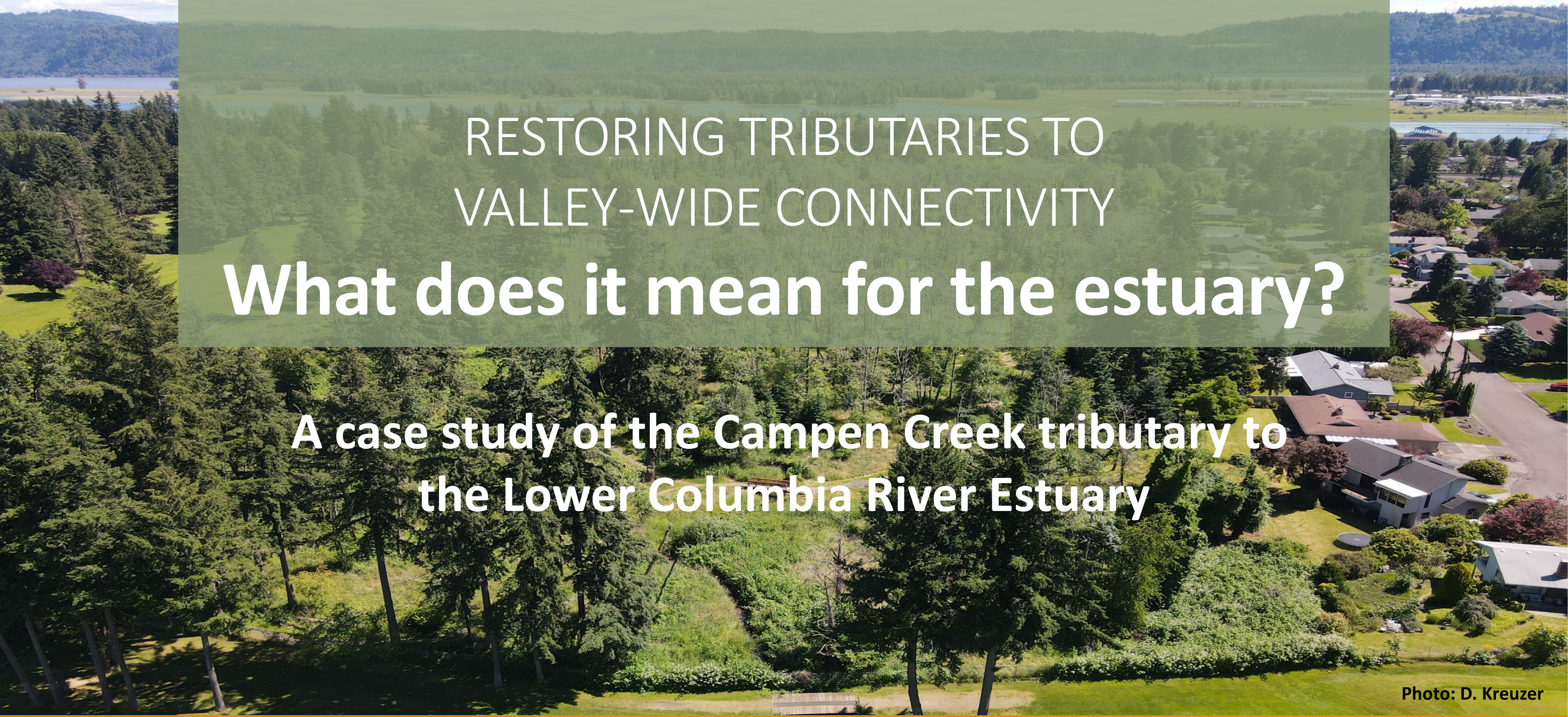
Photo: D. Kreuzer



RESTORING TRIBUTARIES TO VALLEY-WIDE CONNECTIVITY

What does it mean for the estuary?

A case study of the Campen Creek tributary to the Lower Columbia River Estuary

Photo: D. Kreuzer

Lower Columbia Estuary Partnership

WOLF WATER RESOURCES

Columbia River Estuary Conference
May 13, 2025

Alex Morton, Senior Engineer
Liz Hamilton, Engineer
Curtis Loeb, Principal Engineer
Chris Collins, Principal Ecologist
Doug Kreuzer, Principal Ecologist

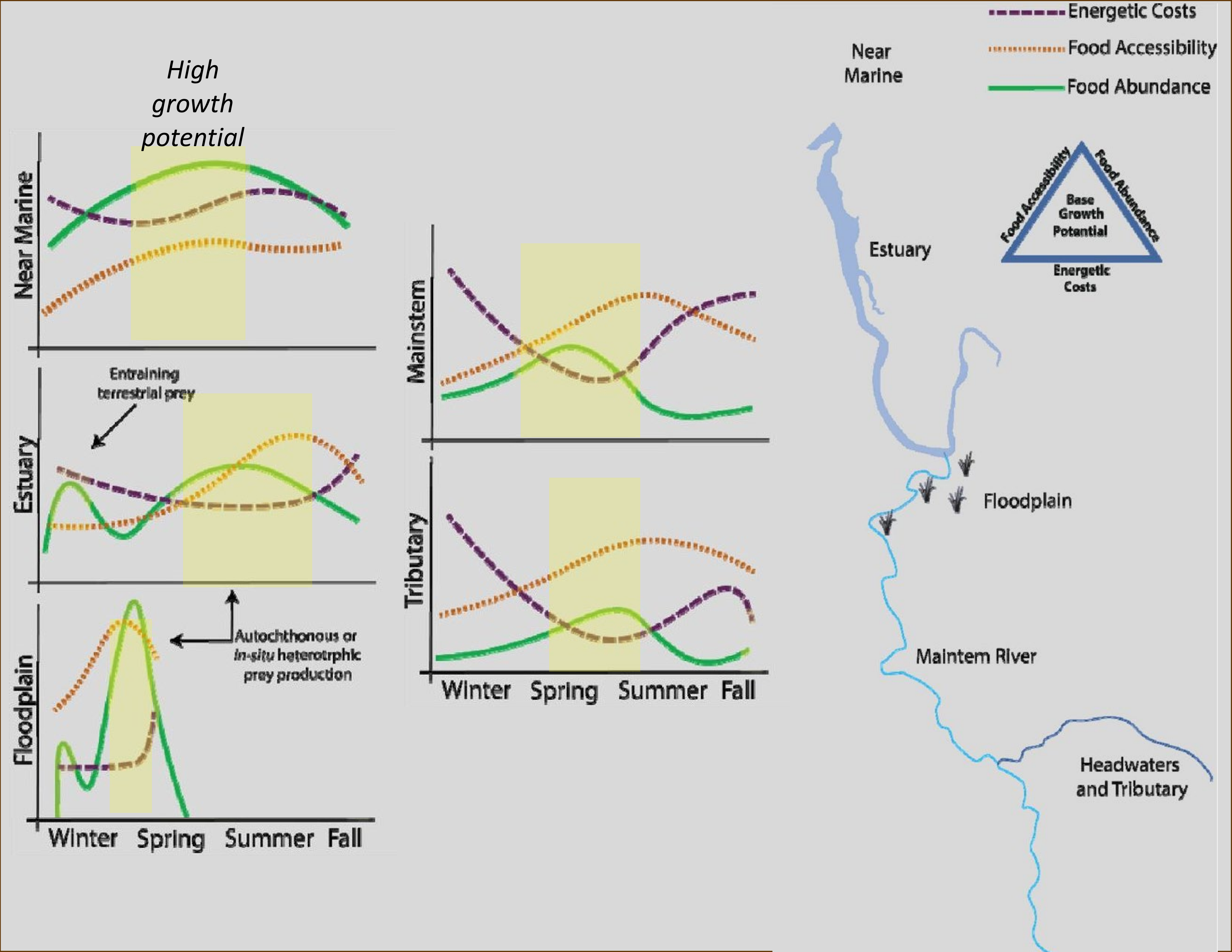
Role of tributaries

Ecological & habitat asynchronousities	Rearing and overwintering habitat Contrasting thermal and flow regimes Suite of habitats that promote expression of juvenile life histories (Schroeder et al., 2016).
Prey export & foodscapes	**Resource subsidy concept** –primary/secondary production upstream (arthropod prey) and transported downstream (Kiffney et al., 2006). Tidal marsh prey export (Roegner GC, Johnson GE (2023); Weitkamp et al., 2022). Variation in mainstem, trib/floodplain/estuary habitats provide permutations of habitat use, foraging, growth **potentials in foodscapes** - differentiating growth trajectories that may promote **life history diversity** and population resilience (Rossi et. al, 2024)
Water Quality	Thermal stress alleviated by local cold-water plumes in tributaries (Wang et al., 2020) Polluted tributary runoff with negative effect on fish and prey health. (NOAA, 2016).

Tributaries - a foodscape for salmon

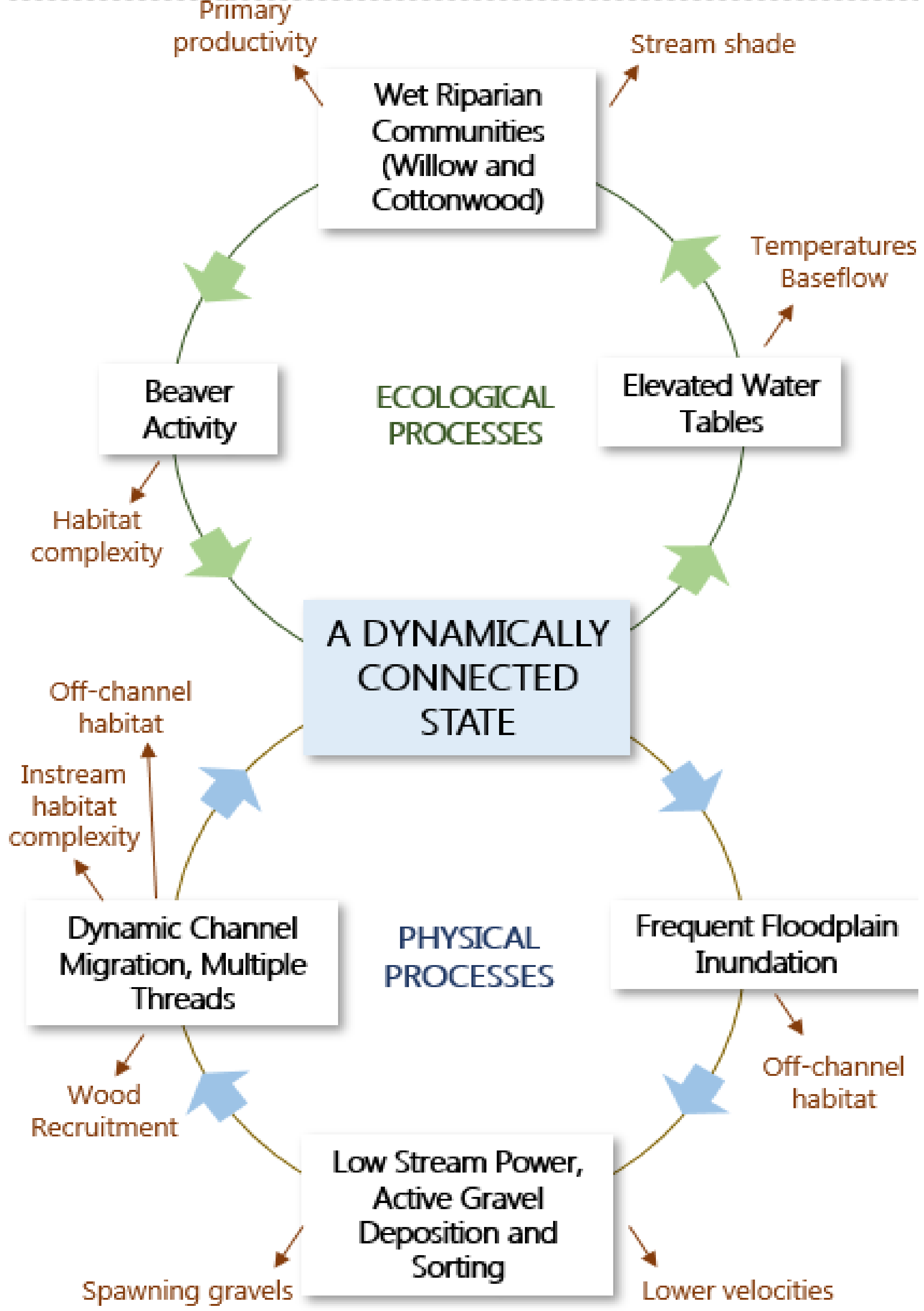
G. Rossi et al., 2024

Integrating spatiotemporal dynamics of growth potential based on food **abundance, accessibility,** and **foraging cost**



High productivity –> high connectivity:

channel-floodplain ecosystem benefits



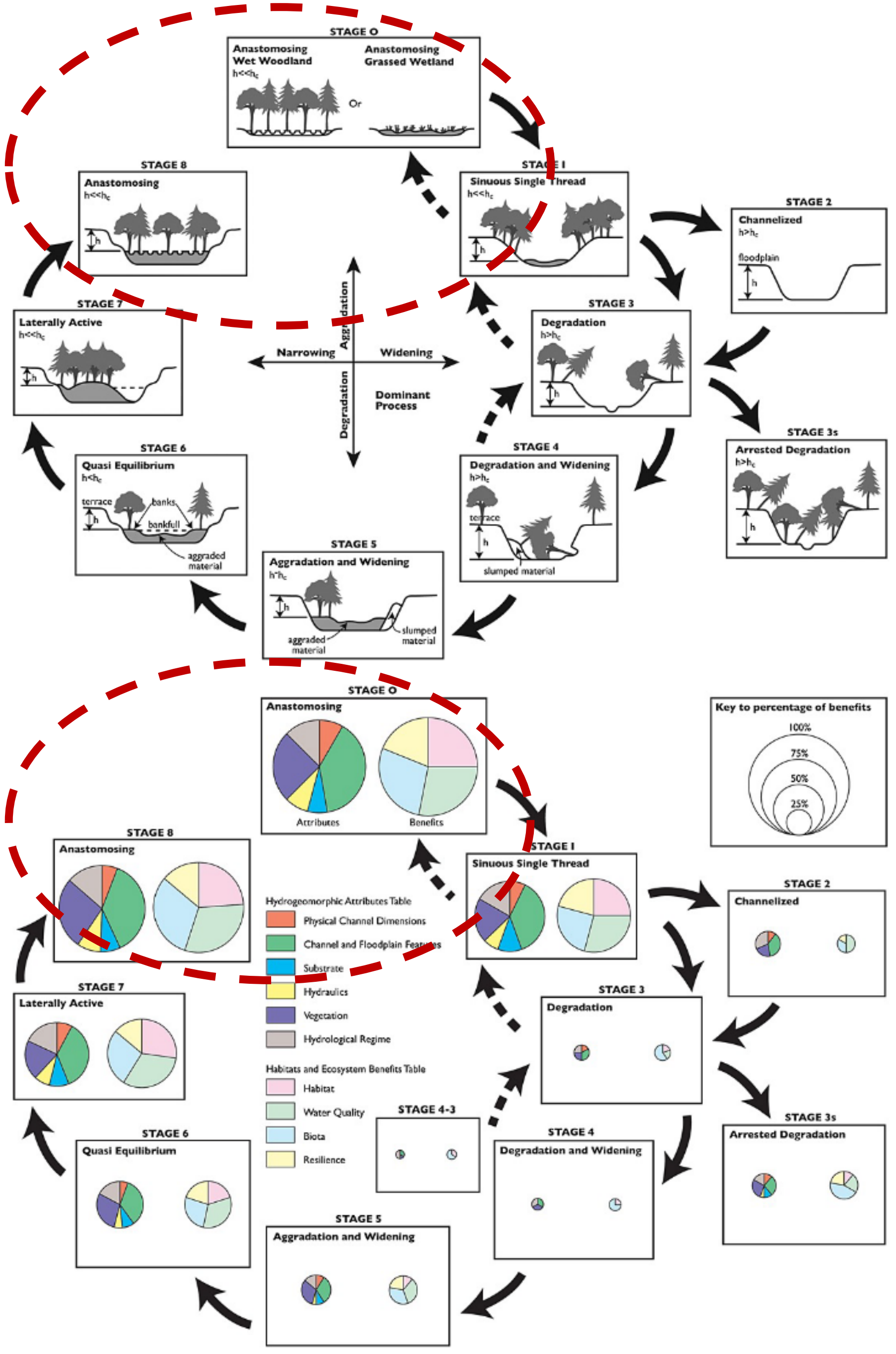
Valley-based connectivity restoration elements

Floodplain grading

Channel filling

High vegetation-based floodplain roughness

Diverse habitat features

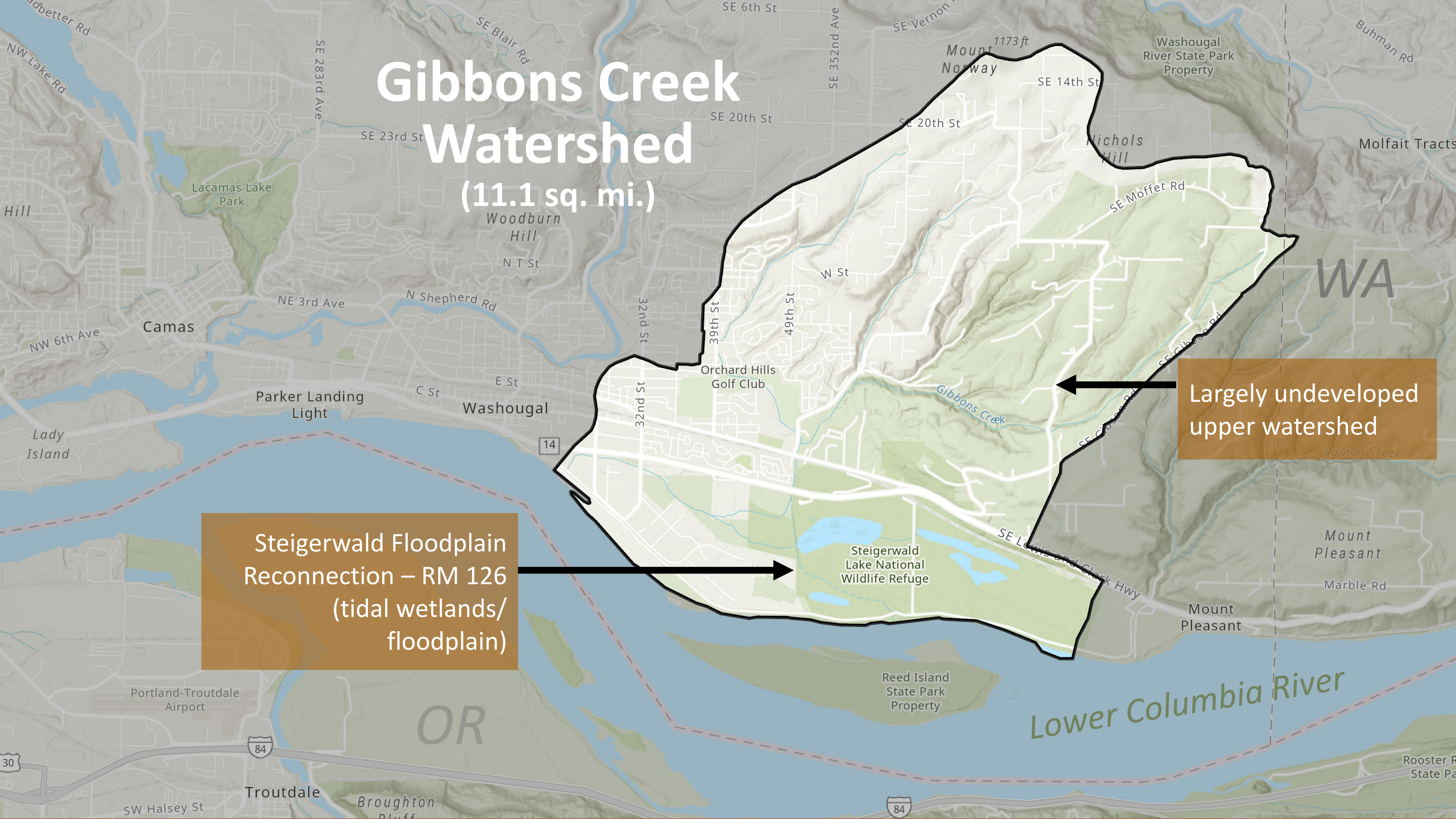


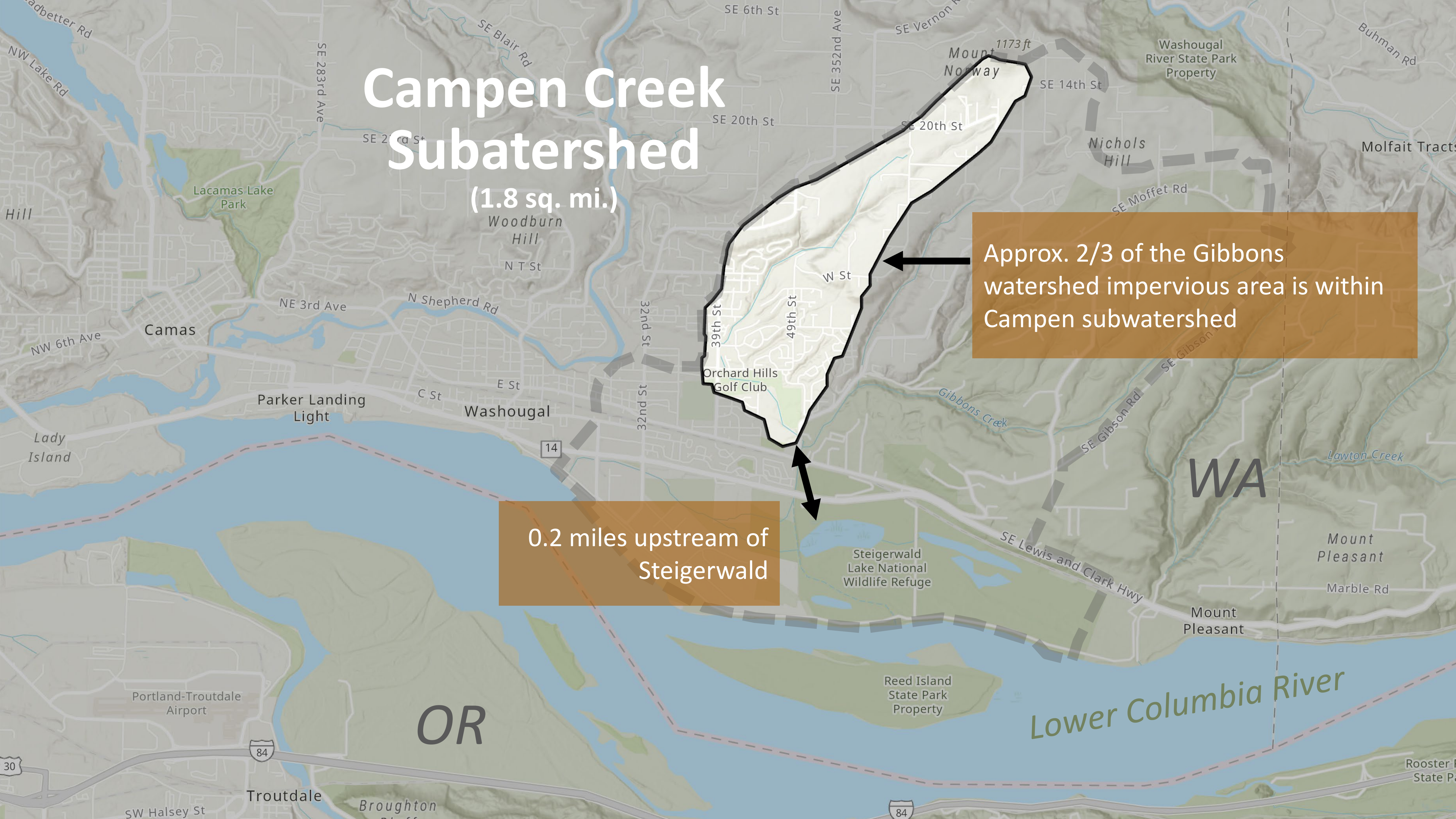
Stream Evolution Model (Cluer and Thorne 2014)

Stage 0 productivity

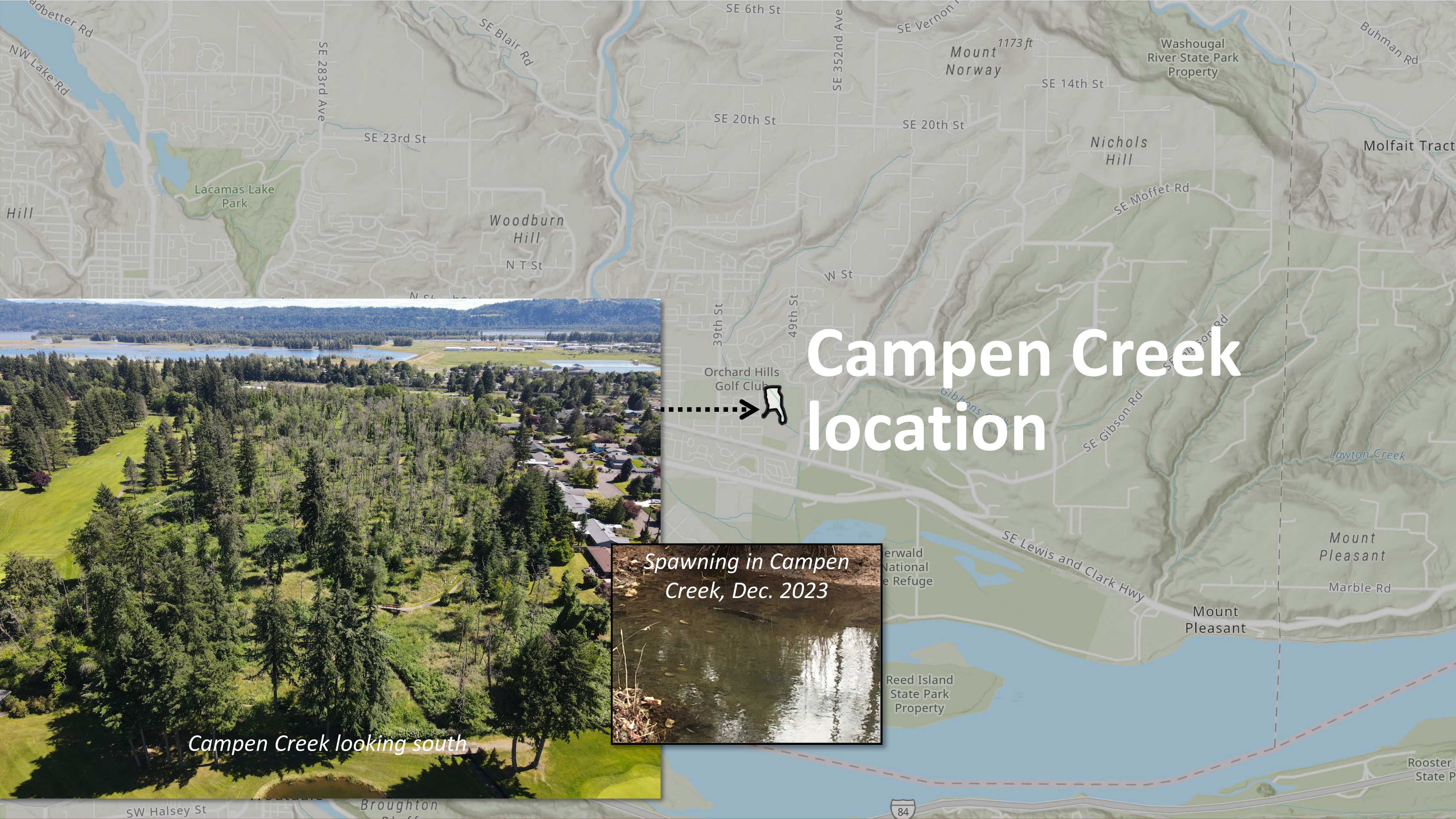
- 2016-2023 Whychus Creek
  - More cold water & sediment tolerant diatoms & algal biomass (P. Edwards, 2020)
  - Increased macroinvertebrate production (1.5x abundance, diversity) (Mathias Perle, 2019)

- 2020 - 2022 SF McKenzie River
  - 3x macroinvert. prod. / km valley length (Flitcroft, 2022)
  - Biomass density (kg/m2) reduction (fewer large bugs, more smaller ones), but overall increase due to larger wetted area


Gibbons Creek Watershed
(11.1 sq. mi.)
Largely undeveloped upper watershed
Steigerwald Floodplain Reconnection – RM 126 (tidal wetlands/ floodplain)
Steigerwald Lake National Wildlife Refuge
Gibbons Creek
Orchard Hills Golf Club
Washougal
Camas
Parker Landing Light
Lady Island
Lacamas Lake Park
Woodburn Hill
Mount Norway
1173 ft
Nichols Hill
Washougal River State Park Property
Molfait Tracts
WA
OR
Mount Pleasant
Reed Island State Park Property
Lower Columbia River
Portland-Troutdale Airport
Troutdale
Broughton Bluff
SE Lewis and Clark Hwy
SE Moffet Rd
SE 20th St
SE 14th St
SE 23rd St
SE 283rd Ave
SE 352nd Ave
SE Blair Rd
NW Lake Rd
NE 3rd Ave
NW 6th Ave
N Shepherd Rd
N T St
W St
E St
C St
32nd St
39th St
49th St
Marble Rd
Buhman Rd
SW Halsey St
14
84
30


Campen Creek Subatershed
(1.8 sq. mi.)
Approx. 2/3 of the Gibbons watershed impervious area is within Campen subwatershed
0.2 miles upstream of Steigerwald
NW Lake Rd
SE 283rd Ave
SE Blair Rd
SE 6th St
SE 352nd Ave
SE Vernon Rd
1173 ft
Mount Norway
SE 14th St
Washougal River State Park Property
Buhman Rd
SE 20th St
SE 20th St
Nichols Hill
Molfait Tracts
SE Moffet Rd
Lacamas Lake Park
Hill
Woodburn Hill
N T St
W St
49th St
39th St
NE 3rd Ave
N Shepherd Rd
32nd St
Camas
NW 6th Ave
Orchard Hills Golf Club
Parker Landing Light
C St
E St
Washougal
32nd St
14
Gibbons Creek
SE Gibson Rd
Lady Island
Lawton Creek
WA
SE Lewis and Clark Hwy
Steigerwald Lake National Wildlife Refuge
Mount Pleasant
Marble Rd
Mount Pleasant
Reed Island State Park Property
Lower Columbia River
Portland-Troutdale Airport
OR
84
30
Troutdale
SW Halsey St
84

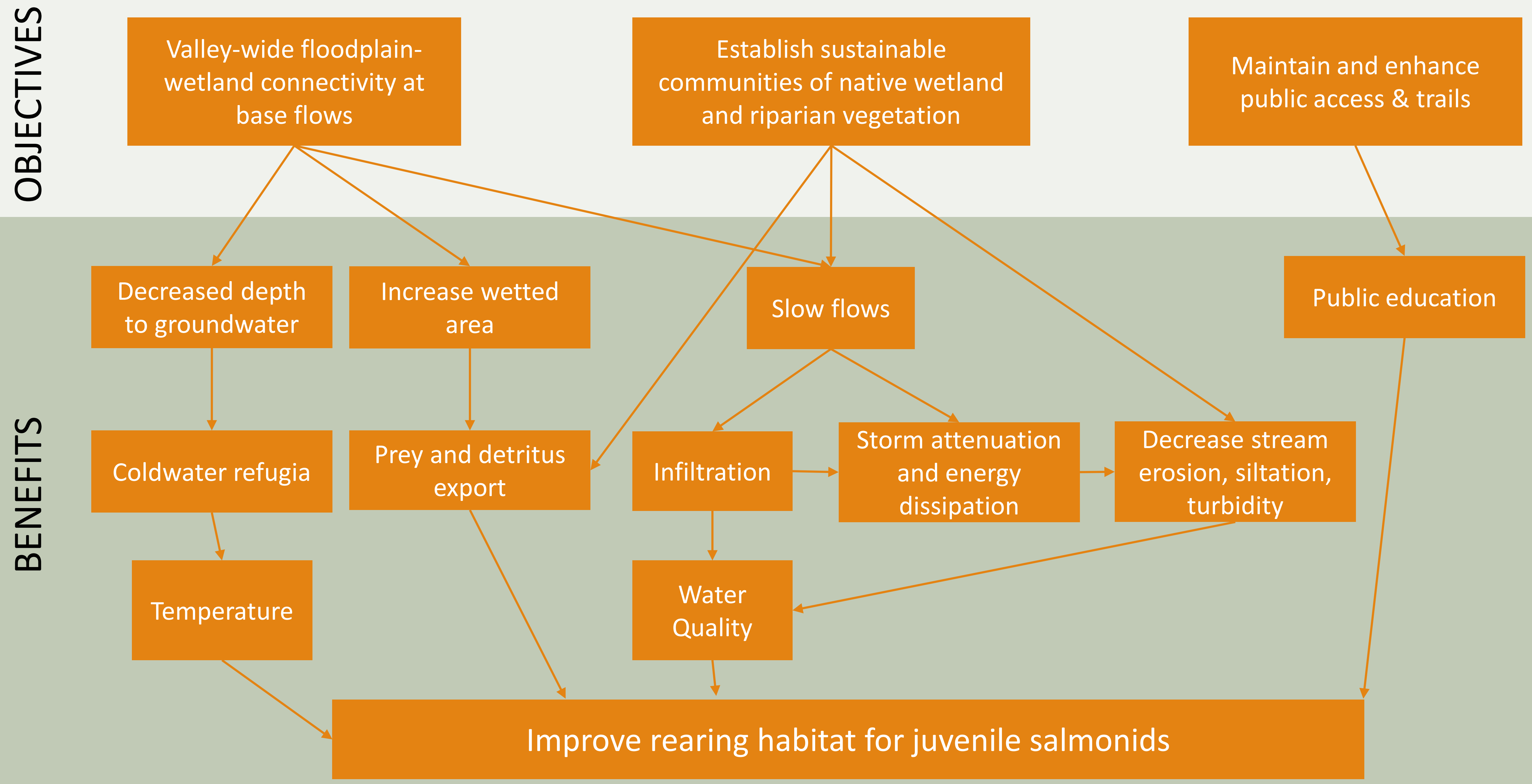
Campen Creek location



Campen Creek looking south

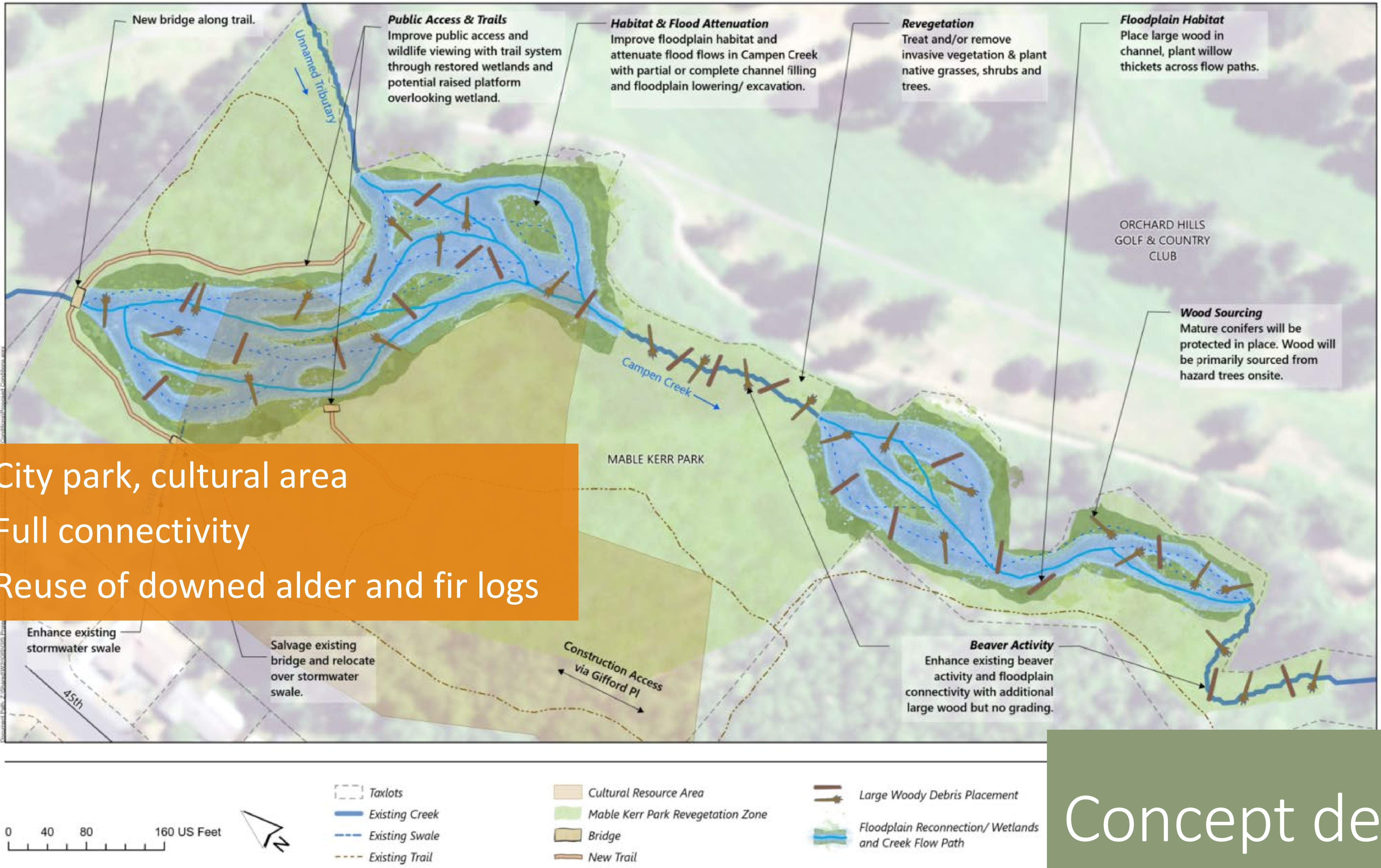
Spawning in Campen Creek, Dec. 2023

Stage 0 target conceptual model – Campen Creek



Existing condition

Future condition



City park, cultural area

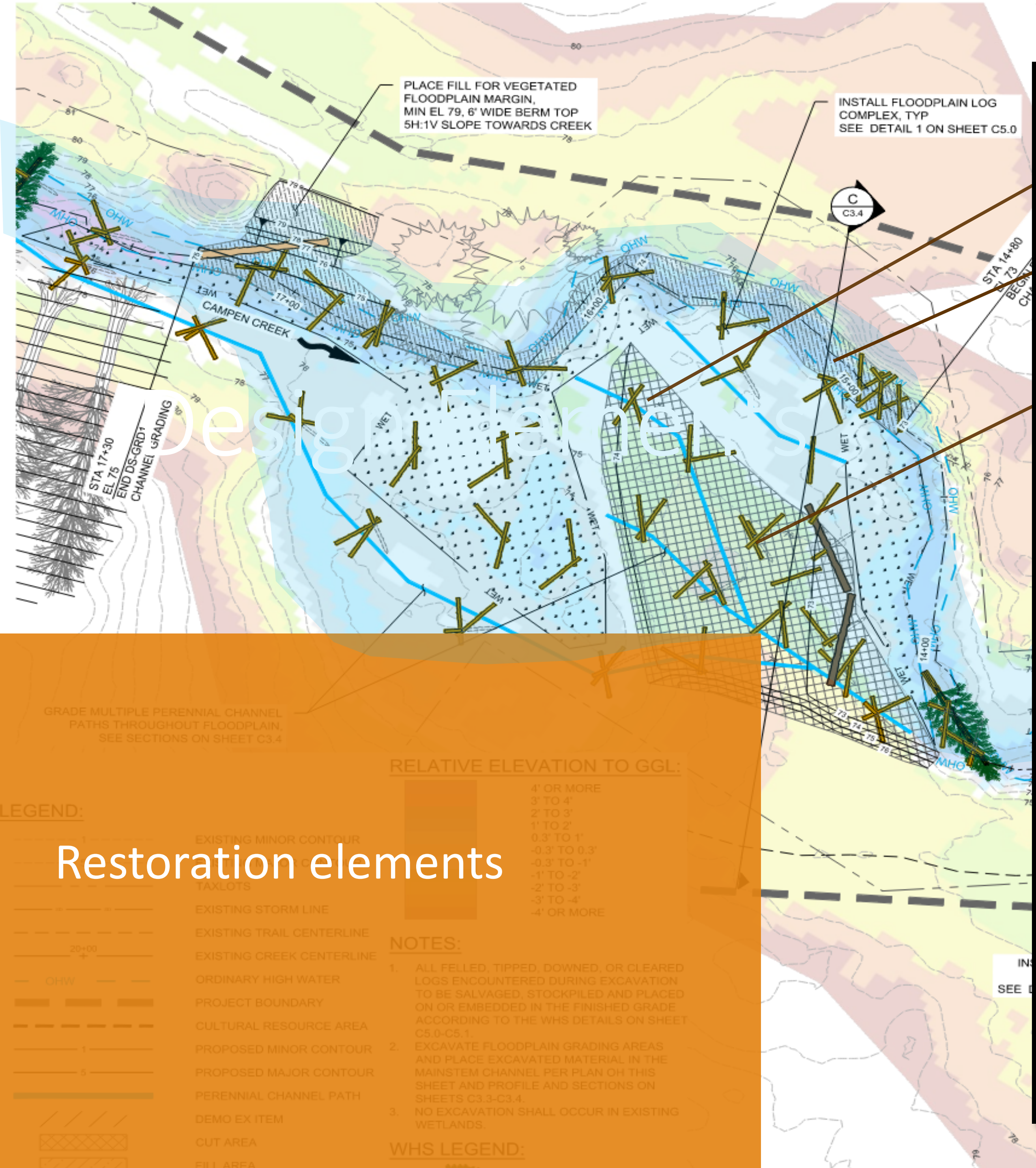
Full connectivity

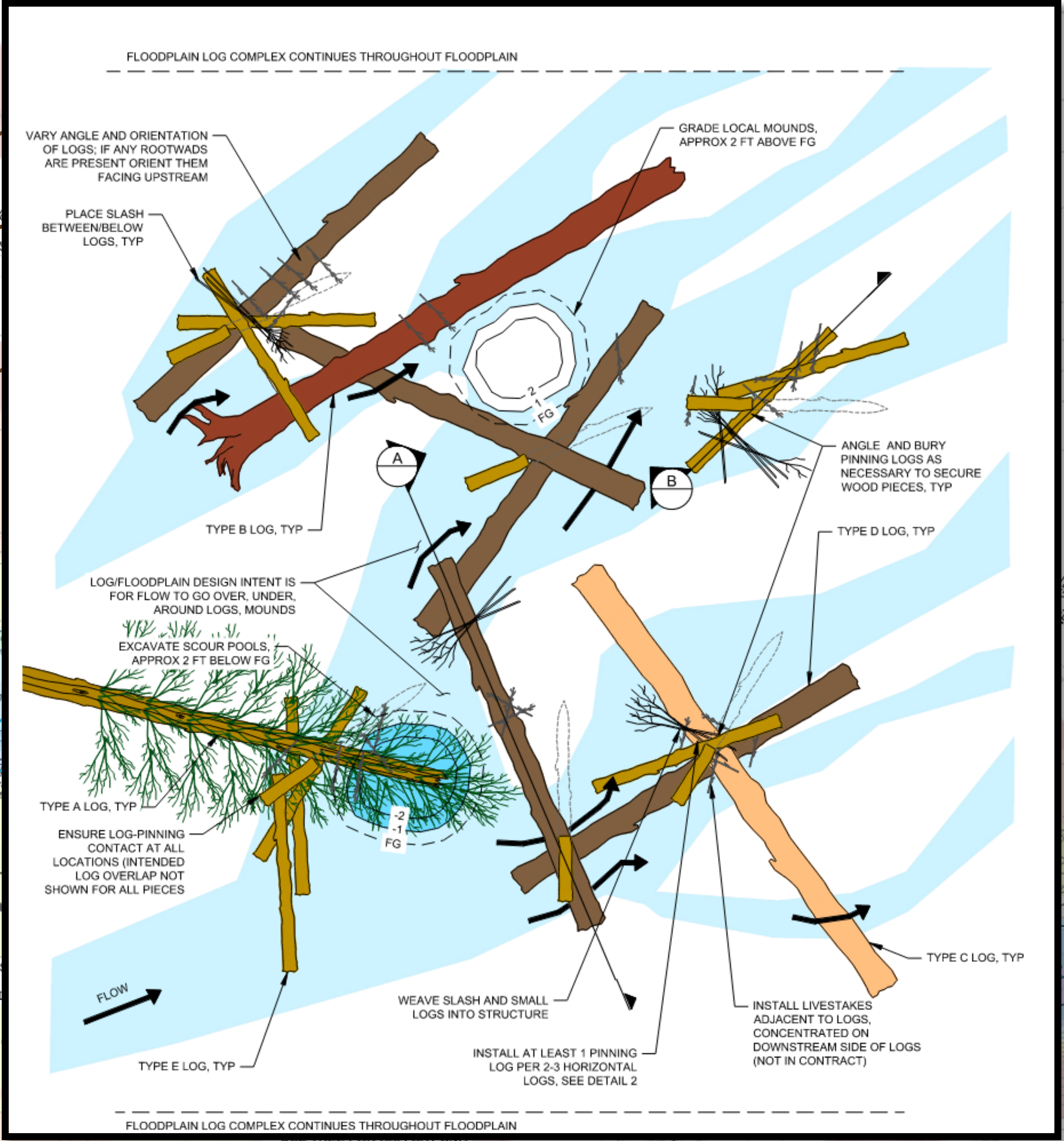
Reuse of downed alder and fir logs

Concept design

FINAL DESIGN
JAN 2025

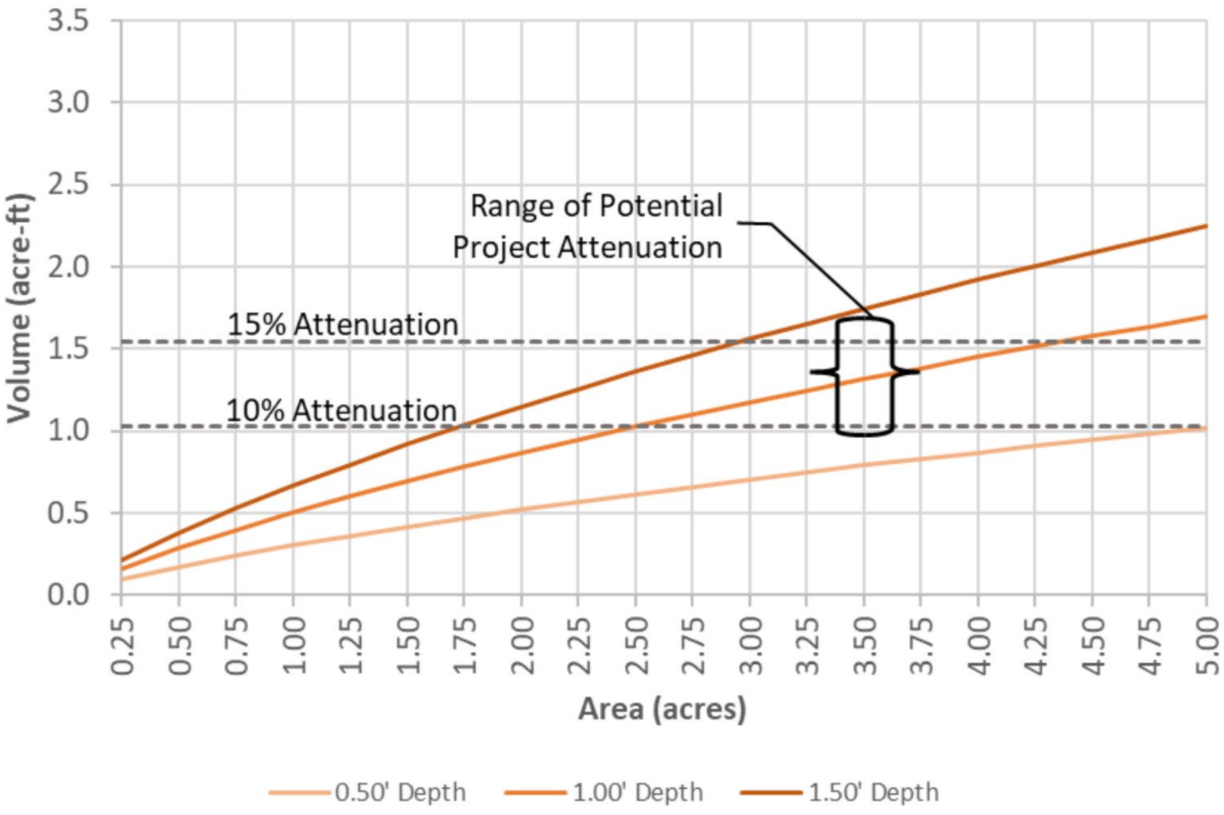
Design Elements

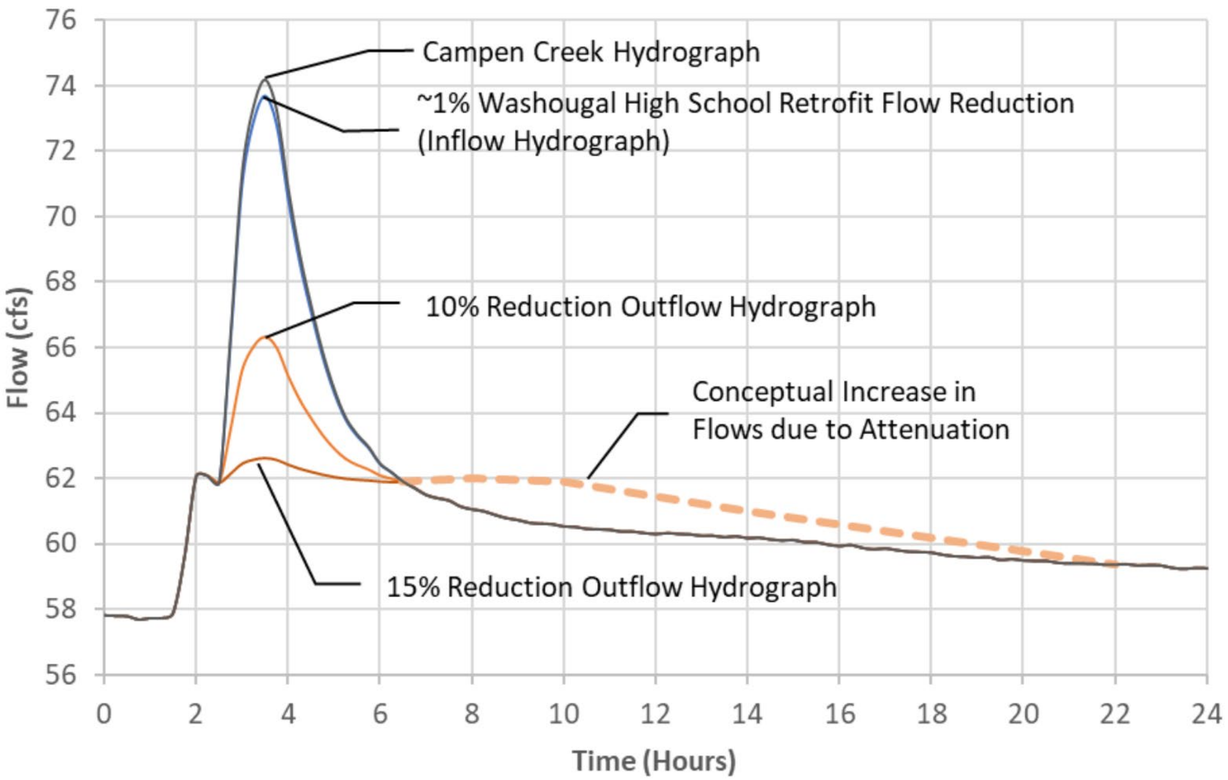




Restoration elements

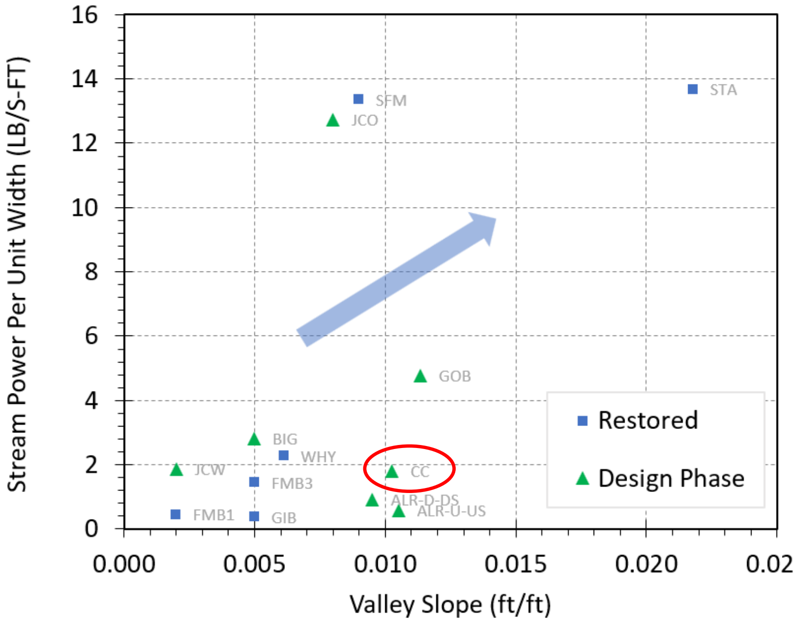
Flow Attenuation

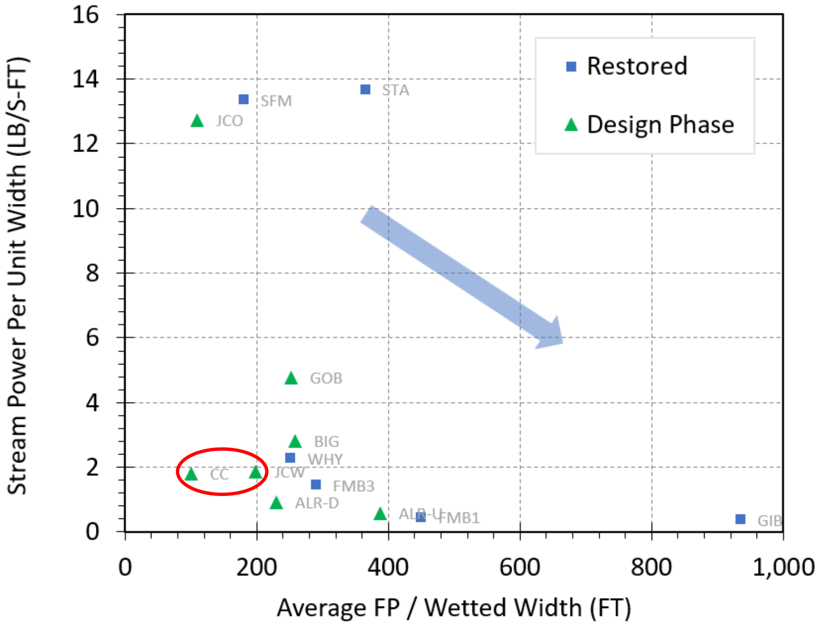


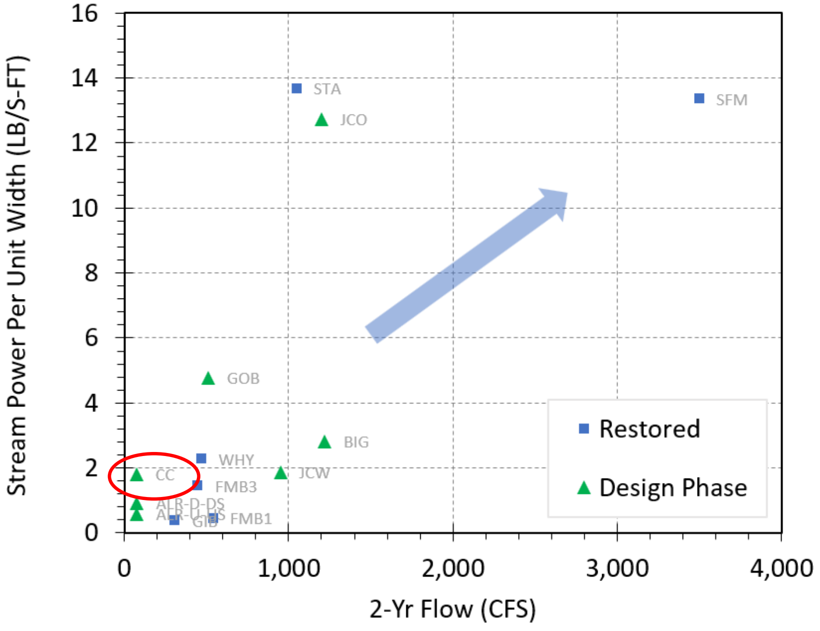


Stage 0 design in small creek systems

Are we reducing streampower below beneficial thresholds?







Summary & recommendations

- Experiment & monitor (streampower, attenuation)
- For LCRE future climates… reduce uncertainty + **maximize inefficiencies**
- Immediate valley reset important when relying on vegetation

Thank you sponsors & partners

Lower Columbia Estuary Partnership

WASHINGTON STATE
Recreation and Conservation Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

City of Washougal

Selected citations

Rossi et al., 2024. Foodscapes for salmon and other mobile consumers in river networks, BioScience, Volume 74, Issue 9, September 2024, Pages 586–600, https://doi.org/10.1093/biosci/biae064+

Flitcroft, R. 2024. Resetting Oregon's Floodplains to Rehabilitate Native Fish Habitats. Article in Science Findings, US Department of Agriculture, USFS Pacific Northwest Research Station, 264: March 2024.

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Roegner GC, Johnson GE (2023) Export of macroinvertebrate prey from tidal freshwater wetlands provides a significant energy subsidy for outmigrating juvenile salmon. PLoS ONE 18(3):e0282655. https://doi.org/10.1371/journal.pone.0282655