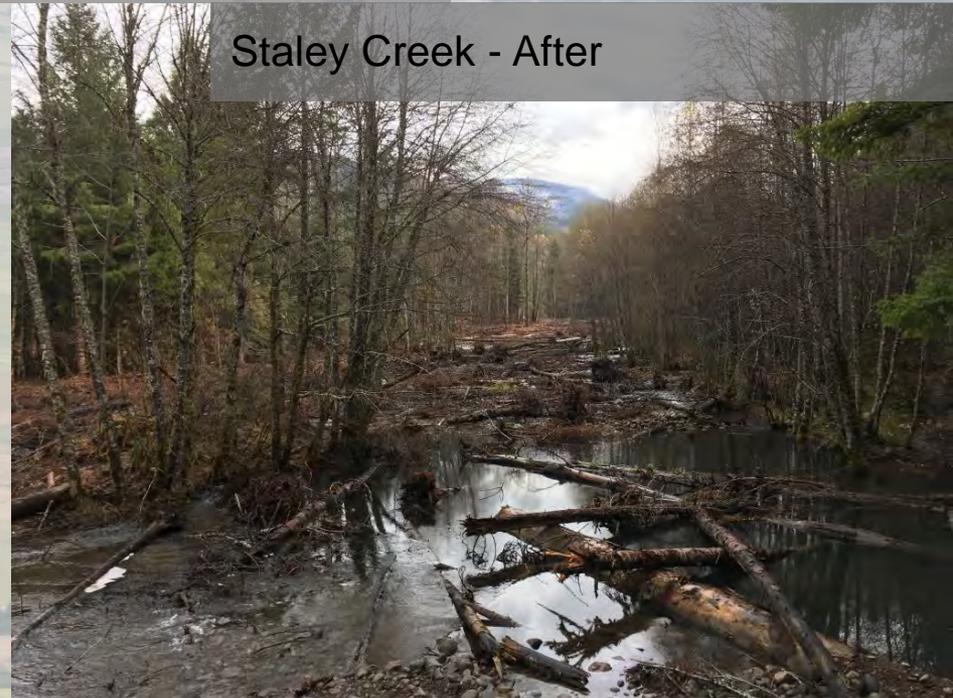
DESIGN
MEASURE 3

Floodplain - focused

Staley Creek, Upper Willamette River

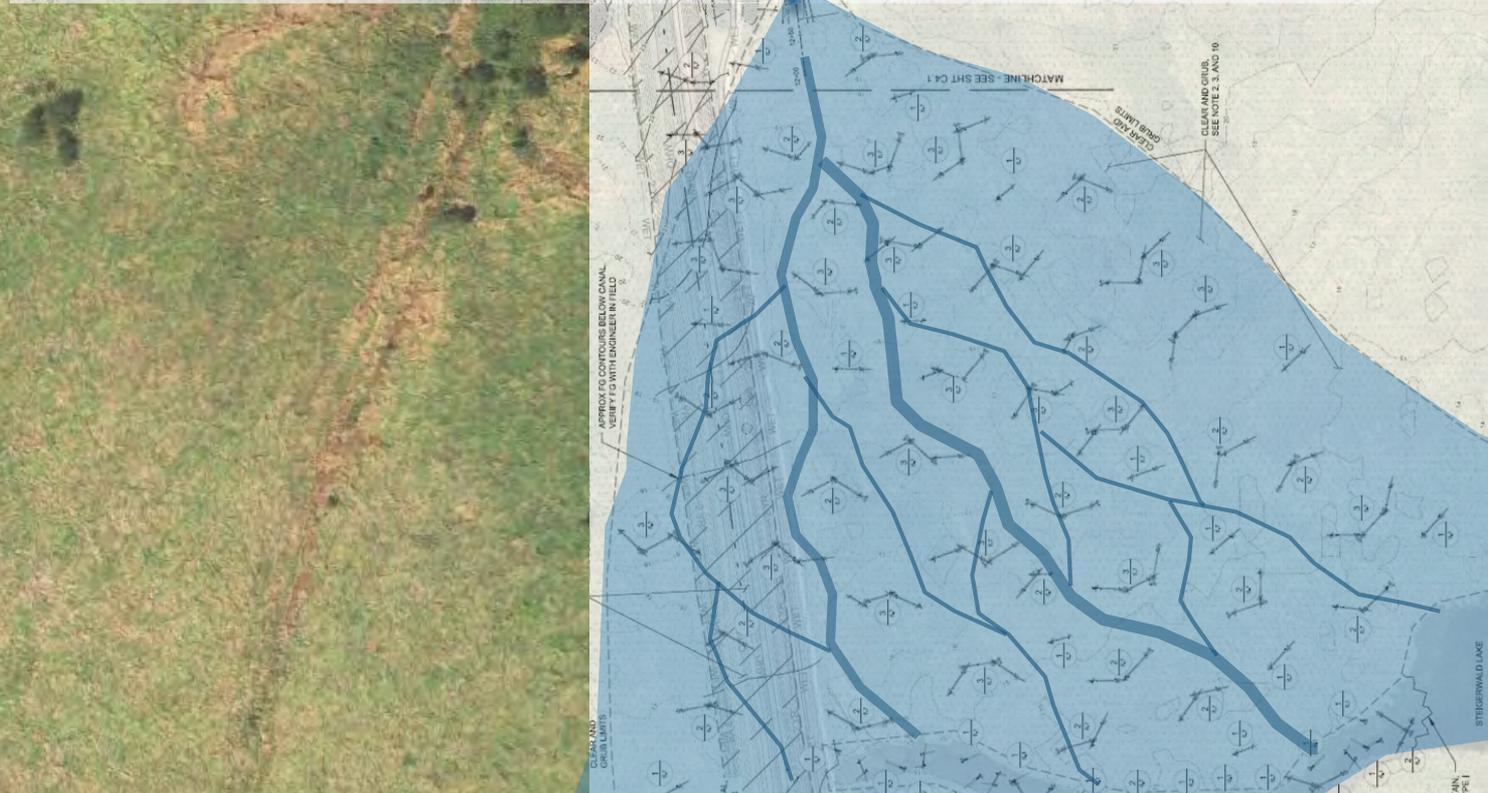


Staley Creek - Before



Staley Creek - After

3. TOPS AND TOES OF BANK ARE APPROXIMATE SHEETS C0.1 AND C0.2 FOR CHANNEL CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE ESTIMATES.



Keys

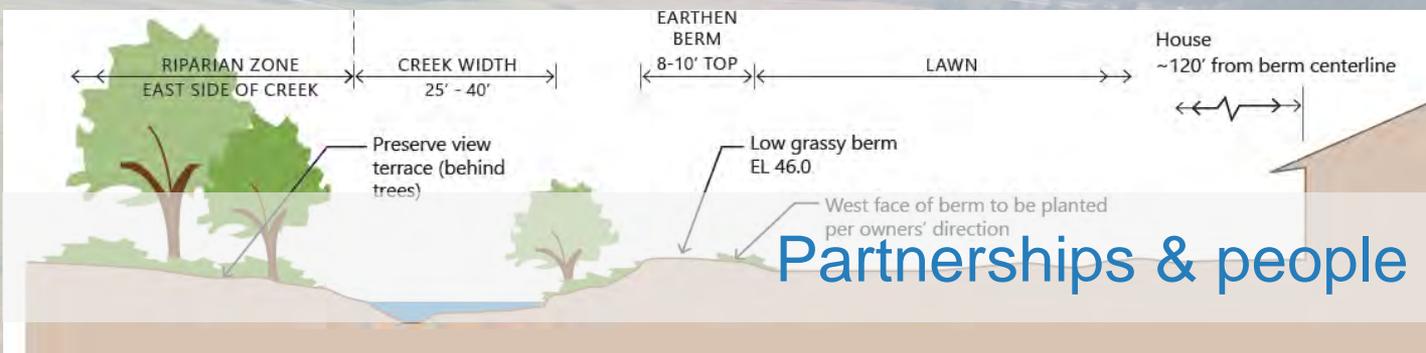
to

climate

resiliency:



Space & scale



Partnerships & people



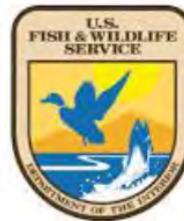
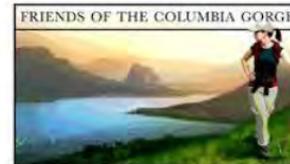
Redundancy & ... redundancy



Questions?



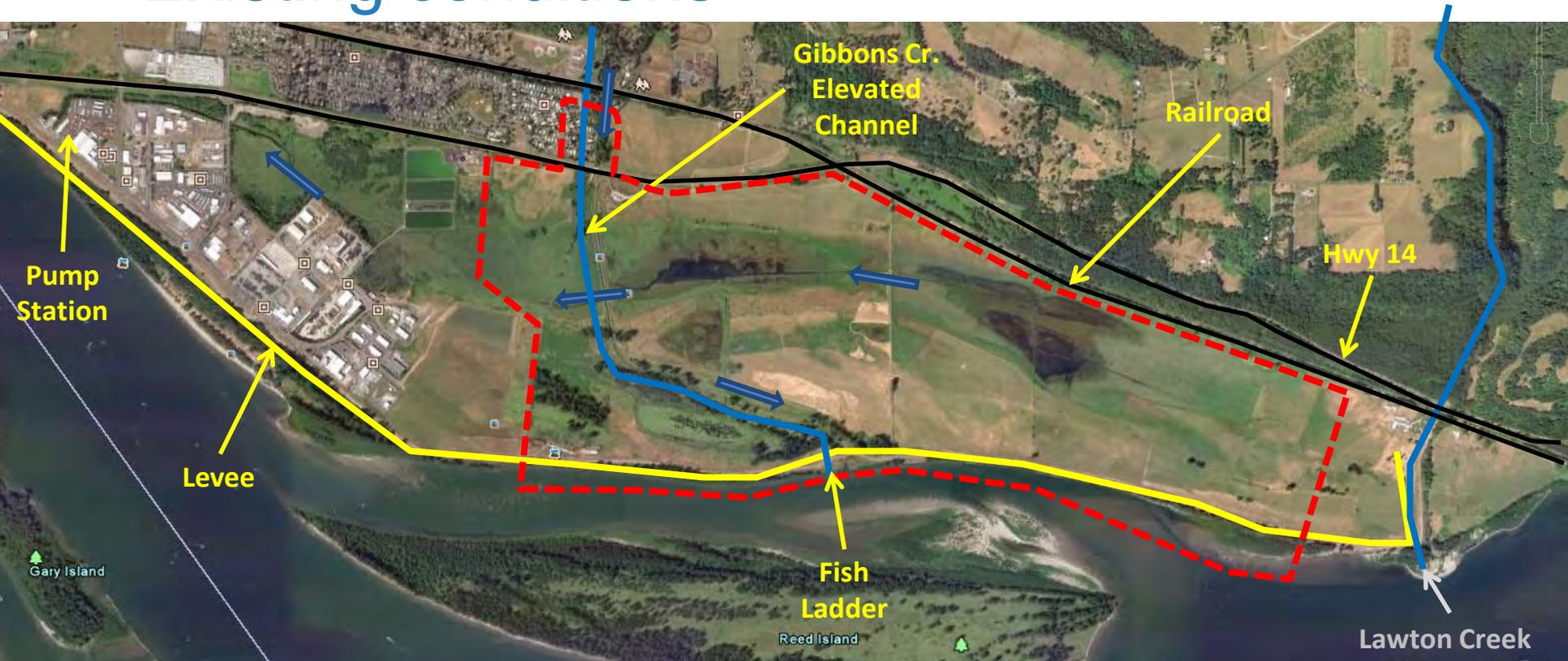
Sponsors & partners



Reference slides



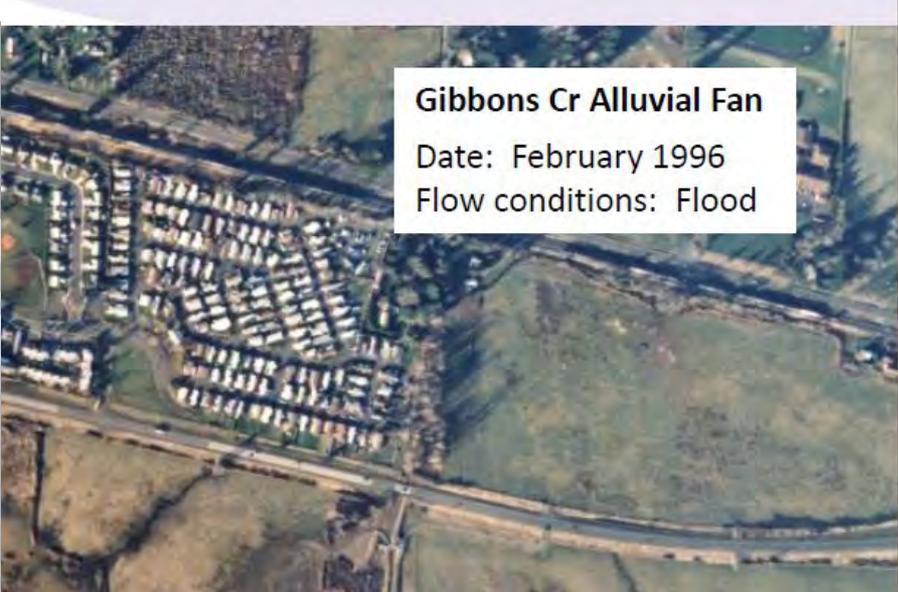
Existing conditions



Refuge size



Private Ranch
(east levee)



Gibbons Cr Alluvial Fan
Date: February 1996
Flow conditions: Flood



Gibbons Cr Alluvial Fan
Date: Nov. 1956
Flow conditions: Unknown



Gibbons Cr Alluvial Fan
Date: Jan. 2015
Flow conditions: Low

Early disturbance conditions



1948 (pre-dam flood peak)

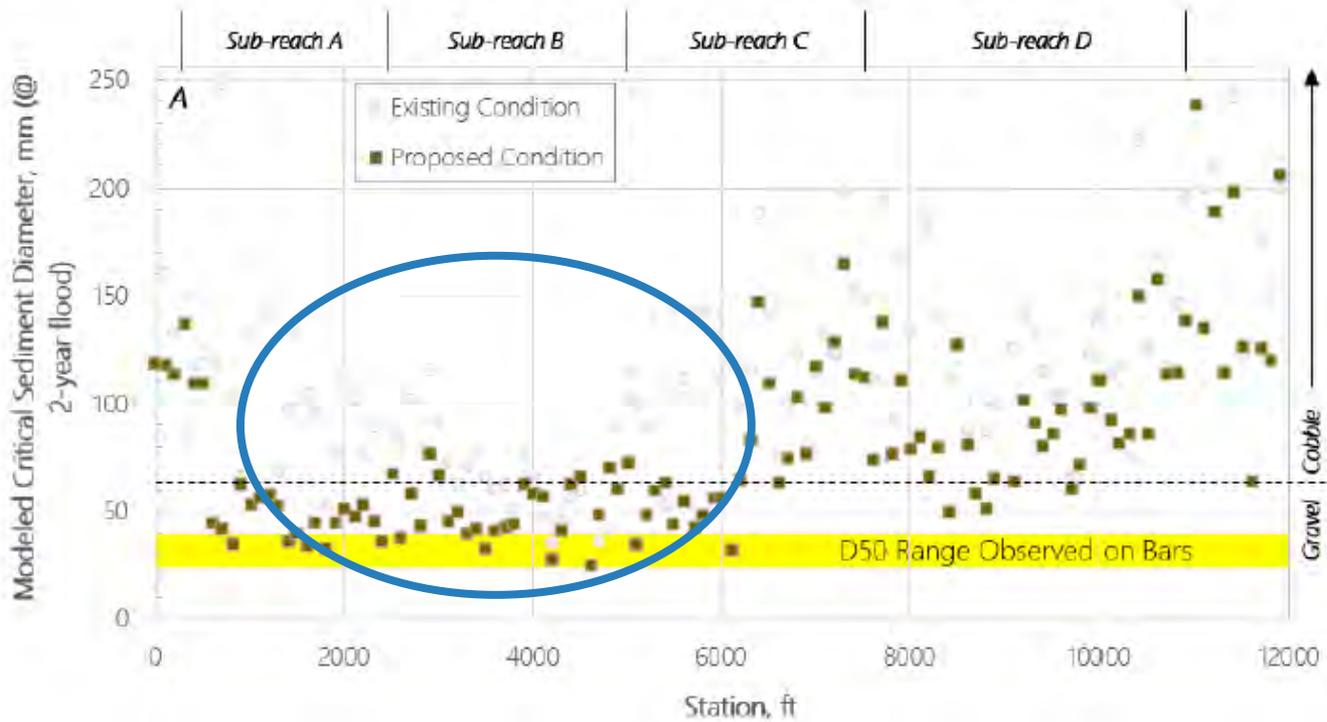
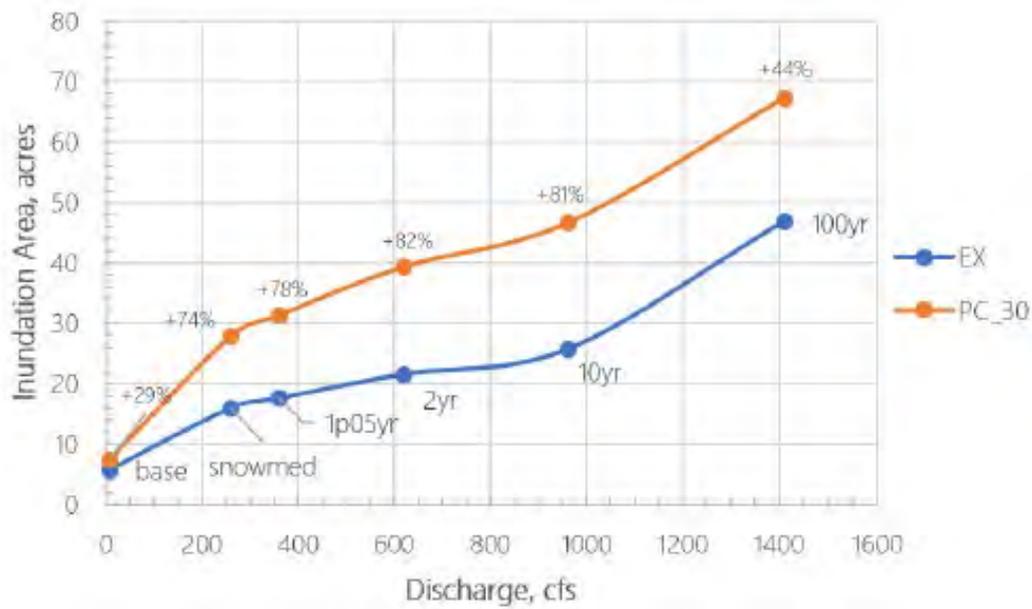
Sandy River Delta

Reed Island

project site

931 COLUMBIA RIVER FLOOD 6/1/48 12:15 D.S.T.

Stage 0 - analysis



Impairments



Columbia River Levee

Date: March 2013

Location: approx. location of low elevation breach

Orientation: East

Flow conditions: Moderate



Source: LCEP