LIVING SEAWALL PILOT

Port Commission Agenda Item #9B

April 12, 2022

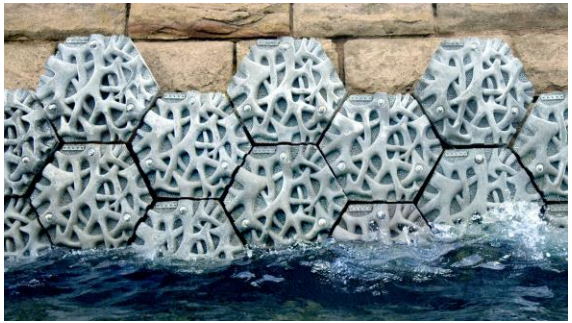
PORT OF SAN FRANCISCO

Waterfront Resilience Program

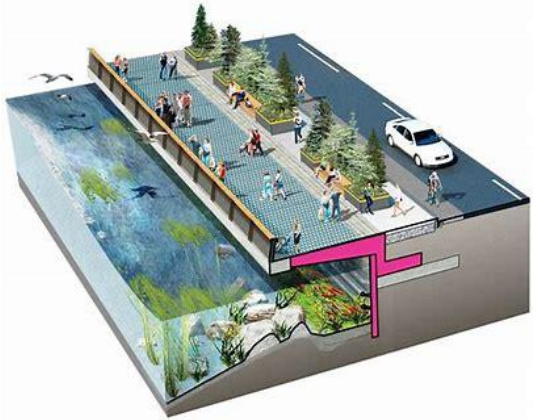
Smithsonian
Environmental Research Center

AGENDA

Presentation Overview



Sydney Harbor's Living Seawall



Seattle's Elliot Bay Living Seawall

- Introduction
- Pilot Overview
- Developing the Pilot
- Native Bay Species and Habitats
- Precedents
- Project Costs
- Next Steps

FOCUS ON NATURE-BASED RESILIENCE

Living Seawall Pilot will bring international research to San Francisco Bay

- Reimagining traditional seawalls
- Emphasis on benefits to native species and potential to improve habitat quality along Bay waterfront
- Opportunities to incorporate Engineering with Nature into future earthquake safety and flood risk reduction projects
- Team collaboration

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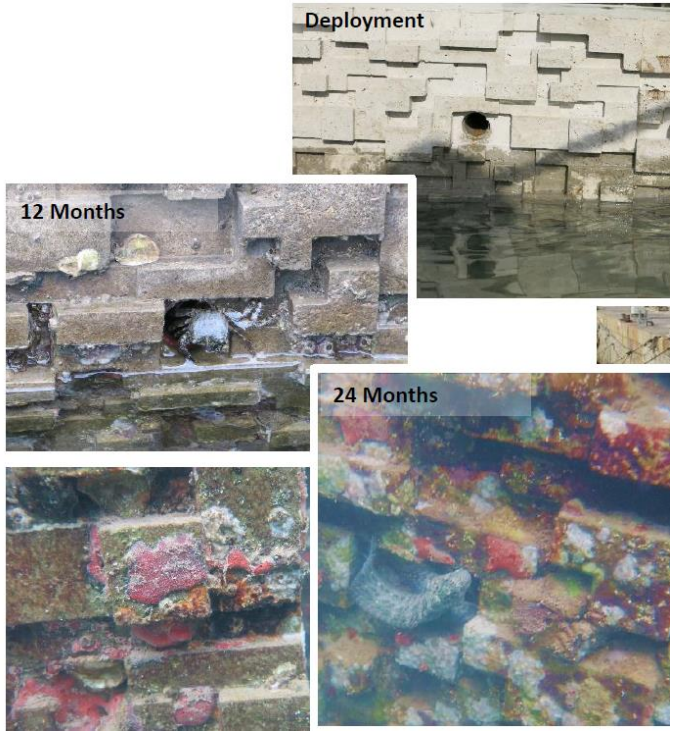
LIVING SEAWALL PILOT

Overview



- Objective: ecological enhancement of seawalls
- Collaboration between Port of San Francisco and Smithsonian Environmental Research Center (SERC)
- Piloting frames with tiles made of precast textured concrete with admixture at:
  - 3 locations along the Embarcadero Seawall
  - 3 tidal elevations
- Study ecological growth on concrete, using textured surfaces and concrete admixture composition
- Two-year monitoring by SERC scientists
- Report on potential benefit to enhance Bay habitat

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Adding to the Port's previous nature-based projects

- Heron's Head Park and Heron's Head Living Shoreline
- Pier 94 Wetlands
- Crane Cove Park
- Mission Rock's China Basin
- India Basin Project

LIVING SEAWALL PILOT STUDY QUESTIONS

Building on existing research

- Nearly all research has been done in the intertidal zones. **Does the benefit of texture addition extend from the high intertidal to the subtidal?**
- Most research has been done in a single location. **Does the benefit of texture addition extend across wave-exposure and salinity gradients?**
- Most research focuses on a single scale (i.e. added panels or tidal pools). **Is there a benefit to larger scale?**
- Most research looks at just a few species or at species richness in general. **Does texture benefit native species more than non-native species?**

LIVING SEAWALL PILOT BENEFITS

Engineering with nature in future resilience projects

Photos courtesy of ECOncrete

- Pilot scale tests of surface complexity and material types
- Testing across salinity/wave exposure gradient
- Testing across tidal elevations
- Testing over two sizes of tiles
- Provide design guidance for seawall renovations
- Allow Port to maximize investments in ecological enhancements where they will have the greatest benefit
- Puts the Port in a leadership role in the development of living seawall designs
- Data can be shared with other ports and landowners around the Bay and the world

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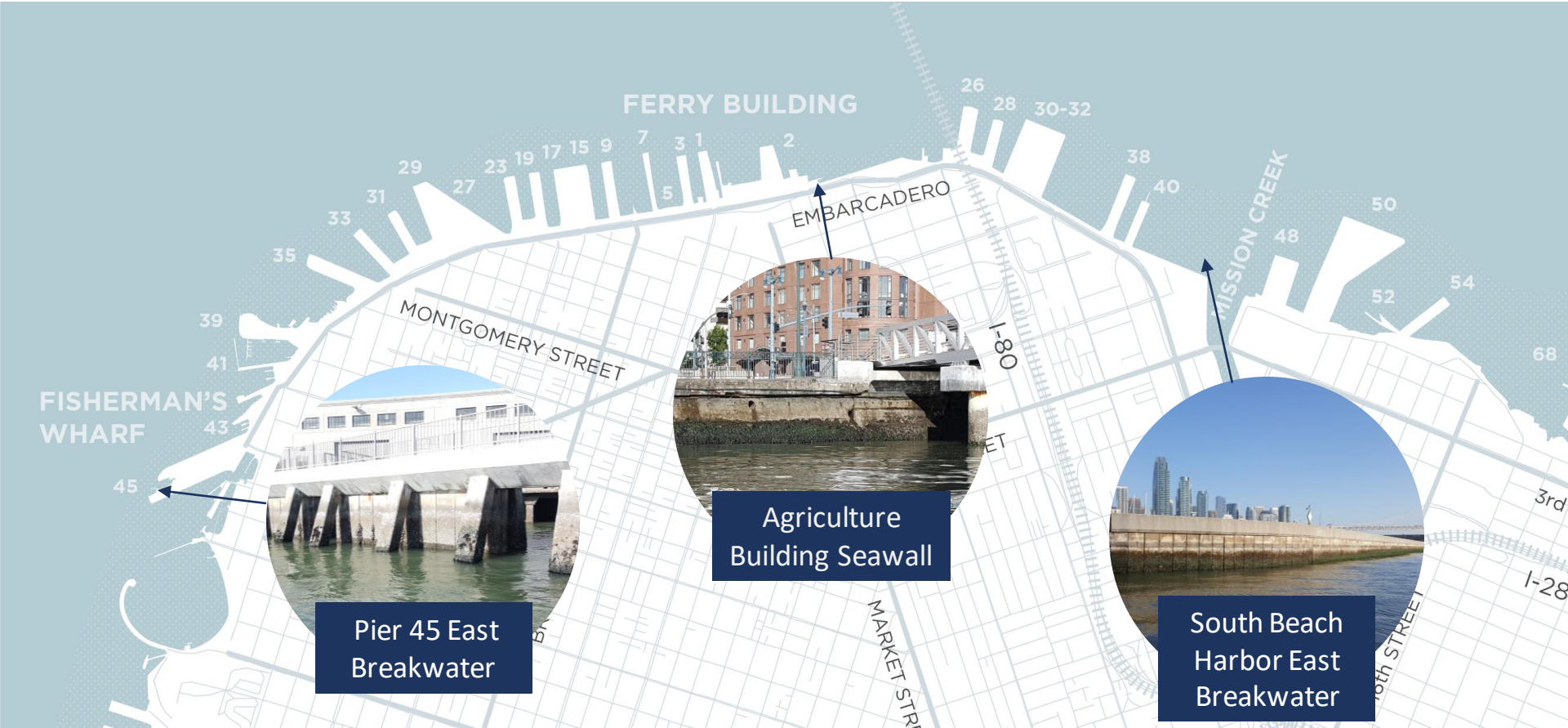
LIVING SEAWALL PILOT PROPOSED SITES

Monitoring different Bay conditions



LIVING SEAWALL PILOT FRAME DESIGN

Collaborative, iterative, innovative engineering

- Tiles mounted to frame for easier and more accurate installation
- Designed standing platform for safer field observation
- Three tiles below the low-tide mark are removeable for observation
- Built prototype frame for hands-on testing, feedback applied to final design

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NATIVE BAY SPECIES

Native Olympia Oysters *(Ostrea lurida)*

- Only oyster native to West Coast
- Target of restoration; population down from historic numbers
- Provides food, habitat for other species
- Ecosystem services

Rockweed *(Fucus distchus)*

- Mid- high intertidal zone
- Foundation species
- Provides food, habitat for other species
- Target for mitigation funding

Pacific Herring *(Clupea pallasii)*

- Supports Bay food webs and commercial fishery
- State-managed fish stock
- Requires hard substrate for spawning; macroalgae best substrate for herring eggs

ROCKY SHORE COMMUNITIES


Feather boa kelp


Rainbow seaweed


Red seaweed

ASSOCIATED FAUNA


Chitons


Bay mussels


Littorines


Limpets


Isopods


Hermit crabs


Rock crabs


Nudibranchs

PRECEDENTS: SEAWALLS THAT MIMIC NATURE

Examples

Crevices, grooves, pits

Seawall made with varying size and shapes of boulders without cement

Pittwater, Australia

Tide pools

Field experiment using planters to create tide pools

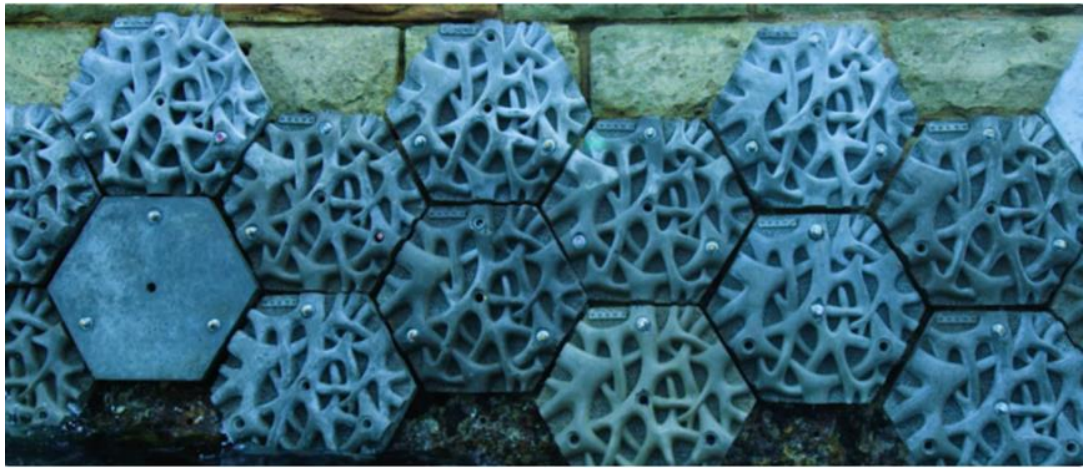
Sydney Harbor, Australia

Interstitial spaces

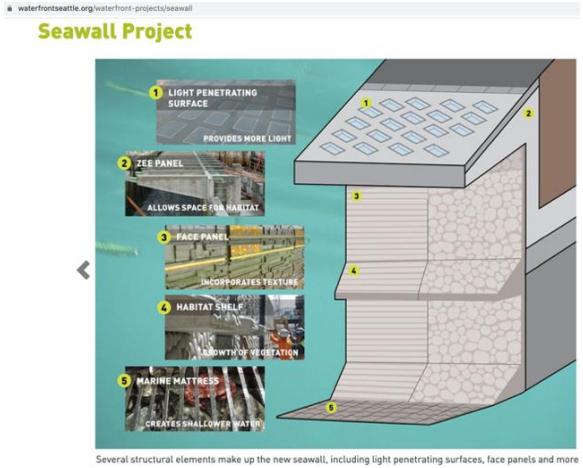
Example of texture and configuration to enhance habitat

ECOncrete website

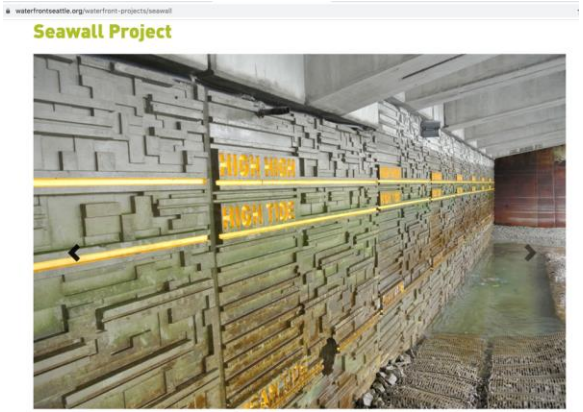
PRECEDENTS: SYDNEY HARBOR

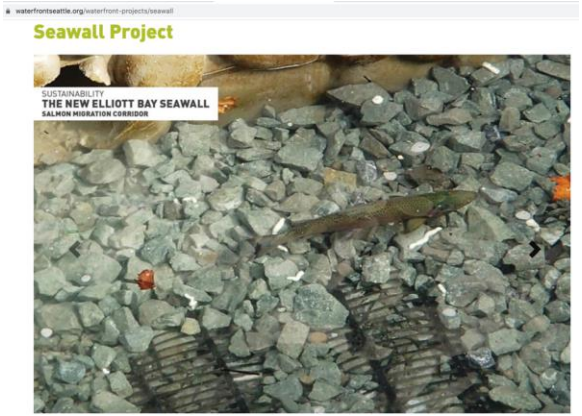


PRECEDENTS: SEATTLE SEAWALL PROJECT - SALMON FOCUSED



Several structural elements make up the new seawall, including light penetrating surfaces, face panels and more





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Project budget & schedule

Phase & Scope	Schedule	Estimated Cost
Phase 1: Scoping & Predesign	2021	$23,000
Phase 2: Design, Permitting, Construction & Pre-construction Baseline Survey	9 months (Jan.-Sept. 2022)	$400,000
Phase 3: Scientific Monitoring (Three surveys per year for two years)	2 years (through 2024)	$385,000
Phase 4: Final Report & Removal of Frames	3 months (4Q24 or 1Q25)	$93,000
Subtotal of Estimated Cost		$901,000
Total Cost Including +15% Contingency (+$135k)		$1,040,000

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LIVING SEAWALL PILOT

Next steps

- Permits/Notifications
- Purchase tiles and materials
- Health and Safety plan
- Fabrication
- Installation
- Baseline Survey
- 2-year Monitoring and Reporting
- Removal
- Report

THANK YOU

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Tim Felton and Luis Vallejos, Port Maintenance

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Waterfront Resilience Program

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