ESTUARY & SALMON RESTORATION PROGRAM

U.S. FISH & WILDLIFE SERVICE

SKAGIT RIVER SYSTEM COOPERATIVE

The Influence of Tidal Channel Geometry on Pocket Estuary Restoration Design

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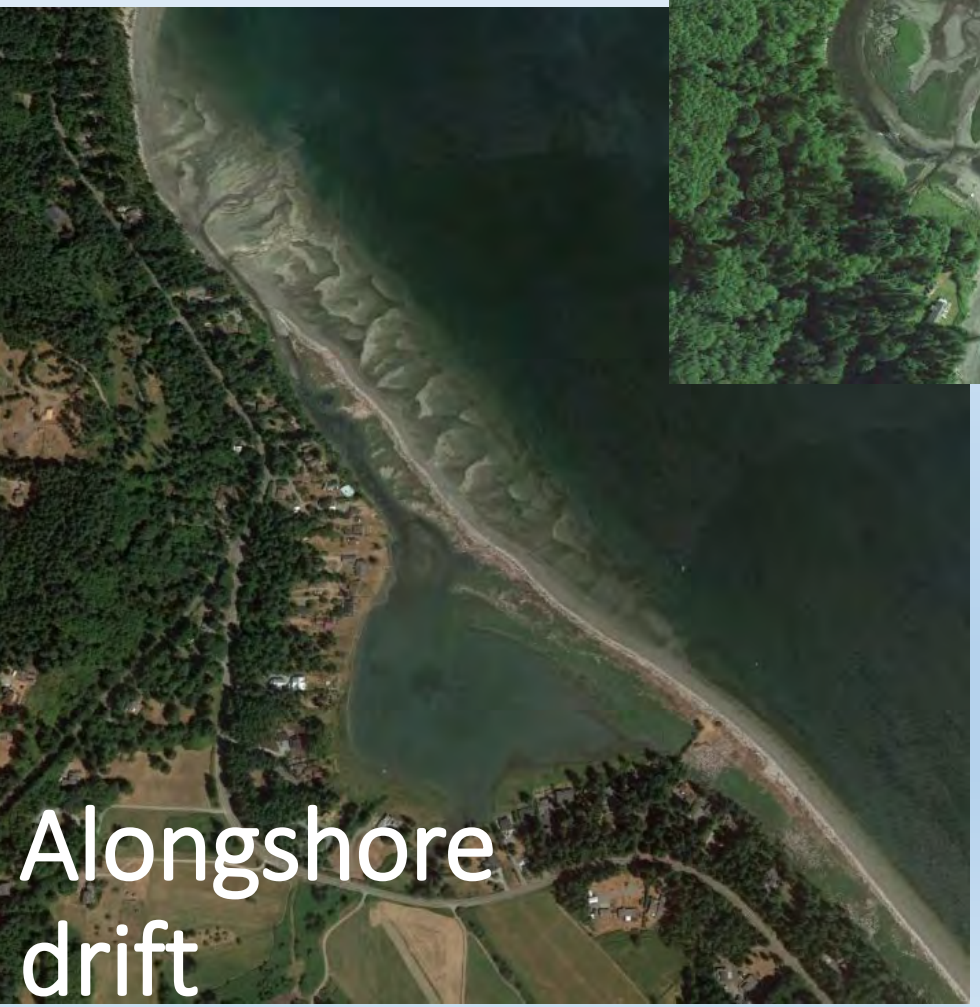
Outline

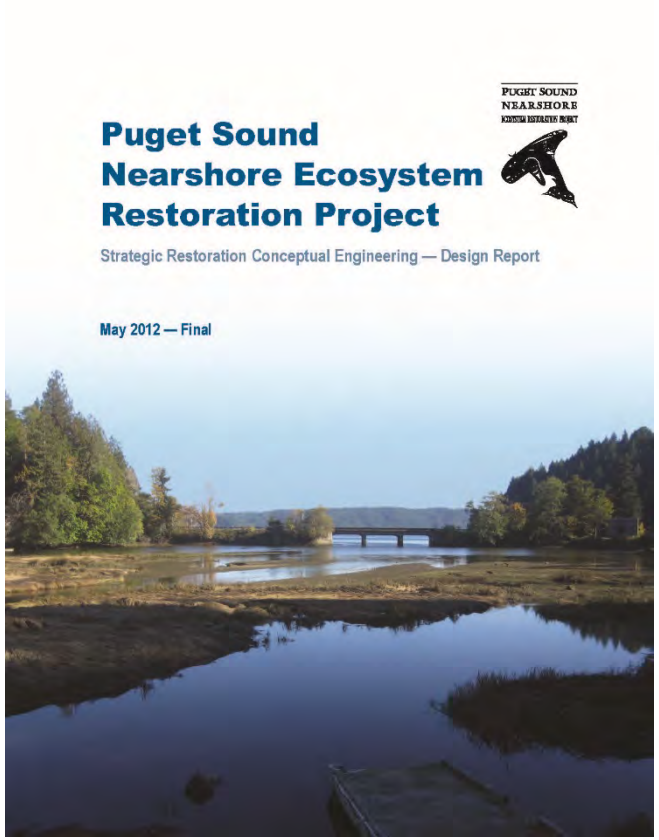
1. Barrier Embayments (aka Pocket Estuary)
2. Restoration Guidelines
3. ESRP Learning Grant Objectives
4. Results of Phase 1
5. Work in Phase 2
6. Phase 3

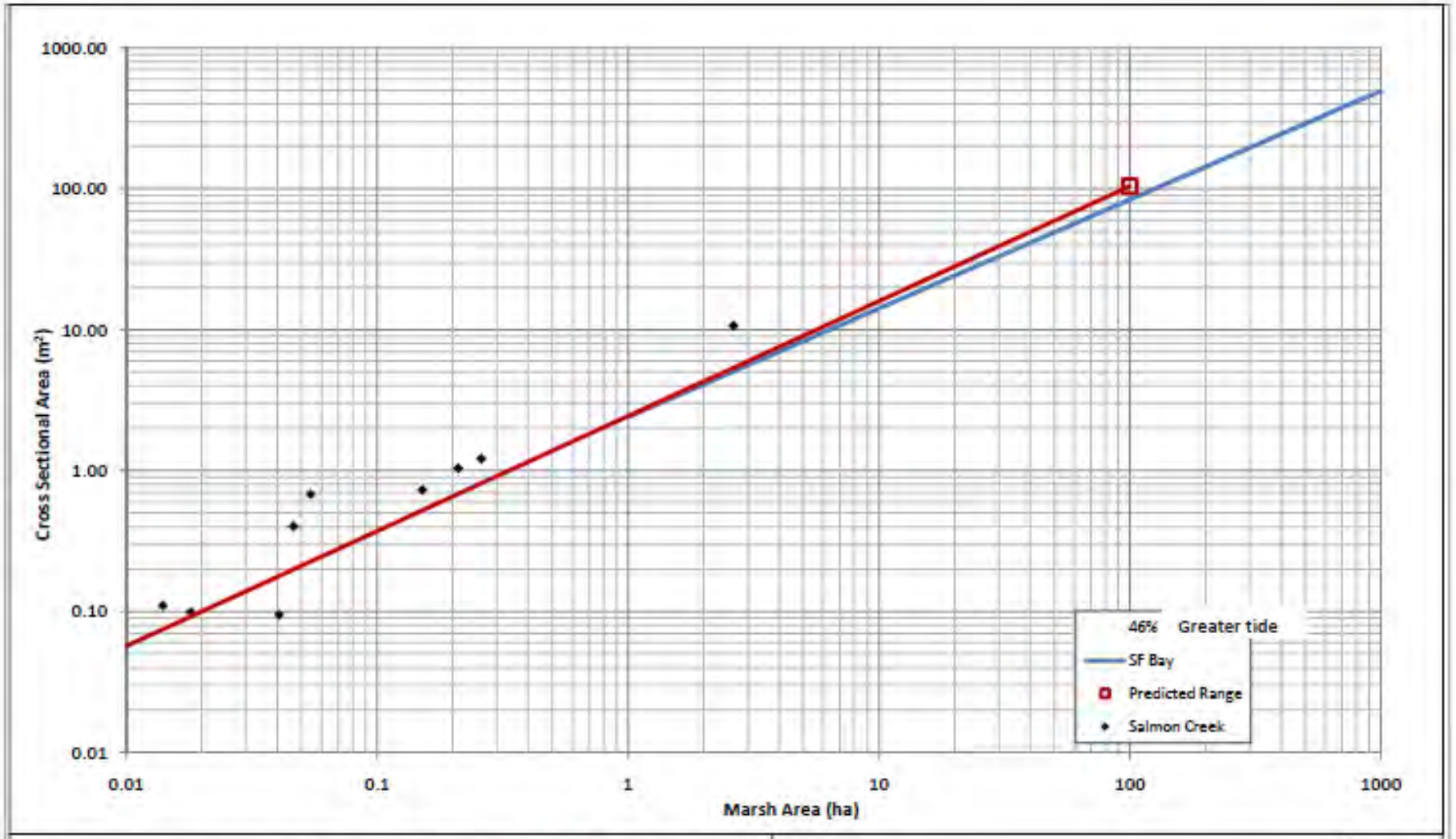
Puget Sound Barrier Embayments



Filled Embayment

Existing Restoration Guidance





Notes: Predicted width regressions are pro-rated based upon the depth and marsh area hydraulic geometry regressions of South SF bay and SF bay and tide range at given location. % greater tide refers to % greater than SF bay tides and is used to determine predicted range.
Source: Regression equations modified from Williams et al. (2002).

figure 2
PSNERP

Channel area hydraulic geometry

PWA Ref #: 2036.00

PWA

Tidal Channel Geometry Learning Project

What is best predictor of primary tidal channel dimensions?

- Marsh area
- Tidal prism
- Watershed Area

Tidal Channel Geometry Learning Project

What are geomorphic factors which keep channels open?

- Geology
- Wind-wave energy
- Sediment Supply
- Shoreline Orientation

Phase 1: Data Collection & Analysis

Field Data Collection

- Tidal prism (volume of water into estuary between MLLW to MHHW)
- Water levels
- Tidal channel cross-section
- Substrate photos (sediment and other features)

Desktop Data Analysis

- Extremal water levels for various intervals (MHHW, 2-yr, 5-yr)
- LIDAR to determine marsh extent at water levels

Year 1 Sites

- 7 sites in total
- 4 of 7 sub-basins
- Variable watershed characteristics
- Small marsh area range (5 to 22 hectare)
- Varied drift cell length/sediment supply

Whidbey Basin Analysis

Beamer et al (in preparation)

- 23 Natural Sites
- Remapped habitat zones with new LIDAR and aerial photos
- Used mapped habitat zones to calculate intertidal area
- Identified other parameters called “factors” for multi-variant regression analysis

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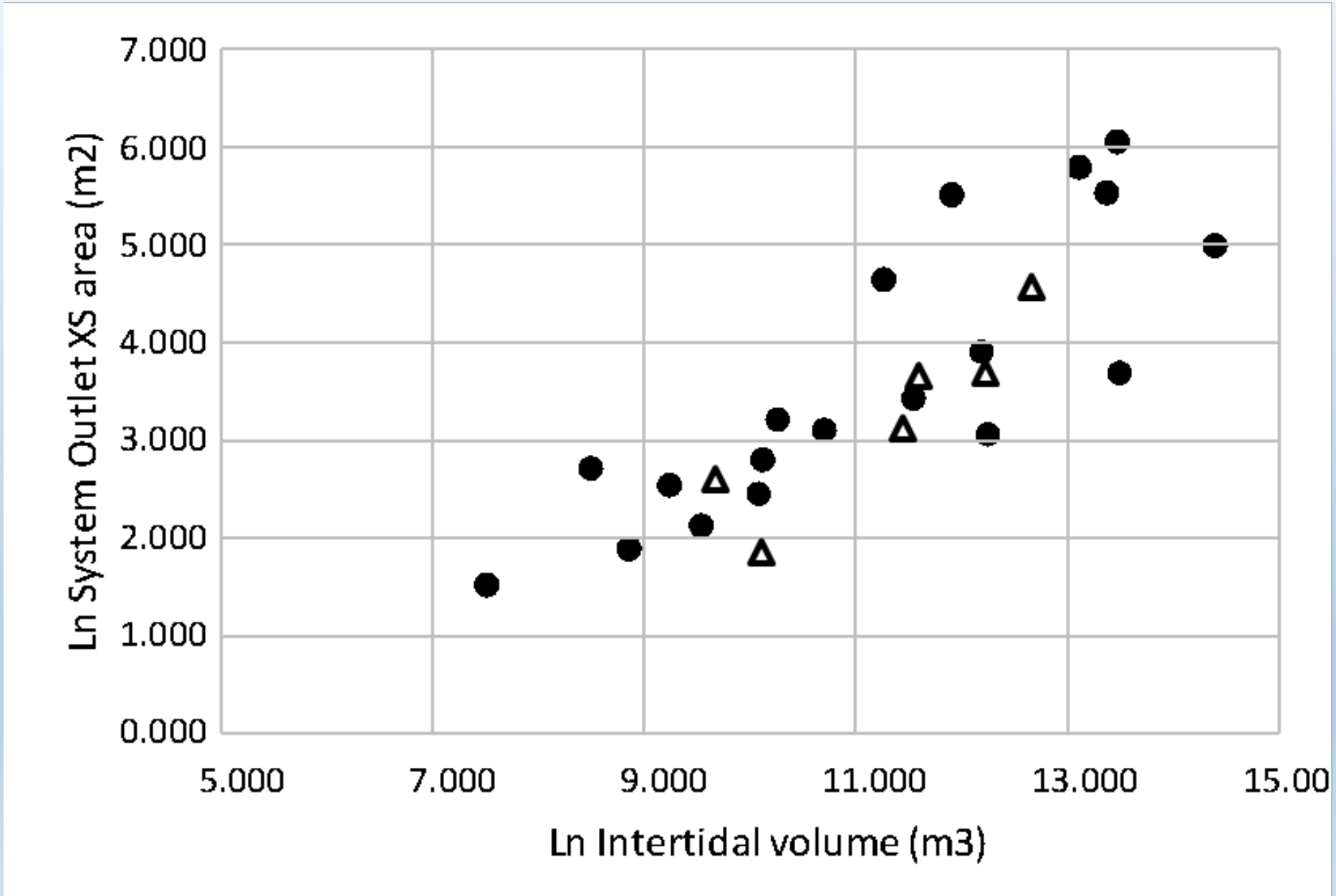
Tidal Prism (Intertidal volume) was best predictor of channel area



Multivariant Regression Analysis (Beamer et al)

Well Predicted

- Tidal Prism was best predictor of channel width or area
- Marsh area positively correlates with watershed area and fetch
- Sediment availability and dominant habitat type together are significant factors

Not Predictive

- Tidal Prism does not predict depth alone
- Neither watershed area nor fetch were good predictors of channel dimensions

Geomorphic Factors

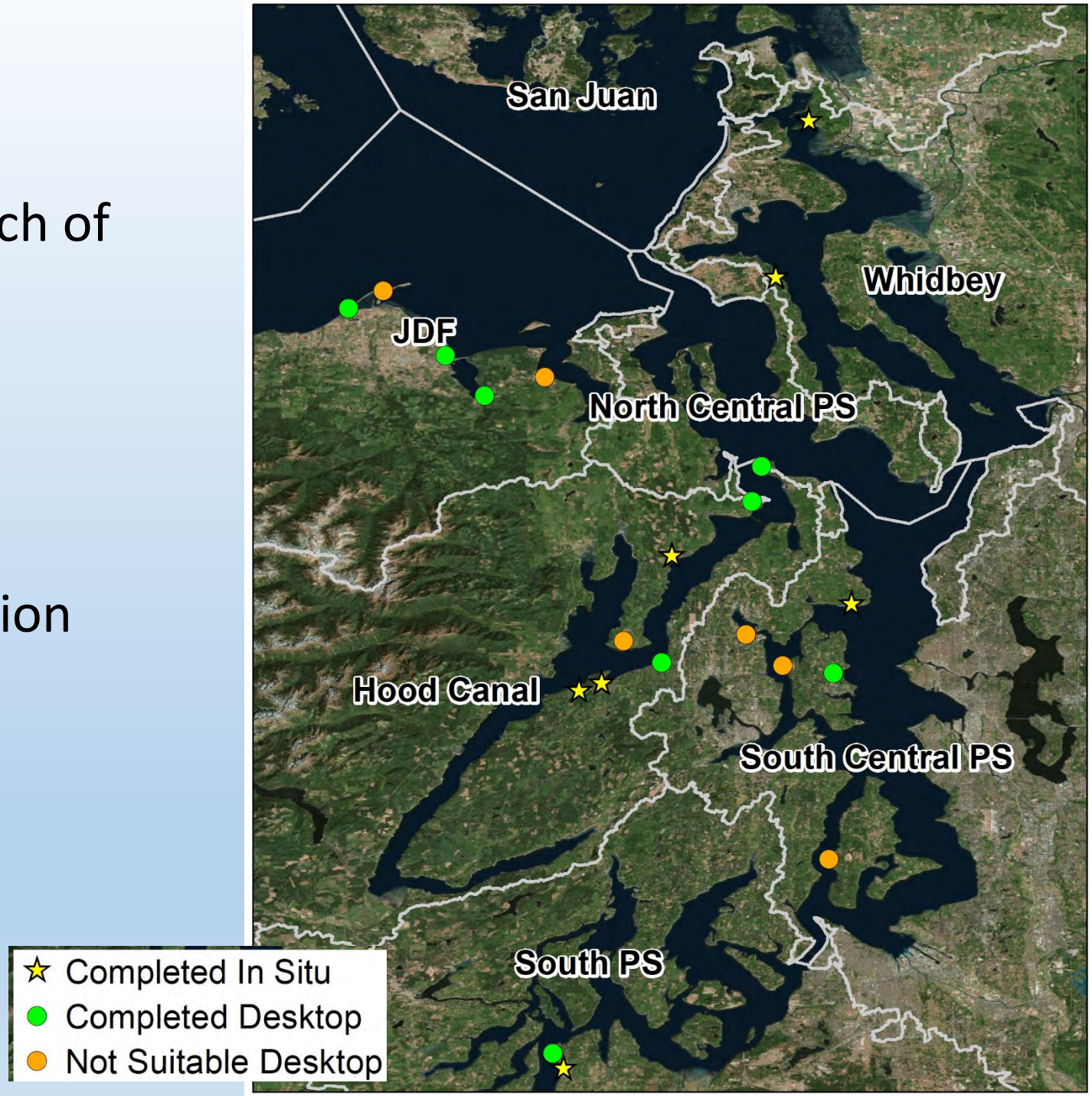
1. Exposed or Protected
2. Location in drift cell
3. Surface water input

Engineering Factors

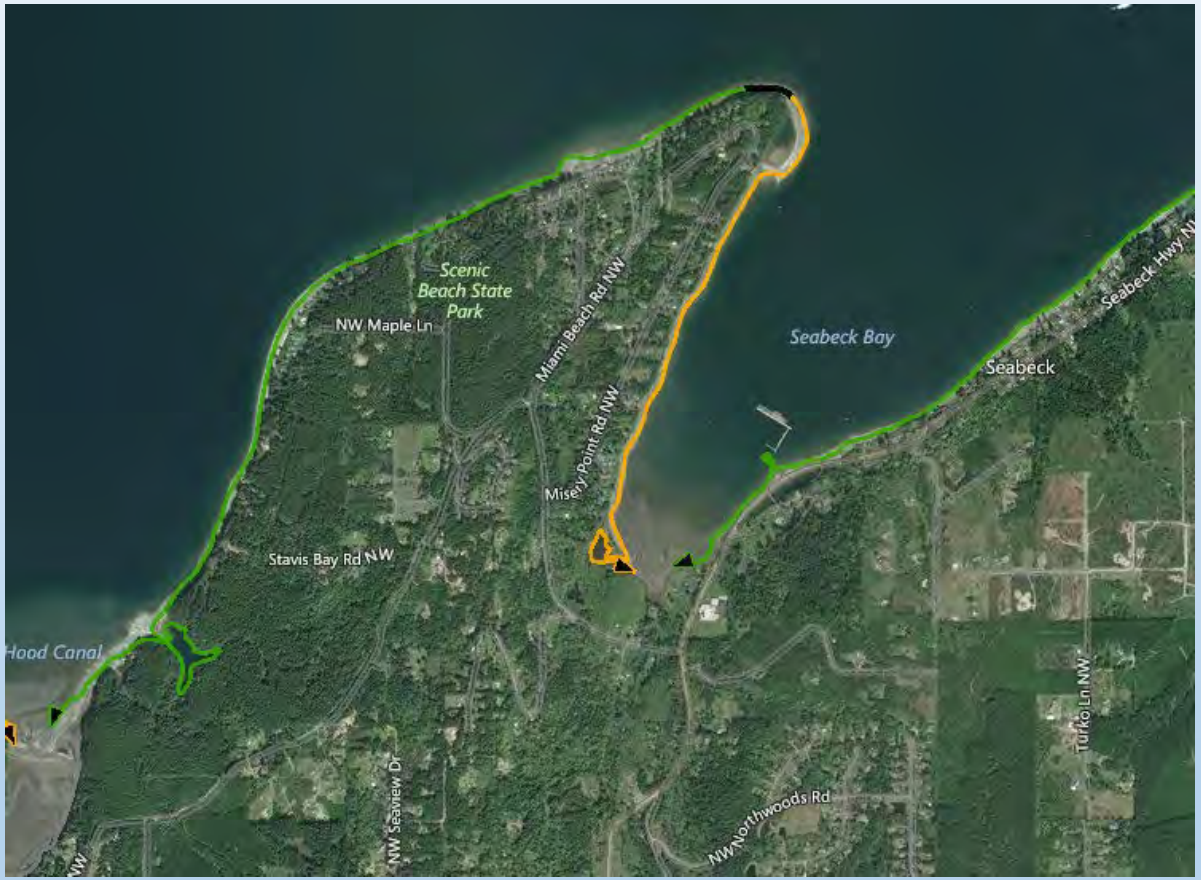
- ✓ Channel thalweg elevation
- ✓ Channel slope
- ✓ Barrier spit configuration

Phase 2 Objectives

1. Parametrize 3 sites within each of 7 sub-basins
2. Sites across full size range
3. Parameterize using LIDAR
4. Identify other factors
5. Conduct multivariant regression on full data set



Phase 3 Research (2019-2021)



1. Field validate additional sites
2. Test sub-basin versus Puget Sound wide regressions
3. Validate empirical models against designed estuary restoration sites

Thank you!

<u>Other Contributors</u>
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