

# Willow Creek Daylight Alternatives Update

**Edmonds City Council Meeting**

**Oct. 22, 2019**

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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.**

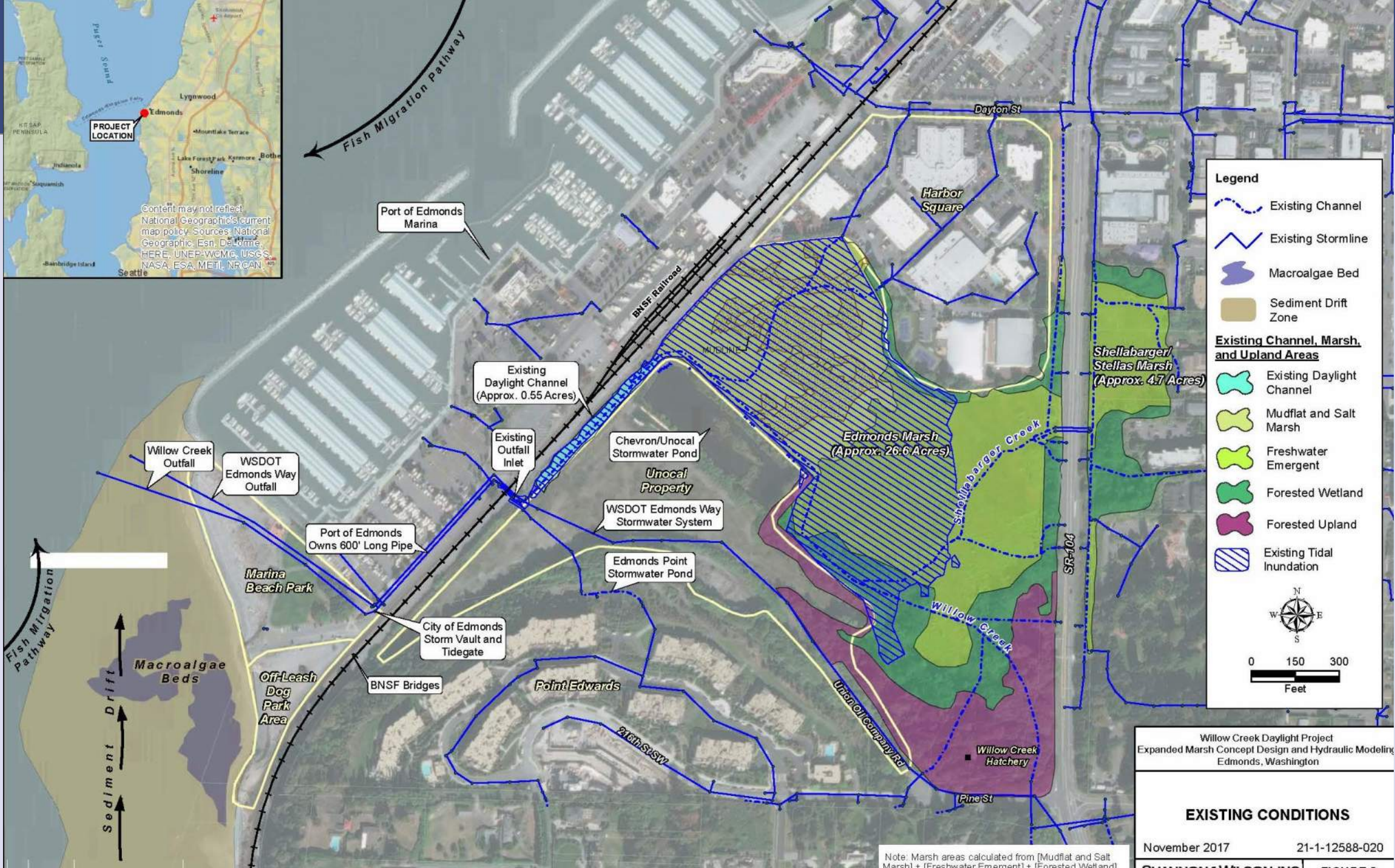
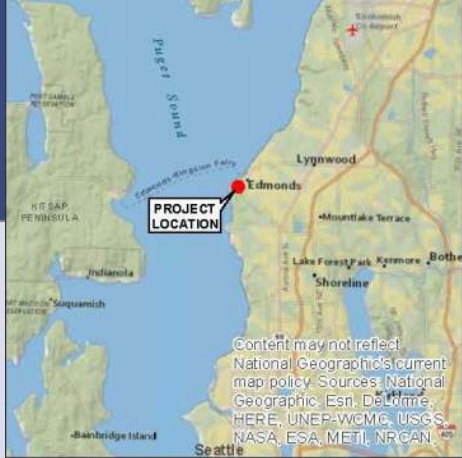
- Marina Beach Park Master Plan Support (2015)
- Final Feasibility (2015)
- Harbor Square Outfall Design (2015)
- Harbor Square and Shellabarger Marsh Wetland Delineations (2015)

# 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





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

Note: Marsh areas calculated from [Mudflat and Salt Marsh] + [Freshwater Emergent] + [Forested Wetland].



# Existing Conditions & Site Constraints

Note: Site Map is  
Conceptual for  
Communication Purposes





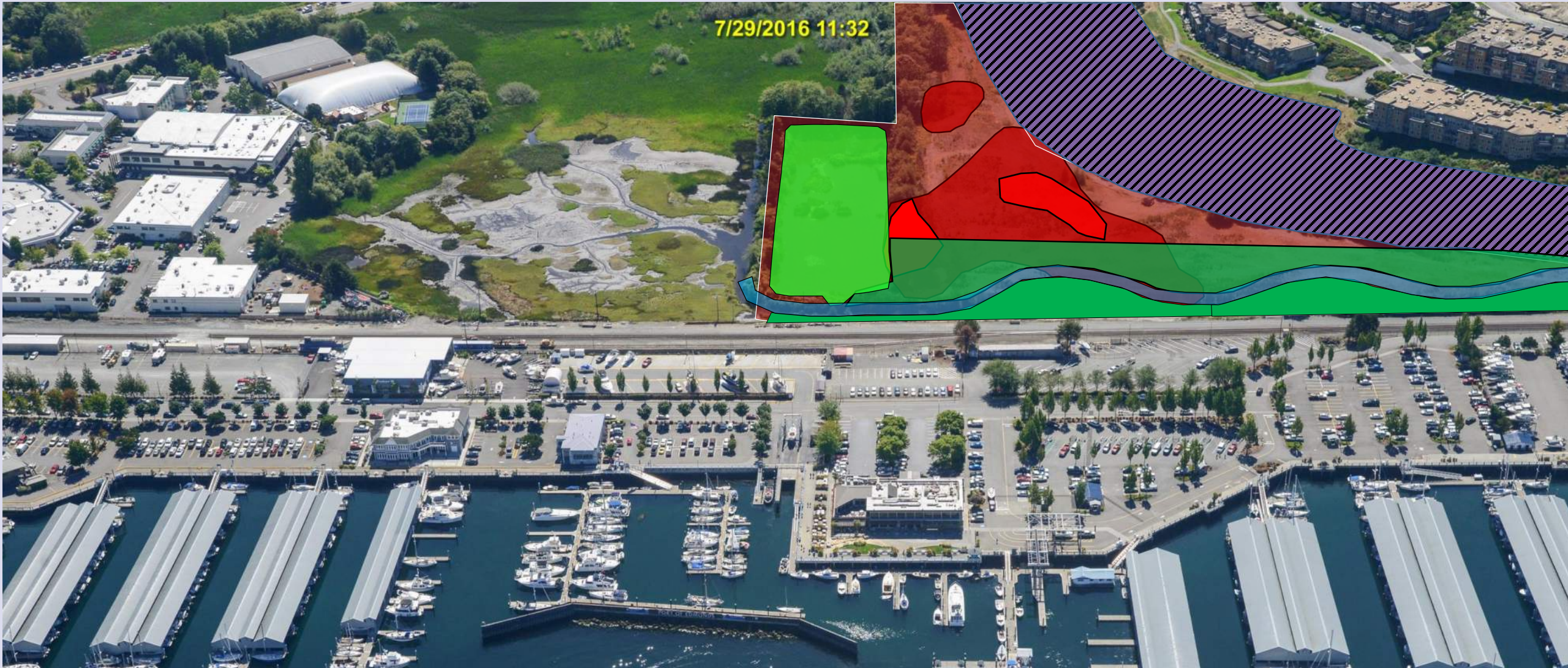
# Existing Conditions & Site Constraints

Note: Site Map is  
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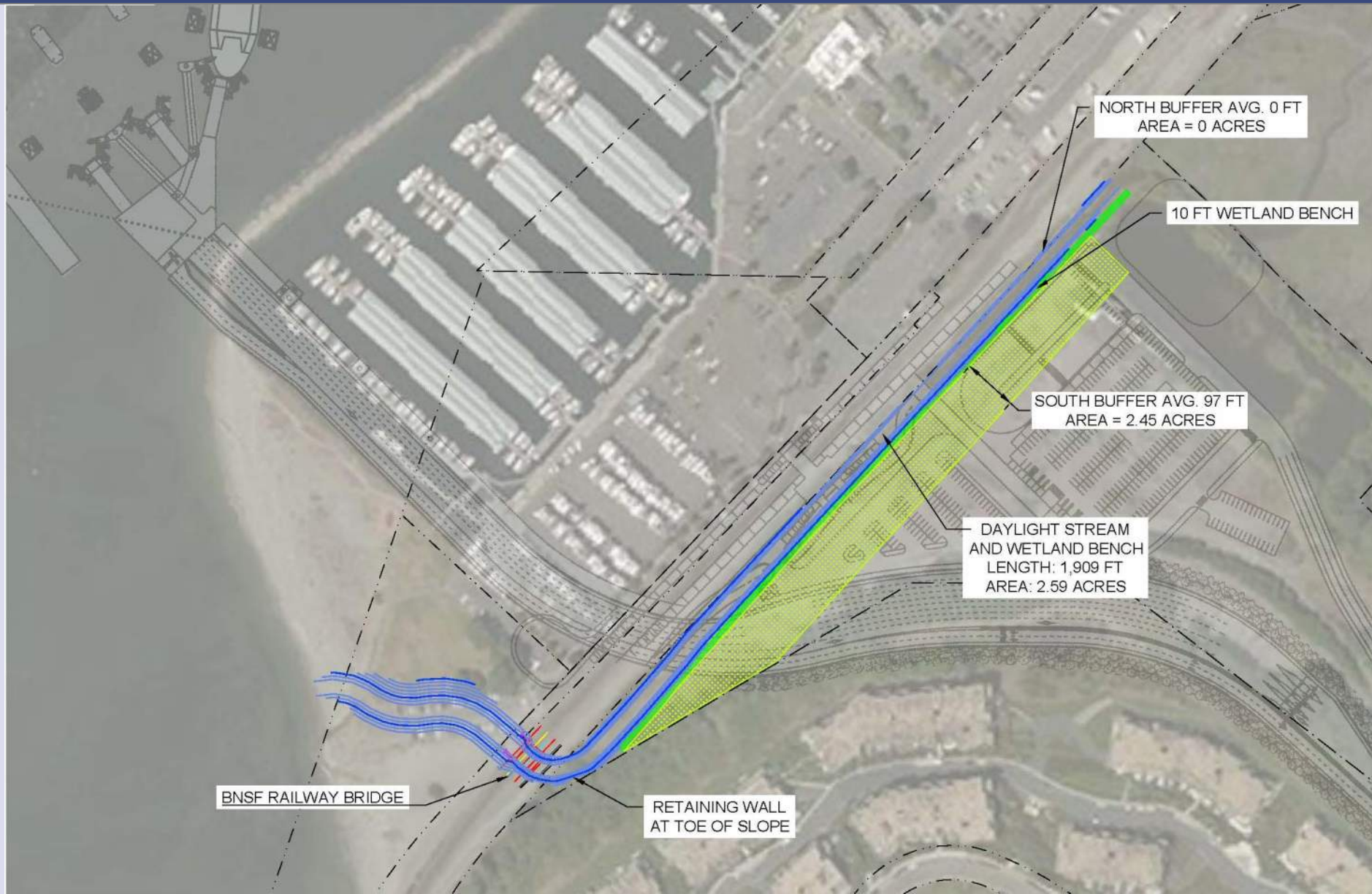


# Existing Conditions & Site Constraints





# Daylight Alignment – Alt. 1



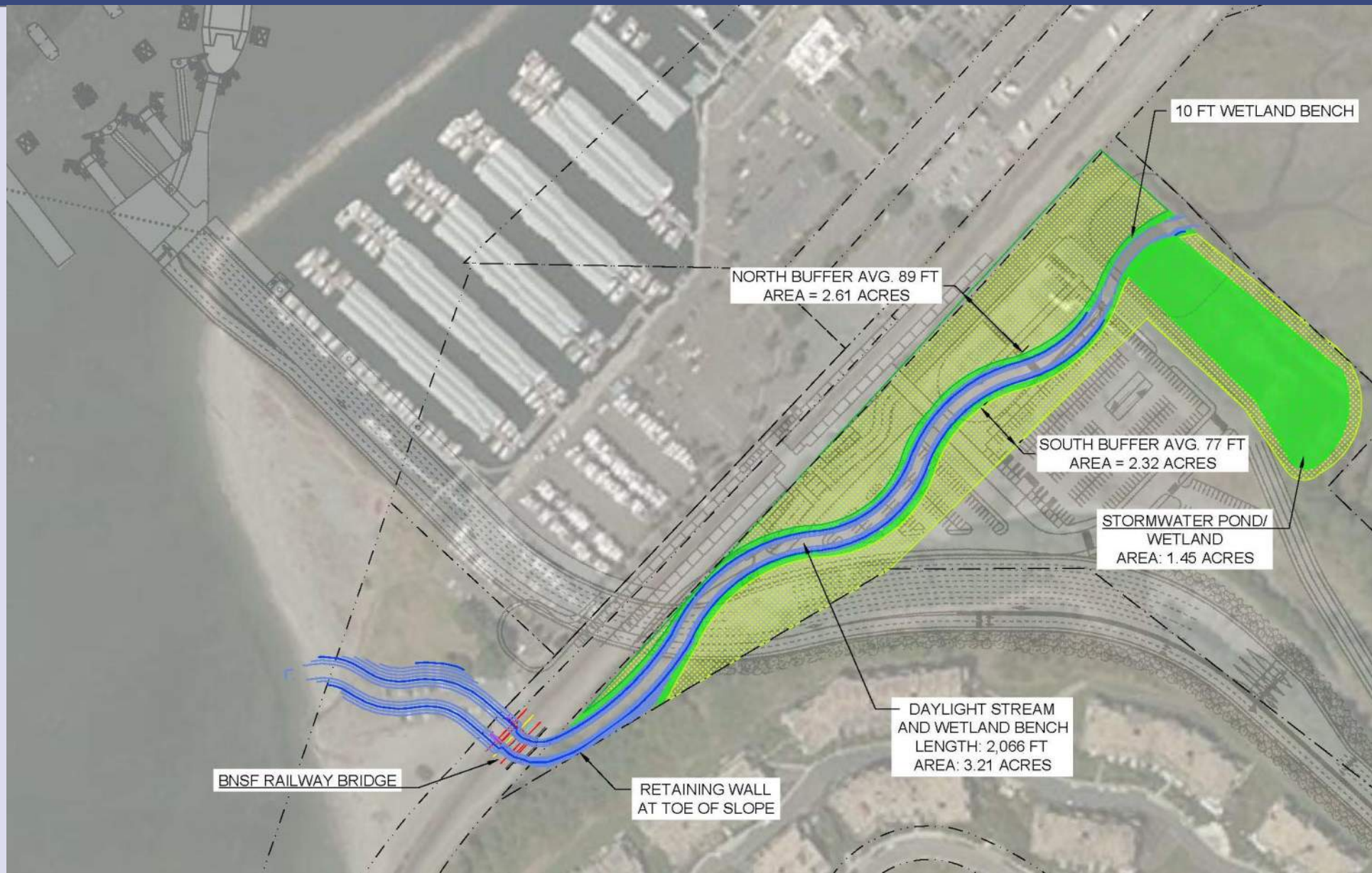
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LEGEND

- PROPOSED DAYLIGHT CONTOUR
- WETLAND RESTORATION
- RIPARIAN BUFFER
- - - SNOHOMISH COUNTY GIS PARCELS



# Daylight Alignment – Alt. 2

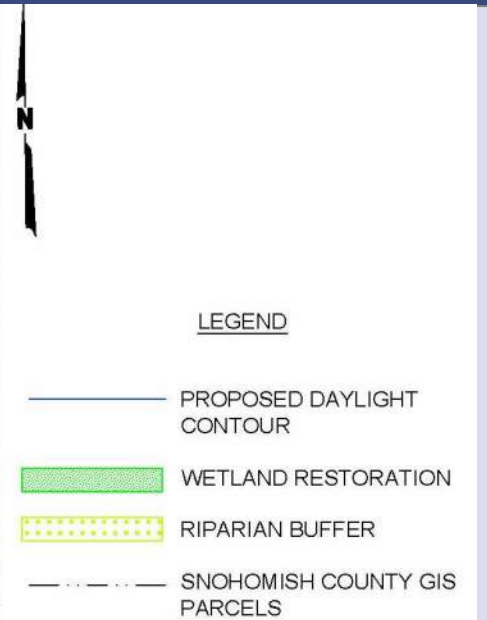
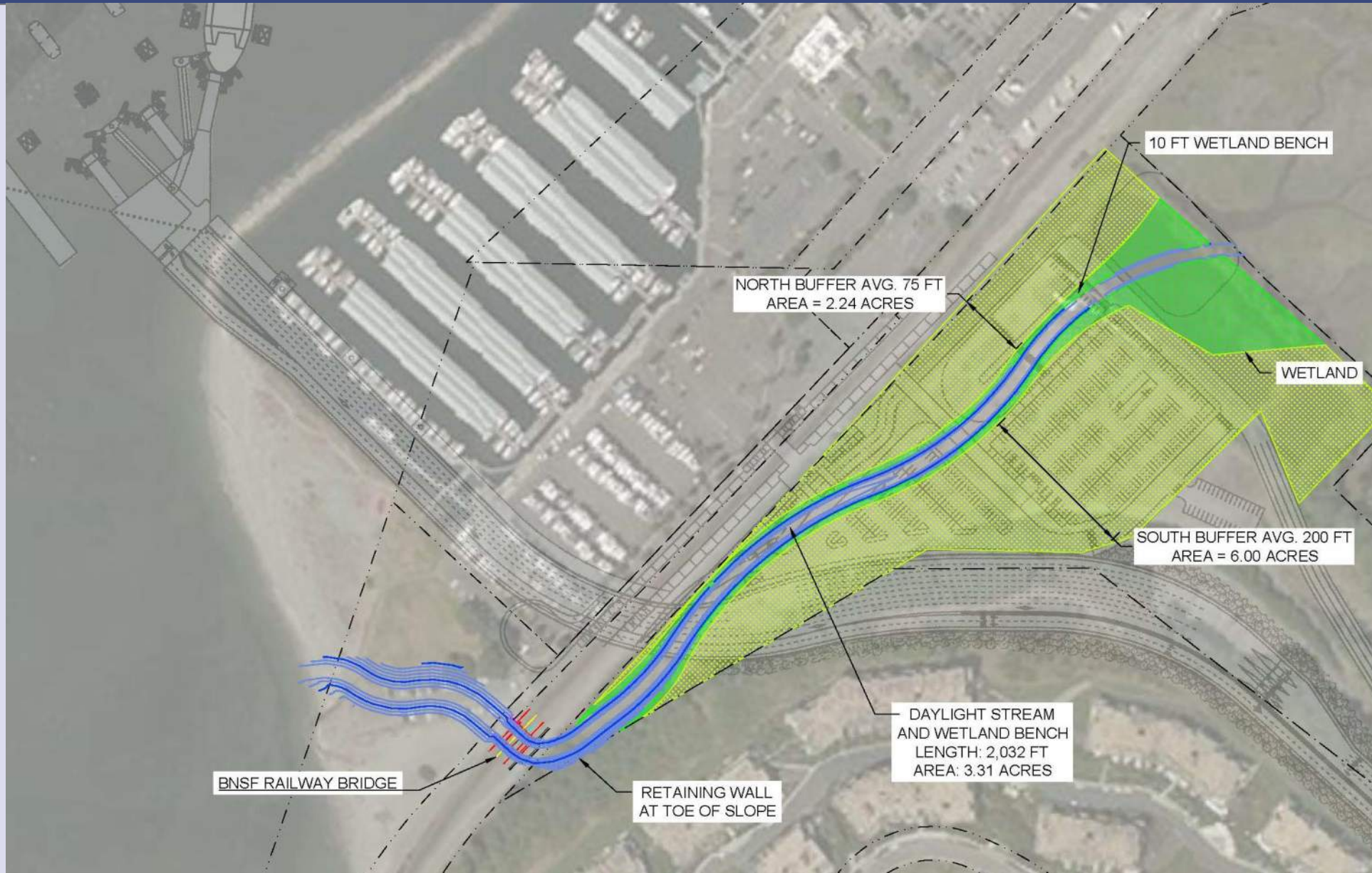


**LEGEND**

- PROPOSED DAYLIGHT CONTOUR
- WETLAND RESTORATION
- RIPARIAN BUFFER
- SNOHOMISH COUNTY GIS PARCELS

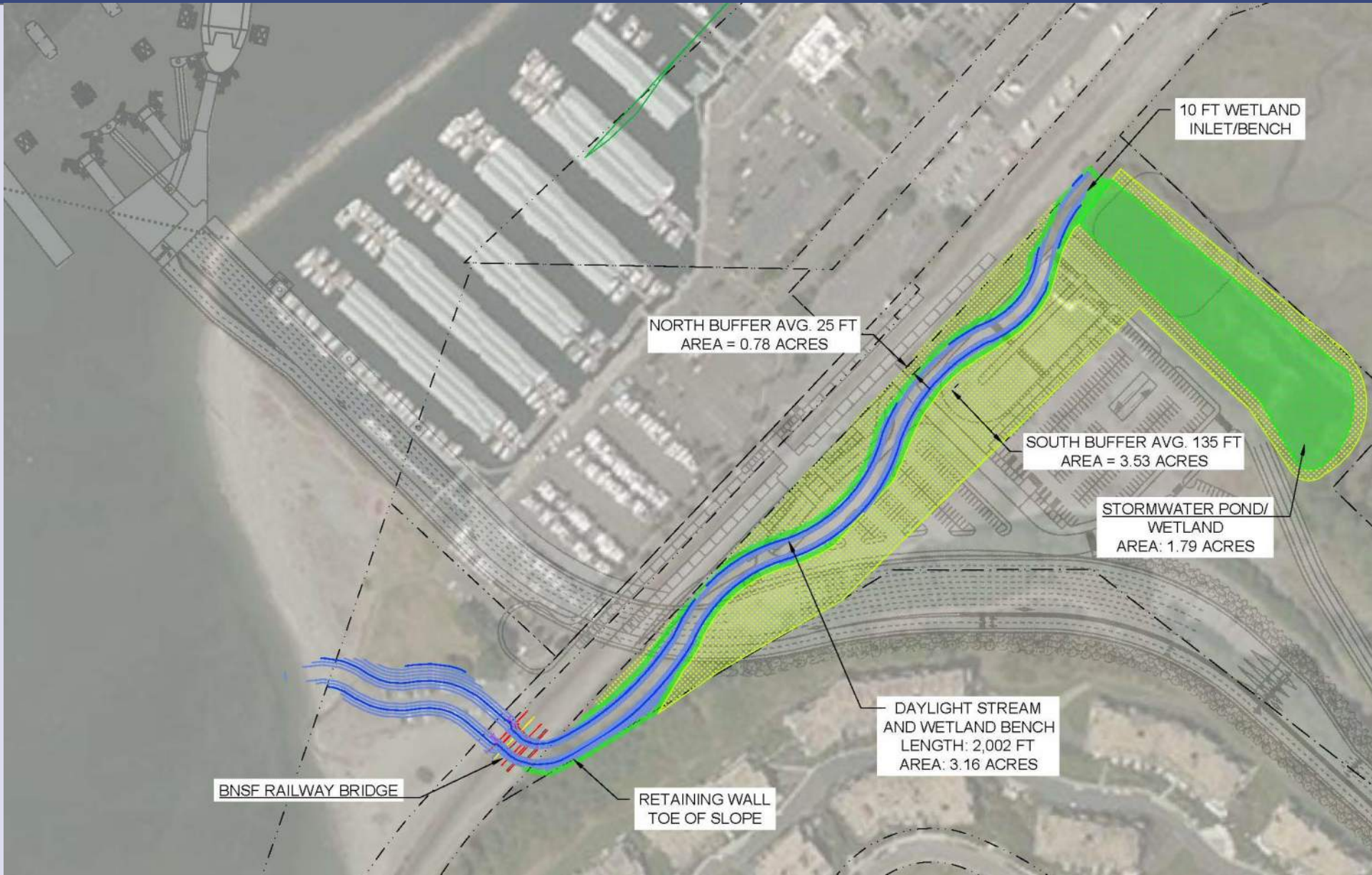


# Daylight Alignment – Alt. 3





# Daylight Alignment – Alt. 4

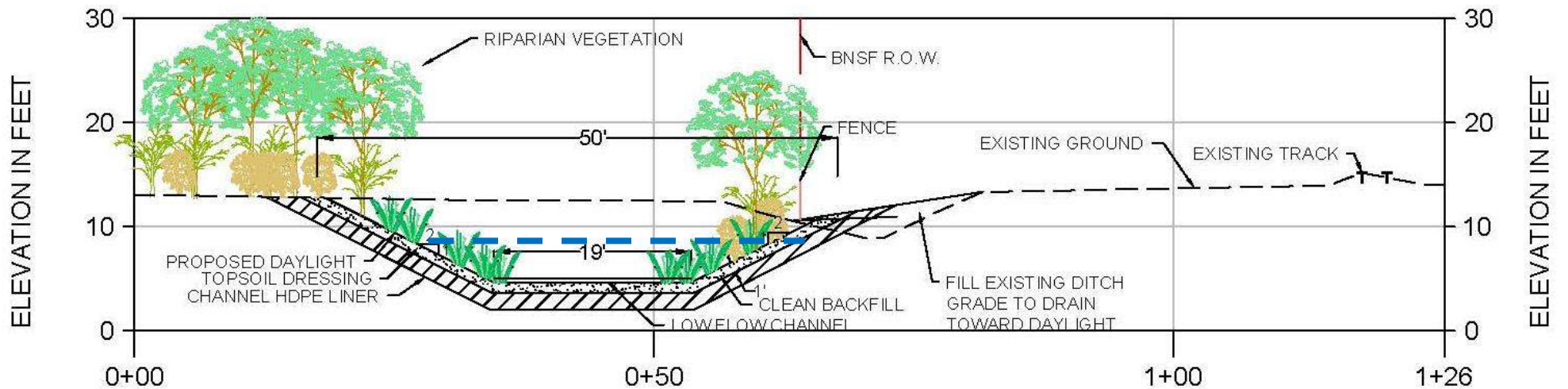


**LEGEND**

- PROPOSED DAYLIGHT CONTOUR
- WETLAND RESTORATION
- RIPARIAN BUFFER
- SNOHOMISH COUNTY GIS PARCELS

# 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

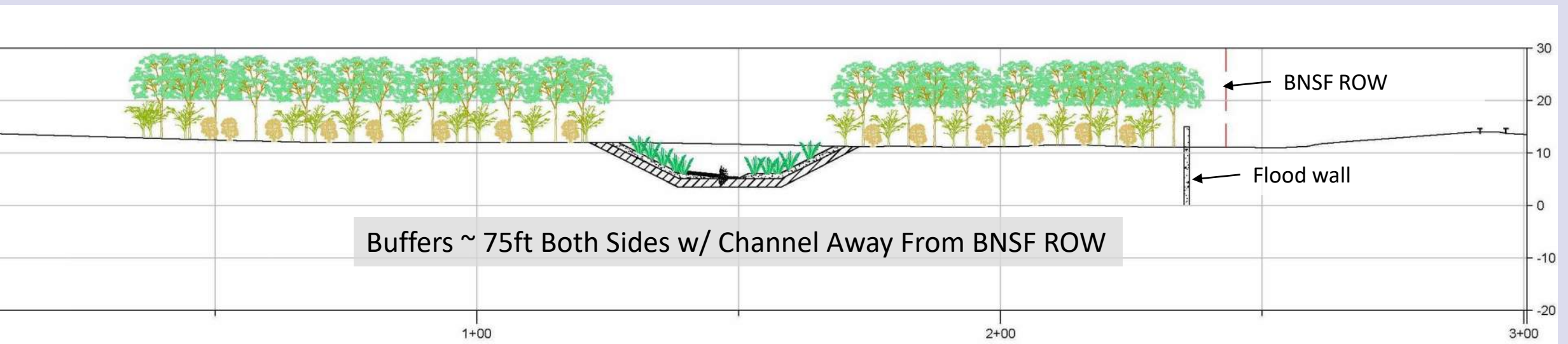
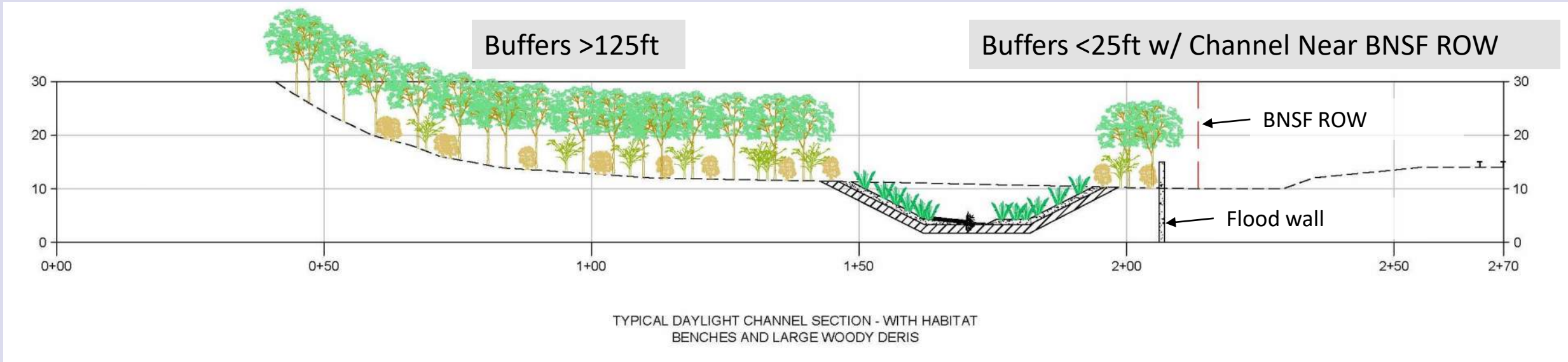
# Additional Modeling Alternatives

## 2018 Tasks

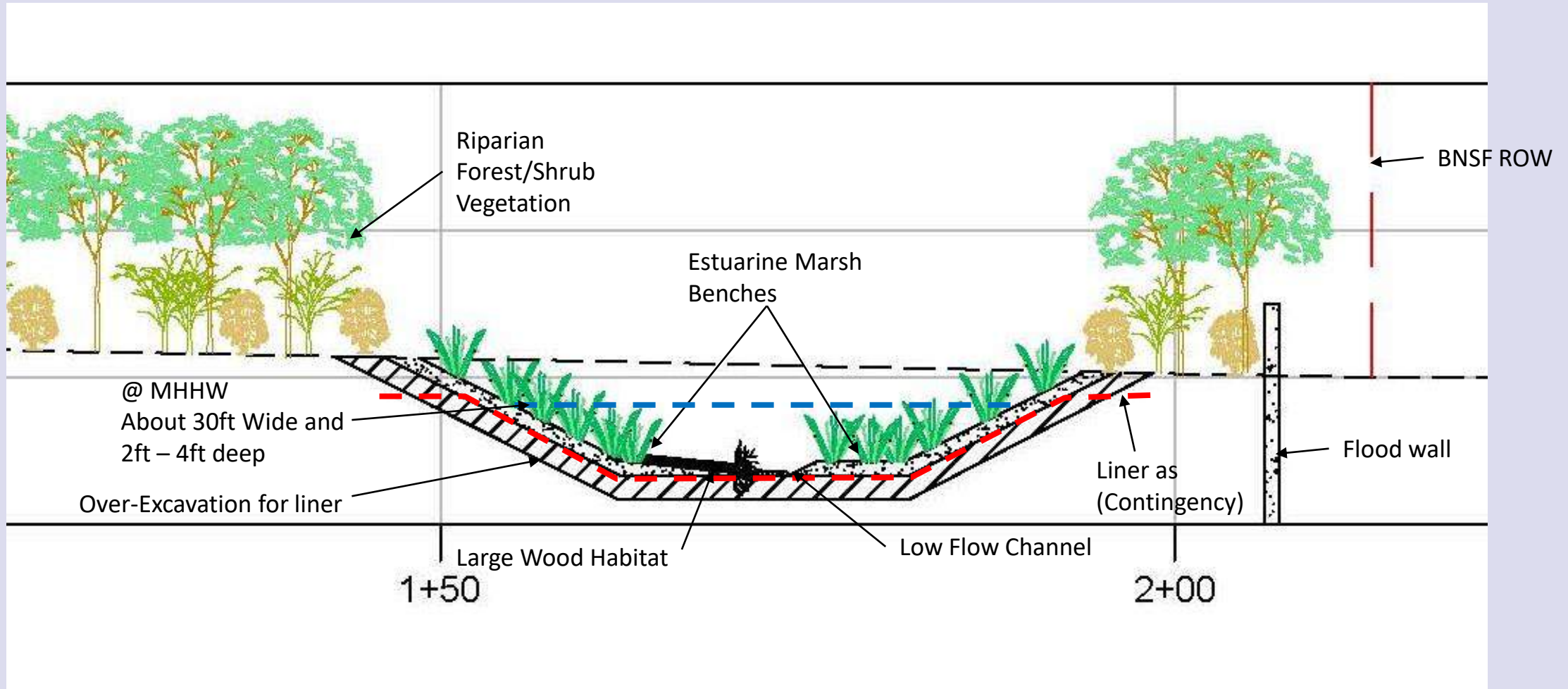
- Additional Modeling Alternatives
  - Modified Channel Cross Section w/ Inset Channel / Marsh Benches
  - Add Habitat Features - Large Woody Debris and Denser Riparian Vegetation for (Roughness)
  - Evaluate Extreme Tide, Storm Surge, Sea Level Rise
  - Evaluate Flood Mitigation Structure – Tidegates,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



# Alt 6. Modified Cross Sections – Buffers



# Modified Cross Section Elements





# Contaminated Soils – Liners, Mixing, Soil Management

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





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



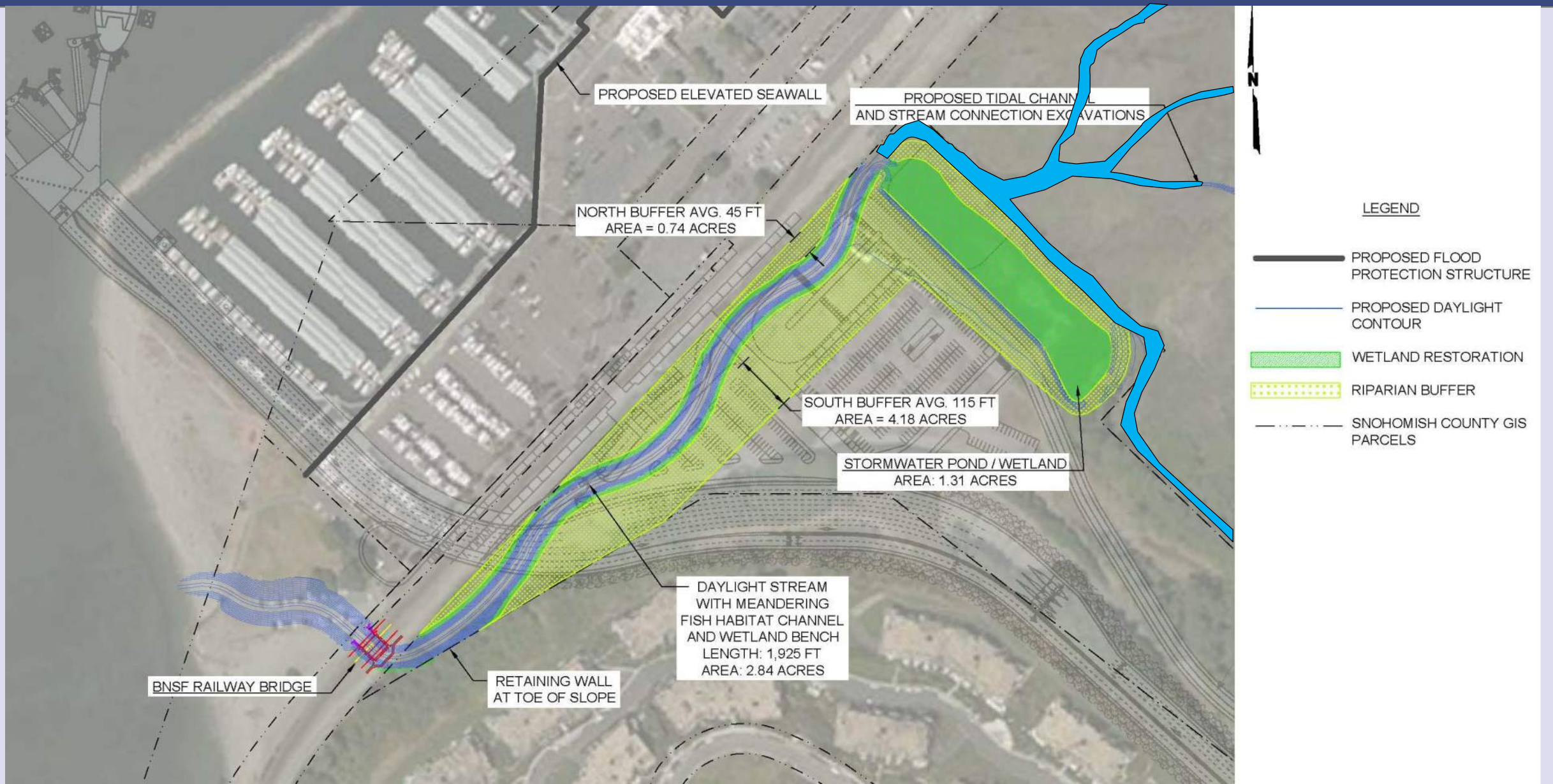
King Tides  
Astronomical / Stillwater / Annual



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



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





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



**EXISTING CONDITIONS**



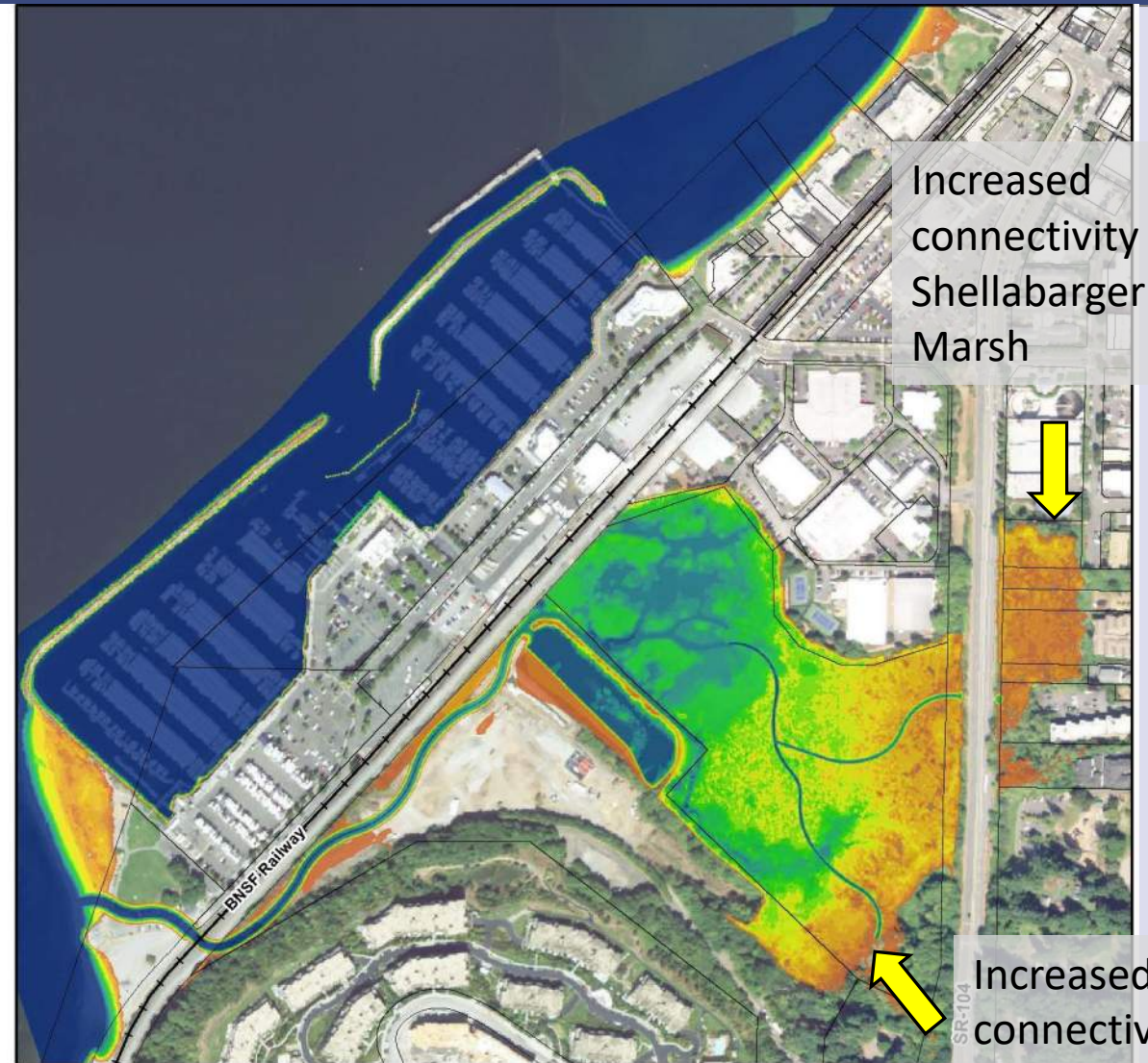
**ALTERNATIVES 5, 6, 7**  
**HABITAT SPRING/EARLY SUMMER**  
**CONDITIONS**



# 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**

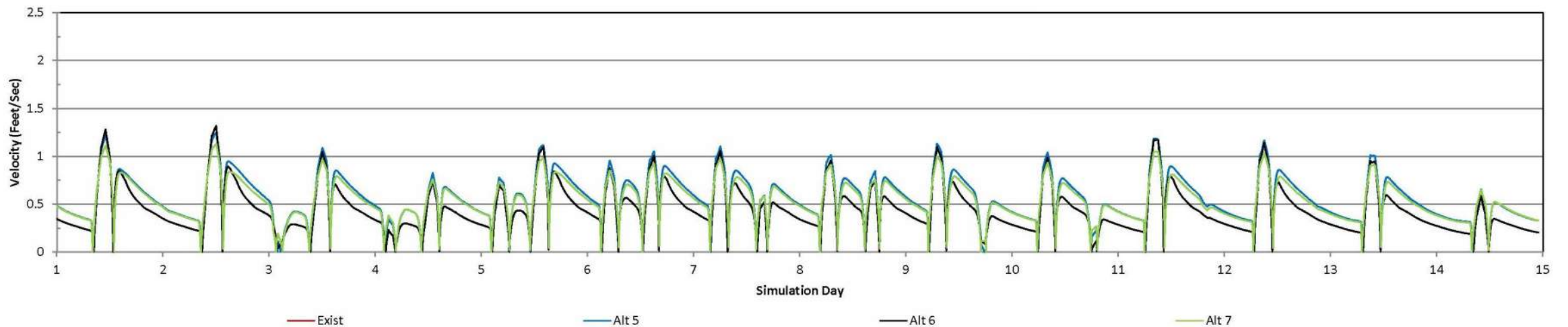
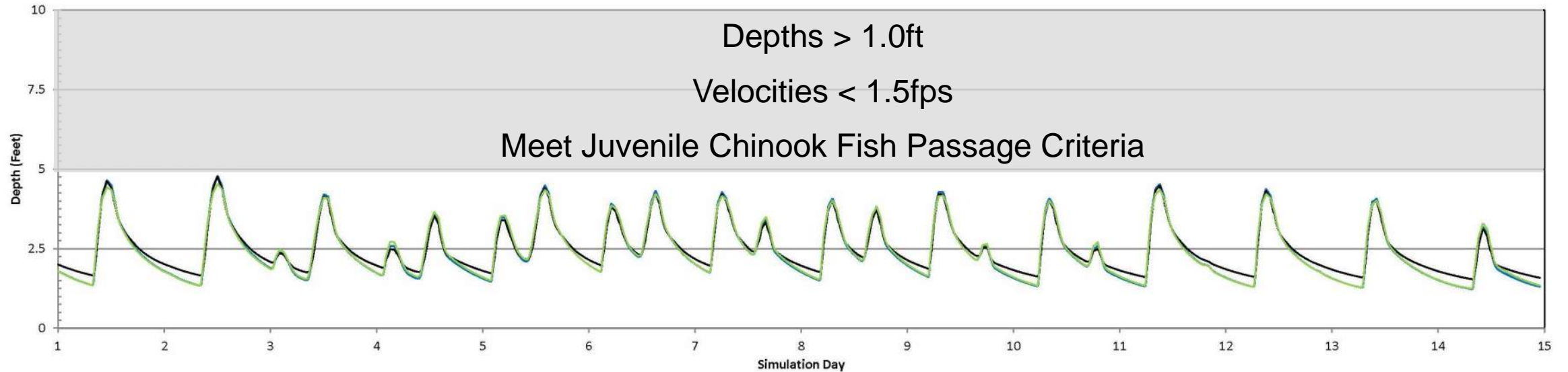
Increased connectivity  
Shellabarger  
Marsh

Increased connectivity  
Willow  
Creek



# Updated Cross Section Cross Sections

## Improve Fish Habitat

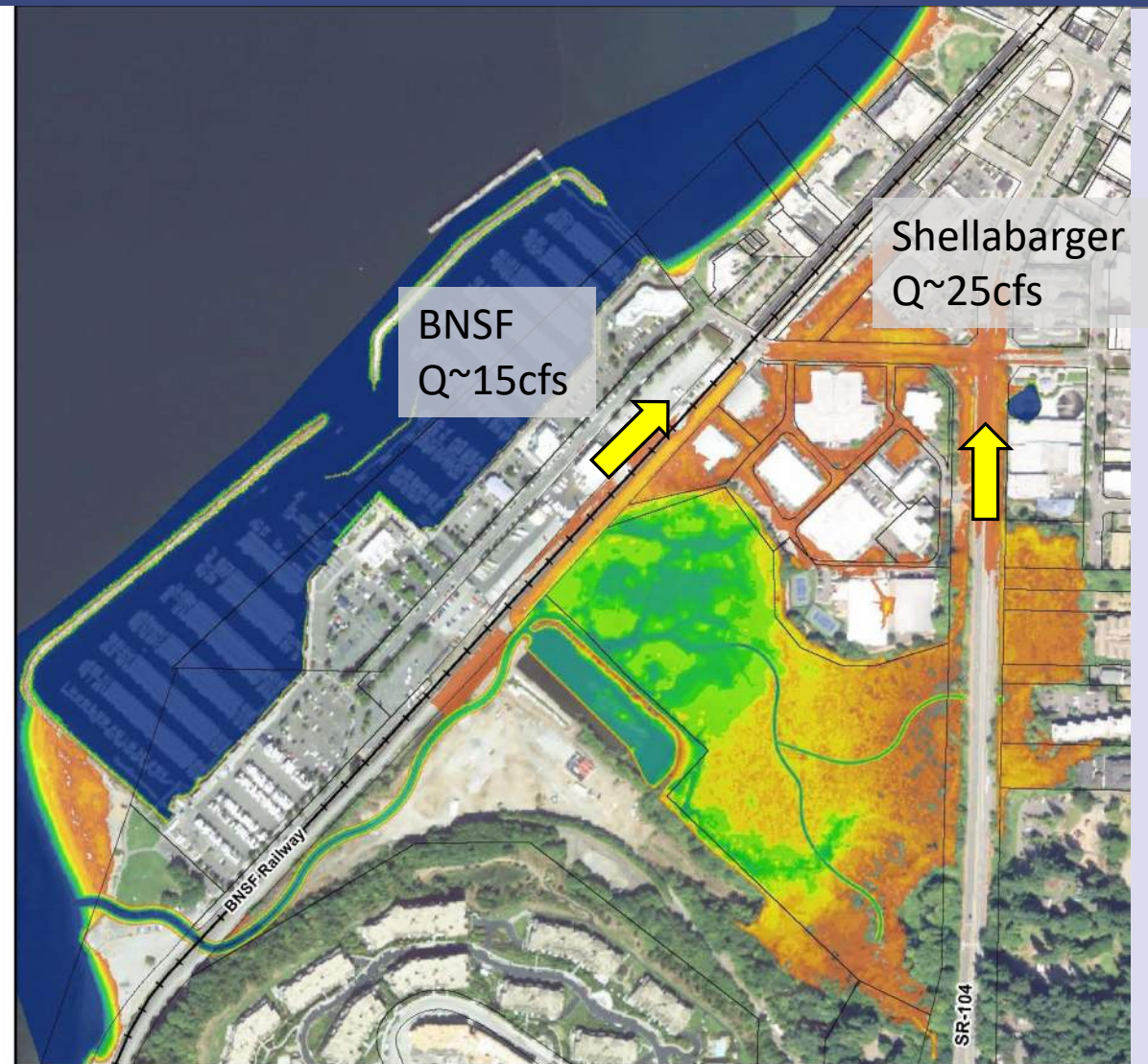




# Alt. 5 – Daylight Channel Only Storm Surge & 2007 Flood Flows



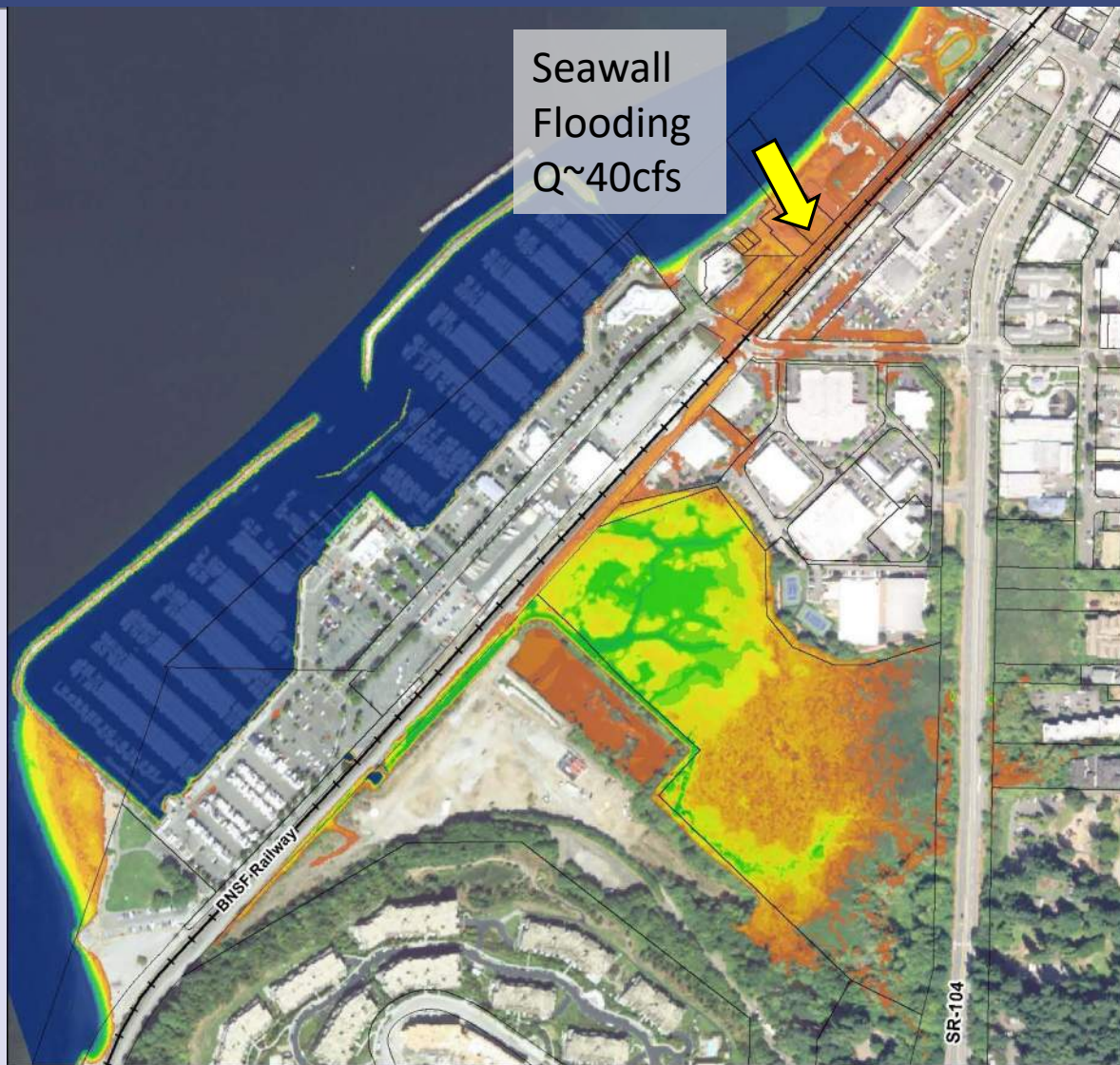
**EXISTING CONDITIONS**



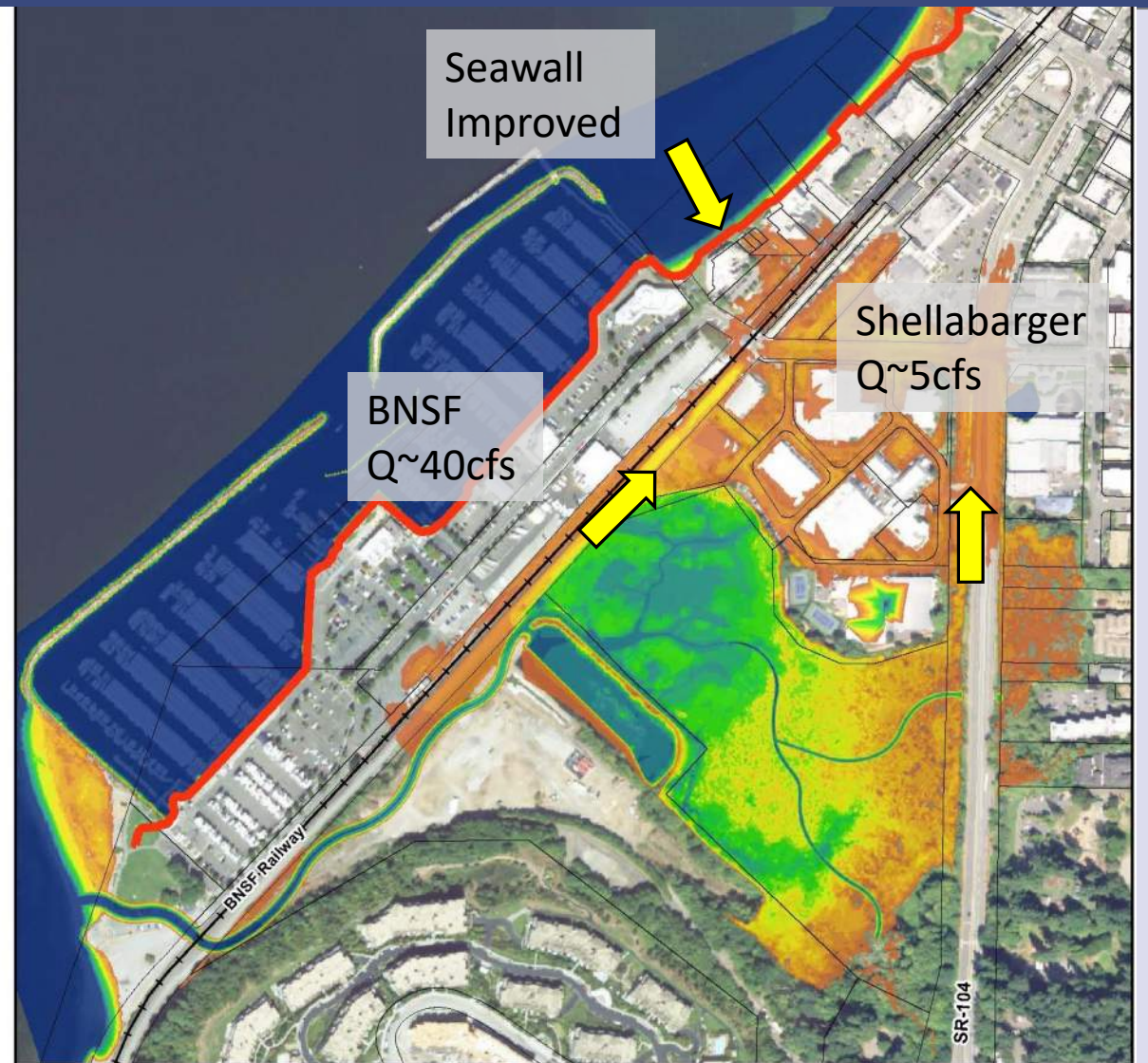
**ALTERNATIVE 5**  
**DAYLIGHT CHANNEL ONLY**



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



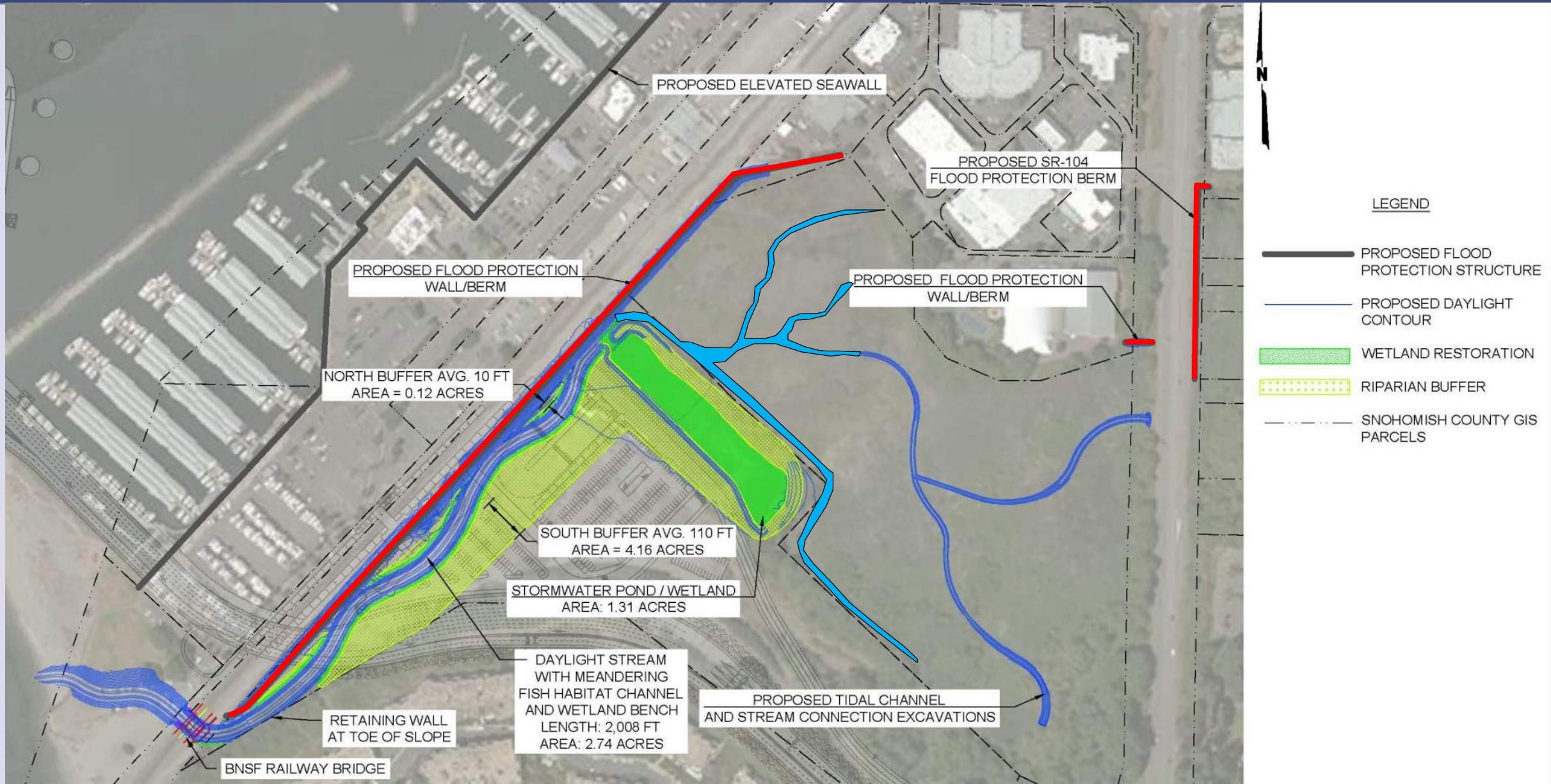
**EXISTING CONDITIONS**



**ALTERNATIVE 5**  
**DAYLIGHT CHANNEL ONLY**



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

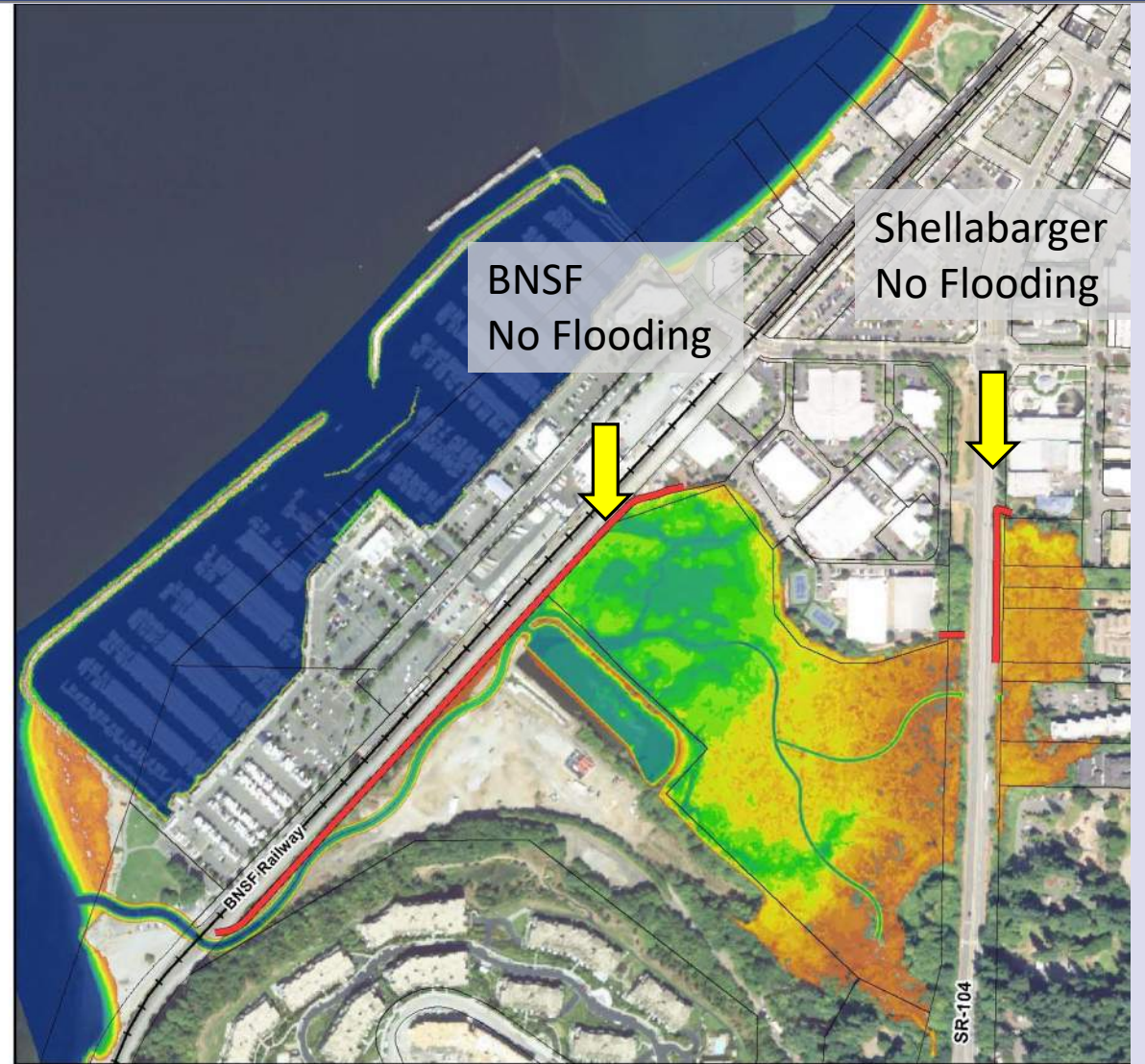




# Alt. 6 – Daylight Channel w/ Flood Berms Storm Surge & 2007 Flood Flows



**EXISTING CONDITIONS**

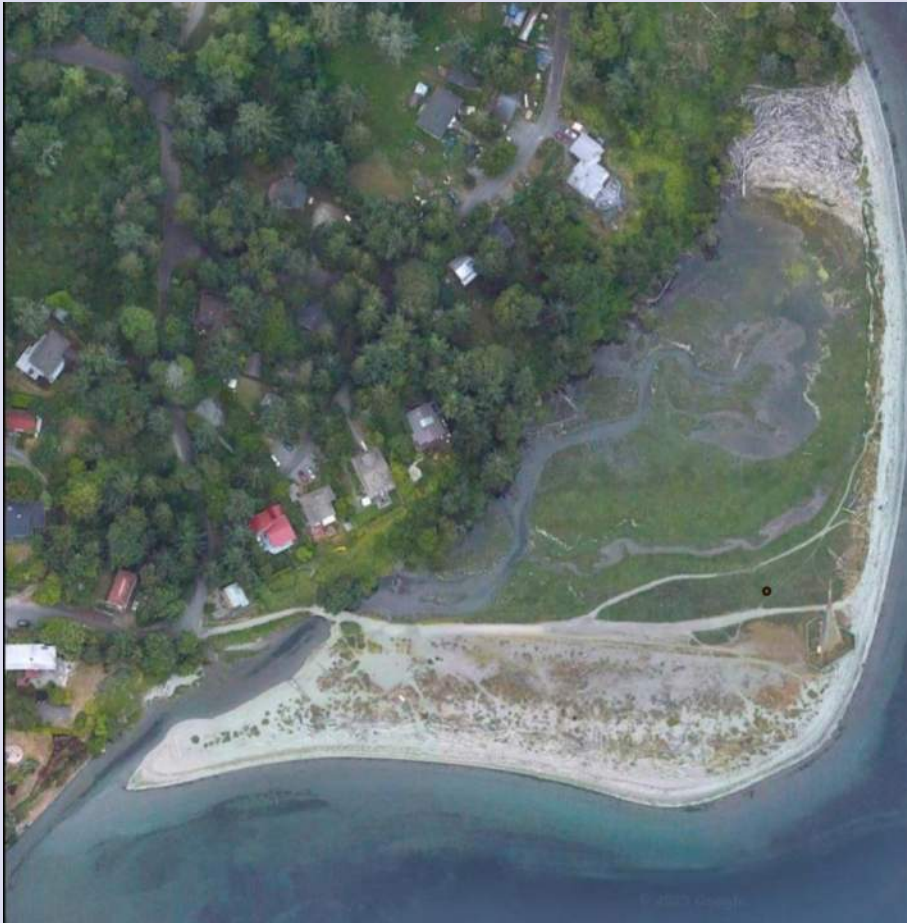


**ALTERNATIVE 6**  
**DAYLIGHT CHANNEL**  
**W/ FLOOD WALL / BERMS**



# 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)**

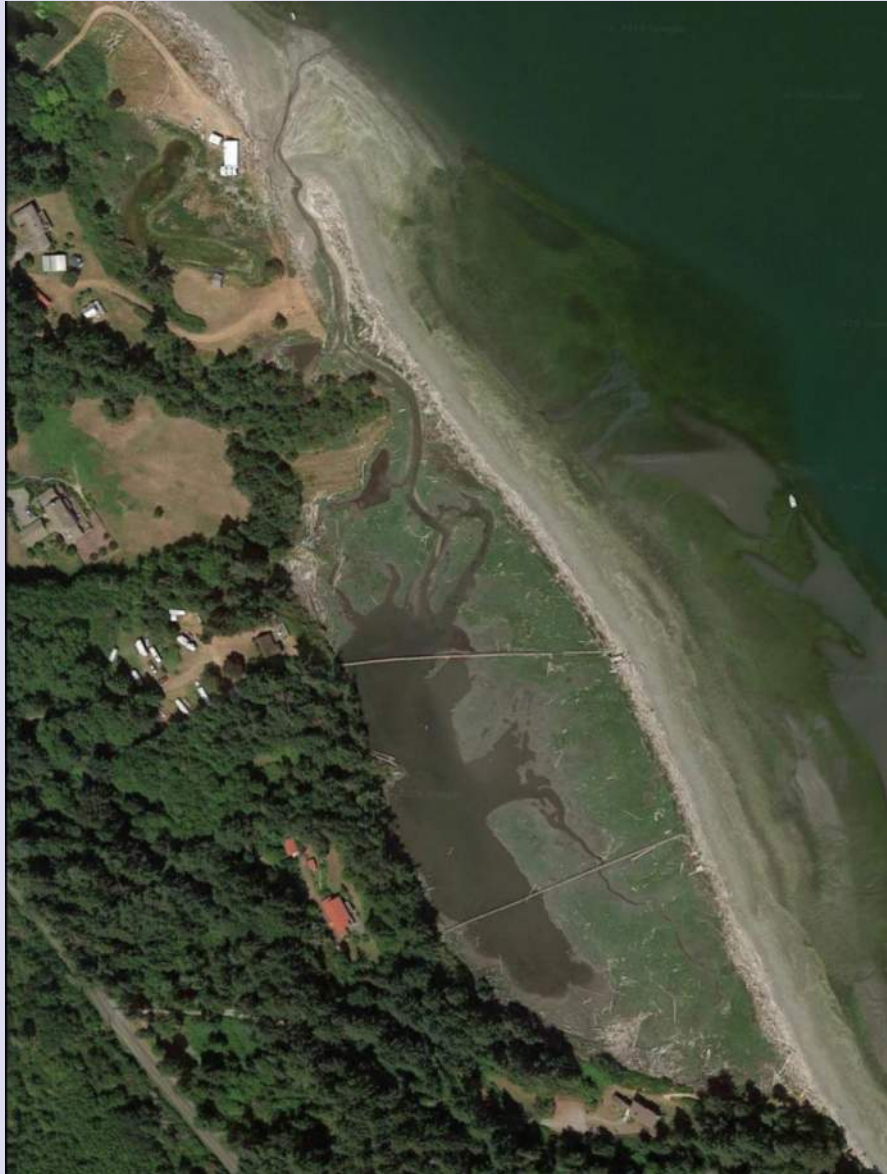
**Sinuosity = 1.23**

**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



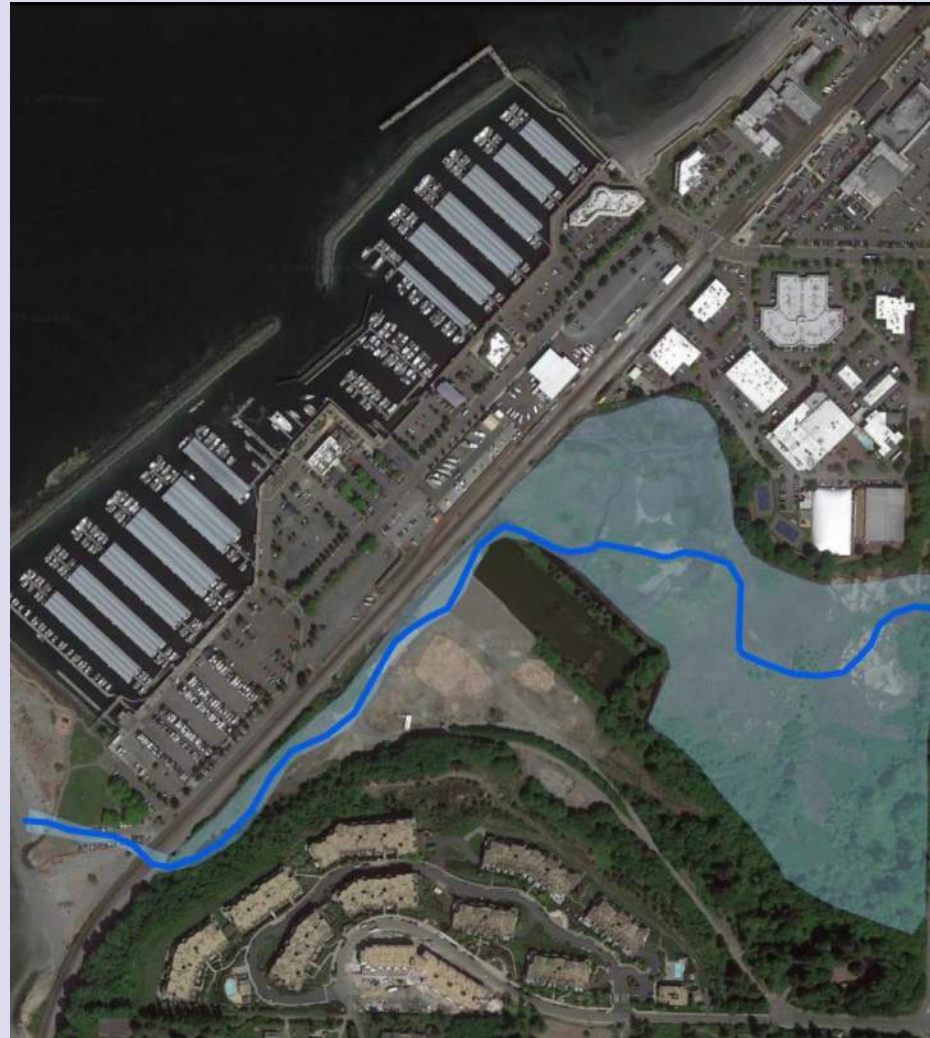
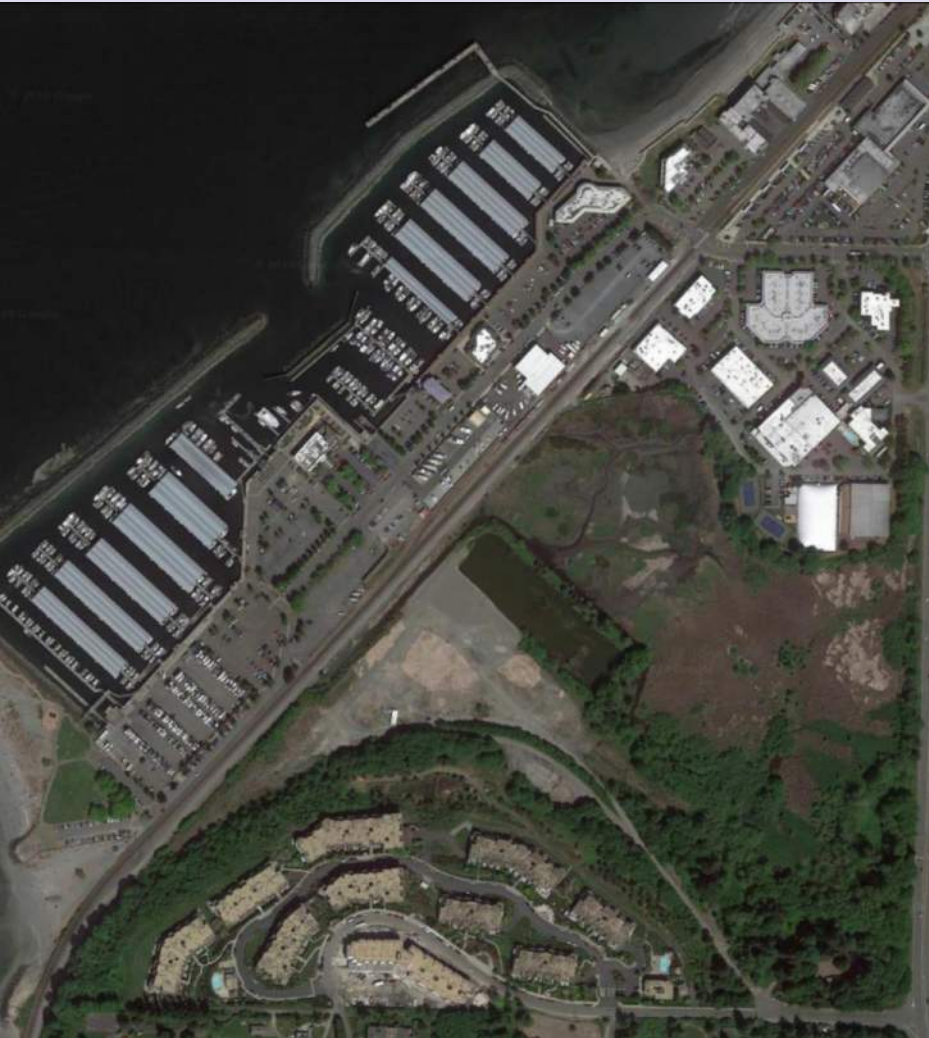
**Race Lagoon  
(Whidbey Island)**

**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**

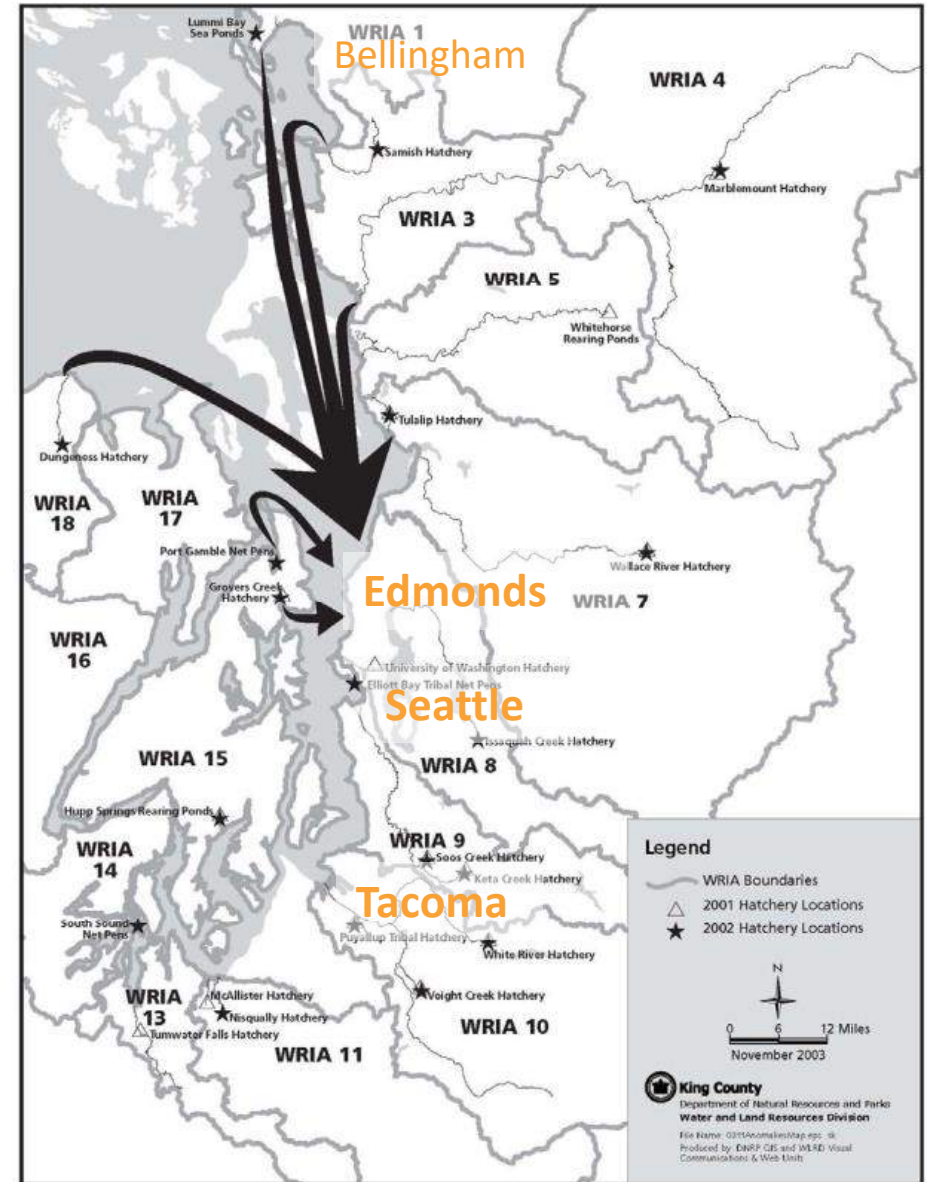




# Adding Context to the Opportunity

## 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

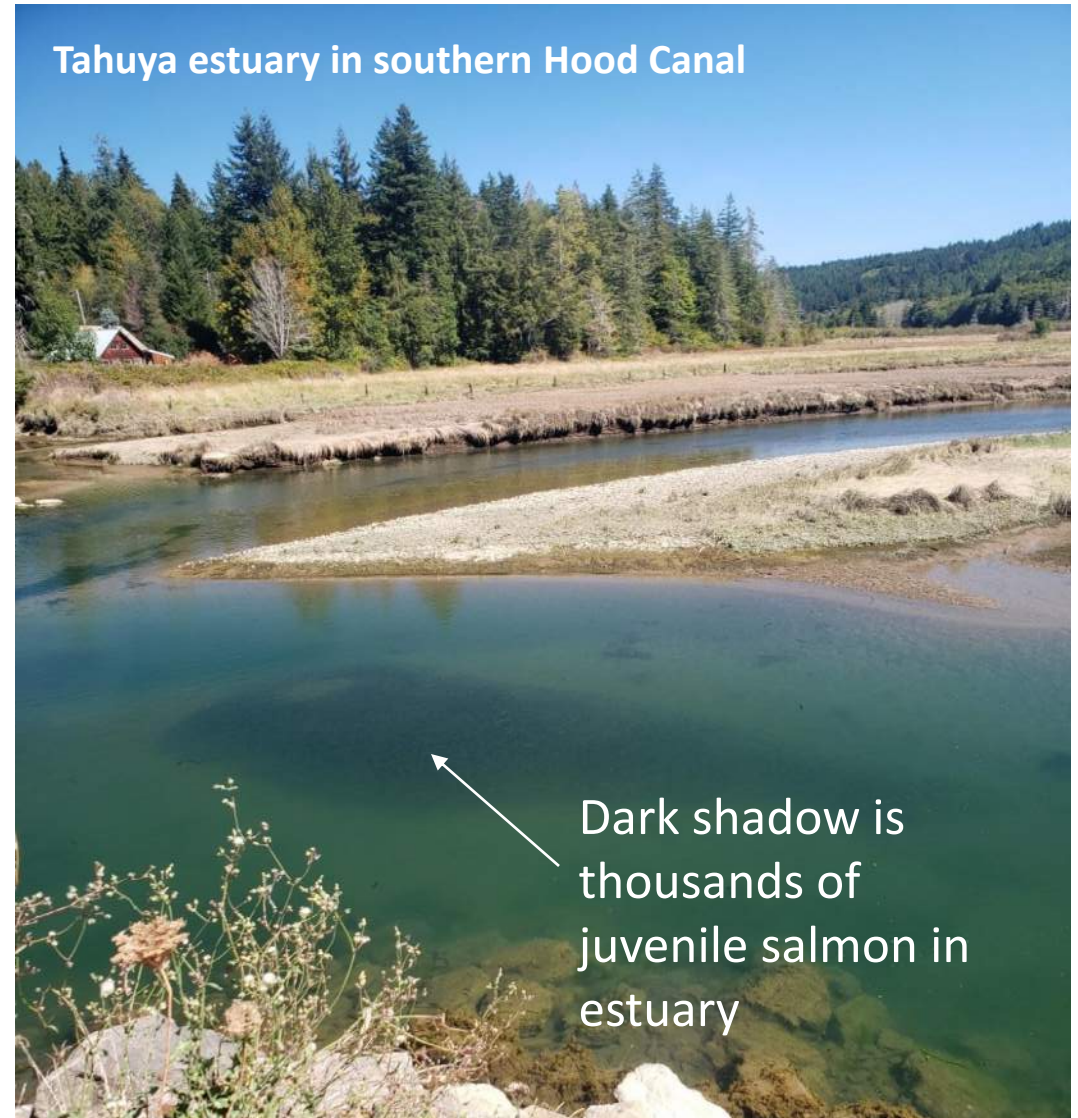


Source: Brennan et al. (2004)



## 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

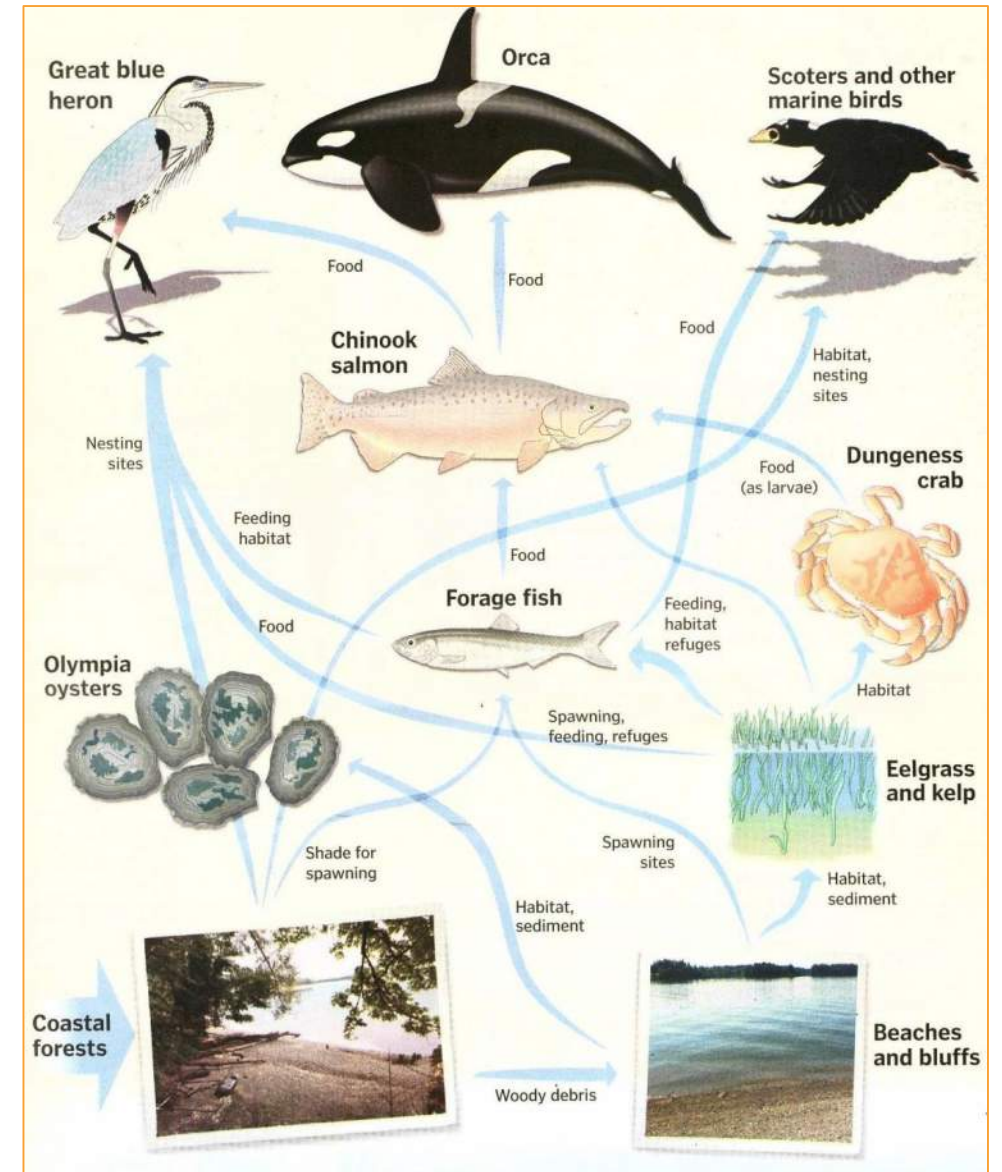
Source: Cereghino et al. (2012)

Edmonds Marsh



# 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*



# 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  
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



Gull Harbor near Olympia



Race Lagoon on Whidbey Island



## 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

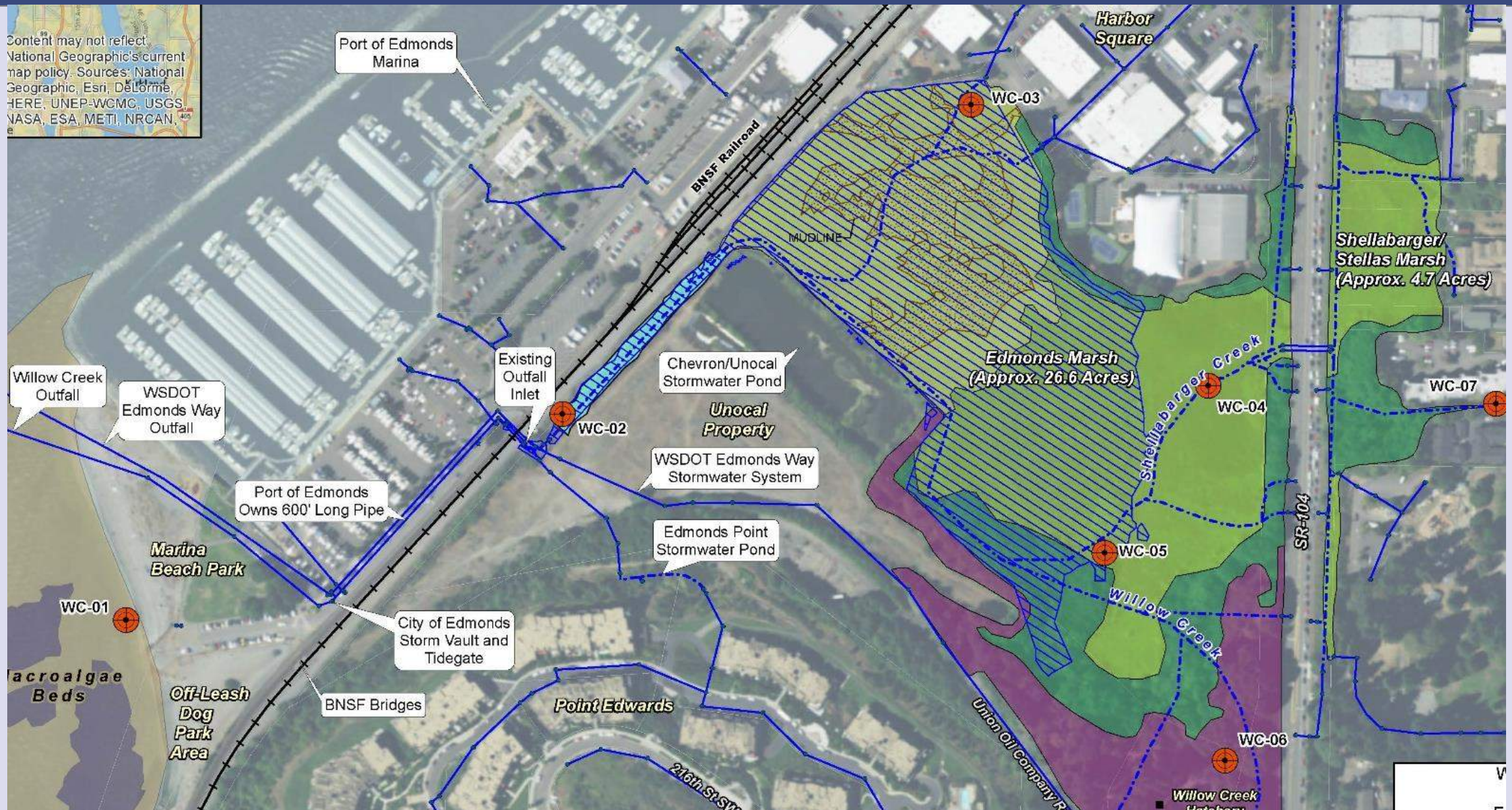




# Willow Creek Daylight Update

## Water and Sediment Quality Monitoring

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, e





# 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
	<b>Construction Subtotal</b>	<b>\$ 8,860,000</b>
	Escalation to 2021/2022 (10%)	\$ 886,000
	Taxes (10%)	\$ 913,000
	Bonding & Insurance (5%)	\$ 443,000
	Contingency (25%)	\$ 2,215,000
	<b>Construction Total</b>	<b>\$ 13,317,000</b>
Other Project Costs		
	Real Estate / Property Acquisition	?
	Engineering, Permits (15% of Construction)	\$ 2,000,000
	Construction Administration (10% of Construction)	\$ 1,350,000
	<b>Construction Total</b>	<b>\$ 16,667,000</b>

# Closing – Thank You

