Willow Creek Daylight Alternatives Update

Edmonds City Council Meeting

Oct. 22, 2019

David Cline, PE, CFM

Shannon & Wilson Inc.

Paul Schlenger, Fish Biologist

Environmental Science Associates




Willow Creek Daylight Update

Willow Creek Daylighting - Previous Studies by Shannon & Wilson Inc.

- Early Feasibility (2013)
- Cultural Resources Review (2014)
- Geotechnical Assessment (2014)
- Contaminated Soils Review (2015)
- Topographic Survey Marsh, Marina Beach Park, Unocal, BNSF (2015)

Willow Creek Daylight Update

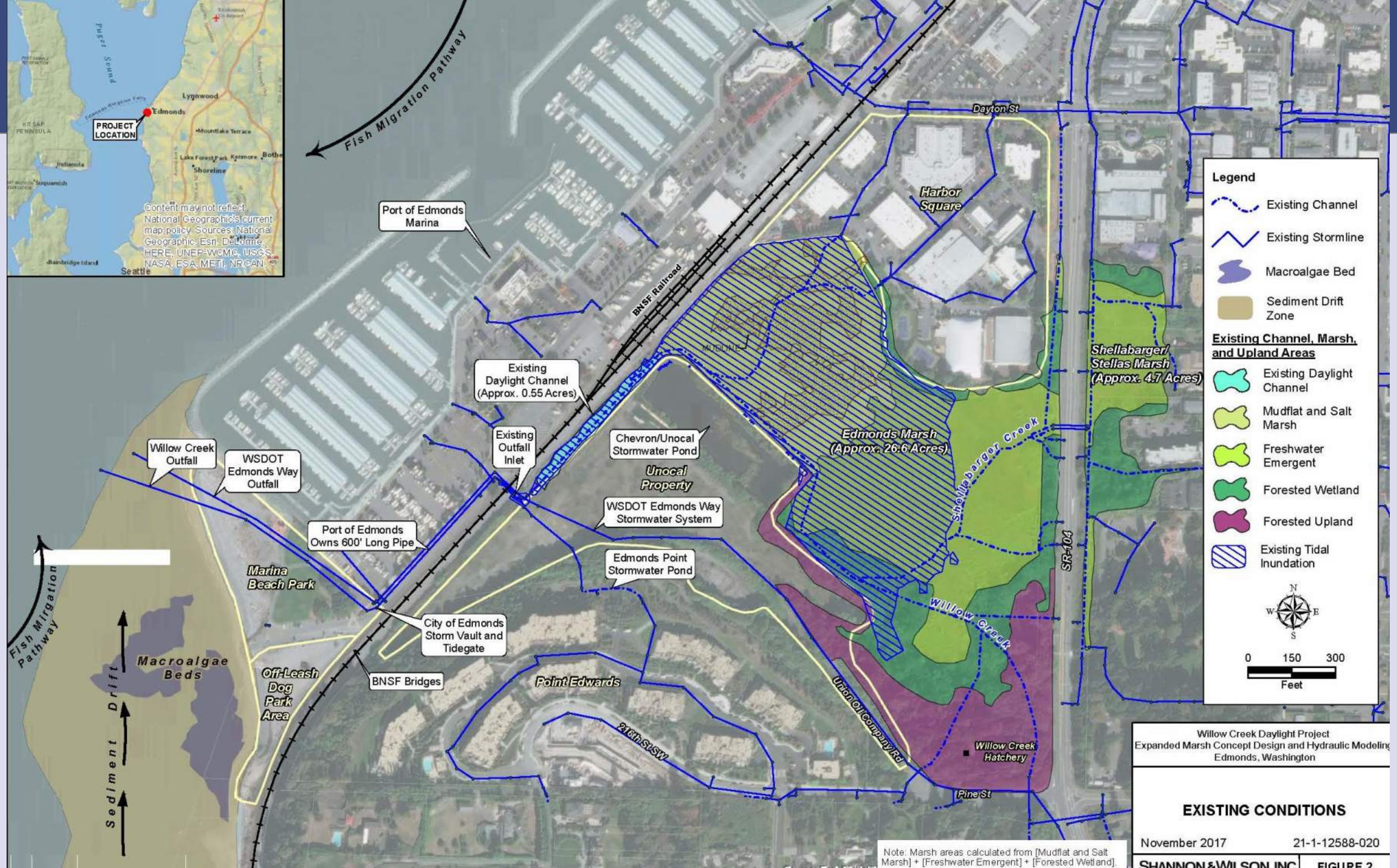
Willow Creek Daylighting - Previous Studies by Shannon & Wilson Inc.

- Marina Beach Park Master Plan Support (2015)
- Final Feasibility (2015)
- Harbor Square Outfall Design (2015)
- Harbor Square and Shellabarger Marsh Wetland Delineations (2015)

Willow Creek Daylight Update

2017 – 2019 Expanded Alternatives Analysis Tasks

- Evaluate Daylight Alignment Alternatives
- Evaluate Improving Daylight In-Channel Fish Habitat Conditions
- Evaluate Extreme Tides, Storm Surge and Sea Level Rise Flooding
- Perform Marsh Water & Sediment Quality Sampling

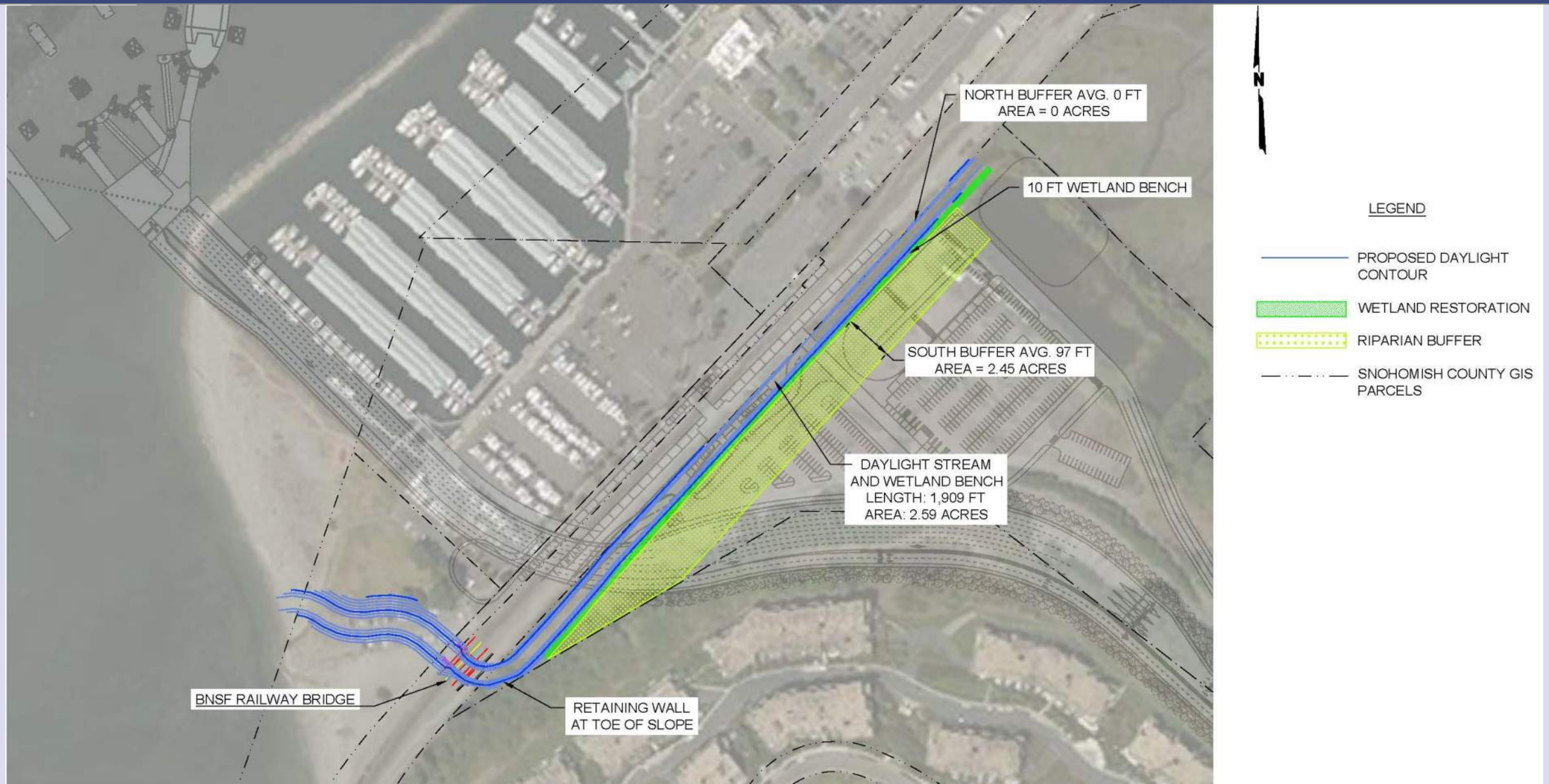

PROJECT LOCATION
Lynnwood
Edmonds
Mountlake Terrace
Lake Forest Park
Kenmore
Shoreline
Indianola
Suquamish
Bainbridge Island
Seattle
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN
Fish Migration Pathway
Port of Edmonds Marina
Dayton St
Harbor Square
BNSF Railroad
MUDLINE
Existing Daylight Channel (Approx. 0.55 Acres)
Existing Outfall Inlet
Chevron/Unocal Stormwater Pond
Unocal Property
Willow Creek Outfall
WSDOT Edmonds Way Outfall
WSDOT Edmonds Way Stormwater System
Port of Edmonds Owns 600' Long Pipe
Edmonds Point Stormwater Pond
Edmonds Marsh (Approx. 26.6 Acres)
Shellabarger Creek
Shellabarger/ Stellas Marsh (Approx. 4.7 Acres)
SR-104
Willow Creek
Marina Beach Park
City of Edmonds Storm Vault and Tidegate
BNSF Bridges
Macroalgae Beds
Sediment Drift
Off-Leash Dog Park Area
Point Edwards
216th St SW
Union Oil Company Rd
Willow Creek Hatchery
Pine St
Legend
Existing Channel
Existing Stormline
Macroalgae Bed
Sediment Drift Zone
Existing Channel, Marsh, and Upland Areas
Existing Daylight Channel
Mudflat and Salt Marsh
Freshwater Emergent
Forested Wetland
Forested Upland
Existing Tidal Inundation
N
W
E
S
0
150
300
Feet
Note: Marsh areas calculated from [Mudflat and Salt Marsh] + [Freshwater Emergent] + [Forested Wetland].
Willow Creek Daylight Project
Expanded Marsh Concept Design and Hydraulic Modeling
Edmonds, Washington
EXISTING CONDITIONS
November 2017
21-1-12588-020
SHANNON & WILSON, INC.
FIGURE 2

Existing Conditions & Site Constraints

Existing Conditions & Site Constraints

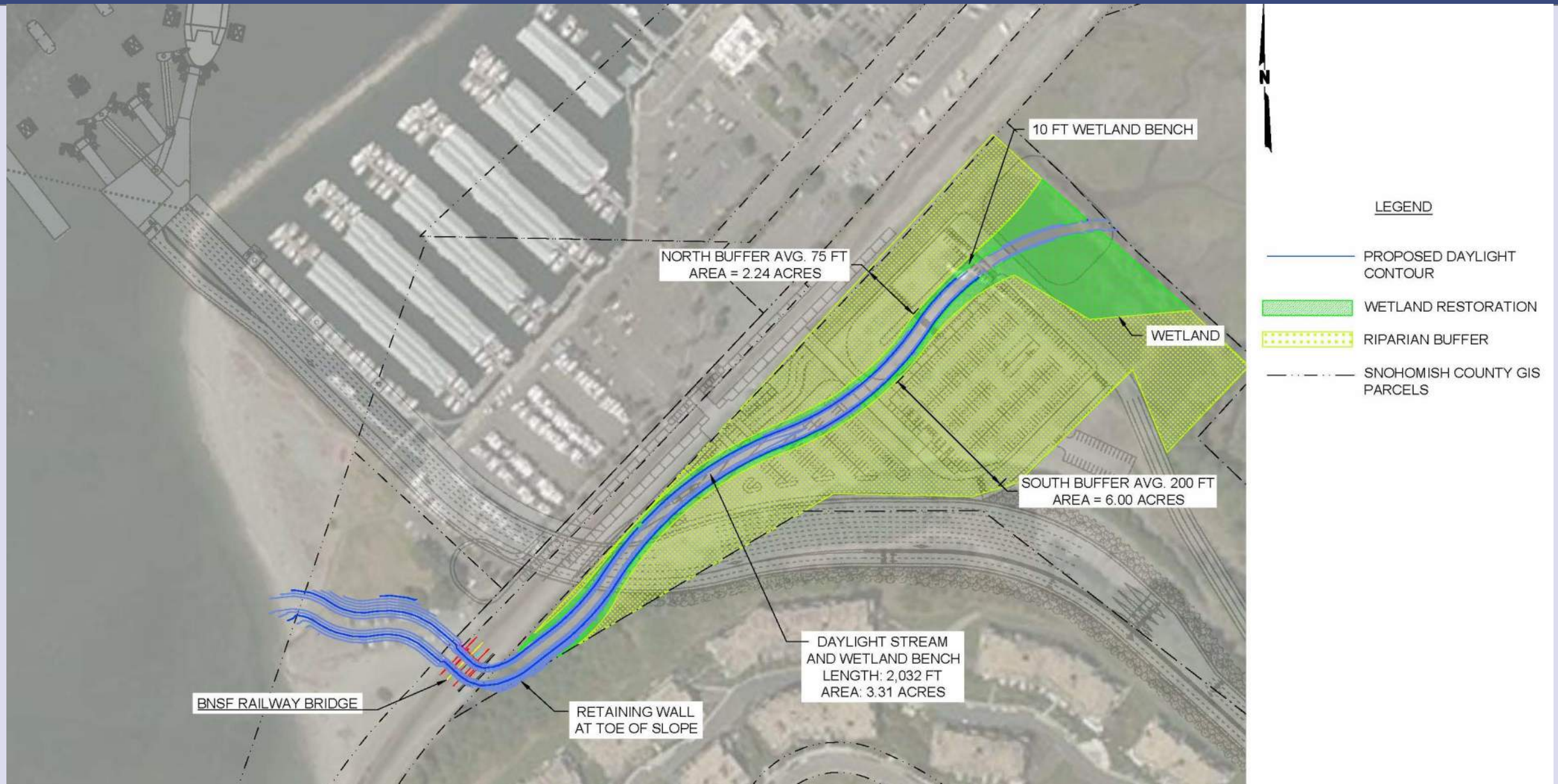
Existing Conditions & Site Constraints

Daylight Alignment – Alt. 1



Daylight Alignment – Alt. 2

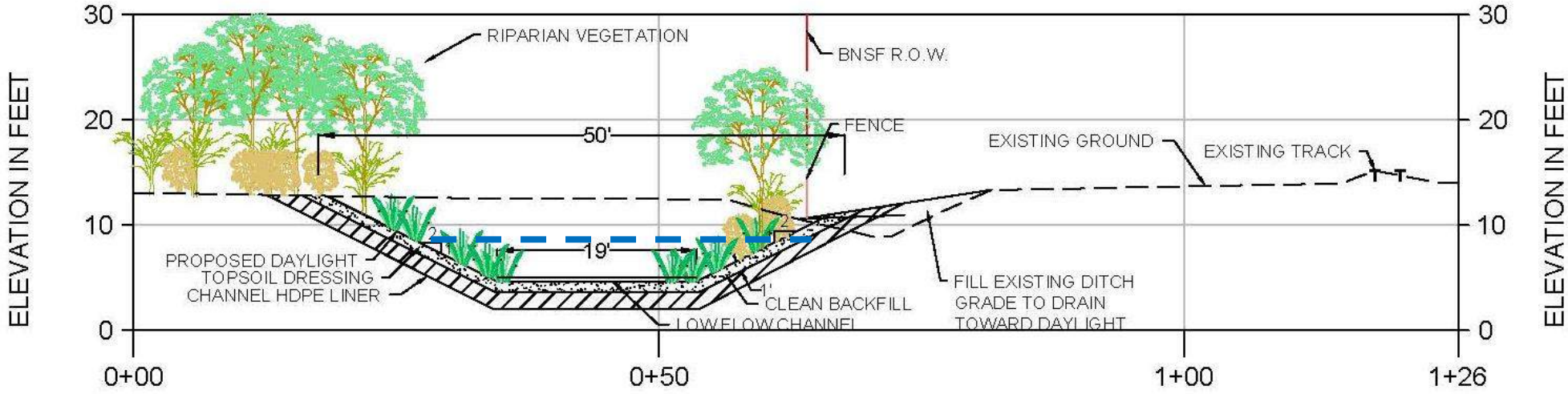
Daylight Alignment – Alt. 3



Daylight Alignment – Alt. 4

Original Cross Section Cross Sections – Improve Habitat

- Modeled Alt. 1 & Alt. 4
- Shallow Depths < 0.5ft
- High Velocity > 1fps
- Flood Elevations Near BNSF
- Minor Differences in Hydraulics between Alts.



TYPICAL DAYLIGHT CHANNEL SECTION - WITHOUT HABITAT BENCHES

Additional Modeling Alternatives

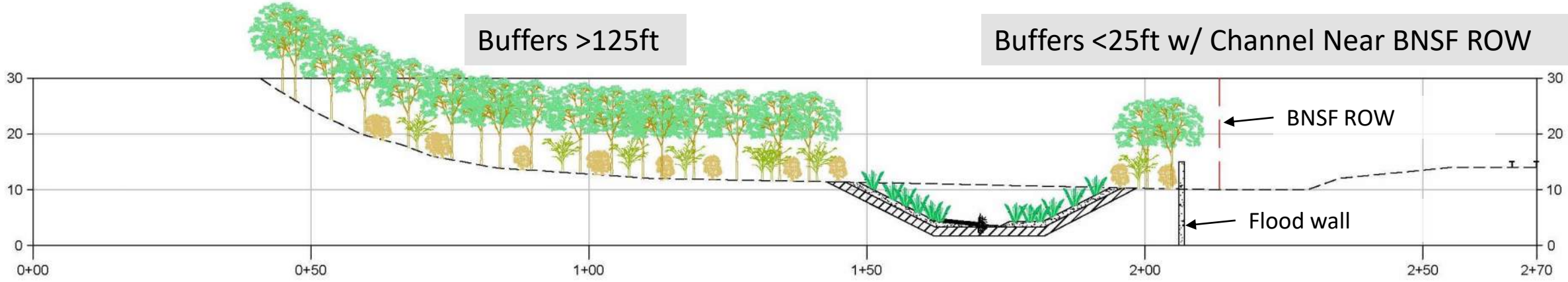
2018 Tasks

- Additional Modeling Alternatives
  - Modified Channel Cross Section w/ Inset Channel / Marsh Benches
  - Add Habitat Features - Large Woody Debris and Denser Riparian Vegetation for (Roughness)
  - Evaluate Extreme Tide, Storm Surge, Sea Level Rise
  - Evaluate Flood Mitigation Structure – Tidegates, Berms & Floodwalls

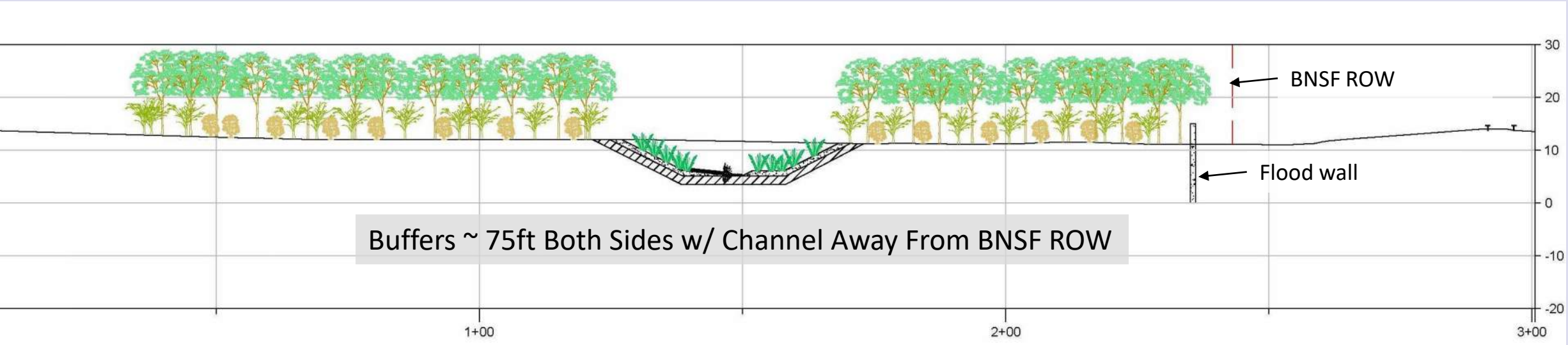
Alt 6. Modified Cross Sections – Buffers

Buffers >125ft

Buffers <25ft w/ Channel Near BNSF ROW

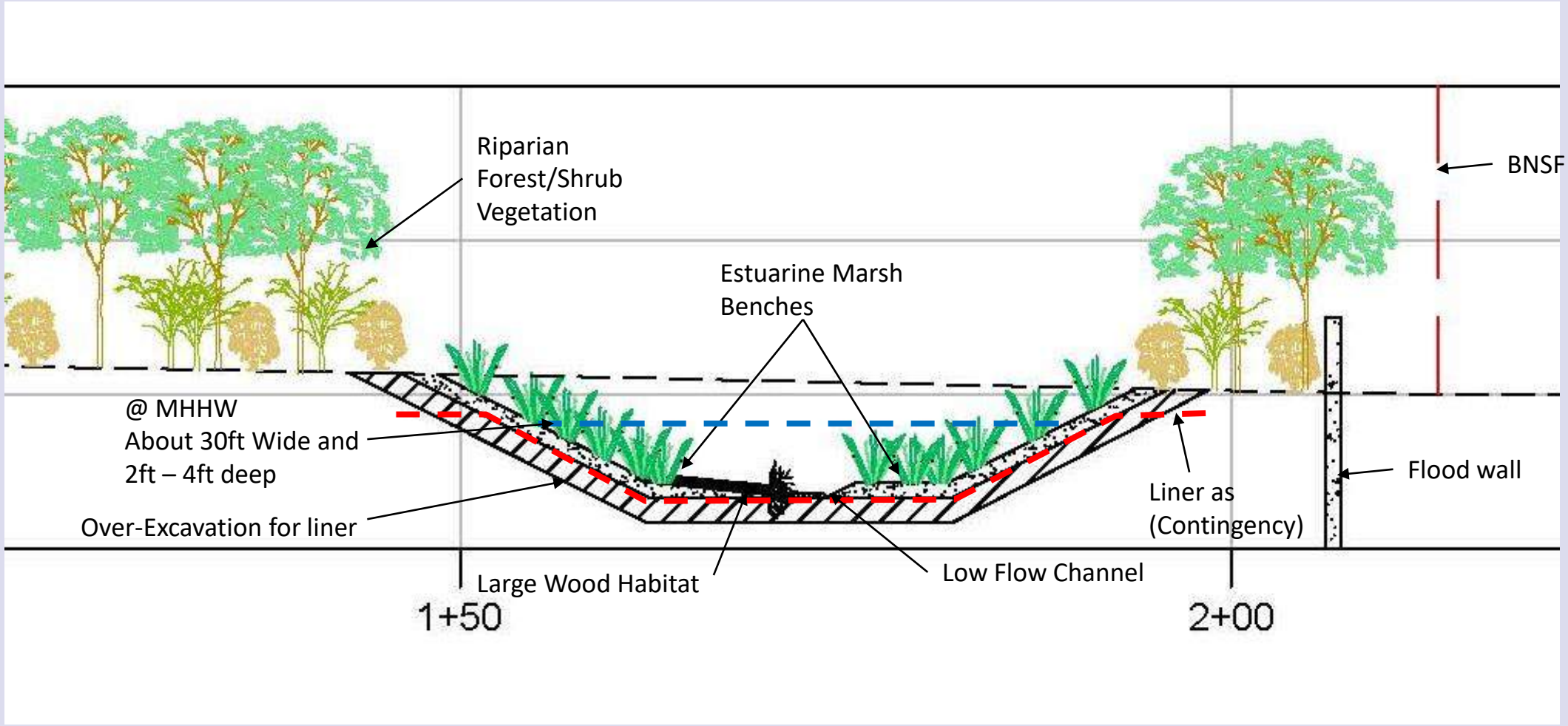


TYPICAL DAYLIGHT CHANNEL SECTION - WITH HABITAT
BENCHES AND LARGE WOODY DERIS



Buffers ~ 75ft Both Sides w/ Channel Away From BNSF ROW

Modified Cross Section Elements



Contaminated Soils – Liners, Mixing, Soil Management

- **<u>Liner is a Contingency Item for Contaminated Soils / Groundwater</u>**
- Used to Isolate Stream Flow from Contamination
- HDPE and Clay Liner Applications in Restoration Settings

Horse Creek – Bothell WA

Blue River – Breckenridge CO

Contaminated Soils – Liners, Mixing, Soil Management

- Soil Management
- Mixing
- Capping
- Off Site Disposal

Duwamish Gardens– Tukwila WA

Smith Island – Snohomish County WA

Habitat Spring Tides, King Tides & Storm Surge

Habitat Spring Tides

Base Stream Flows

King Tides

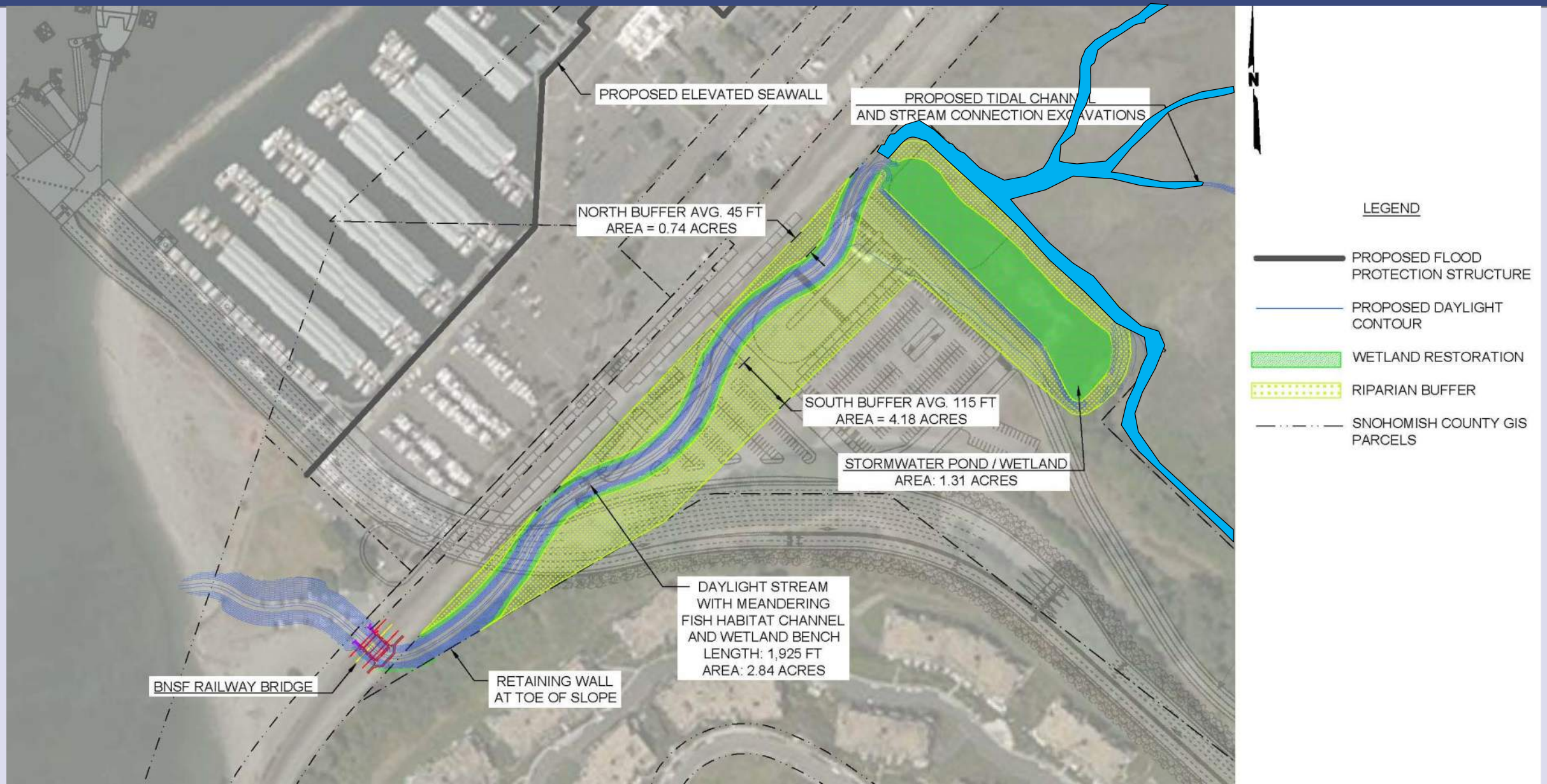
Astronomical / Stillwater / Annual

Storm Surge

Low Pressure / Wind Surge / Wind Waves / Semi-Annual

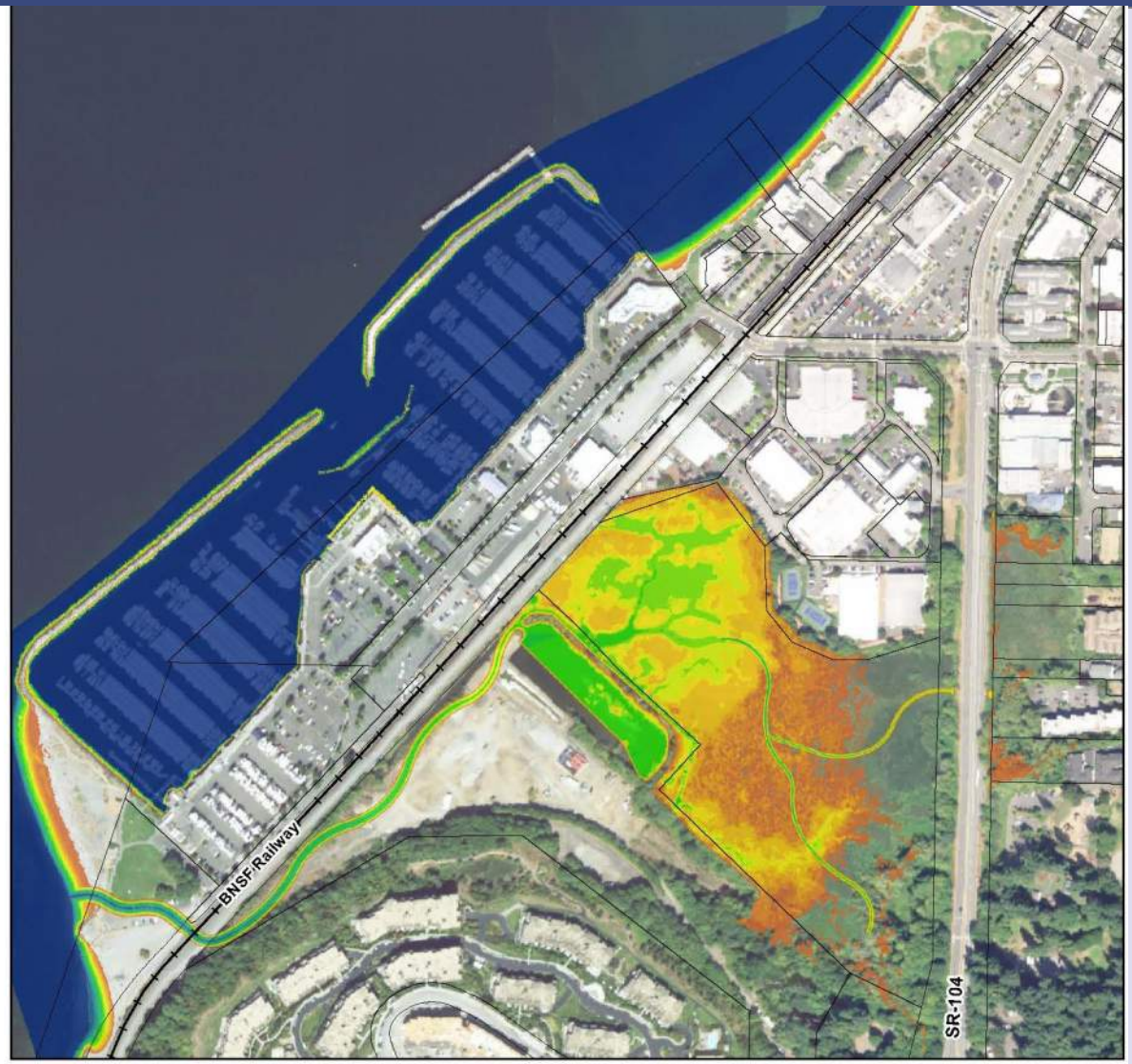
- Habitat Spring Tides and Stream Flows
- King Tides with Base Stream Flows
- Storm Surge w/ 2007 Flood Flows

Daylight Alignment – Alt. 5
(Channel Only – No Flood Mitigation)



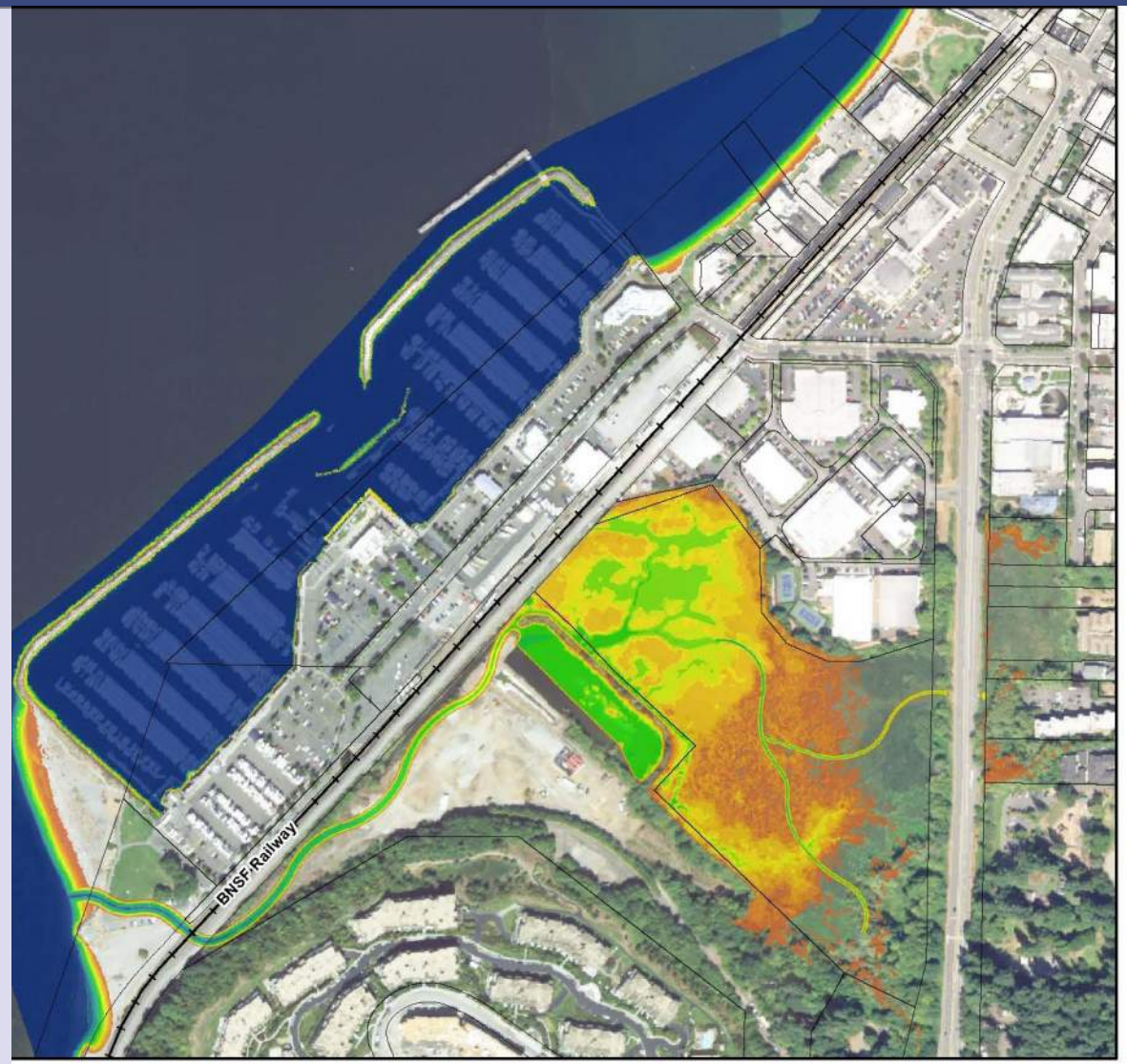
Alts. 5, 6 and 7 – Daylight Channel Only
Habitat - Late Spring / Early Summer

EXISTING CONDITIONS

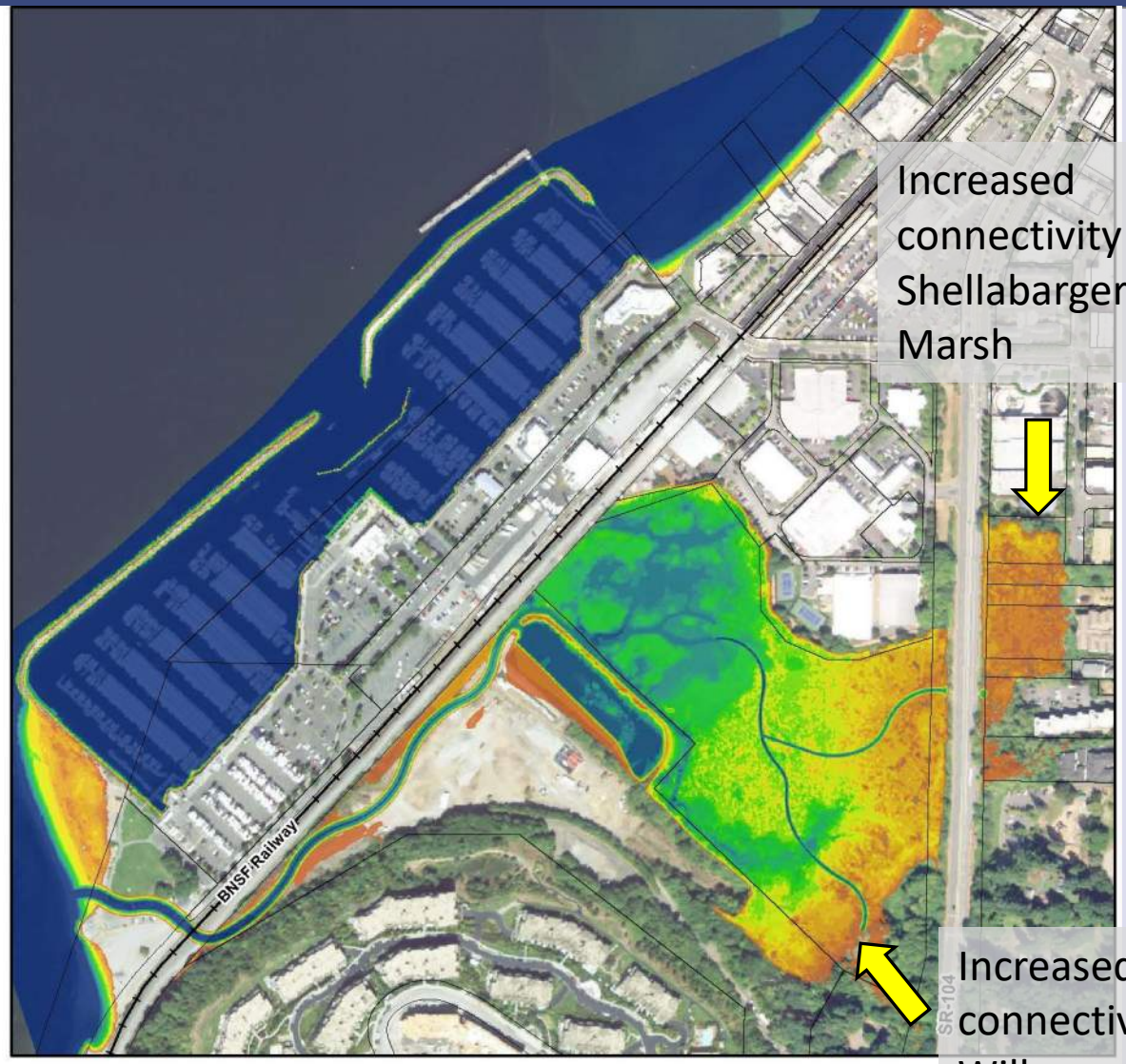


ALTERNATIVES 5, 6, 7
HABITAT SPRING/EARLY SUMMER CONDITIONS

Alts. 5, 6 and 7 – Daylight Channel Only
Habitat - Late Spring / Early Summer w/ SLR 2100



ALTERNATIVES 5, 6, 7
HABITAT SPRING/EARLY SUMMER CONDITIONS

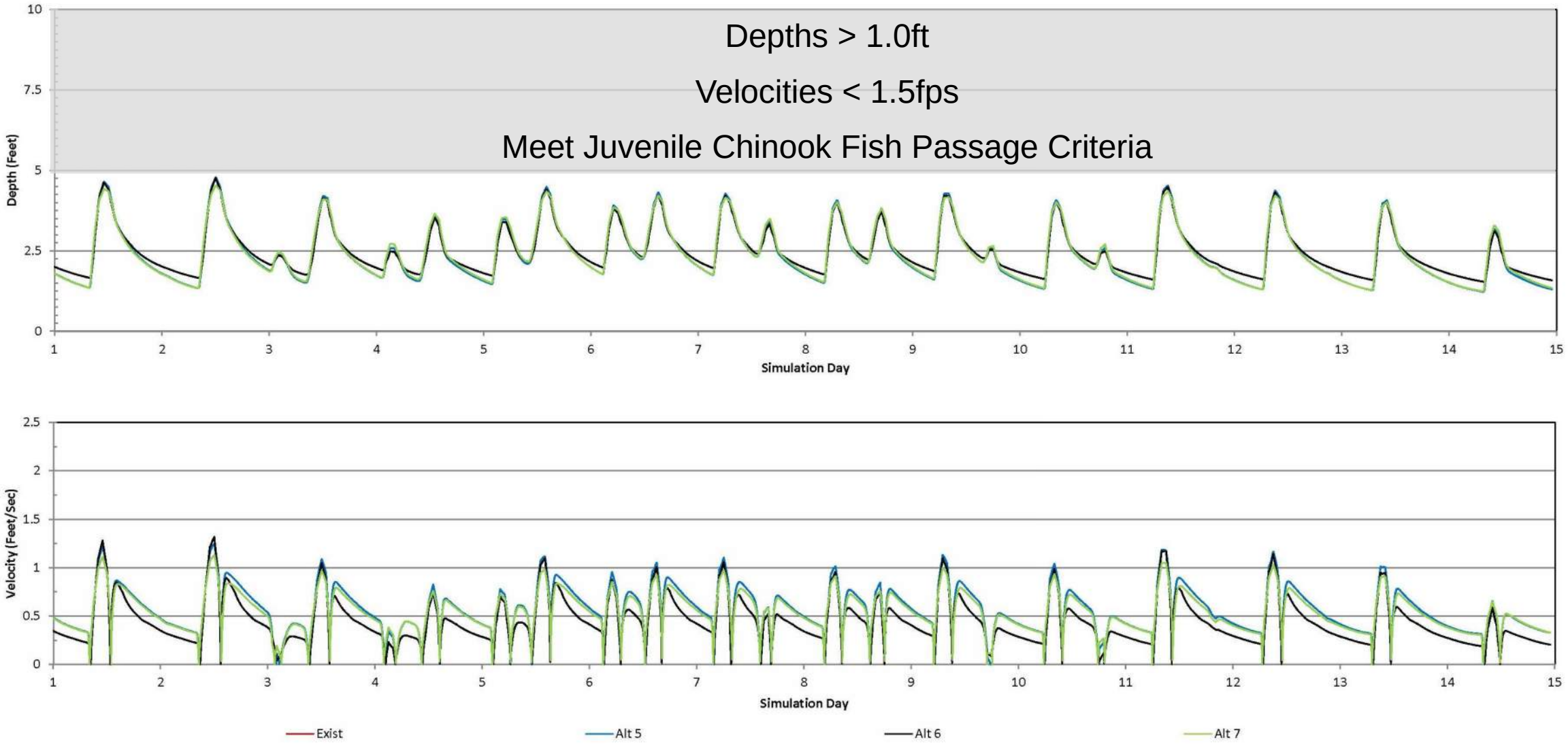


ALTERNATIVES 5, 6, 7
HABITAT SPRING/EARLY SUMMER CONDITIONS W/ SLR 2100

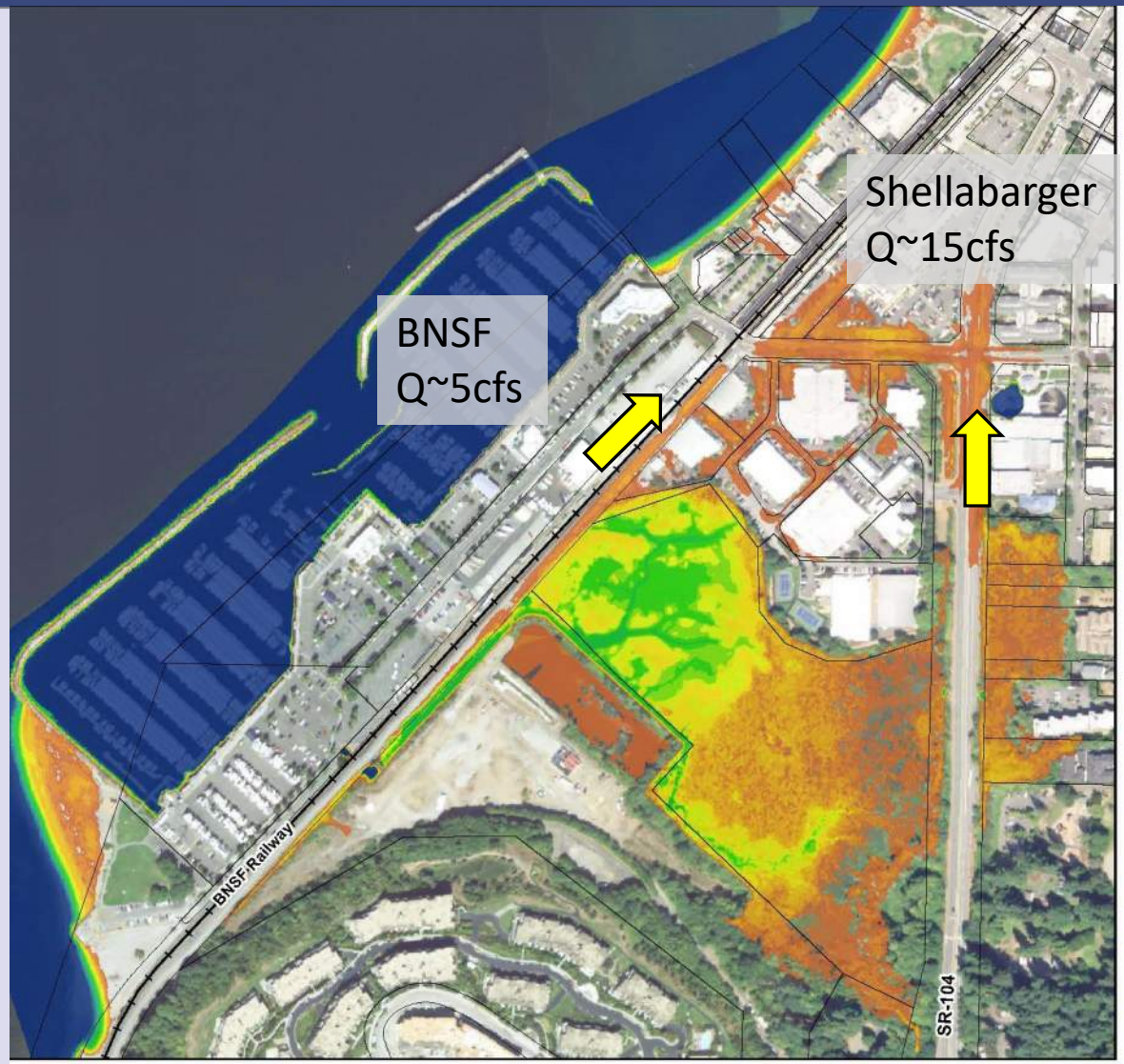
Increased connectivity Shellabarger Marsh

Increased connectivity Willow Creek

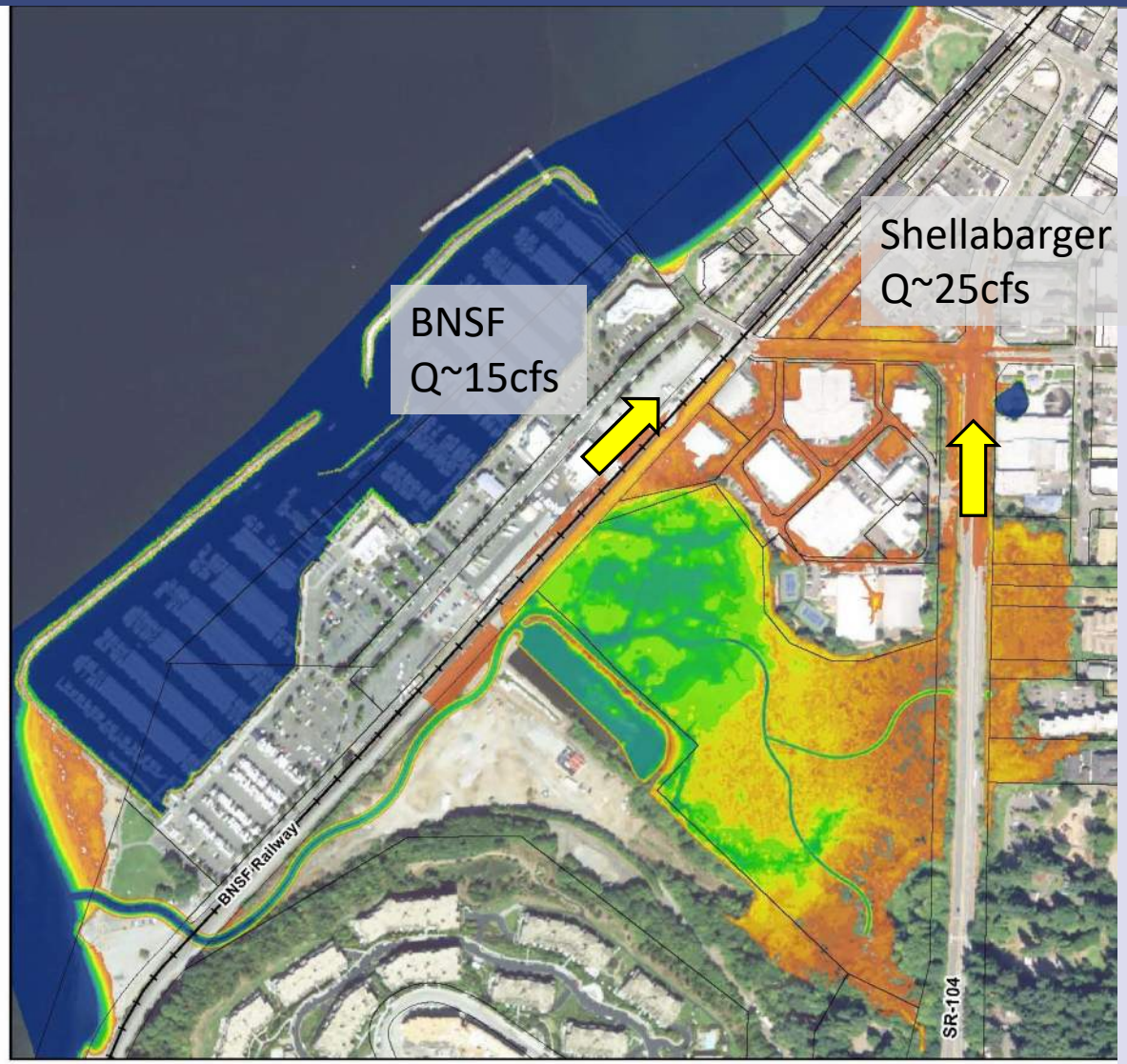
Updated Cross Section Cross Sections Improve Fish Habitat



Alt. 5 – Daylight Channel Only
Storm Surge & 2007 Flood Flows

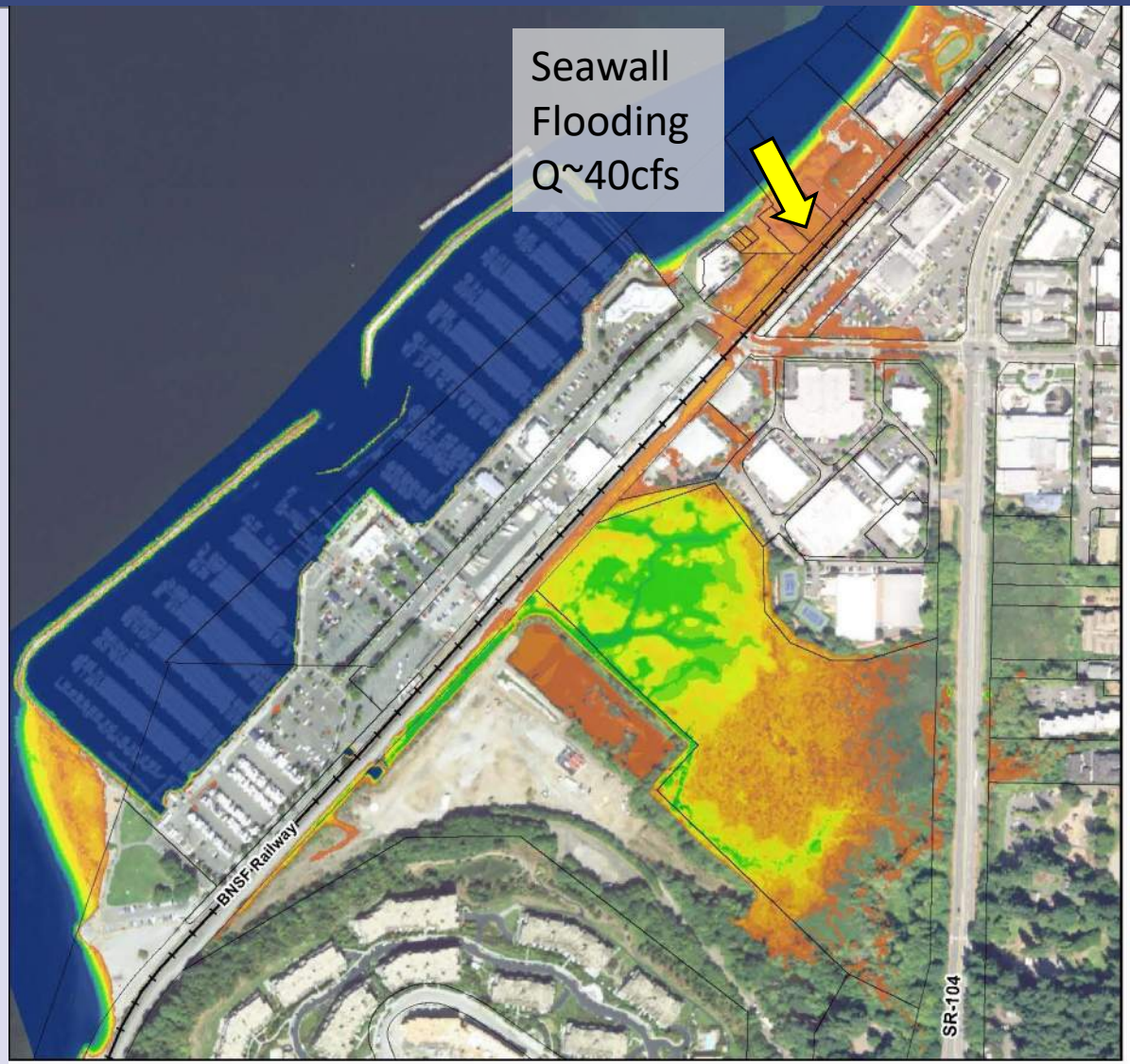


EXISTING CONDITIONS

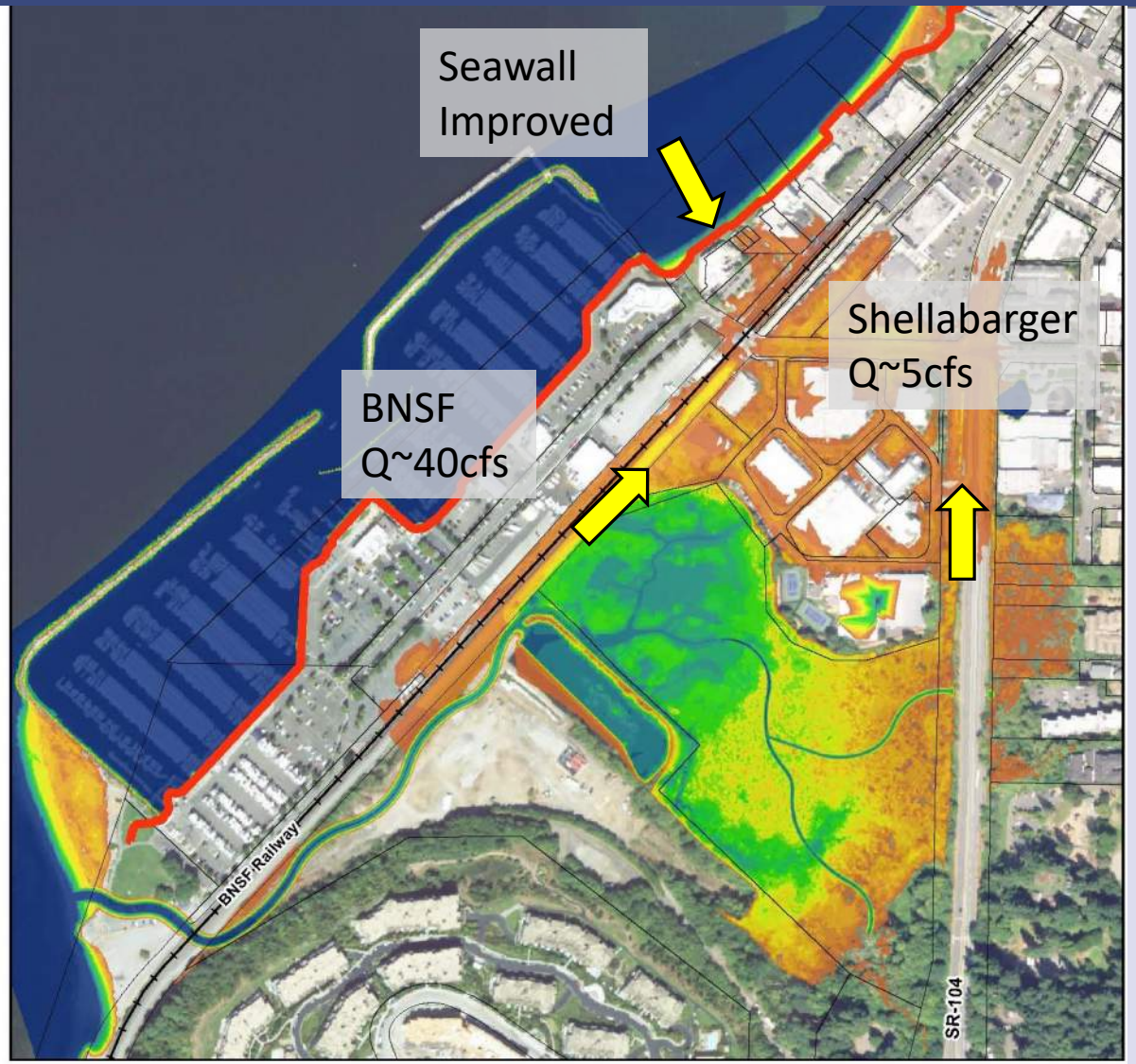


ALTERNATIVE 5
DAYLIGHT CHANNEL ONLY

Alt. 5 – Daylight Channel Only
King Tides & SLR 2100

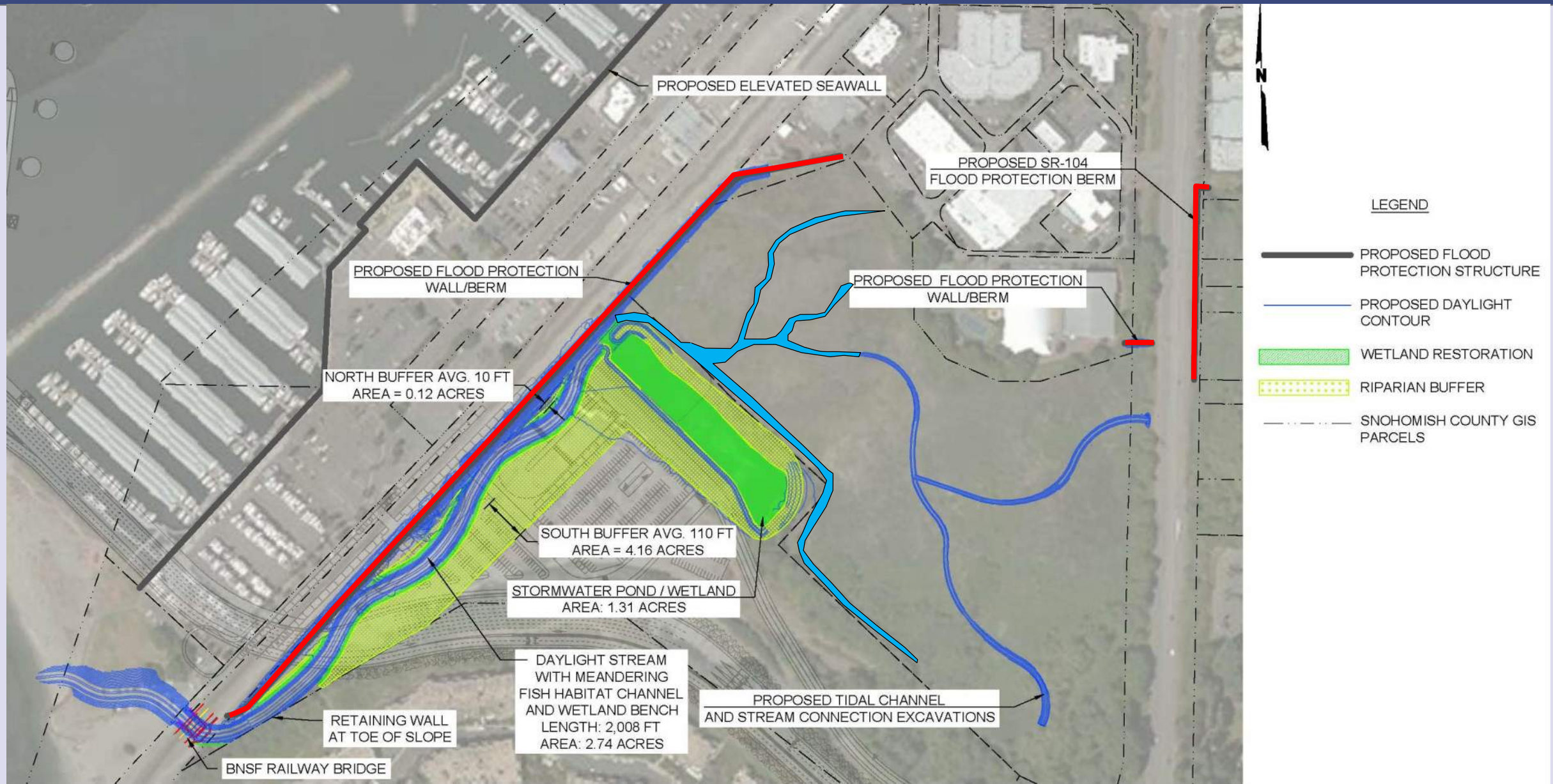


EXISTING CONDITIONS



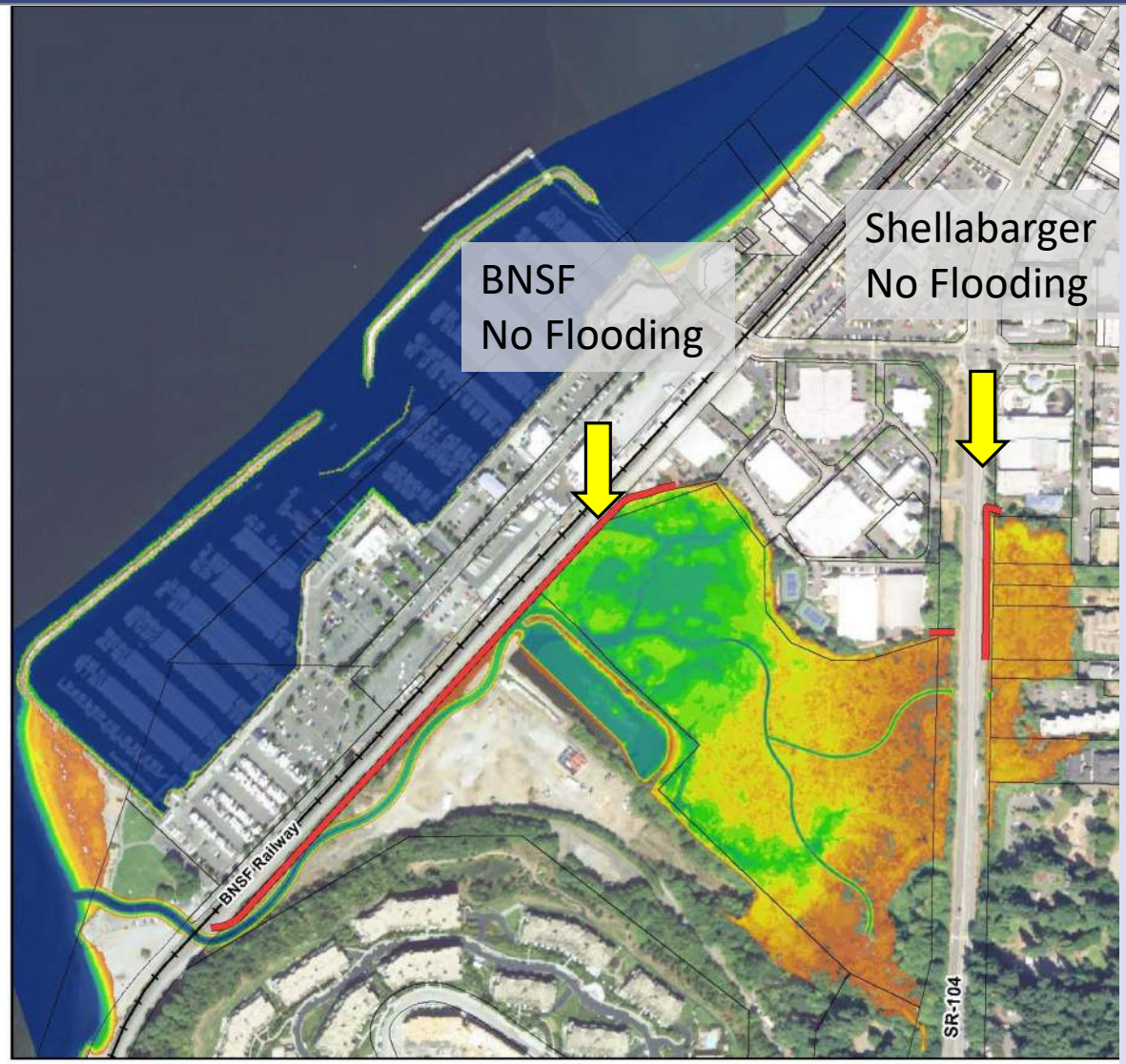
ALTERNATIVE 5
DAYLIGHT CHANNEL ONLY

Daylight Alignment – Alt. 6
(Channel w/ Flood Wall or Berm)



Alt. 6 – Daylight Channel w/ Flood Berms
Storm Surge & 2007 Flood Flows

EXISTING CONDITIONS



ALTERNATIVE 6
DAYLIGHT CHANNEL
W/ FLOOD WALL / BERMS

Additional Questions
Sinuosity / Planform / Dendritic and Braided Channels

Point Heyer

(Vashon Island)

Sinuosity = 1.17

Marsh Area = 4.1ac

Additional Questions
Sinuosity / Planform / Dendritic and Braided Channels

Talagwa Lagoon

(Camano Island)

Sinuosity = 1.29

Marsh Area = 7.6ac

Additional Questions
Sinuosity / Planform / Dendritic and Braided Channels

Maylor Point

Whidbey Island)

Sinuosity = 1.23

Marsh Area = 57.2ac

Additional Questions
Sinuosity / Planform / Dendritic and Braided Channels

North Lagoon

(Whidbey Island)

Sinuosity = 1.08

Marsh Area = 4.9ac

Additional Questions
Sinuosity / Planform / Dendritic and Braided Channels

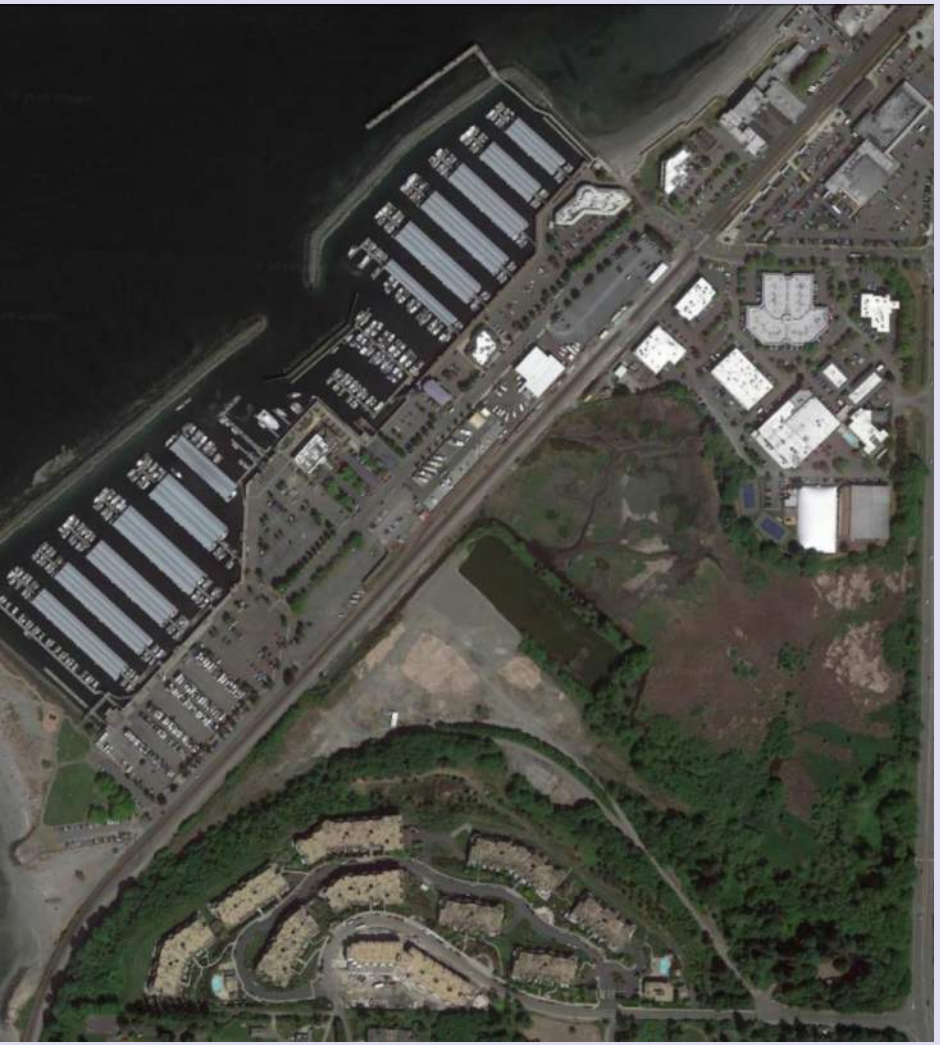
Race Lagoon

(Whidbey Island)

Sinuosity = 1.37

Marsh Area = 22.7ac

Questions About Sinuosity / Planform Dendritic and Braided Channels



Edmonds Marsh

Willow Creek Proposed

Sinuosity = 1.29

Marsh Area = 26.6ac

Willow Creek Daylighting / Edmonds Marsh Restoration

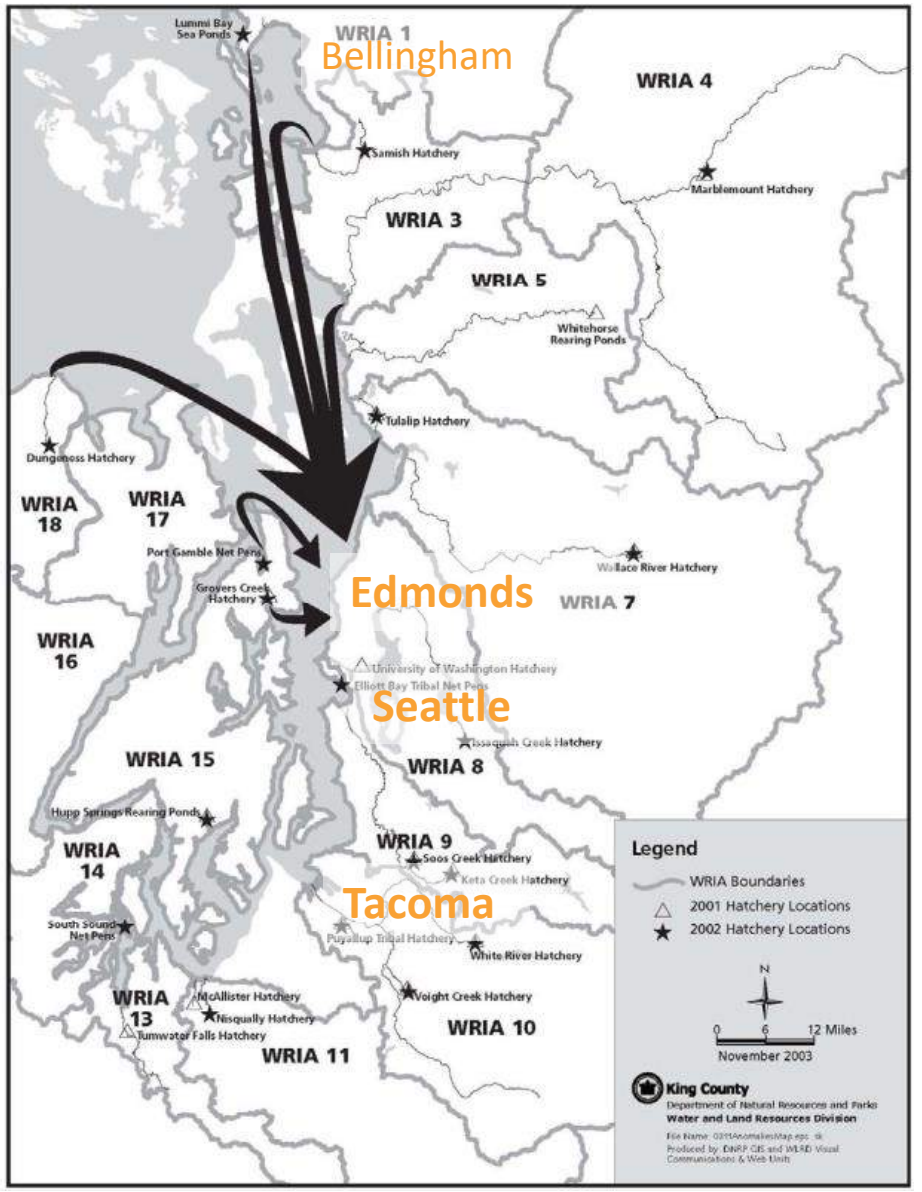
Ecological Considerations in Restoration Design

Paul Schlenger, Environmental Science Associates

Adding Context to the Opportunity

Young Salmon Stay in Puget Sound before swimming to ocean

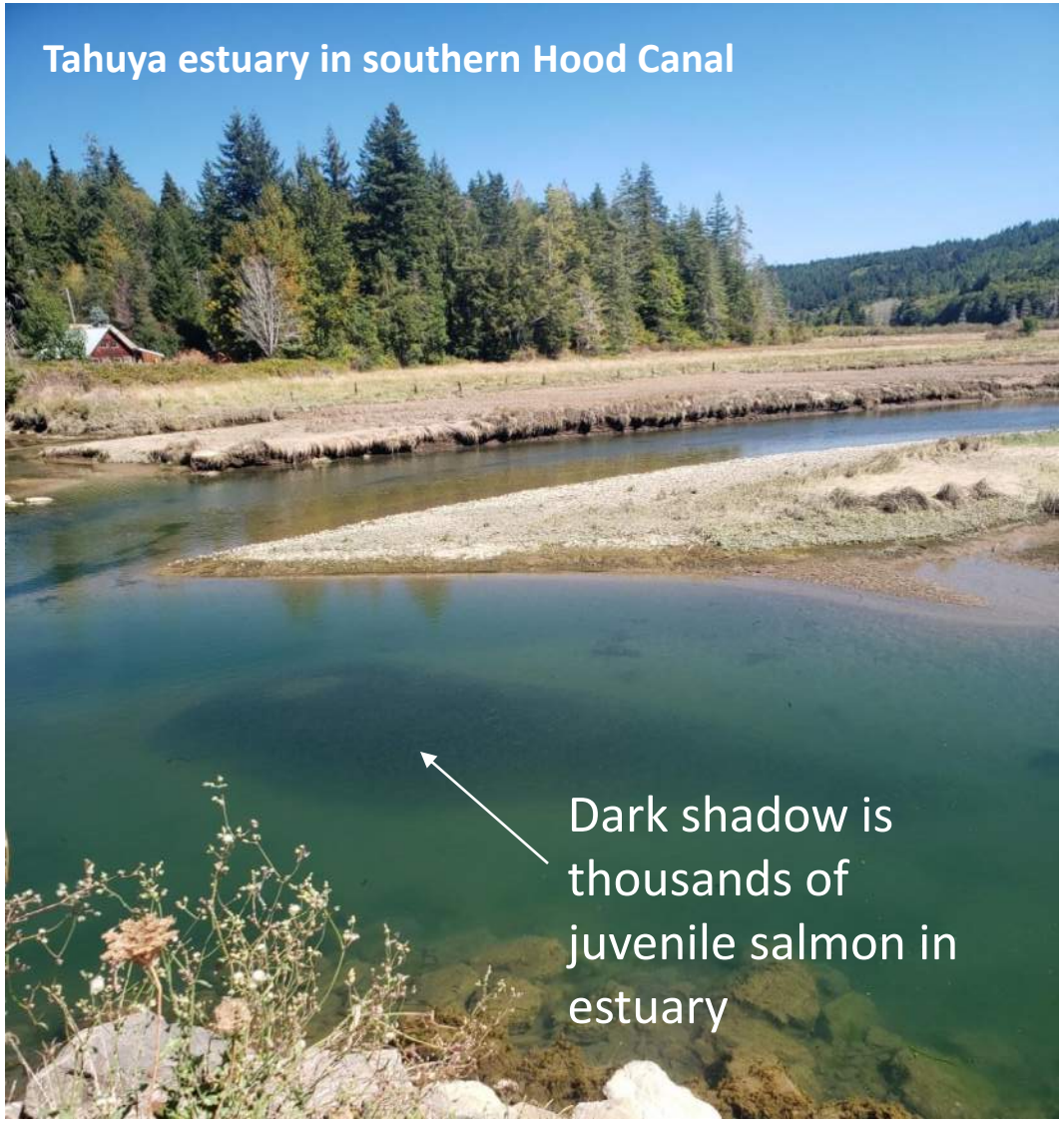
- Study in Edmonds and Seattle showed juvenile salmon from many river systems coming to this area to feed and grow



Source: Brennan et al. (2004)

Adding Context to the Opportunity

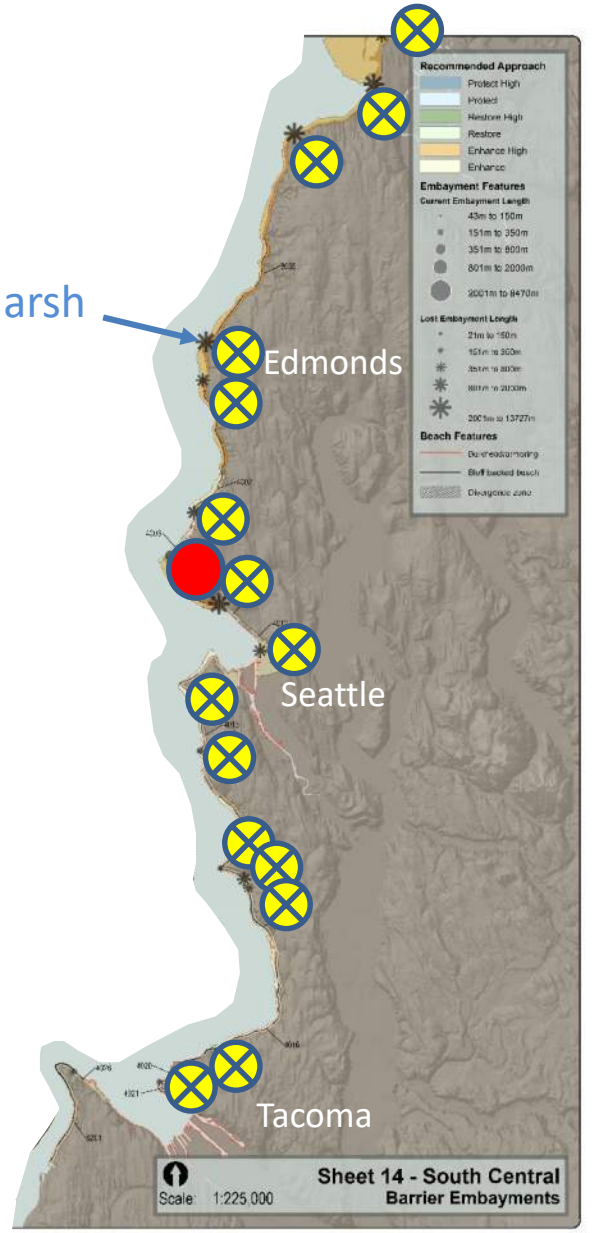
- While in Puget Sound, young salmon use small stream estuaries and coastal embayments



Adding Context to the Opportunity

Unfortunately, we have lost almost all of these habitats in this part of Puget Sound, including the Edmonds Marsh, and the last one is struggling badly

- **15 out of 16 historic coastal embayments between Everett and Tacoma have been lost**



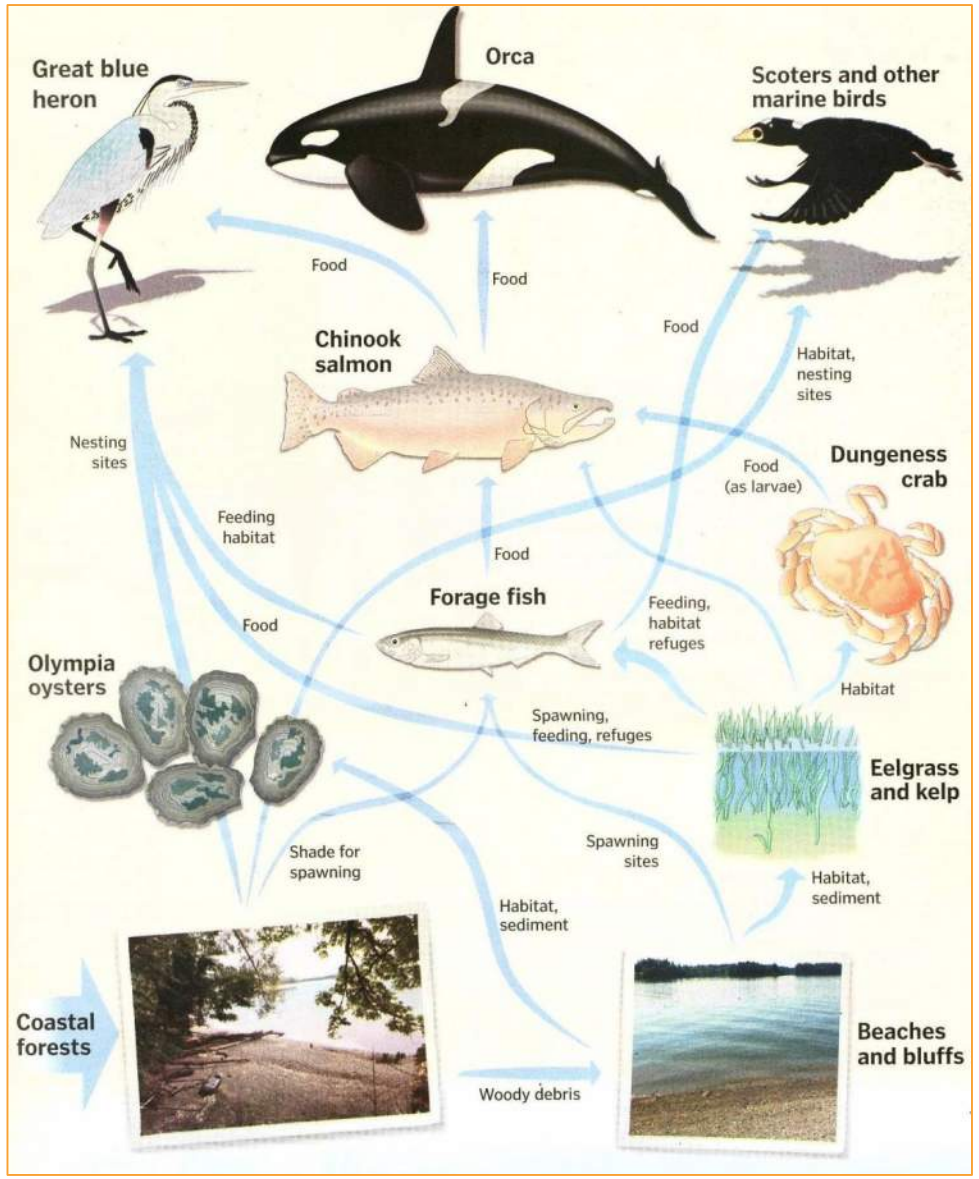
"Lost" Historic Coastal Embayment

Remaining Coastal Embayment

Source: Cereghino et al. (2012)

Adding Context to the Opportunity

- **Edmonds Marsh Restoration is Needed!**
- **Project benefits all nearshore communities of Puget Sound**
- **It's All Connected!**



Source: The Daily Olympian

ESA 50 YEARS 1969-2019

Existing and Desired Conditions

Race Lagoon on Whidbey Island

Source: WA Dept. Ecology

Fundamental Design Considerations

- **Develop design appropriate for tidal setting; considering reference sites**
- **Consider entire salt marsh community with focus on Chinook salmon (based on urgent need and funding availability)**
- **Maximize accessibility of Edmonds Marsh for fish entering channel from Puget Sound**
- **Make design "implementable" – well-aligned with grant funding sources and permits can be obtained**

Ecological Approach to Restoration of Edmonds Marsh

- **Fish access**
  - For salmonids entering from Puget Sound
  - For salmonids to/from creeks

- **Quality habitats in entrance channel and main marsh area**
  - Aquatic habitats
  - Riparian habitats
  - Water/sediment quality

Fish Access From Puget Sound

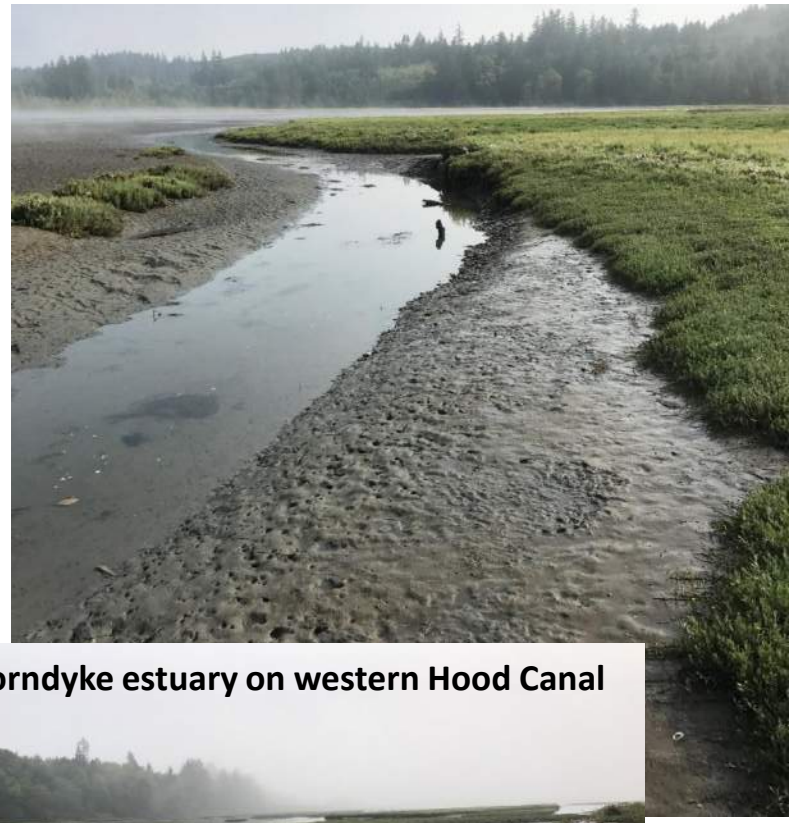
- **Tidal cycles and stream flows determine the depth and water velocity conditions fish will experience in the designed channel and the main marsh**
- **Access to coastal embayments is naturally intermittent**

Fish Access to Creeks

- **Restored tidal connection will improve fish access to interior portions of marsh**
- **Proposed tidal channel connections to Shellabarger and Willow Creeks**
- **Interior areas will transition from freshwater (cattails) to saltwater (some mud, some emergent vegetation)**

Aquatic Habitats

- **Important, of course, because this is where the fish are**
- **Habitat quality and quantity matter**
- **Gentle slopes, substrates (sand, gravel), emergent vegetation**
- **Edge complexity; in-channel wood**



Thorndyke estuary on western Hood Canal

Aquatic Habitats – Channel Alignment

- **Tidal channels forming outlet of coastal embayments are often fairly straight**
- **Not uncommon for outlet channel to be pushed close to barrier berm**
- **Alignment along railroad right-of-way is not ideal, but does not meaningfully reduce the benefits of the project**


Gull Harbor near Olympia


Doe Kag Watts near Kingston


Race Lagoon on Whidbey Island

Source: *WA Dept. Ecology*

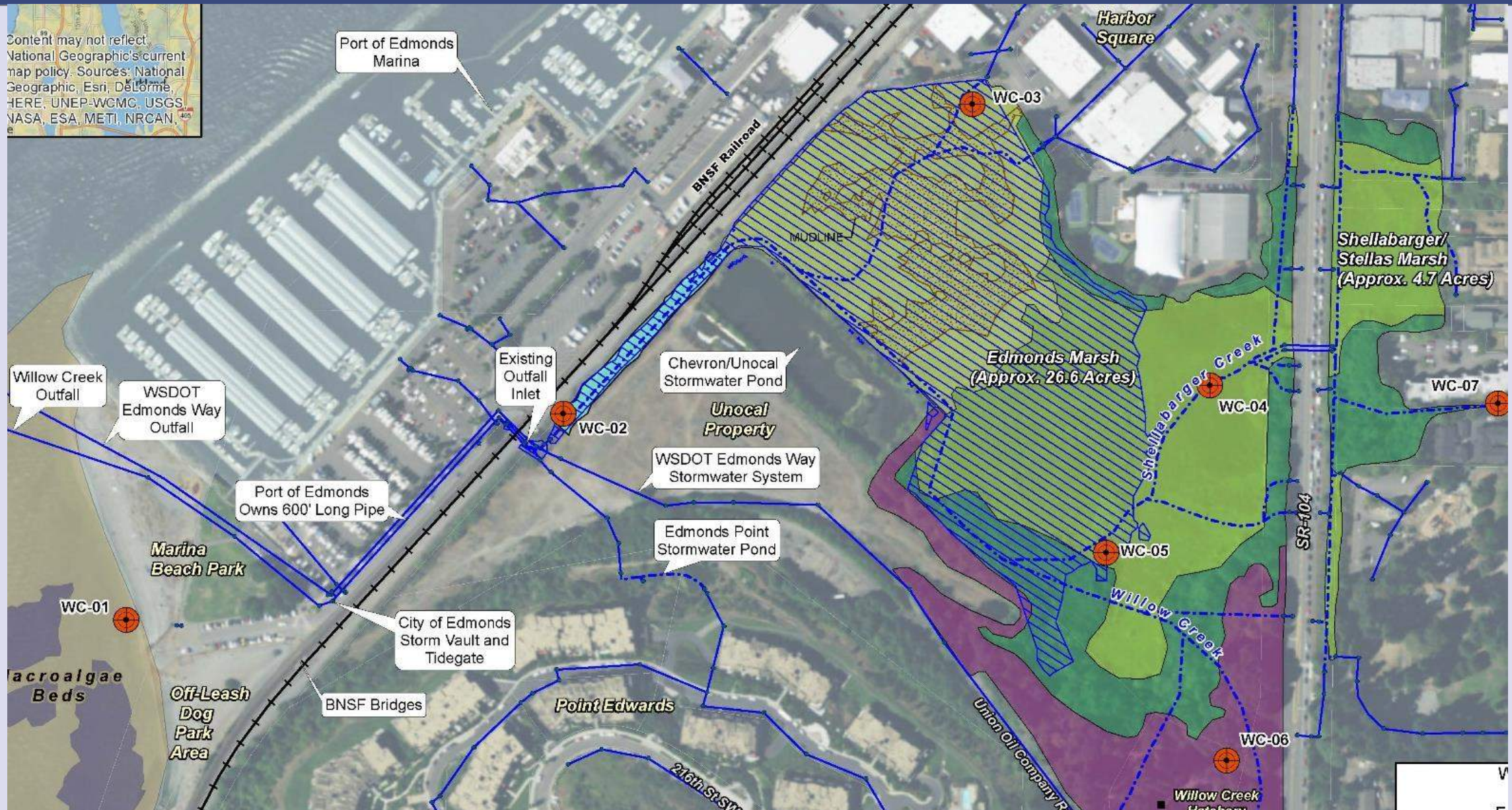
Riparian Habitats

- **Desire is for wide riparian buffer**
- **Within available width, there is a trade off between aquatic and riparian habitat**
  - Emphasis has been toward wider aquatic habitat
  - Emphasis on quality of riparian corridor; dense vegetation establishment
- **Of note, it is a common condition that salt marshes are not entirely surrounded by woody riparian vegetation**
  - Sand/gravel berm between Puget Sound and embayment naturally too low and dynamic for woody vegetation

Water & Sediment Quality

- Restored tidal exchange will improve water quality in Edmonds Marsh (e.g., water temperatures and dissolved oxygen)
  - Factors affecting water quality of creek and stormwater inflows should be addressed, as needed
- Available sediment quality data indicate contamination near outfall along northern margin of marsh & near creek mouths, especially Willow Creek
- Macroinvertebrate community classified as “poor” & “very poor” in samples
  - Factors affecting sediment quality in marsh will be necessary for the restoration to achieve goals

Willow Creek Daylight Update
Water and Sediment Quality Monitoring



Willow Creek Daylight Update
Water and Sediment Quality Sampling

- **Sediment Quality**
  - **WC-03 (Harbor Square Outfall)**
    - **Semi-Volatile Organic Compounds (SVOCs) Exceedances (Significant)**
  - **WC-04, WC-05, WC-06 Showed lesser (minor) exceedances of SVOCs**
- **Water Quality**
  - **Fecal Coliform exceedances – all stations, periodically, except none at WC-01 (Marina Beach Park)**
  - **Lead – One exceedance at WC-05 (Dec. 2016)**
  - **D.O & pH – Minor, periodic exceedances at WC-03**
- **City is working with Ecology to further characterize sediment contamination and next steps.**
- **Tidal flushing will remove/reduce D.O. and pH (and likely FC) exceedances.**

Willow Creek Daylight Update
Macroinvertebrate Sampling

Station ID	Station Name	B-IBI Score	B-IBI Rating
WC-01	Puget sound	18	Poor
WC-02	Lower Willow Creek	14	Very Poor
WC-03	Willow Creek Marsh	12	Very Poor
WC-04	Willow Creek Marsh	16	Very Poor
WC-05	Willow Creek Marsh	18	Poor
WC-06	Upper Willow Creek	18	Poor
WC-07	Upper Shellebarger Creek	14	Very Poor

Establishment of tidal flushing, appropriate substrate, vegetation and riparian and marsh functions will improve biotic integrity of the marsh and daylight channel.

Cost Estimate - Alternative 6B Floodwall

Item	Description		Cost ($s) (2018)
1	Mobilization / Demobilization / Misc.	$	150,000
2	Marina Beach Park Channel / Habitat	$	1,147,000
3	Daylight Channel Construction	$	3,541,000
4	Marsh Improvements / Tidal Channels / Revegetation	$	1,233,000
5	BNSF Floodwall	$	2,639,000
6	Shellabarger / Harbor Square Flood Berms	$	150,000
	Construction Subtotal	**$**	**8,860,000**
	Escalation to 2021/2022 (10%)	$	886,000
	Taxes (10%)	$	913,000
	Bonding & Insurance (5%)	$	443,000
	Contingency (25%)	$	2,215,000
	Construction Total	**$**	**13,317,000**
Other Project Costs			
	Real Estate / Property Acquisition		?
	Engineering, Permits (15% of Construction)	$	2,000,000
	Construction Administration (10% of Construction)	$	1,350,000
	Construction Total	**$**	**16,667,000**

Closing – Thank You