



# Herring's House Shoreline Restoration Feasibility Study



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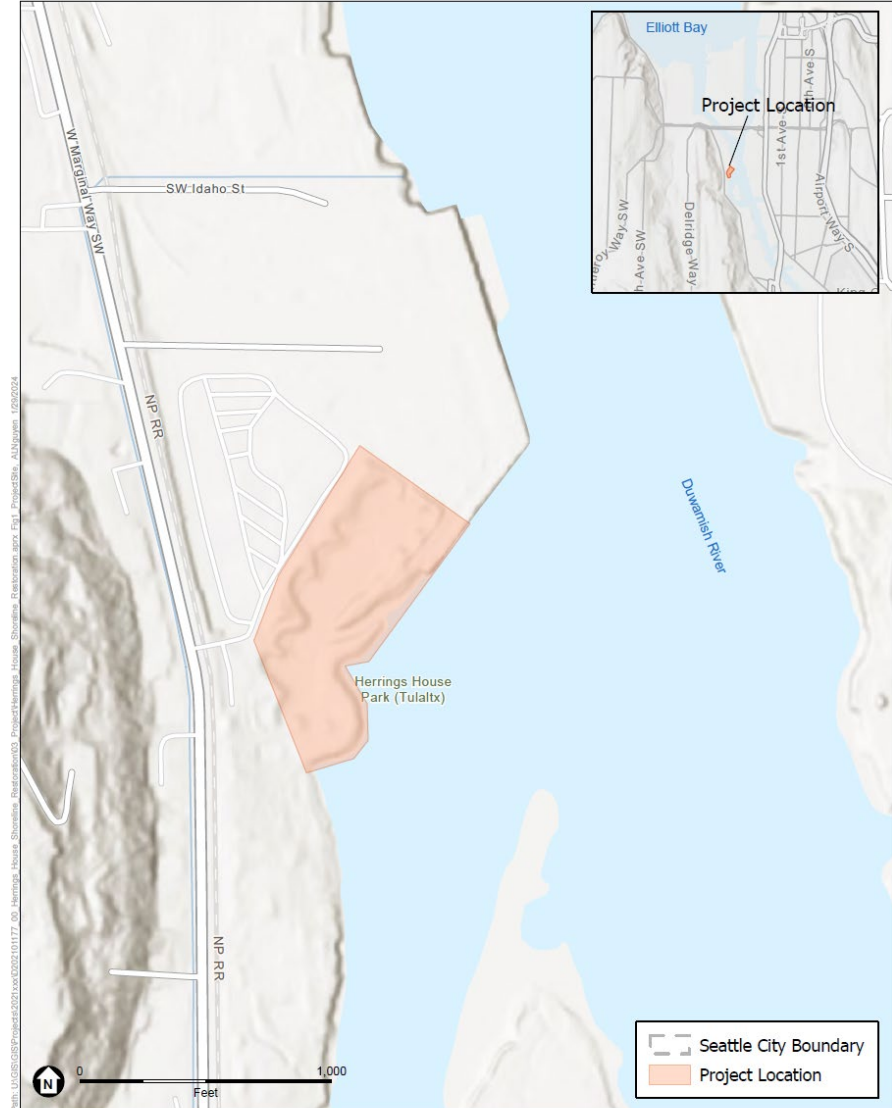
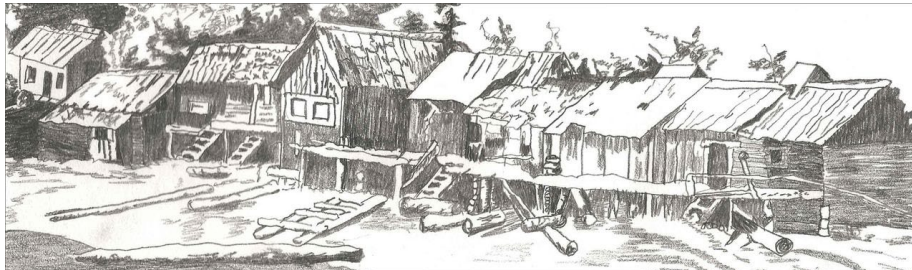


Next Steps



# Project Setting

- Evaluate Alternatives to improve the Site's Ecological Performance.
- Herring's House Park Situated on the Puget Sound Along the Duwamish River
- Holds Historical Significance deeply rooted in the cultural heritage of the *dx<sup>w</sup>dəwʔabš*
- Duwamish
- Currently, Park use includes leisurely walks, nature viewing, and cycling.



Basemap: Esri; County Boundaries: WA DNR; City Boundary: ArcGIS; Study Area: ESA

# Site Investigation

## Previous Restoration Efforts



J.A. Brennan Design, 1999



Aerial Photo, 1993



Aerial Photo, 2001



# Site Investigation

## Survey and Aerial Data Acquisition



Figure 2-1 Survey and Aerial Data Acquisition. a. Drone, b. Ground control points for aerial correction. c. Herring's House South View.

# Site Investigation

## Water Levels

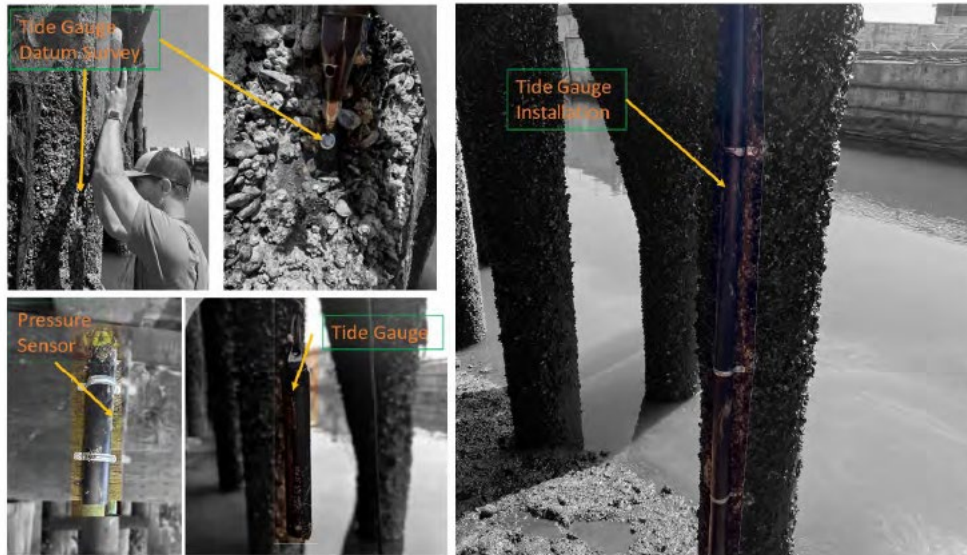
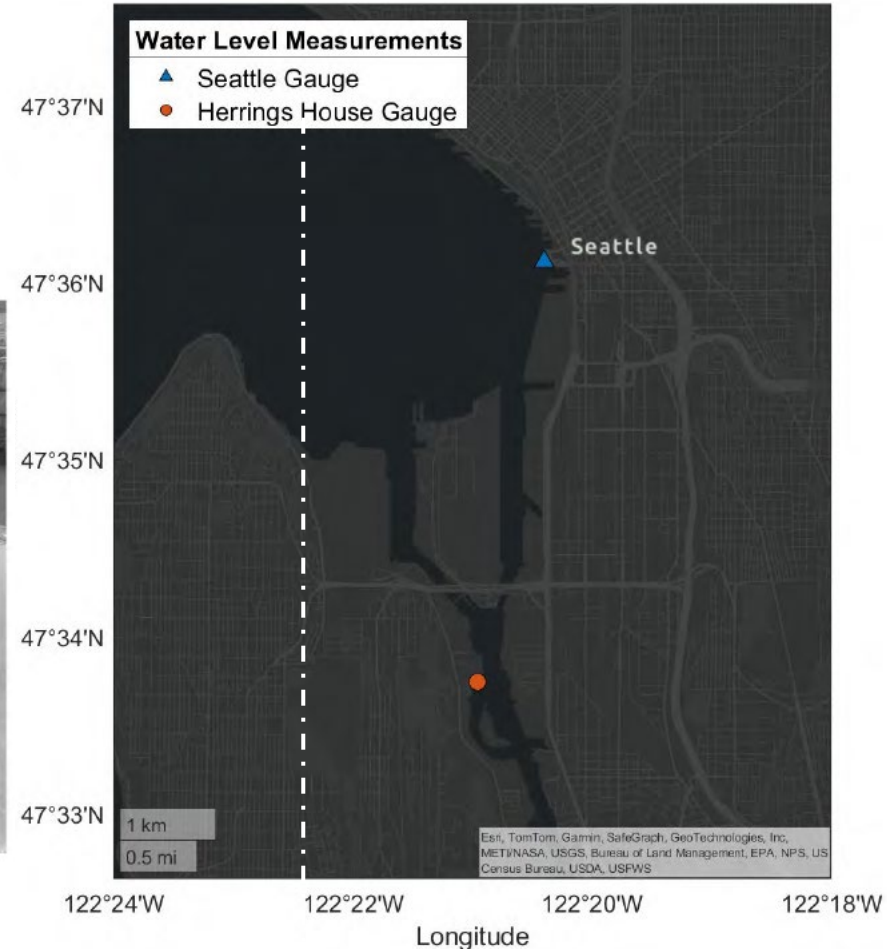
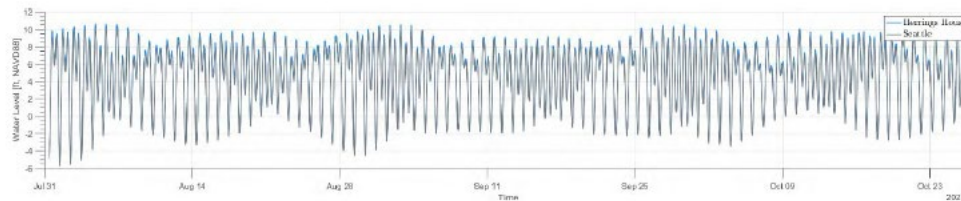


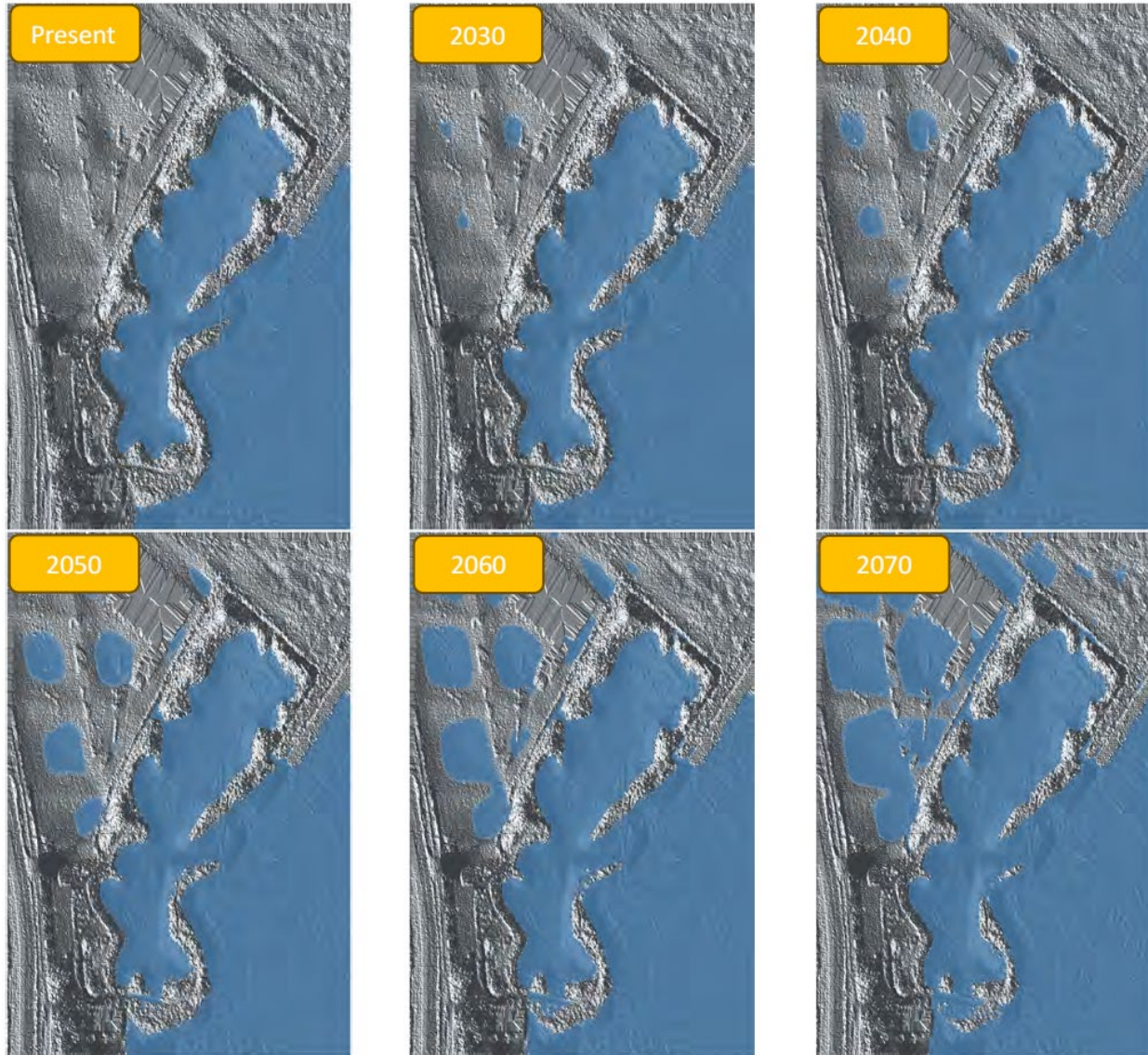
Figure 2-6 Tide Gauge Setup





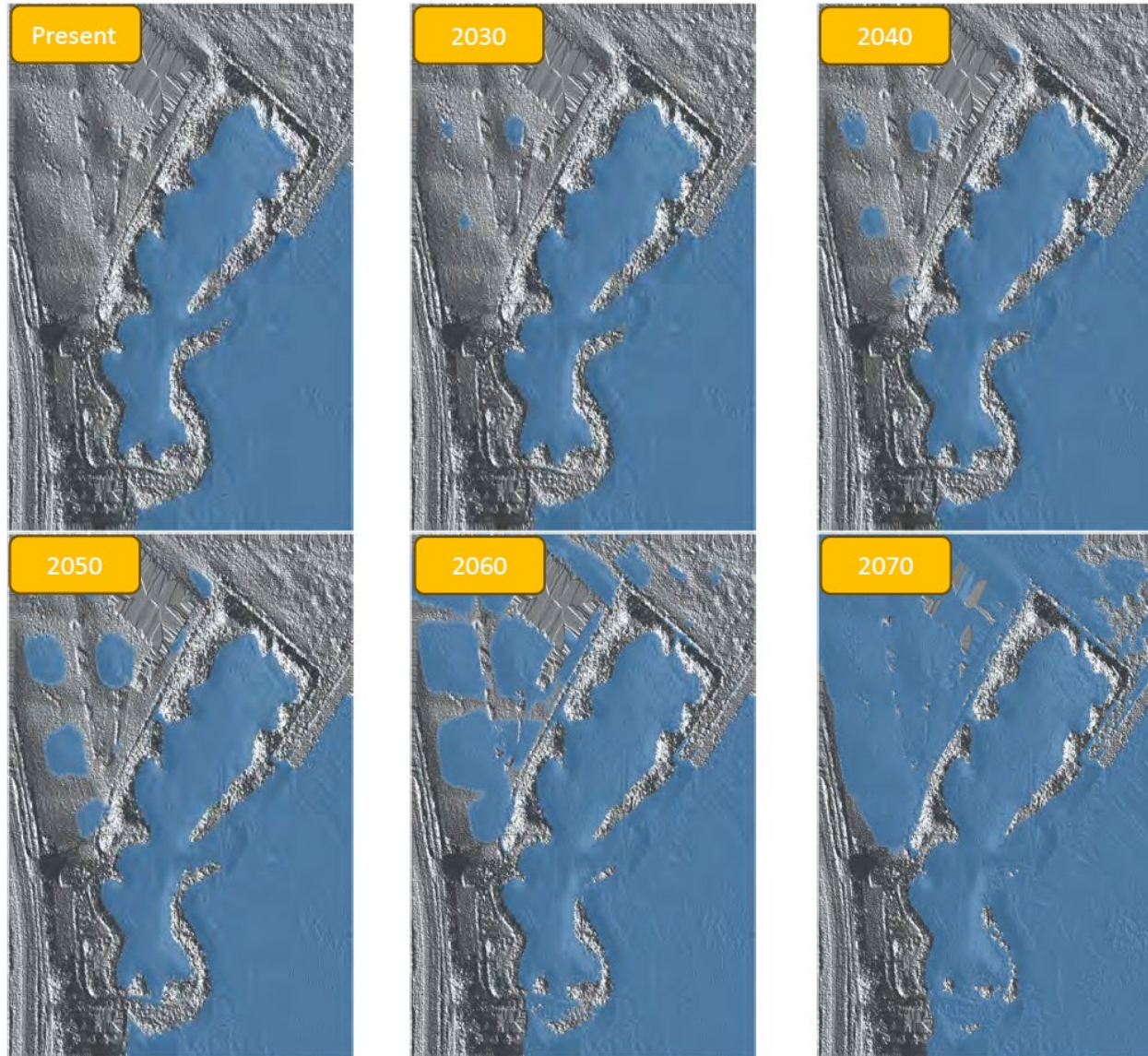
# Site Investigation

## Sea Level Rise – Low Emissions



# Site Investigation

## Sea Level Rise – High Emissions





# Estuarine Processes

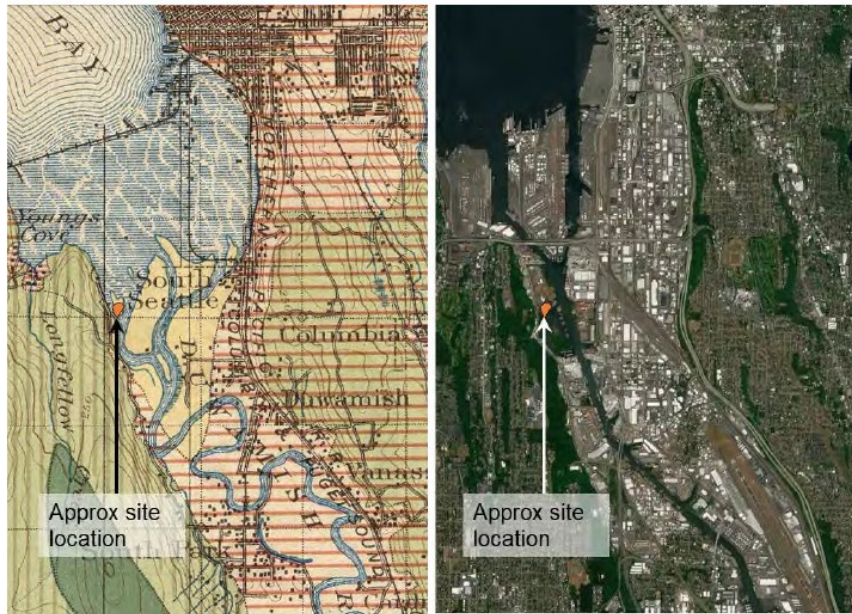


Figure 3-1 Comparison of the lower Duwamish River and project site (left) in 1900 and (right) in 2023.

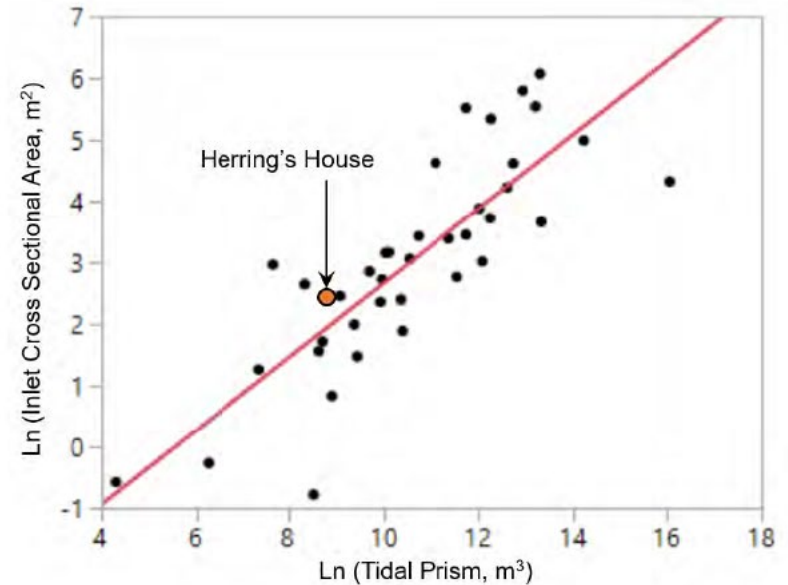


Figure 3-2 Inlet cross sectional area vs lagoon tidal prism from Puget Sound systems, from Côté et al. 2023

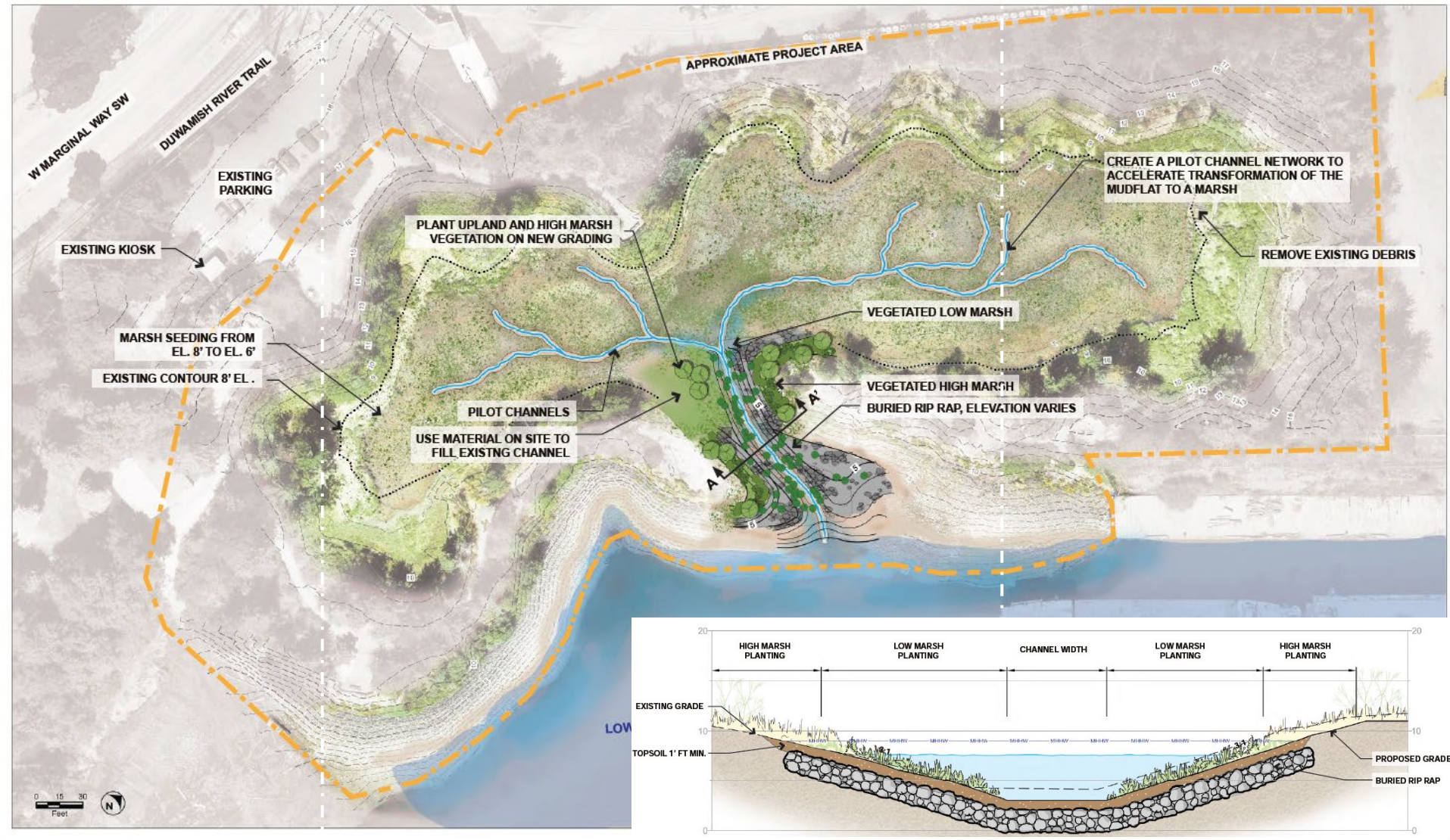
	Observed <sup>1</sup>		Predicted <sup>2</sup>	
	Mean	95% confidence range	Mean	95% confidence range
Tidal Prism (ft <sup>3</sup> )	223,000	--	--	--
Cross Sectional Area <sup>3</sup> (ft <sup>2</sup> )	116	101-127	80	0-240
Mean Width <sup>4</sup> (ft)	33	28-37	50	23-90
Mean Depth <sup>5</sup> (ft)	3.6	3.2-3.7	1.3	0.7-2.0





# Development of Alternatives

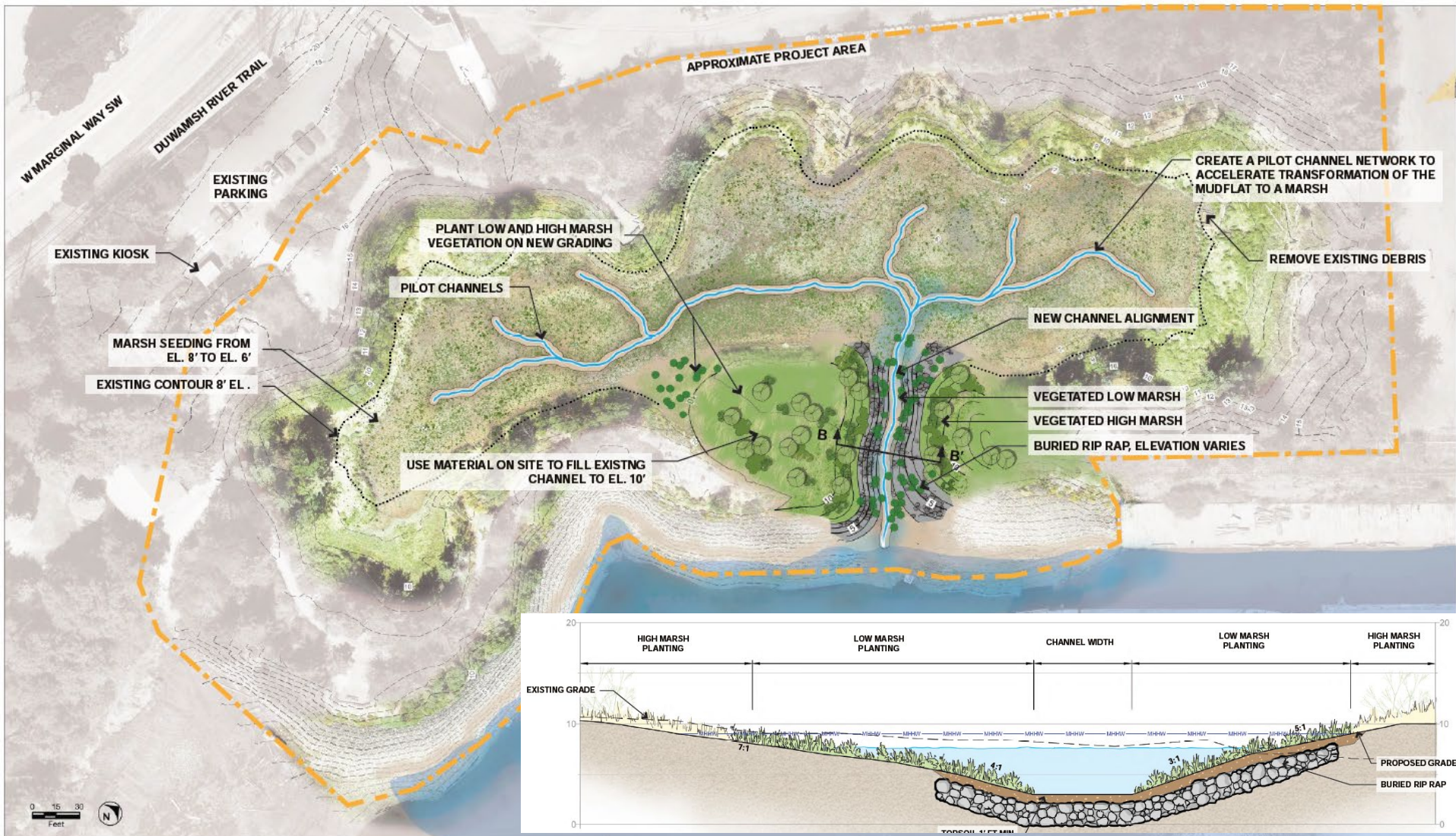
## Estuarine Restoration- Concept 1





# Development of Alternatives

## Estuarine Restoration- Concept 2





# Development of Alternatives

## Upland Improvements – Alternative A





# Development of Alternatives

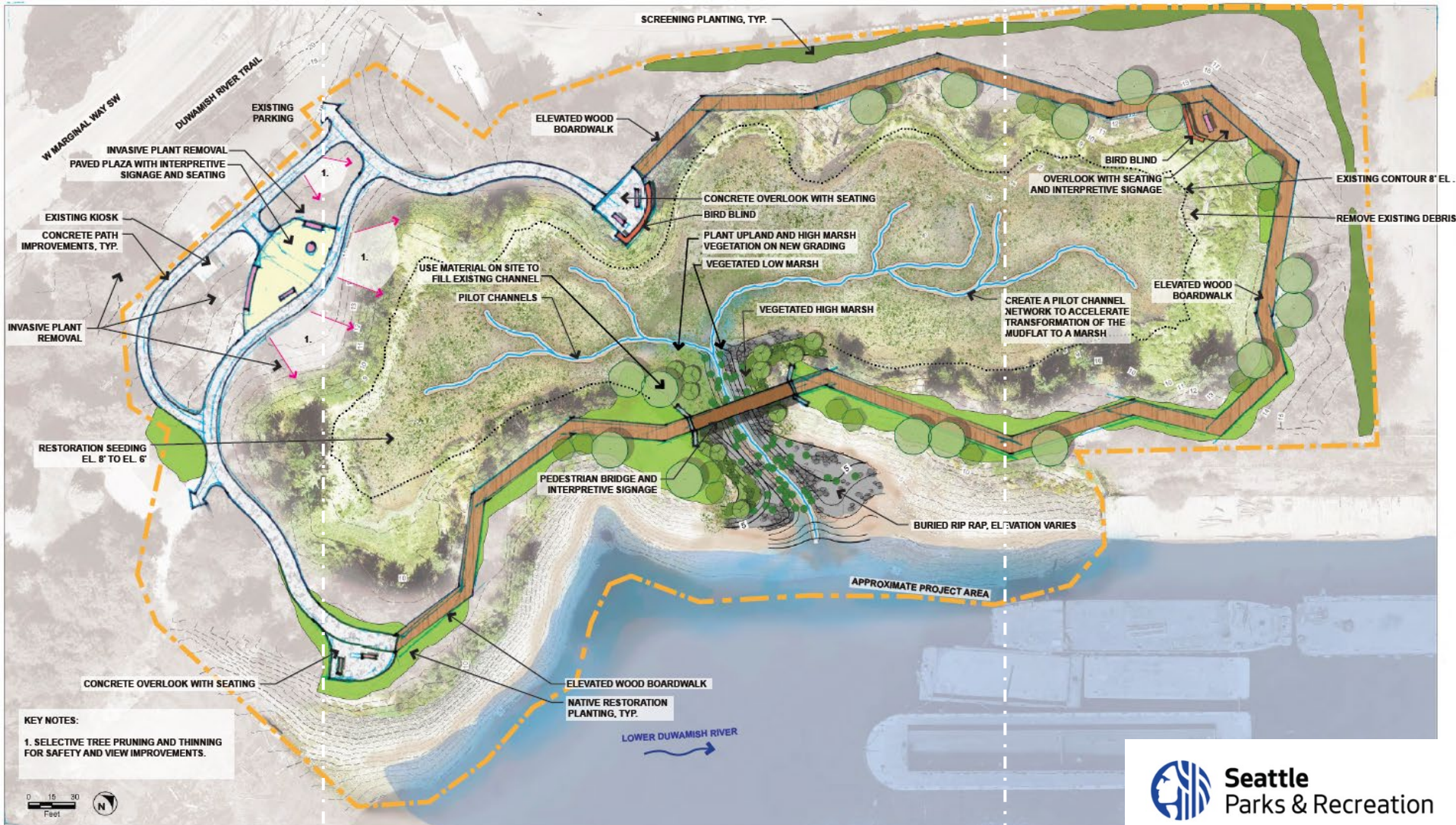
## Upland Improvements – Alternative B





# Development of Alternatives

## Upland Improvements – Alternative C





# Evaluation of Alternatives

Design Parameters	Concept 1	Concept 2	Alternative A	Alternative B	Alternative C
Estuarine Processes	✓ ✓	✓	—	—	—
Resilience to Sea Level Rise	✓	✓	✓	✓ ✓	✓ ✓ ✓
Nearshore Habitat	✓	✓ ✓	—	—	—
Recreation	✓ ✓	✓	✓	✓ ✓	✓ ✓ ✓
Constructability	✓ ✓	✓	✓ ✓ ✓	✓ ✓	✓
Maintenance	✓	✓	✓ ✓ ✓	✓ ✓	✓
Construction Cost	\$	\$ \$	\$	\$ \$	\$ \$ \$



# Key Findings & Recommendations

Design Parameters	Recommendations
Inlet Stability	<ul style="list-style-type: none"> <li>The inlet was found to be too narrow and too long relative to similar sites connected to Puget Sound. To restore natural processes, we recommend shortening and widening the inlet to a minimum of 50 ft wide to meet hydrology requirements and widening to at least 120 ft to support salmon habitat.</li> <li>Additionally, it is recommended to over-excavate the inlet channel to provide additional accommodation space for sedimentation.</li> </ul>
Channel Geomorphology	<ul style="list-style-type: none"> <li>Adjust Channel Alignment: Rotate the Channel so that it is perpendicular to the existing shoreline.</li> <li>Dredge Pilot Channels: Excavate pilot channels within the marsh to a depth of at least 4 ft NAVD88. This will enhance regular tidal inundation and facilitate the natural “washing: the process of the imported soil, a process needed to support wetland vegetation.</li> </ul>
Riparian and Wetland Vegetation	<p>Riparian and wetland re-vegetation is recommended:</p> <ul style="list-style-type: none"> <li>Plant riparian and wetland vegetation at elevations between 8 ft and 10 ft NAVD88.</li> <li>Once tidal flow is established, seed the existing estuary area, which ranges from 5 to 8 feet above NAVD88.</li> </ul>
Sea Level Rise	<ul style="list-style-type: none"> <li>Between 2030 and 2050, 2-year and 5-year water level events are expected to exceed 12.5 feet NAVD. These events will flood certain upland areas within the park. By 2050-2070, these incidents are anticipated to occur annually.</li> <li>It is recommended to consider the impact of rising sea levels when designing and elevating upland areas within the park. A phased approach can be used, gradually transitioning from marshland to higher elevations.</li> </ul>



# Key Findings & Recommendations

Design Parameters	Recommendations
Upland Improvements and Park Use Opportunities	<p>The proposed inlet modifications and corresponding enhancements will allow park visitors to observe and monitor the restoration progress of this shoreline segment. To facilitate this, consider the following actions:</p> <p><b>Selective Vegetation Trimming:</b> Trim and thin existing vegetation to improve visual access to the park.</p> <p><b>Bird Blinds Installation:</b> Install bird blinds at locations where overlooks provide views into the wetland.</p> <p><b>Navigation Route Demarcations:</b> Clearly mark navigation routes to guide visitors away from critical habitat and restoration areas. This may involve using split-rail fencing, signage, and strategic planning.</p> <p><b>Habitat Signage:</b> Install signage to identify habitat planting locations.</p>
Permitting Requirements	<ul style="list-style-type: none"> <li>• A comprehensive review of the permitting requirements is needed, including any potential issues. The project will likely require federal, state, and local permits.</li> <li>• The location is marked to have high sensitivity for cultural resources. Additional review will be necessary to identify and evaluate the potential impacts of cultural resources</li> </ul>
Contaminated Soil	<ul style="list-style-type: none"> <li>• Records suggest the presence of contaminated soils below grade at the project site. Further investigation of the soils within the proposed excavated and regrading area will be needed to inform future plans and decisions.</li> </ul>
Cost Estimate	<p>Total costs were estimated on a first order of magnitude at the concept level.</p> <ul style="list-style-type: none"> <li>• The total cost of the marsh restoration alternatives is estimated at \$800 K to \$900 K.</li> <li>• The Upland Improvements cost estimate for the evaluated alternatives fluctuates between \$900 K to \$3.6 M depending on the chosen alternative.</li> </ul>



## Next Steps

- Incorporate feedback and refine concepts
- Determine the preferred concept
- Recommended Further Investigation:
  - Permitting Requirements & Strategy
  - Cultural Resources
  - Contaminated Soils
  - Marsh and Upland Vegetation
  - Coastal Resilience
- 30% Design of Preferred Alternative