LEVEE PROTECTION PLANNING AND IMPROVEMENTS PROJECT

Improving Today and Preparing for Tomorrow

DESIGN VARIATIONS

Special Council Meeting

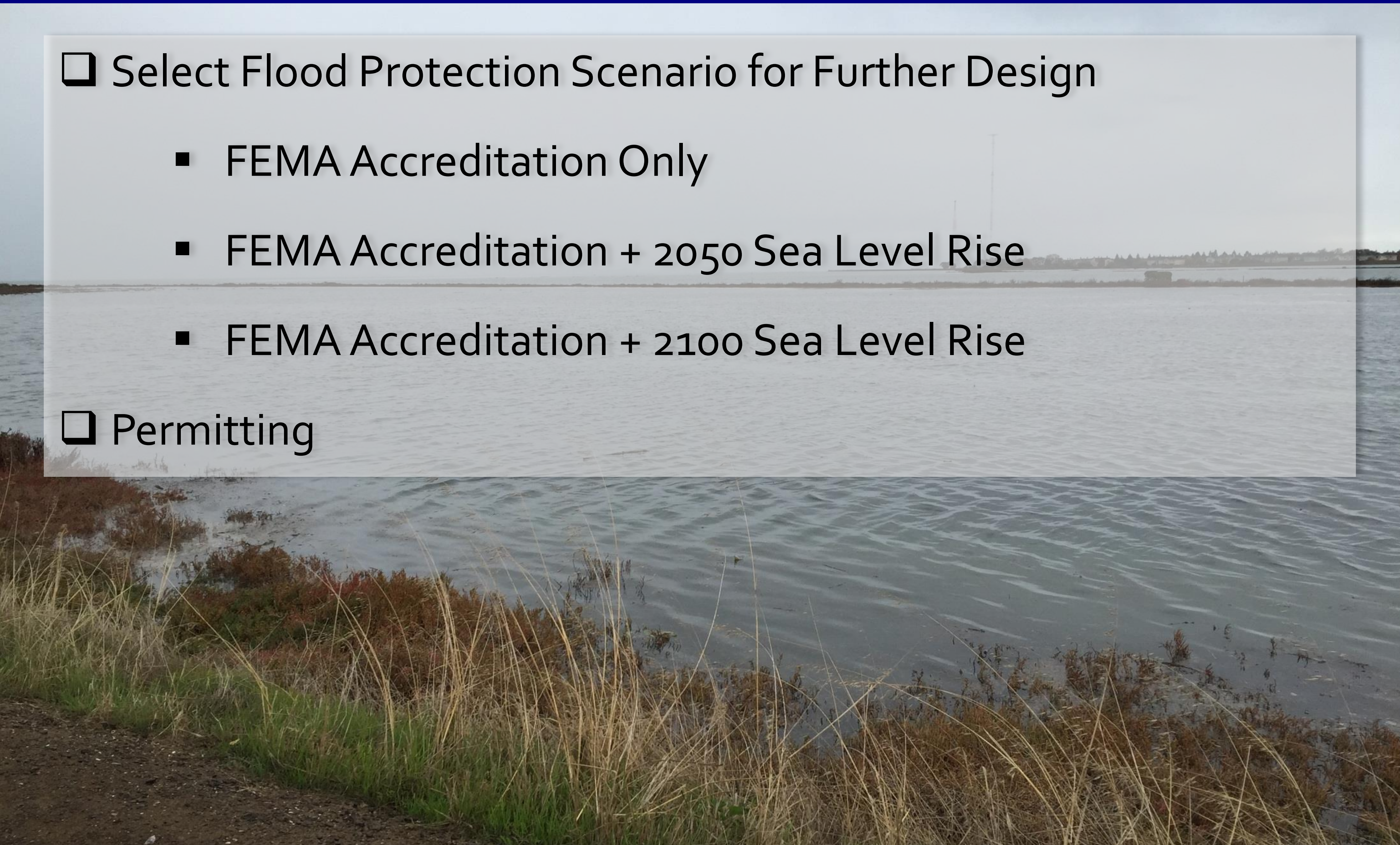
May 8, 2017

City of Foster City · Incorporated 1971

Schaaf & Wheeler

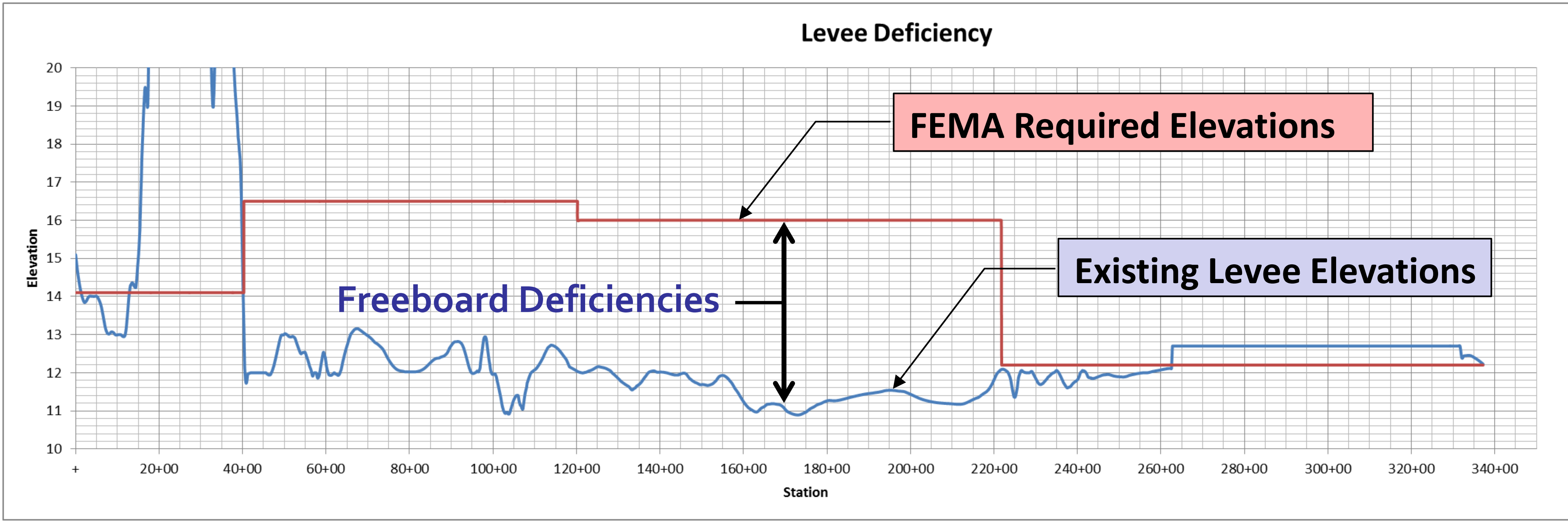
CONSULTING CIVIL ENGINEERS

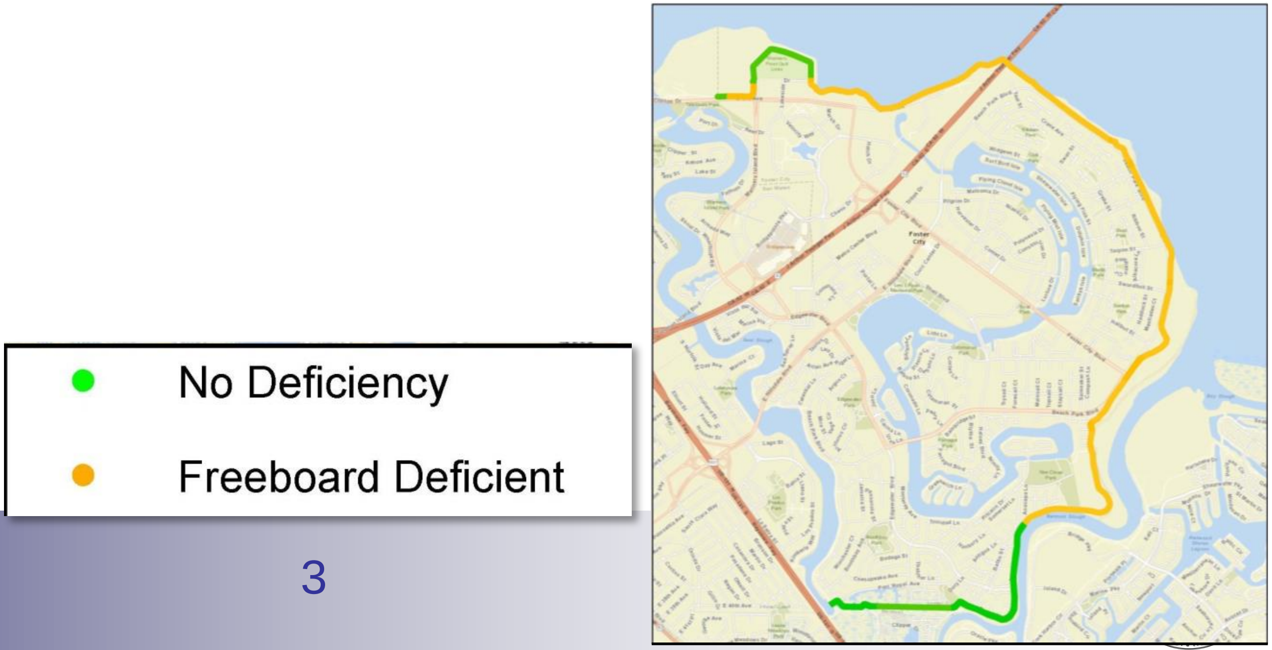
Presentation Topics



- ❑ Select Flood Protection Scenario for Further Design
  - FEMA Accreditation Only
  - FEMA Accreditation + 2050 Sea Level Rise
  - FEMA Accreditation + 2100 Sea Level Rise
- ❑ Permitting

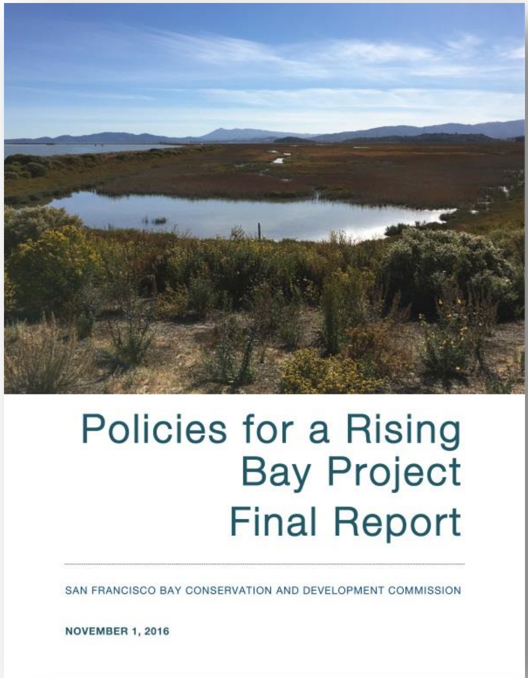
Providing FEMA Freeboard for Accreditation





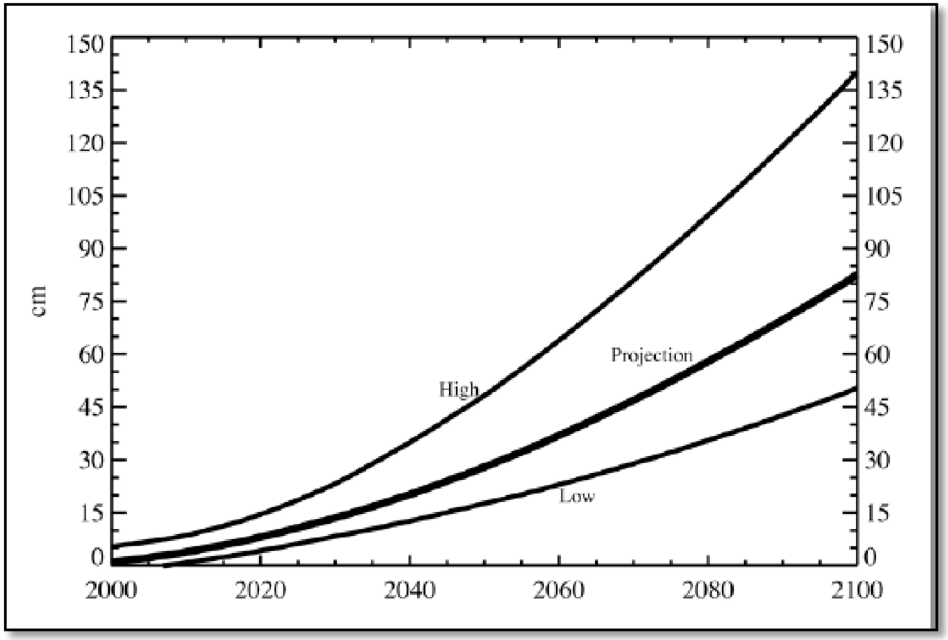
Flood Protection Scenario Feasibility

- ❑ Levee improvement project requires numerous permits
- ❑ The State recognizes that Sea Level Rise (SLR) is a significant threat
- ❑ BCDC requires resilience through design to the high range of 2050 SLR
- ❑ Both RWQCB and BCDC require risk assessments and adaptation strategies to address 2100 SLR



CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Sea Level Rise Predictions



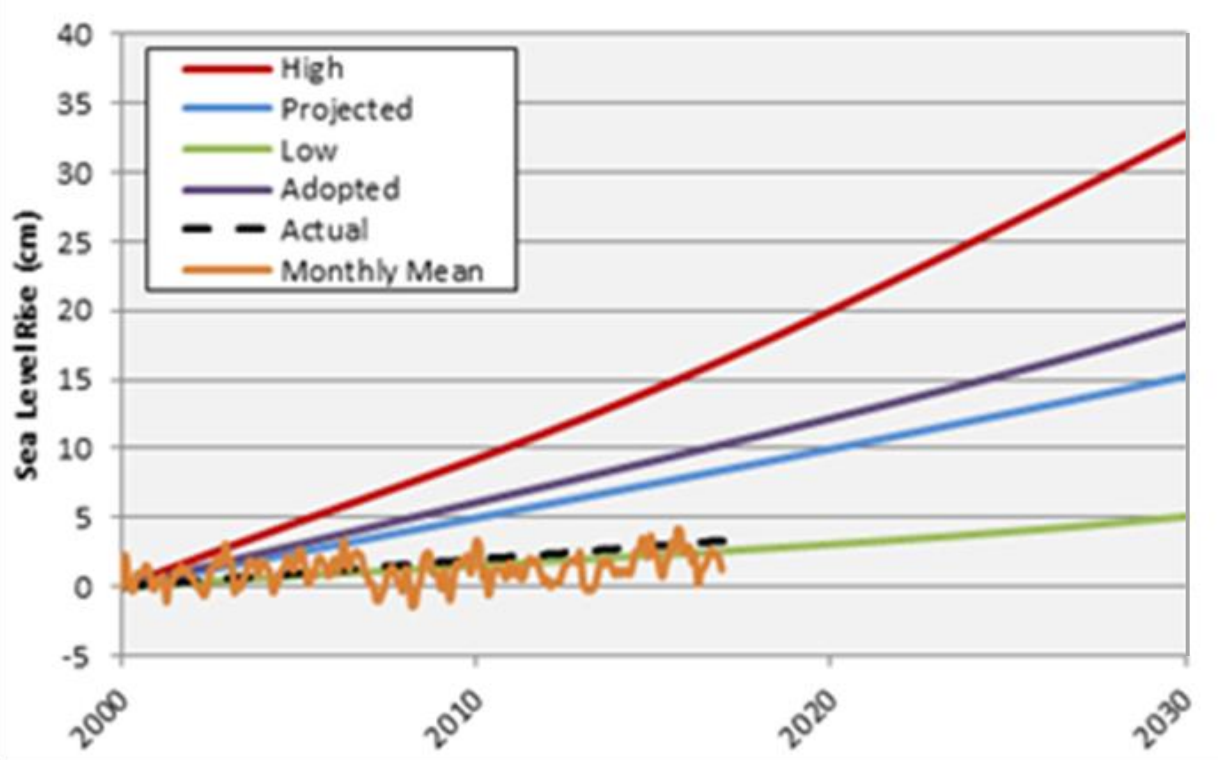
Adaptively raising levees for future sea level rise is a policy decision that will affect project design.

Permit agencies are now asking for resilience to high range 2050 SLR and adaptability to high range 2100 SLR.

2012 SLR Curves

Time Period	Projection (inches)	Range (inches)	CEQA Project Description (inches)
2000 – 2030	6±2	2 to 12	---
2000 – 2050	11±4	5 to 24	15
2000 – 2100	36±10	17 to 66	46

Sea Level Rise Predictions



Year 2000 remains a valid index for SLR predictions.

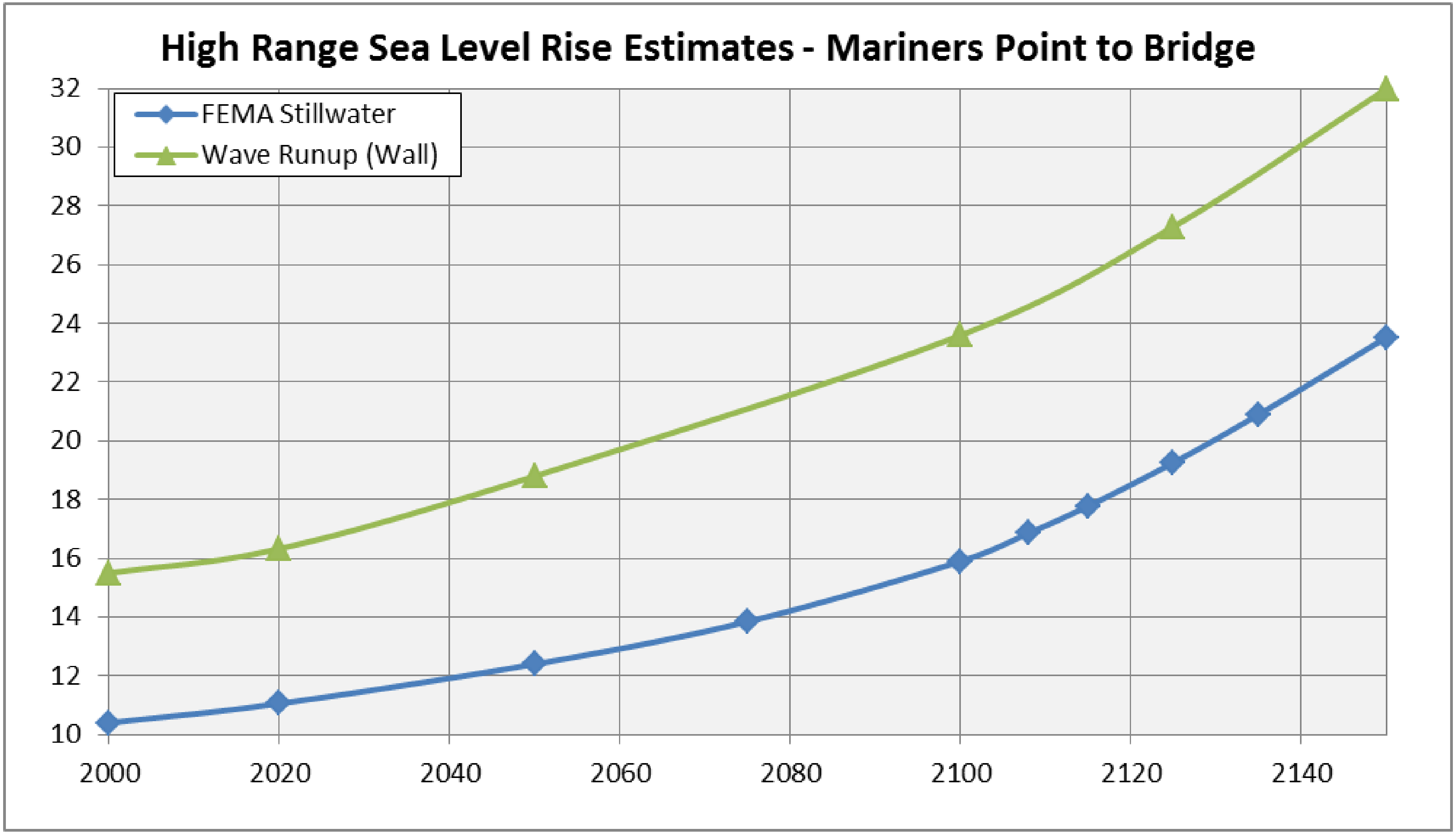
Select Flood Protection Scenario

- Flood Protection Scenarios
  - FEMA Freeboard **(FEMA)**
  - FEMA Freeboard + 15" Sea Level Rise for 2050 **(2050 SLR)**
  - FEMA Freeboard + 46" Sea Level Rise for 2100 **(2100 SLR)**

The 2050 SLR and 2100 SLR scenarios were analyzed in the EIR at an equal level of detail. The FEMA scenario was analyzed as a project alternative.

A project scenario is considered feasible if we have confidence that it can be permitted, financed and built.

Resilience to Mid-Century Sea Level Rise



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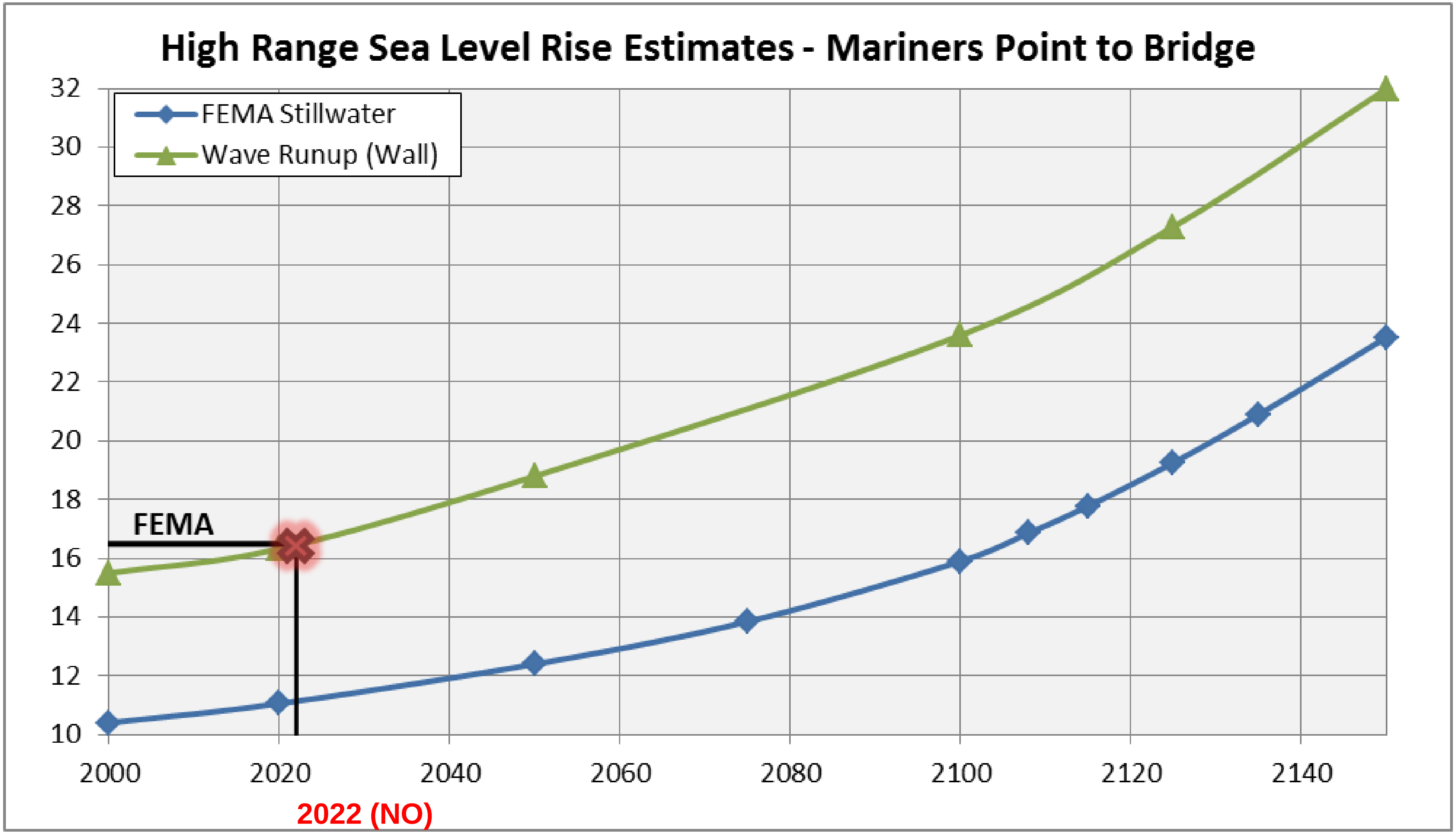

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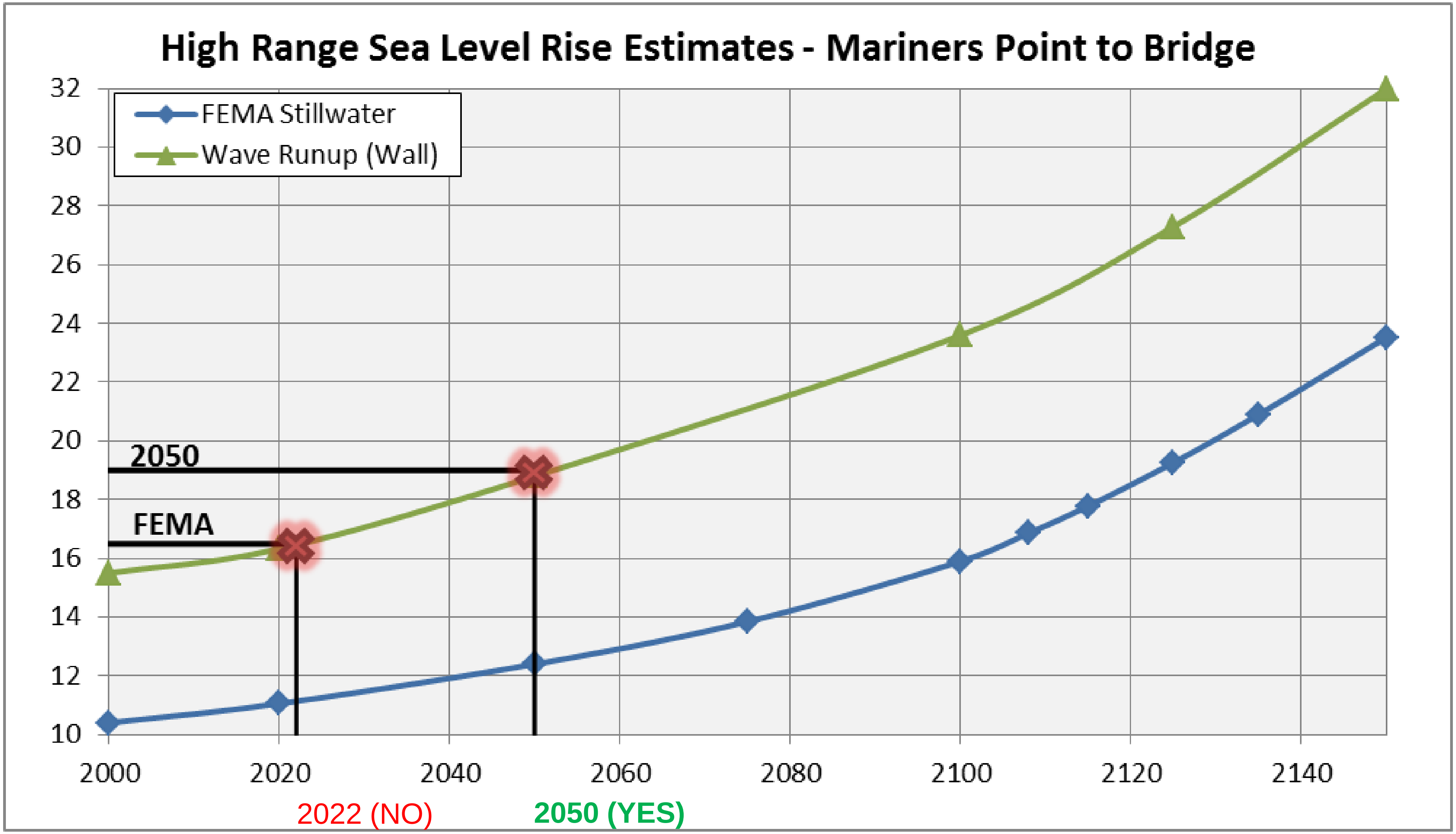

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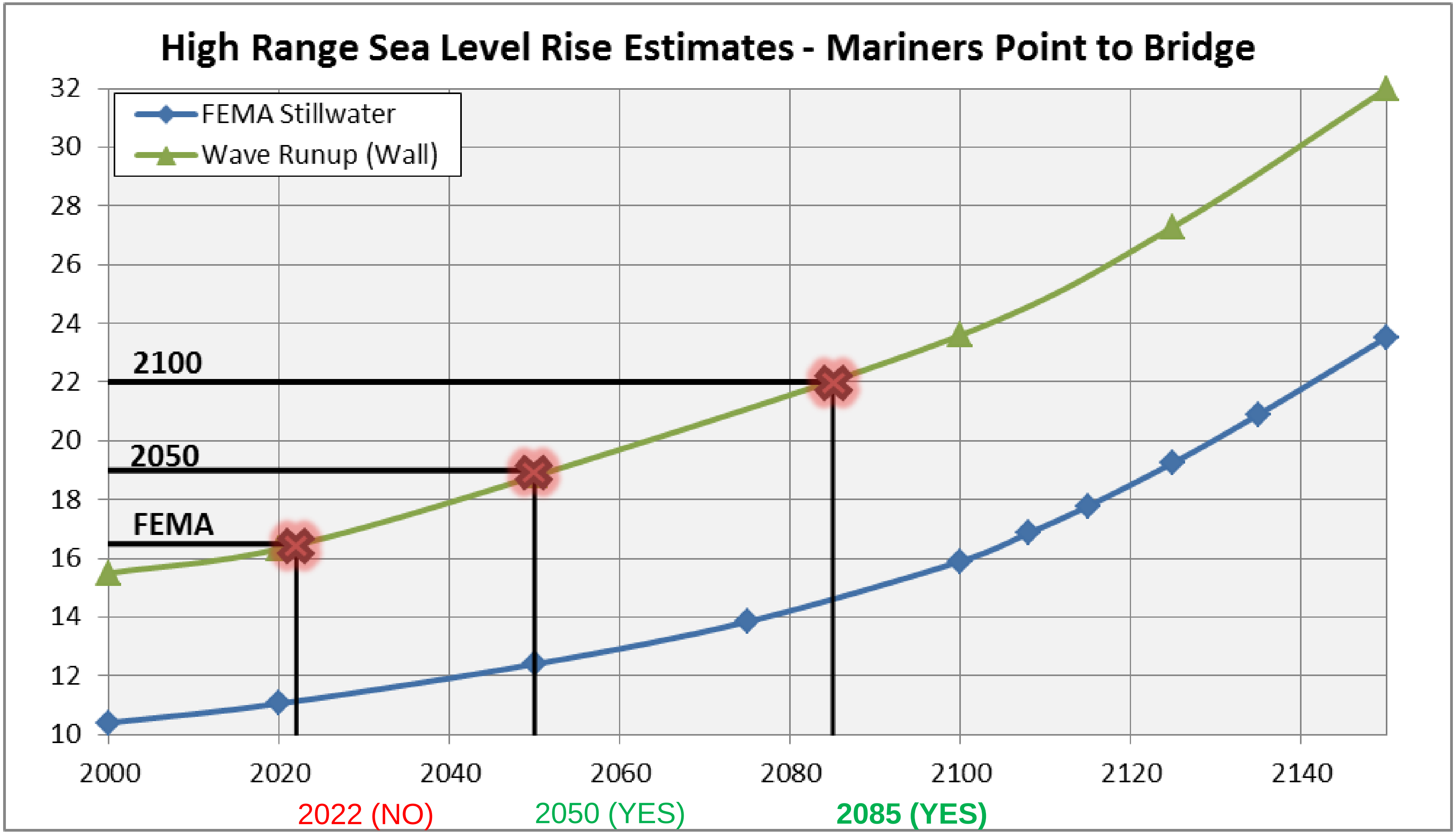

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Select Flood Protection Scenario

Project Alternative	Estimated Cost
1. FEMA Accreditation Only[1]	$60 million
2. 2050 SLR[2]	$90 million
3. 2100 SLR[3]	$170 million

1. Does not meet regulatory requirements for permitting.
2. Assumes 80-year life.
3. Based on projection of future SLR. May require additional future adaptation.

Higher Elevations Have More Immediate Impacts

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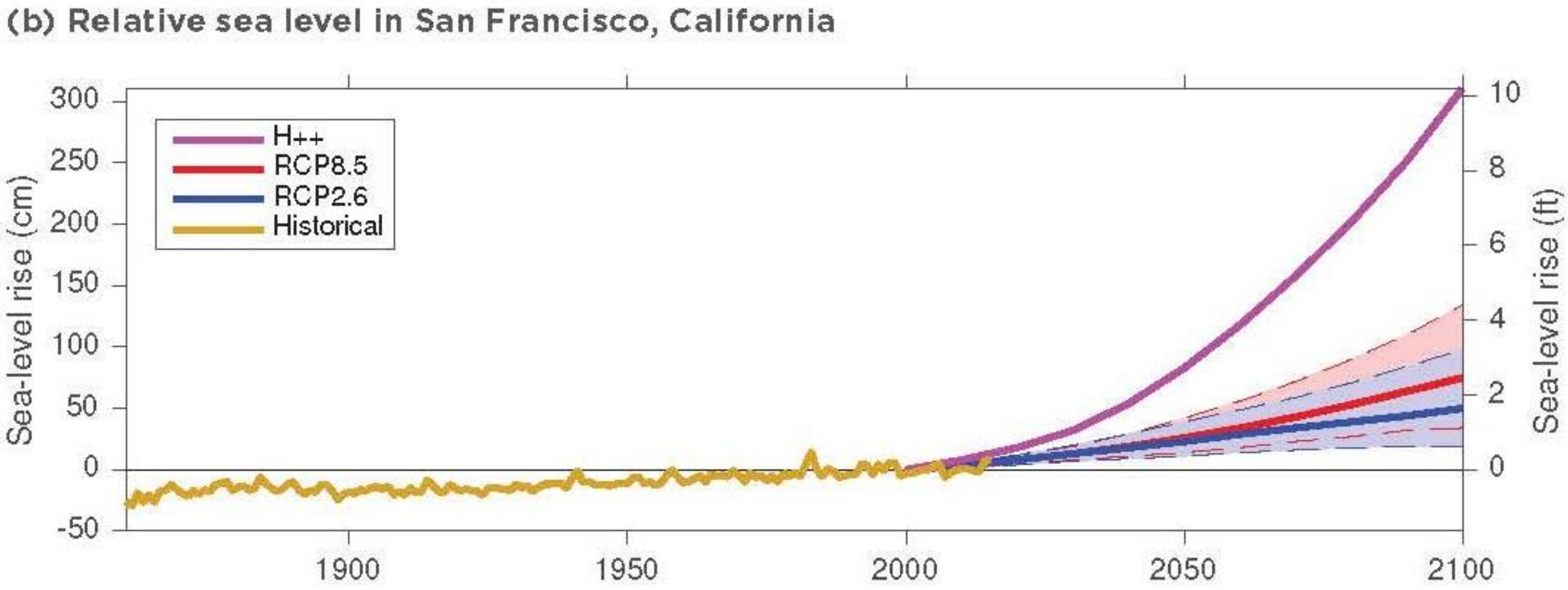
Permitting

Future Sea Level Rise Adaptation Strategies

- ❑ Build another project in the future if and when it is needed
- ❑ Build a project designed for 2100 high range SLR now
- ❑ Adapt to rising sea level over time
  - Foundation depth for 2100 SLR now; add wall height later
  - Future anchor walls
  - Future offshore solutions

Sea Level Rise Predictions – April 26, 2017



California Ocean Protection Council, Rising Seas in California: An Update on Sea-Level Rise Science, April 2017.

Sea Level Rise Predictions – April 26, 2017

Year	Projection Published in 2012 (feet)	Project Flood Protection Scenarios (feet)	67% Confident "Likely" (feet)	95% Confident (feet)	99.5% Confident (feet)	Extreme "H++" (feet)
2030	0.5	---	0.3 – 0.5	0.6	0.8	---
2050	0.9	1.3	0.6 – 1.1	1.4	1.9	---
2100	3.0	3.8	1.6 – 3.4	4.4	6.9	10.0
2150	---	---	2.8 – 5.8	7.7	13.0	22.0

2017 SLR estimates presented in the table reflect the RCP 8.5 Scenario, which is consistent with a future in which there are no significant global efforts to limit or reduce emissions.

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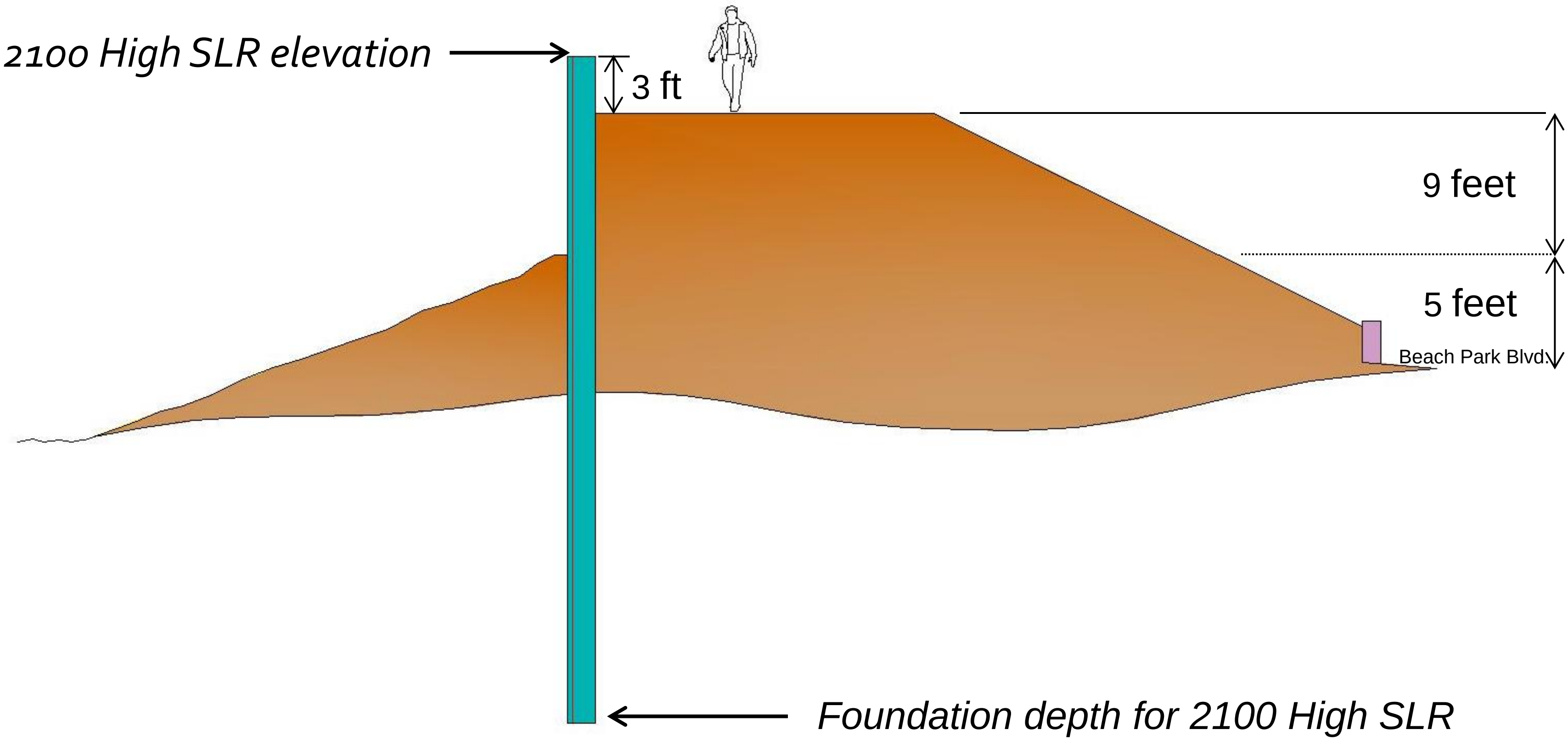
Adaptation Strategy No. 1 – Build for 2100 High SLR Now

Initial (and Final) Construction

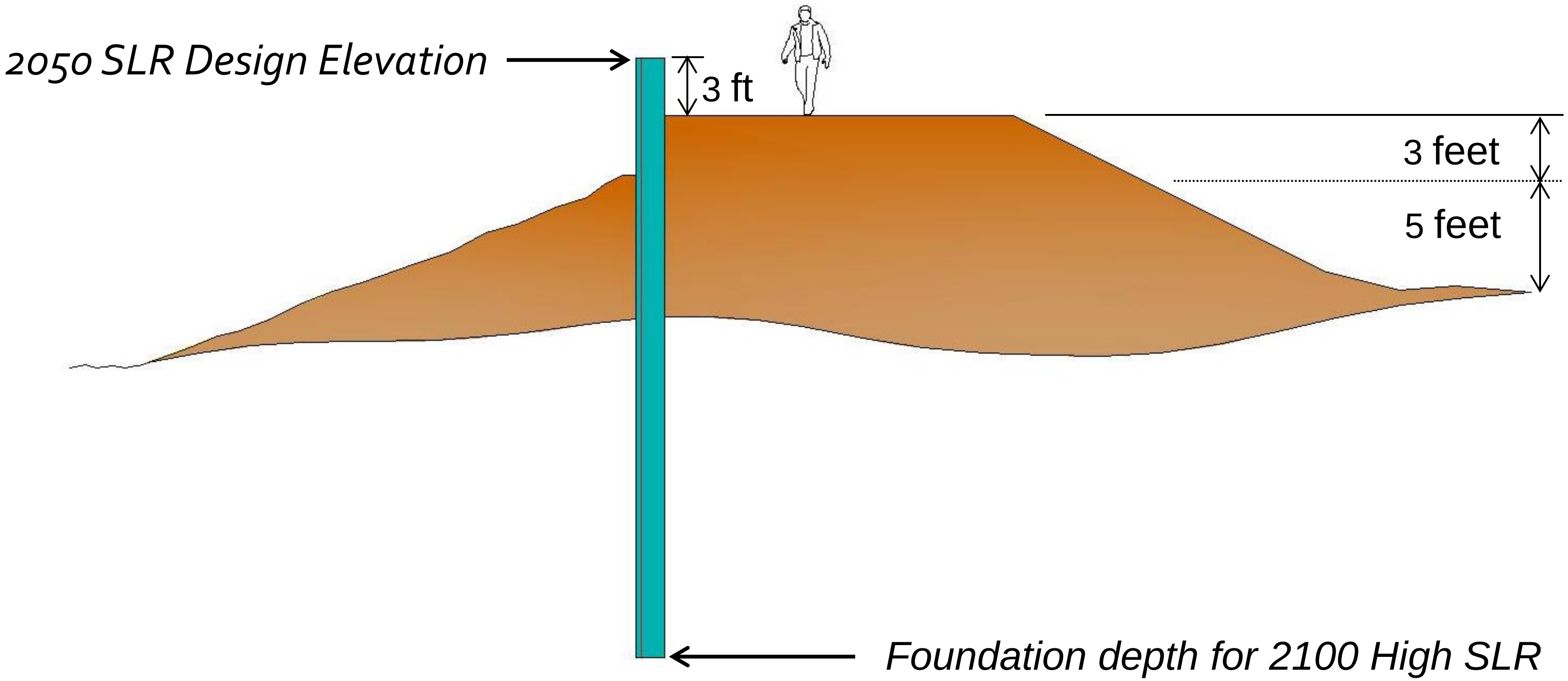
$380 million



Adaptation Strategy No. 2 – Build to 2050 SLR and foundation depth for 2100 High SLR to allow future adaptation by adding wall height

Initial Construction

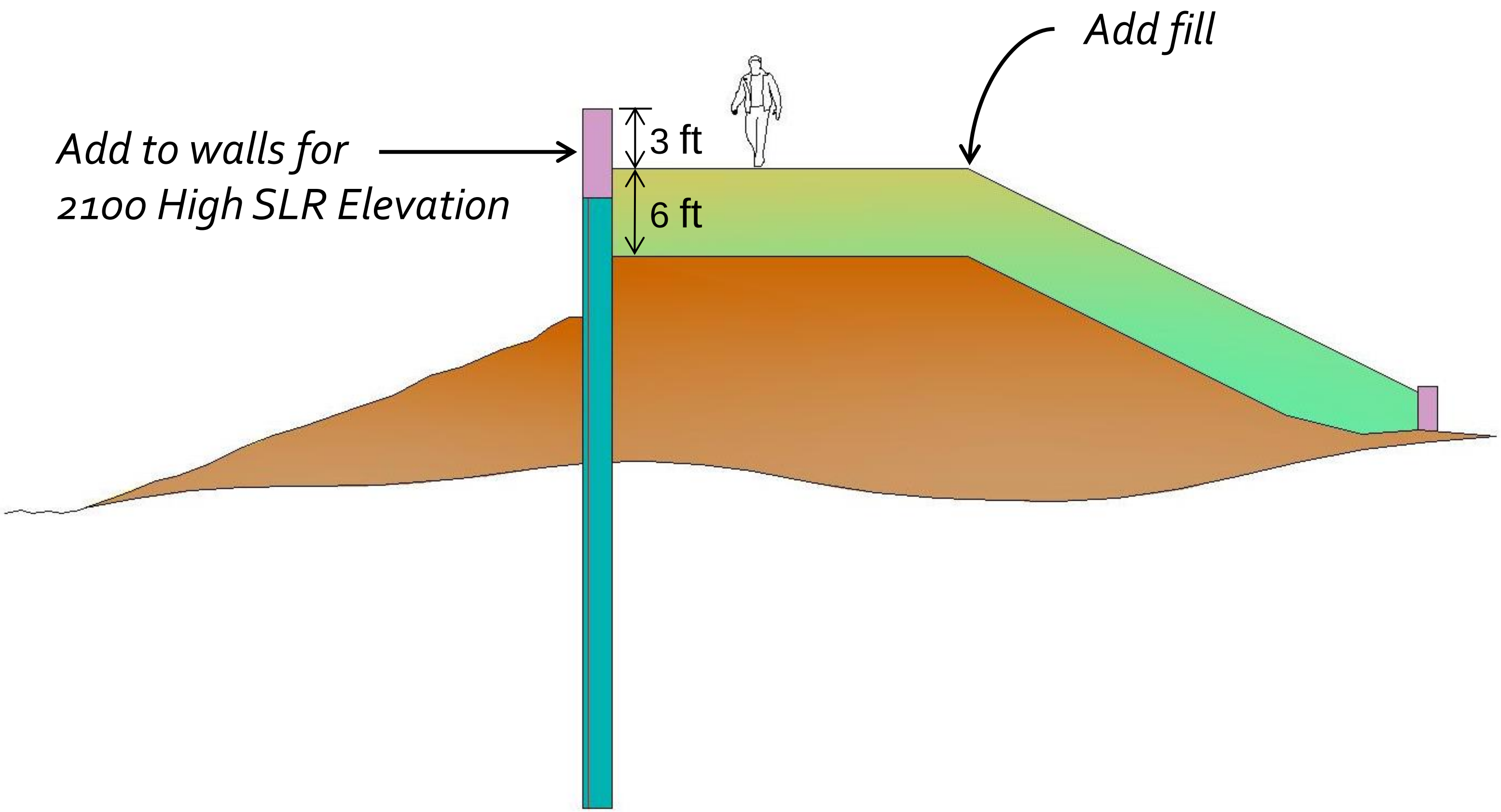
$240 million



Adaptation Strategy No. 2 – Future Additional Wall Height

Adaptive Construction in Future

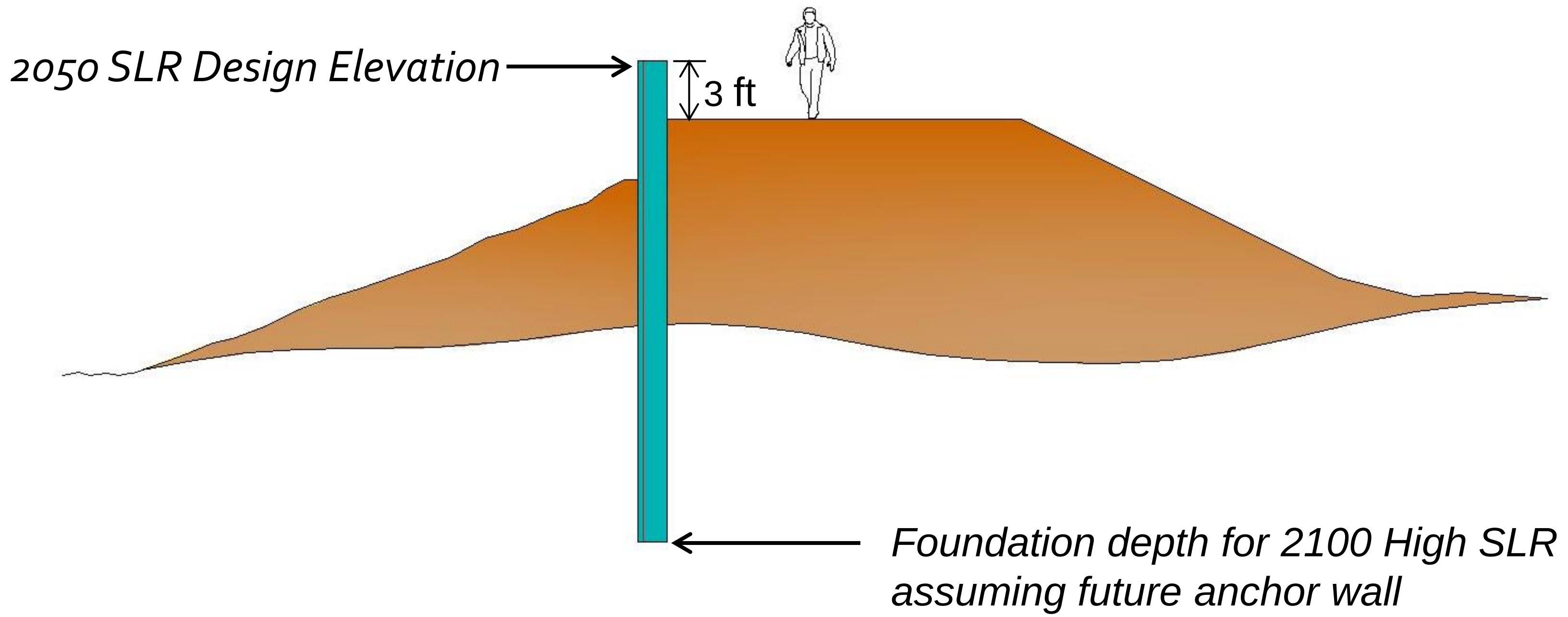
$150 million



Adaptation Strategy No. 3 – Build to 2050 SLR and foundation depth for 2100 High SLR to allow future adaptation for a secondary wall anchor

Initial Construction

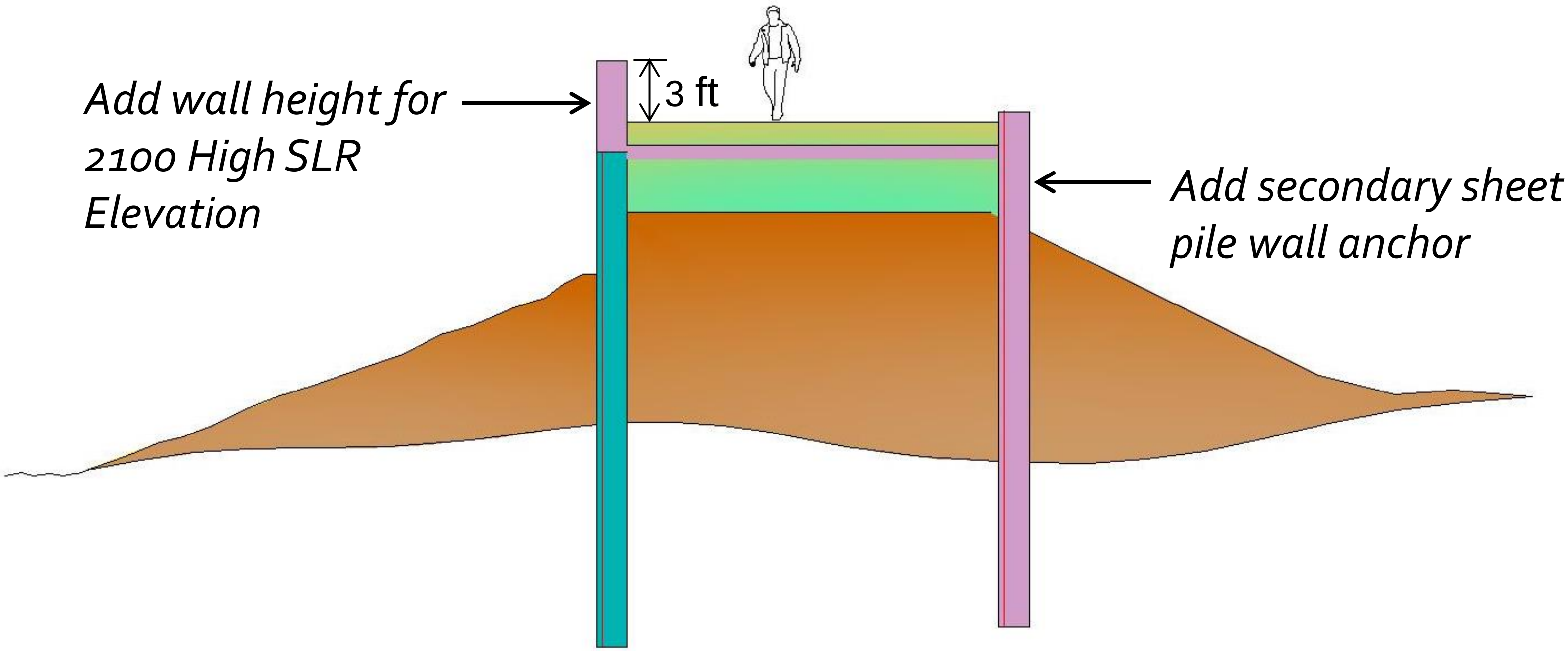
$130 million



Adaptation Strategy No. 3 – Future Secondary Wall Anchor

Adaptive Construction in Future

$200 million

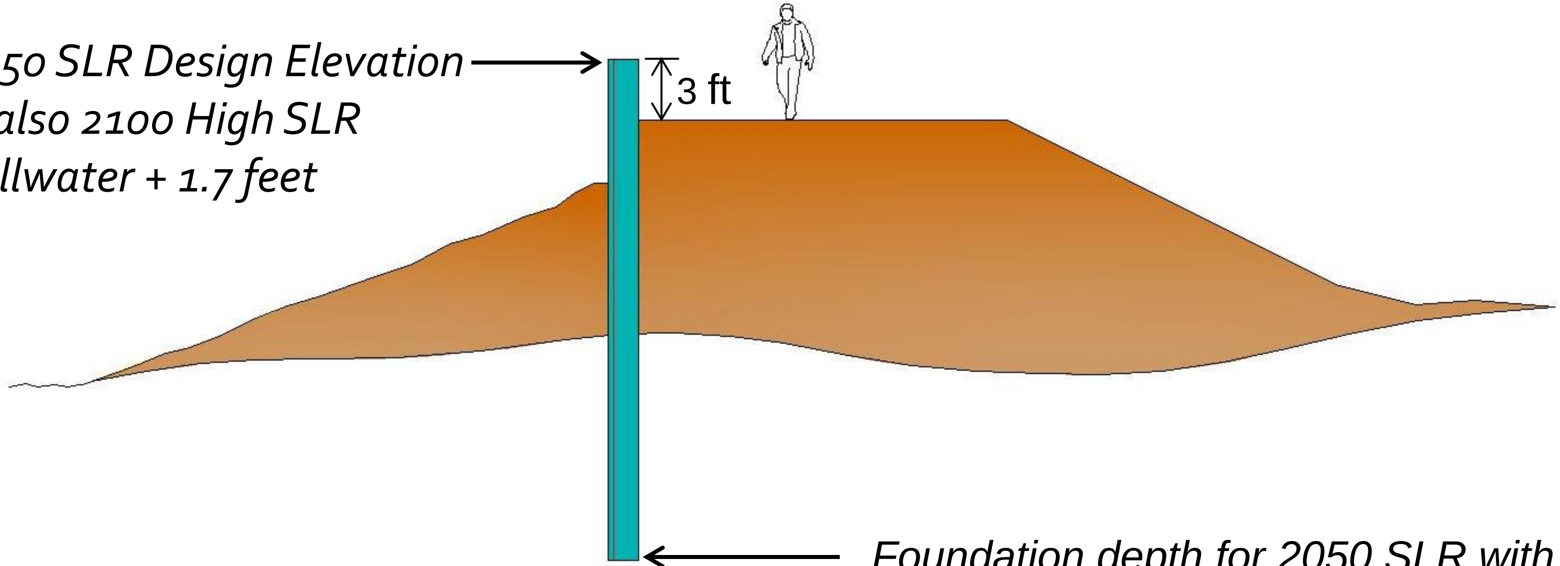


Adaptation Strategy No. 4 – Build to 2050 SLR and foundation depth for 2100 High SLR to allow future adaptation using offsore features

Initial Construction

$90 million

2050 SLR Design Elevation is also 2100 High SLR stillwater + 1.7 feet

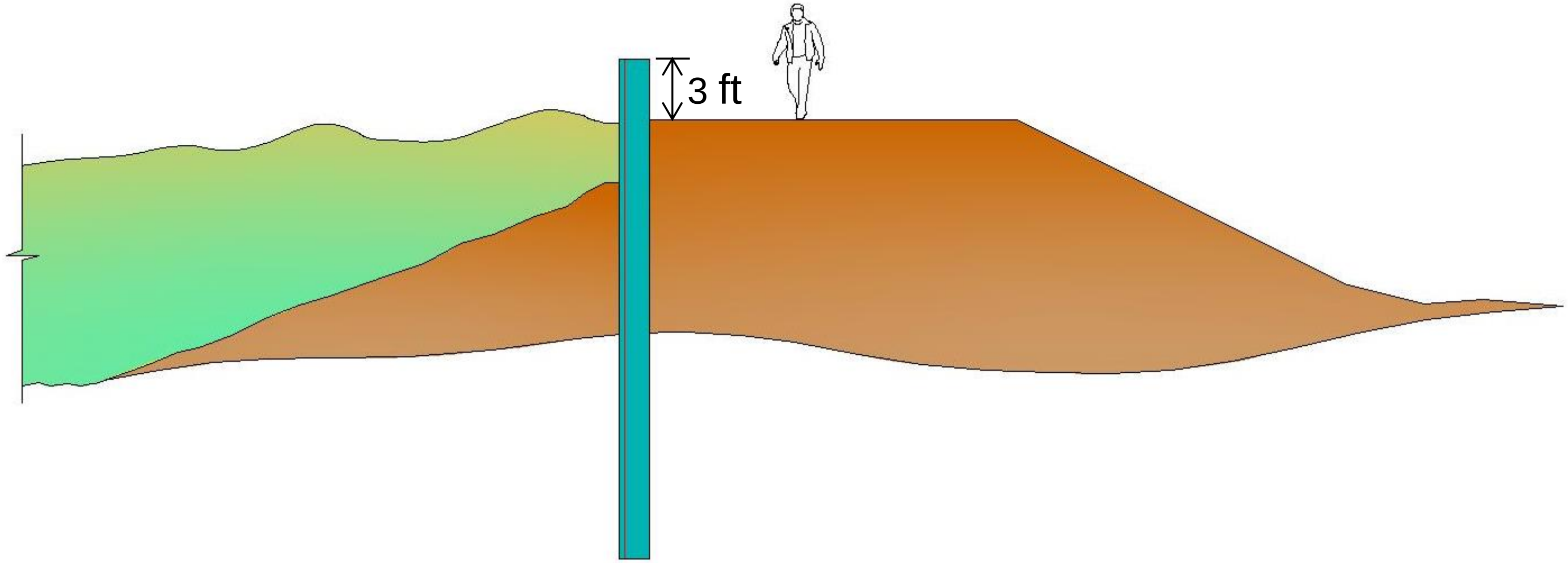


Foundation depth for 2050 SLR with waves is same as foundation depth for 2100 High SLR back levee without waves

Adaptive Construction in Future

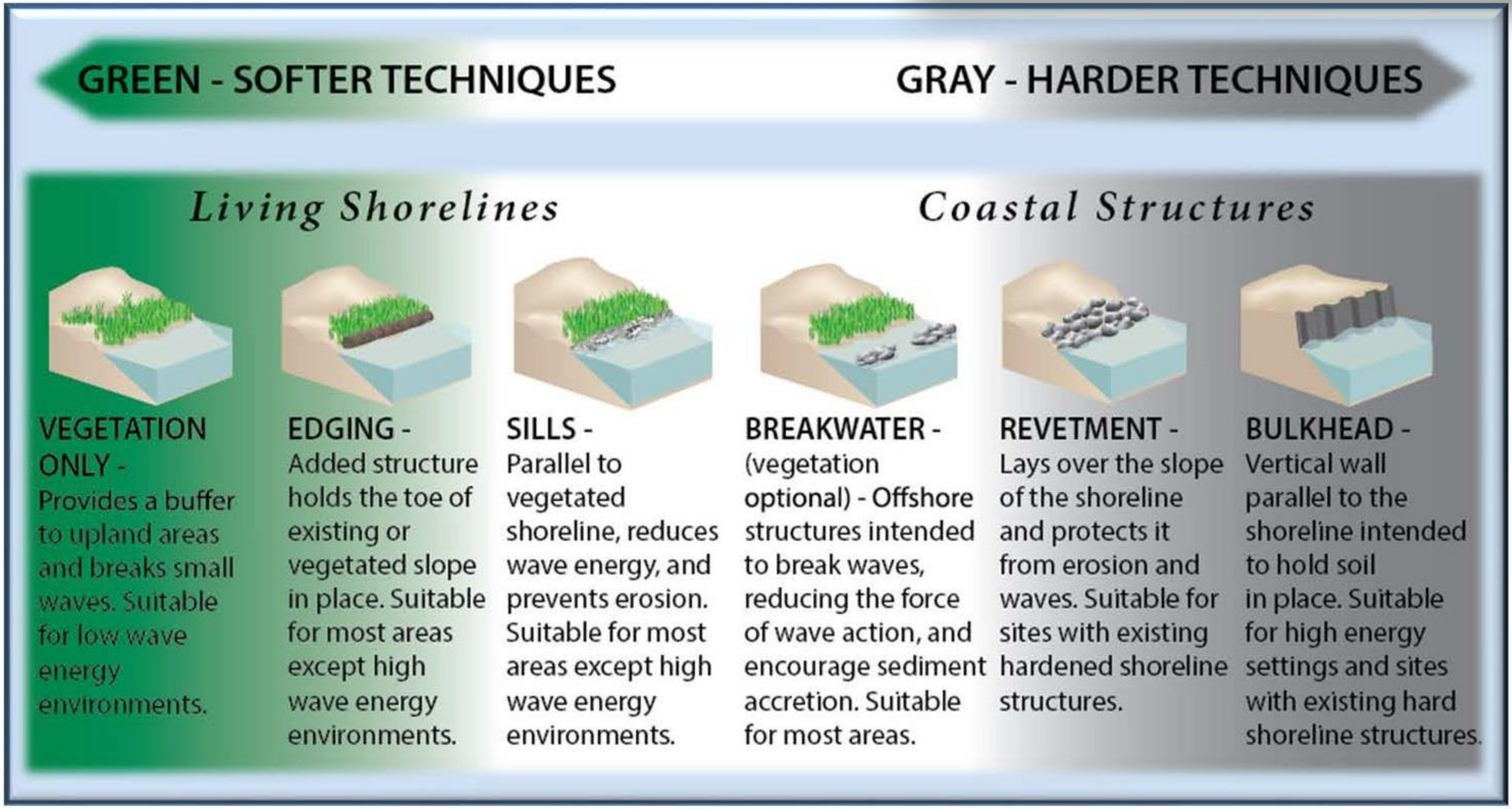
$100 million

Adaptively build up offshore breakwater and beach forms



Adaptation Strategy No. 4

Source: NOAA



Adaptation Strategy No. 4

Why don't we pursue constructing a living shoreline (LS) now?

Regulatory Challenges

- Lack of LS data
- Beneficial Fill
- Suitable Materials
- Construction Methods/ Timing
- Sequential permits
- Long timeframes
- High cost

Source: California Coastal Conservancy

Adaptation Strategy No. 4

Adaptation Strategy Cost Matrix

Adaptation Strategy	Initial Cost	Future Adaptation Cost	Total Cost
1. 2100 High SLR Now	$380 million		$380 million
2. 2050 SLR and Deep Foundations with Future Addition of Wall Height	$240 million	$150 million	$390 million
3. 2050 SLR with Future Anchor Walls	$130 million	$200 million	$300 million
4. 2050 SLR with Future Offshore Adaptation	$90 million	$100 million	$190 million

All listed strategies are initially resilient to 2050 sea level rise and adaptable to 2100 SLR with 99.5% confidence.

Project Recommendation

Project Alternative	Initial Cost	Future Cost
2050 SLR Flood Protection Scenario + Future Offshore Features Adaptation Strategy for Permitting	$90 million	$100 million

1. Assumes 80-year project life.
2. Meets regulatory requirements for permitting.
3. Future estimated cost of $100 million is based on offshore improvements with anticipated sea level rise. Costs may vary.

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