# Point Hudson

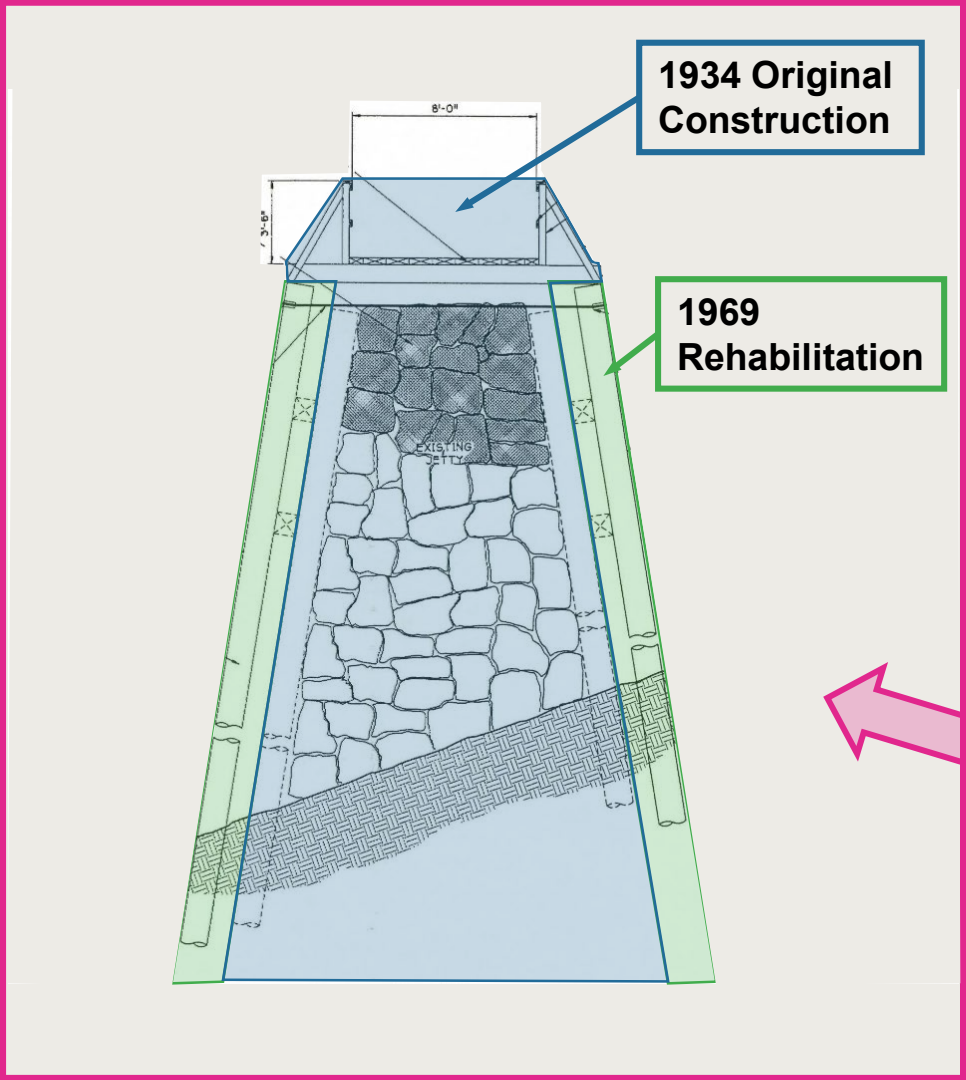
## Breakwater Improvement Project

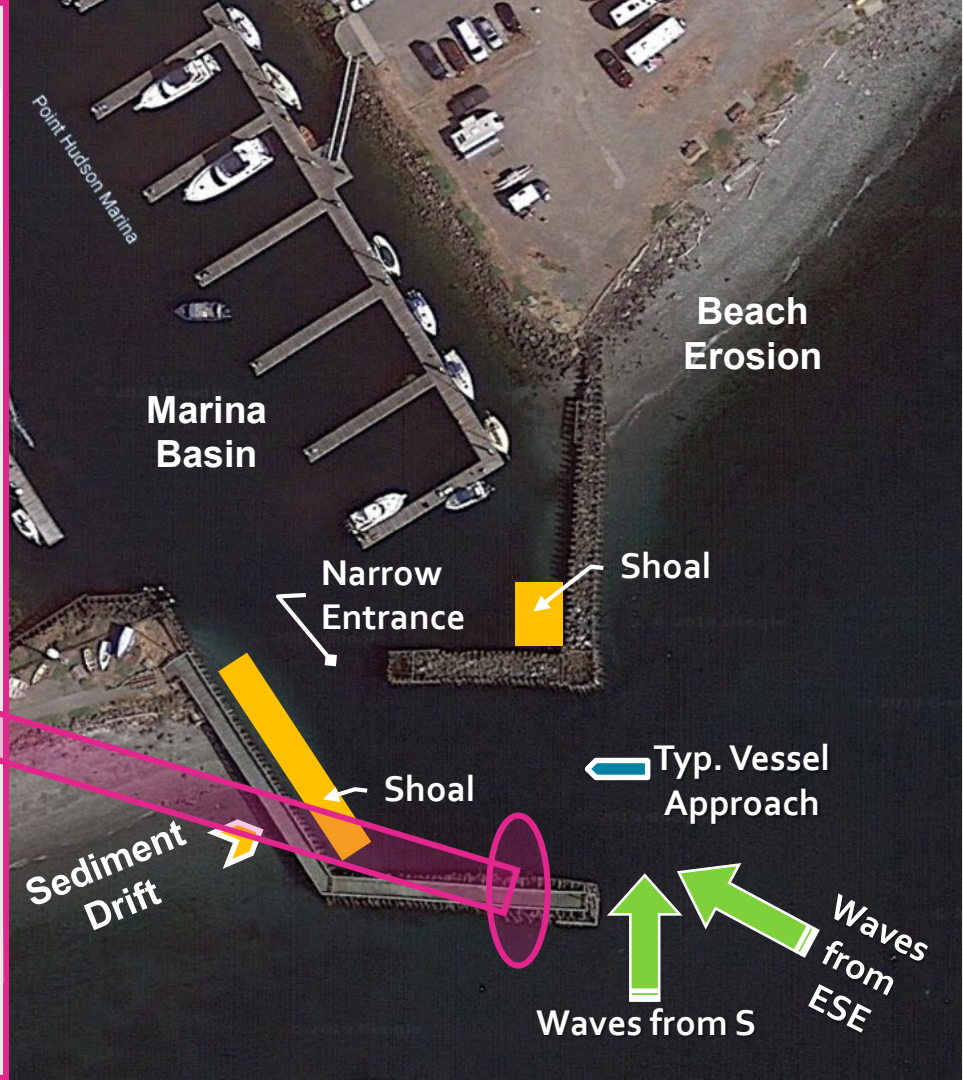
Selected Alternative
Feb 12th, 2020

MOTT MACDONALD

PORT OF PORT TOWNSEND

# Introduction & Assessment


1934 Original Construction
1969 Rehabilitation
8'-0"
3'-6"
EXISTING


Point Hudson Marina
Marina Basin
Beach Erosion
Narrow Entrance
Shoal
Shoal
Typ. Vessel Approach
Sediment Drift
Waves from S
Waves from ESE

# Introduction

## Existing Condition

**Timber piles, walers, cable tiebacks, and armor rock are at or beyond useful life. Stability of the overall structural system is compromised.**

- The most advanced structural deterioration was observed at the end of the south breakwater.
- Voids in the riprap reduce the system's wave protection capability.





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# Design Objectives & Alternatives

# Design Objectives

## Overview

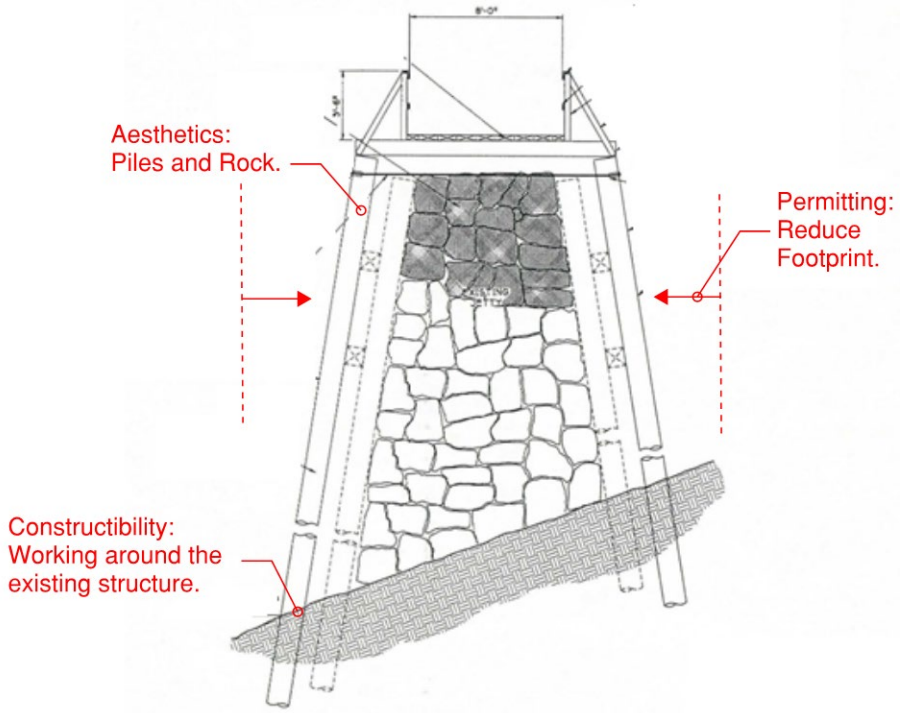
**The guiding objectives are to provide a breakwater rehabilitation/replacement design that:**

- Provides wave protection for the Point Hudson Marina for a minimum design life of 30 years.
- Responds to community concerns to maintain the aesthetic of the existing breakwater.
- Can be permitted, constructed and maintained.

# Design Objectives

## Considerations

- **Engineering.** Protect the existing marina and the Port operations against wind waves and vessel waves for at least the next 30 years. Considers navigation channel impacts.
- **Aesthetics.** Similar in appearance to the existing breakwater (rocks and piles) using modern materials.
- **Permitting.** Remove creosote and reduce footprint of the breakwater to minimize offsite mitigation requirements.
- **Constructability.** Minimize risks to the Port from potential cost overruns, delays, errors, and obstacles during construction.
- **Cost.** Cost efficient design that minimizes capital and maintenance costs.



# Alternatives Considered

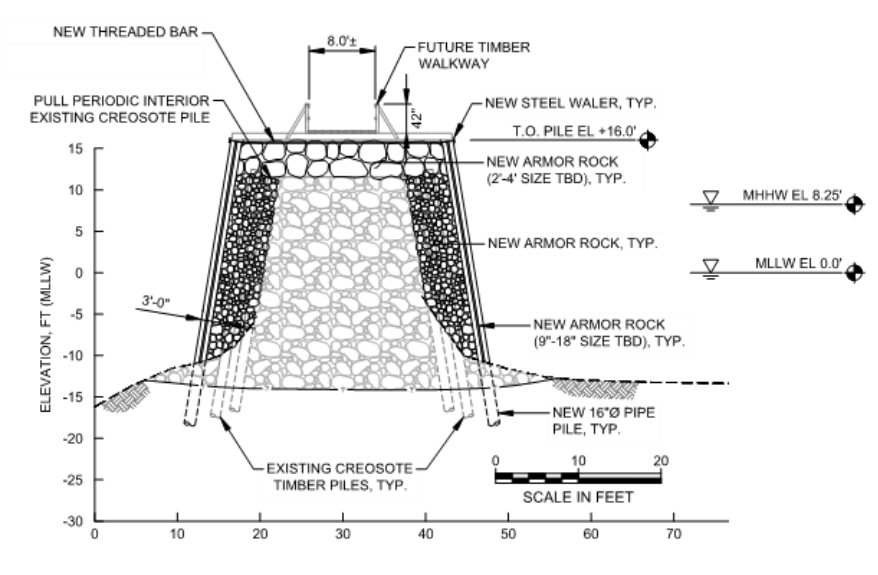
- **Alternative 1.** Full Length Encapsulation. Entire length of the existing south breakwater leg is encapsulated with new piles, rock, and lagging.

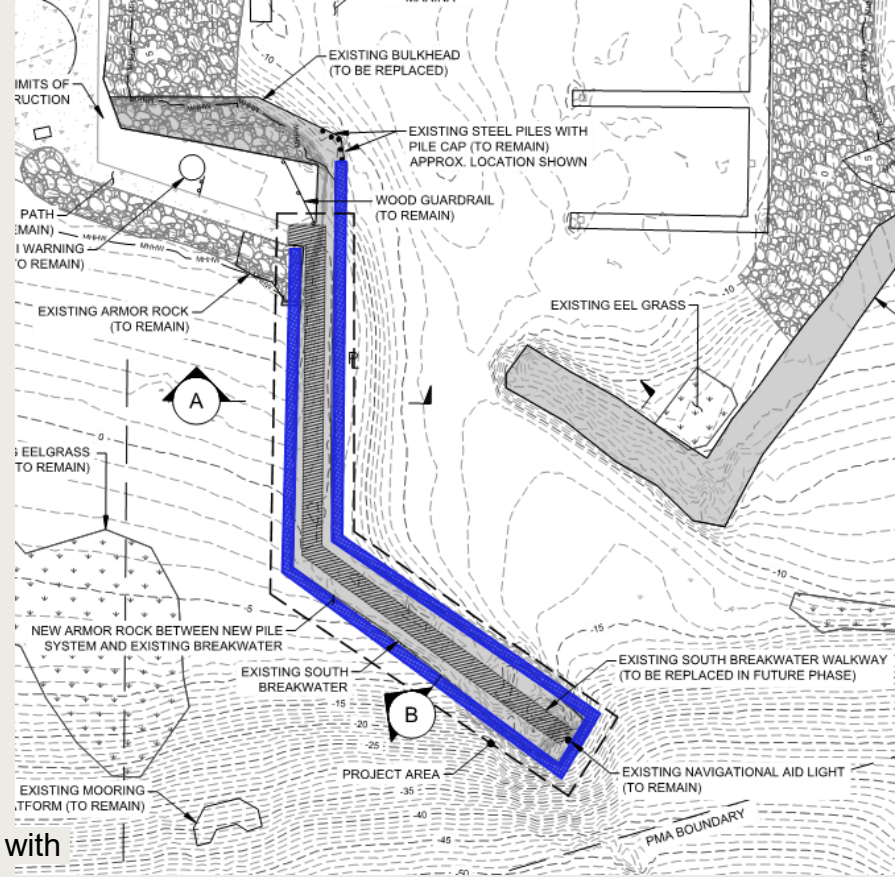
- **Alternative 2.** Partial Replacement with Encapsulation. Partial length of the existing south breakwater leg removed and reconstructed and the remaining is encapsulated with new piles, rock, and lagging.

- **Alternative 3.** Full Replacement. Entire length of the existing south breakwater leg is removed and reconstructed with new piles, rock, and lagging.

# Alternative 1

## Full Length Encapsulation

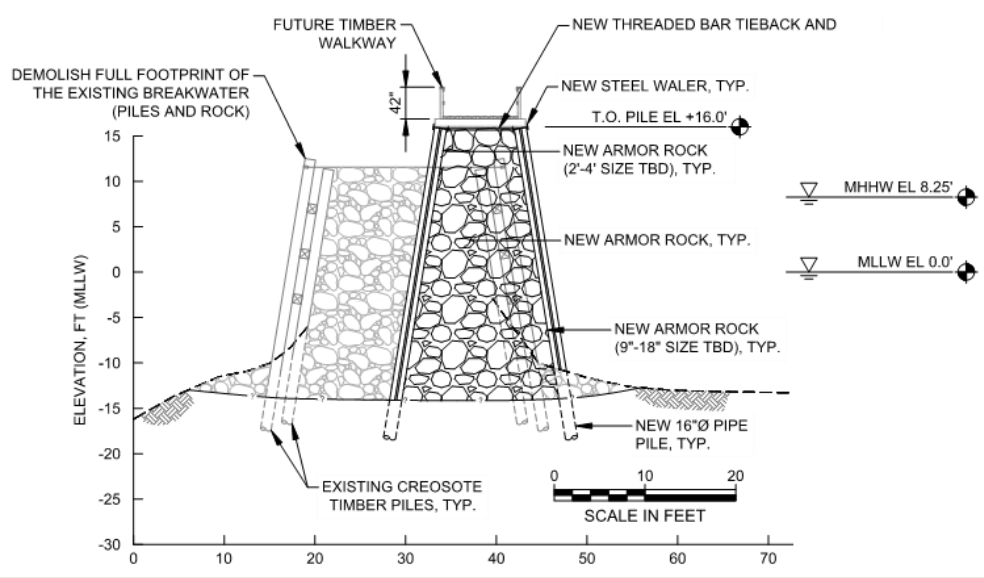


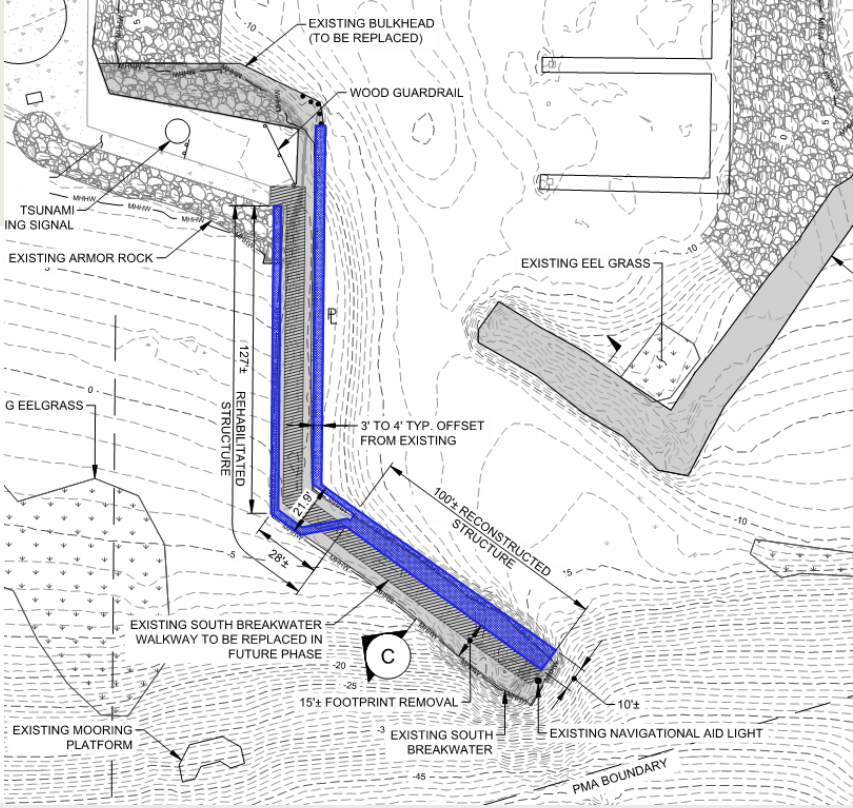




- Entire length of the existing south breakwater leg is encapsulated with new piles, rock, and lagging.
- Large expansion of footprint.
- Offsite mitigation needed for expansion of area and remaining creosote.
- Narrows navigation channel width.

# Alternative 2

## Partial Replacement with Encapsulation

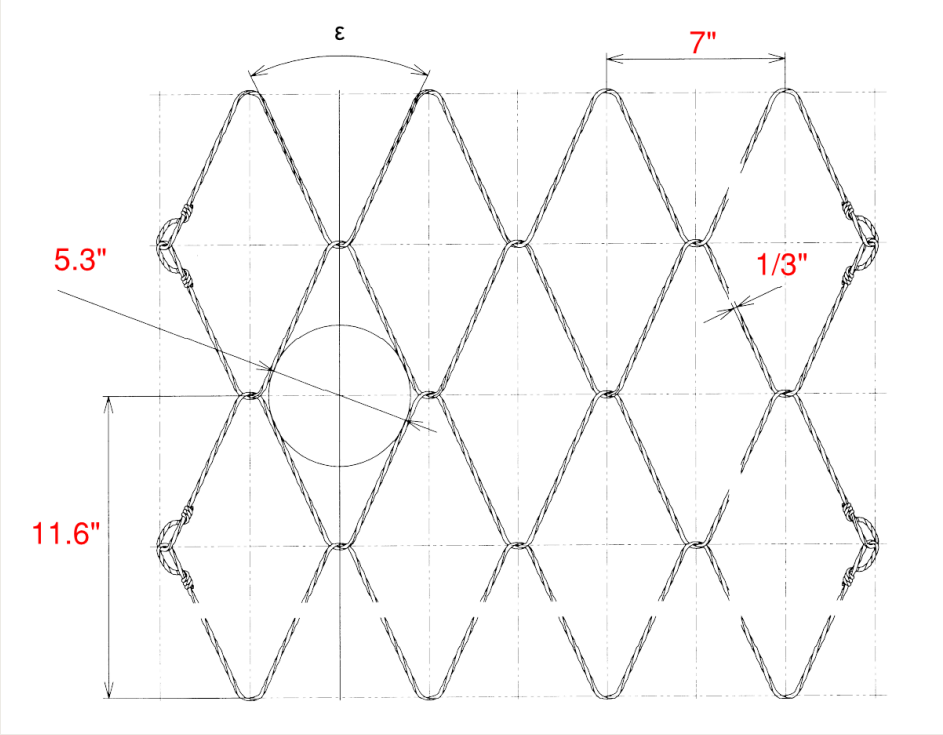



- Partial length of the existing south breakwater leg removed and reconstructed and the remaining is encapsulated with new piles, rock, and lagging.
- Overall structure footprint is maintained, some creosote remains.
- Potentially self mitigating for area.
- Narrows navigation channel width.

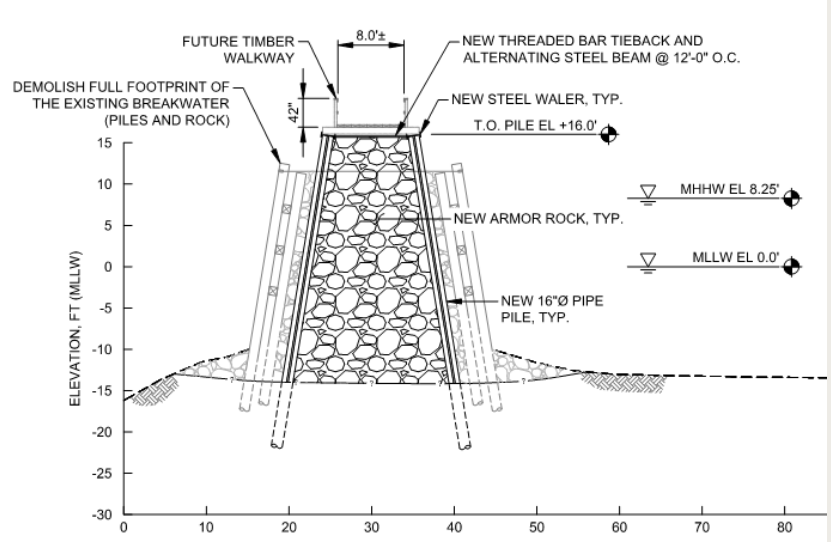
# Mesh Lagging System for Encapsulation – Alternative 1 and 2

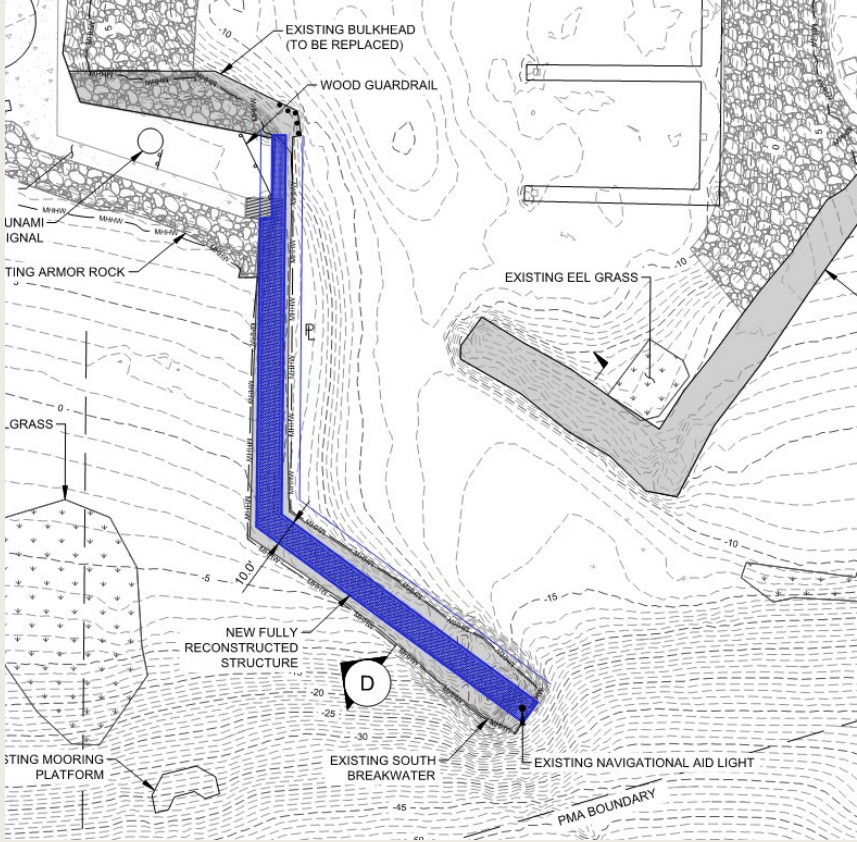
- Mesh would help retain rock between new piles.
- Mesh would be marine grade stainless steel.
- Would not be used for the reconstruction option.



# Alternative 3

## Full Replacement




- Entire length of the existing south breakwater leg is removed and reconstructed with new piles, rock, and lagging.
- Reduction in footprint, removal of creosote, reduction in environmental impacts.
- Self mitigating for area and creosote.
- Widens navigation channel.

# Design Alternatives

## Evaluation

- Several Alternatives were considered and evaluated using the design objectives and then presented to the stakeholders.

| Category | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Description** | • Existing structure remains and is encapsulated. | • Partial reconstruction and encapsulation. | • The entire leg to be reconstructed in a smaller footprint. |
| **Engineering and Performance** | • Challenging to design and construct around the existing structure.<br>• Reduced navigation. | • Most complex and challenging. Additional maintenance.<br>• Partially reduced navigation | • Built from ground up with most control of end product.<br>• Improved navigation |
| **Constructability** | • Difficult to install new piles and rock around existing structure, risks of slow downs and issues. | • Very challenging and risky to demolish only part of the structure. | • Lowest risk but still challenging. |
| **Permitting** | • Most challenging, requiring mitigation. | • Would likely require some mitigation. | • Seeks to be self mitigating. |

- After review of the different alternatives, stakeholders selected Alternative 3 as their preferred alternative with some additional input.

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# Selected Breakwater Design

# Breakwater Design

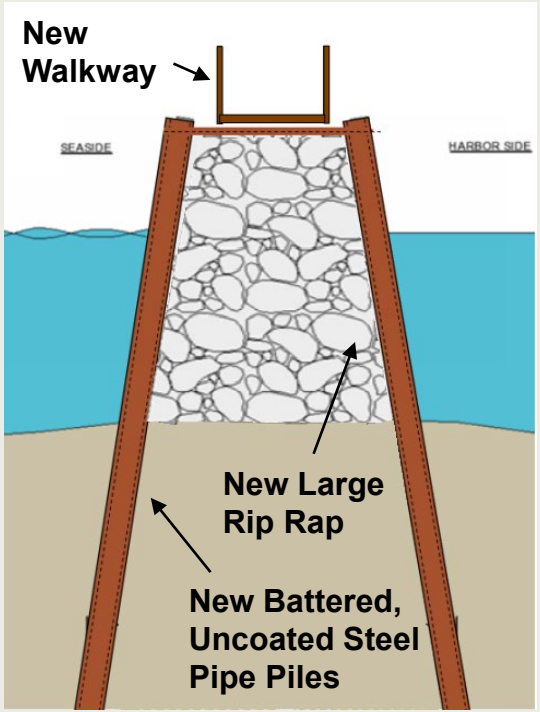
## Stakeholder Input

In addition to selecting Alternative 3 as the preferred design, the stakeholders presented the following suggestions and guidance:

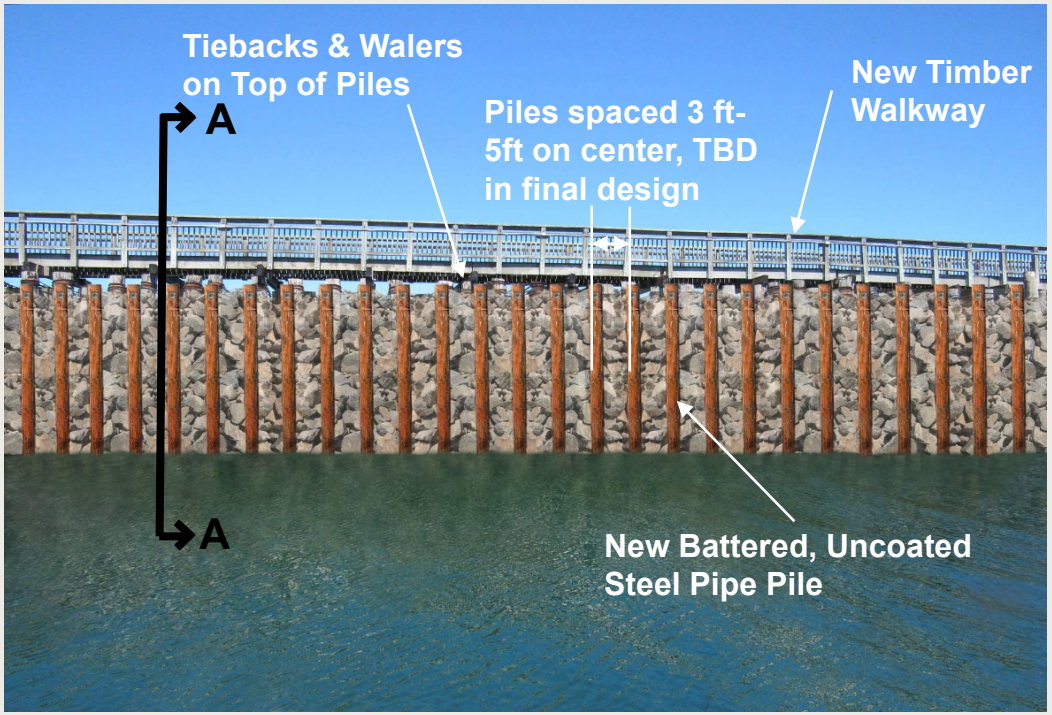
| Category | Alternative 3 |
|---|---|
| **Pile** | • Piles should be closely spaced, similar to the existing<br>• Piles should be uncoated steel pipe piles with sacrificial corrosion thickness, no composite piles<br>• Piles should be battered to match existing aesthetics<br>• Piles should be supported with tie rod cross-ties and potential walers |
| **Breakwater Core** | • Large high quality riprap (granite)<br>• No mesh for rock containment |
| **Walkway** | • Design and system should allow for installation of walkway on top of the south breakwater<br>• End of walkway waterside should incorporate a wider turnaround and look out area |
| **Permitting** | • North and south breakwaters should be designed and permitted together |

# Breakwater Design

## Selected Cross-Section and Elevation




Section A - A



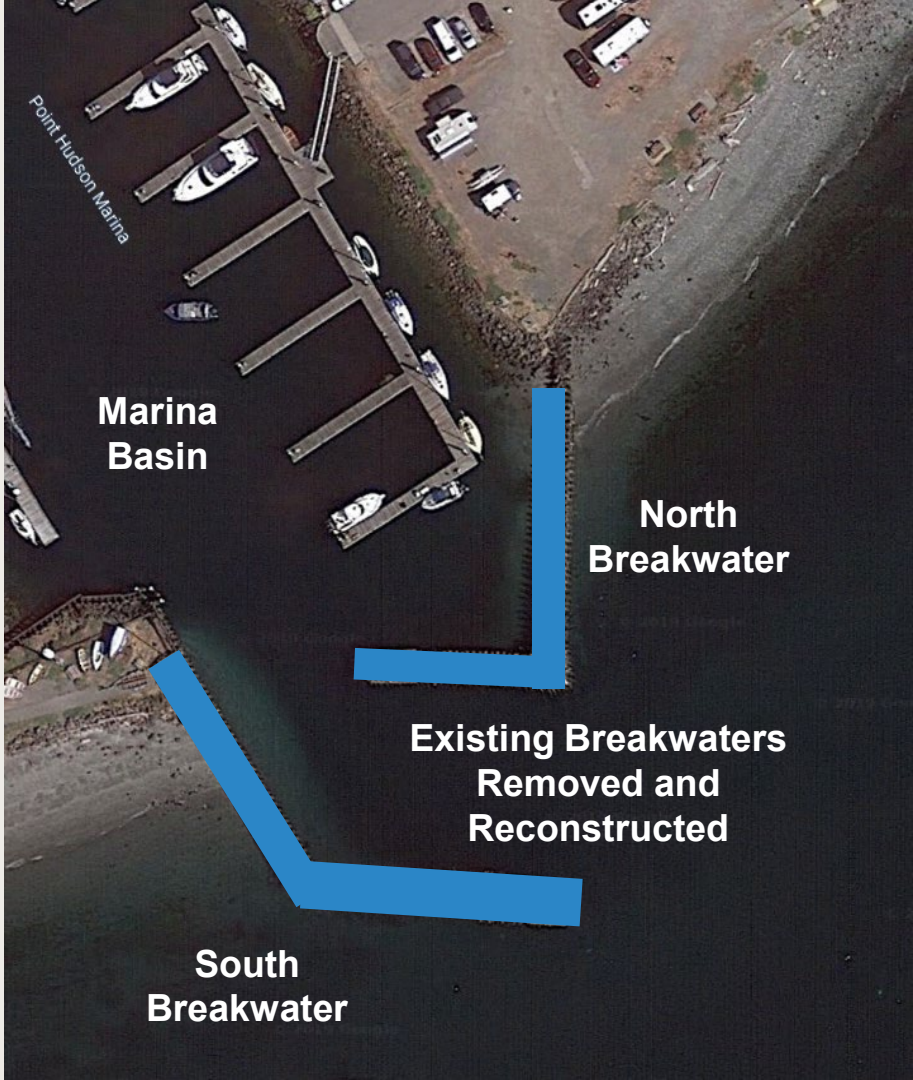

Elevation View

# Phasing, Cost, Challenges and Next Steps

# Phasing and Cost

## North and South Breakwaters

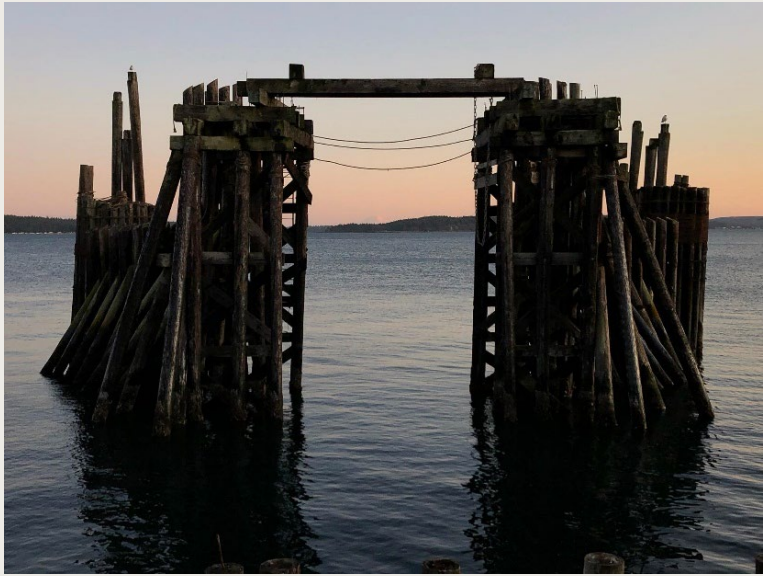
- **Condition.** North breakwater in slightly better condition than the south. Therefore, replacement of the south breakwater should occur before the north breakwater.
- **Construction Schedule.** South breakwater replacement anticipated in winter of 2021 (dependent on permitting). North breakwater to be replaced in a subsequent phase.
- **Demolition.** Demolish both structures and remove all existing timber piles and rock down to the mudline.
- **Footprint.** The new breakwater constructed within similar footprint and alignment as the original.
- **Walkway.** Walkway to be added on top of south breakwater.
- **Replacement Cost.** $5.5M to $6.5M (South), TBD (North). Replacement cost of north breakwater will be slightly less than the south, but depends on timing and inflation.



# Upcoming Challenges

## Considerations

- **Permitting.** Changing and ever more challenging permit climate is difficult to predict. May impact schedule, design and associated construction costs.
- **Environmental Impact Mitigation.** Upon permit review, agencies may still require some mitigation. Mitigation options include using plumb piles vs. batter, reducing breakwater footprint further, and/or incorporating the Quincy St. Dock creosote pile removal.
- **Replacement Design.** Replacement structure is very unique and complex to analyze and design especially with a smaller footprint. Will take time to evaluate and finalize methods and procedures for coastal analysis and design. Results have direct impacts to cost, constructability and permitability.



Quincy St. Dock

# Next Steps

- **Design Refinement**
  - Permitting Outreach
  - Coastal Assessment of new design
  - Refined breakwater sizing
  - Architectural considerations
  - Constructability Review
- **60% Design / Permitting**
  - Coastal and Structural Analysis and Design
  - Architectural Design
  - Finalize Permit Drawings
- **Final Design and Bid Documents**

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# Questions?