



Storms, Flooding & Sea Level Rise Defense Conference

Port of San Francisco

November 19, 2020



WATERFRONT RESILIENCE PROGRAM EFFORTS

Key Initiatives: Embarcadero Seawall Program and USACE Flood Resiliency Study

PORT-WIDE

Adapt Plan

USACE Flood Resiliency Study

Floodproofing the Piers

1

EMBARCADERO

Embarcadero Seawall Program

2

MISSION CREEK / MISSION BAY

Southern Waterfront Seismic Vulnerability Assessment

3

ISLAIS CREEK / BAYVIEW

Southern Waterfront Seismic Vulnerability Assessment

Islais Creek Adaptation Strategy

Related Port Projects

Project SLR Adaptations

Utilities Projects

Waterfront Plan

Historic Pier Rehabilitation

SAN FRANCISCO BAY

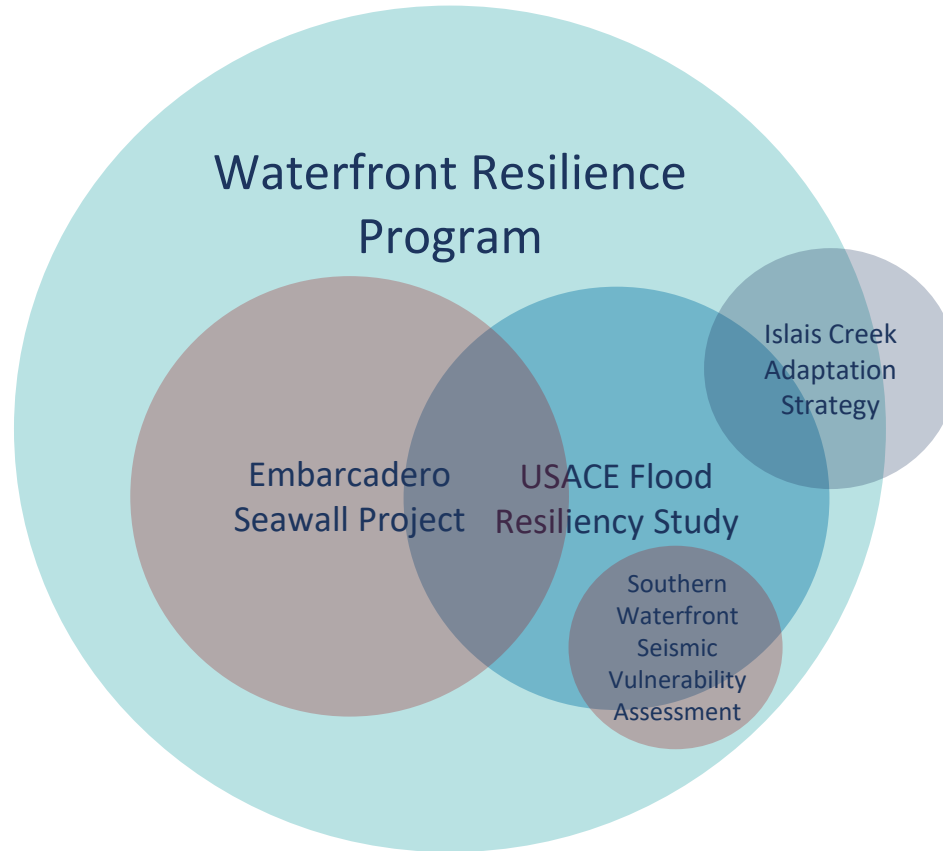
1

2

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Port Jurisdiction

USACE FLOOD RESILIENCY STUDY AND EMBARCADERO SEAWALL PROGRAM



USACE FLOOD RESILIENCY STUDY

Overview and Key Highlights



- Port is local sponsor, seeking assistance since 2012
- Local and Federal Expertise
- ~5 years (subject to waiver), 50/50 cost share
- Assess flooding under five sea level rise curves, including 3 USACE curves (low, medium, high) and two additional curves requested by the Port
- Robust community input
- If USACE finds a Federal interest and Congress authorizes a Project:
 - Design/construction of project cost-shared 65% Federal, 35% Local



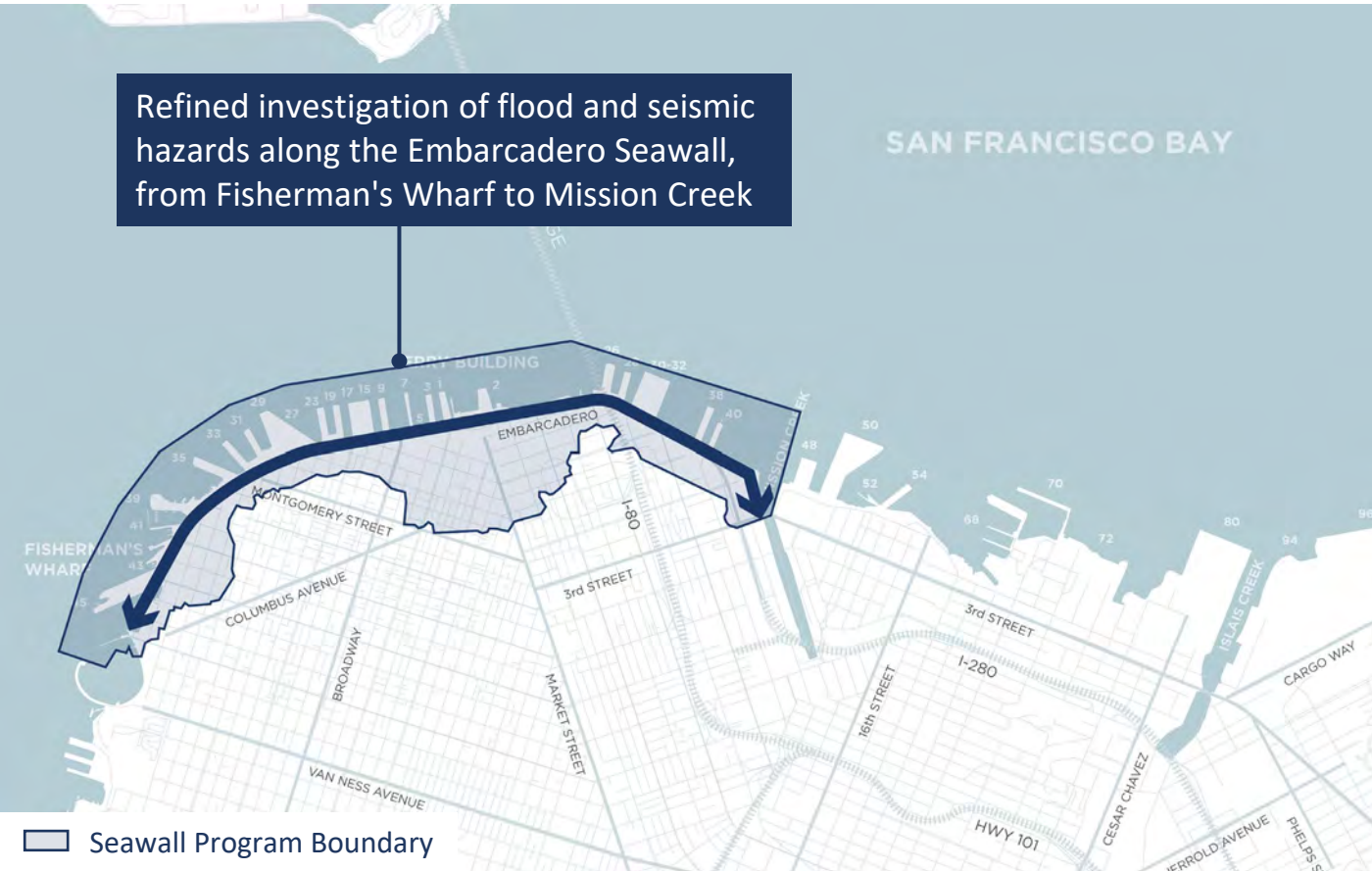
What have we learned?

Key Findings from the Embarcadero Seawall
Multi-Hazard Risk Assessment (MHRA)

WHAT IS THE MULTI-HAZARD RISK ASSESSMENT (MHRA)?

Proposition A Voter-Approved Bond Required a Detailed Risk Assessment of the Embarcadero

Refined investigation of flood and seismic hazards along the Embarcadero Seawall, from Fisherman's Wharf to Mission Creek

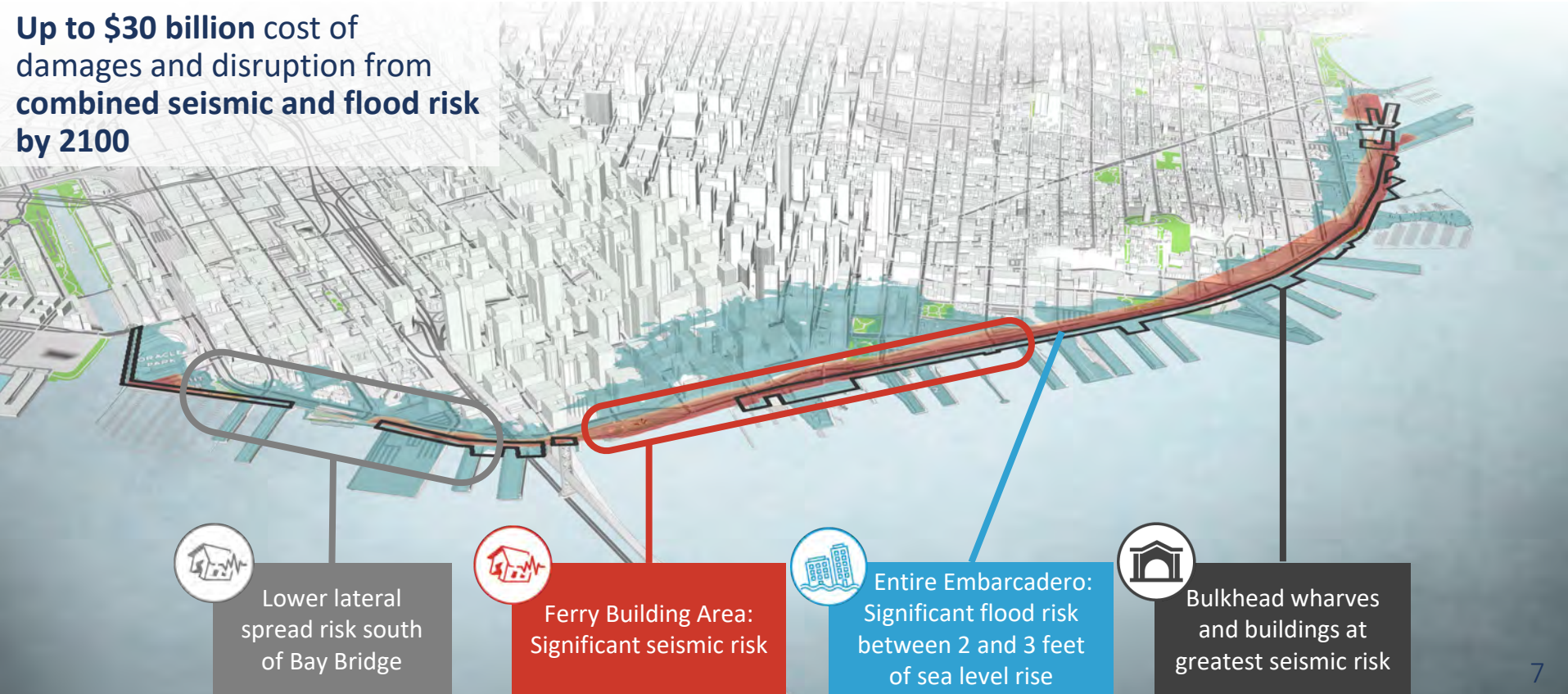


- Range of seismic hazards assessed within Embarcadero Seawall area
- Range of flood hazard scenarios assessed including impacts to critical City infrastructure
- Methodology: Bored holes and used lasers to uncover what is happening under the Bay and worked closely with agency partners to understand impacts to assets and services that the City and the region rely upon

HAZARDS AND CONSEQUENCES

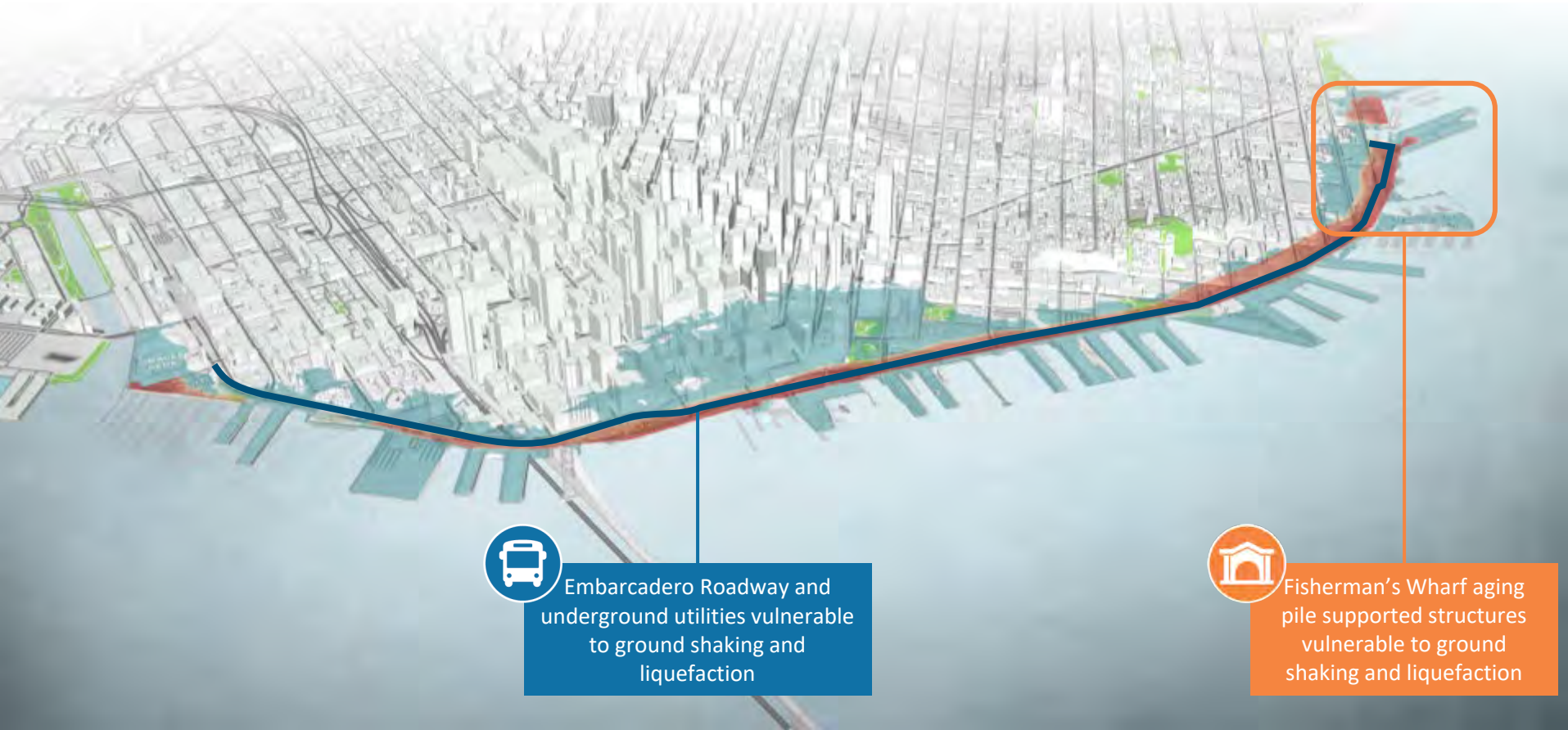
MHRA Key Findings

Up to \$30 billion cost of damages and disruption from combined seismic and flood risk by 2100



OTHER EARTHQUAKE HAZARDS AND CONSEQUENCES

MHRA Key Findings



Embarcadero Roadway and underground utilities vulnerable to ground shaking and liquefaction



Fisherman's Wharf aging pile supported structures vulnerable to ground shaking and liquefaction

EXISTING SHORELINE

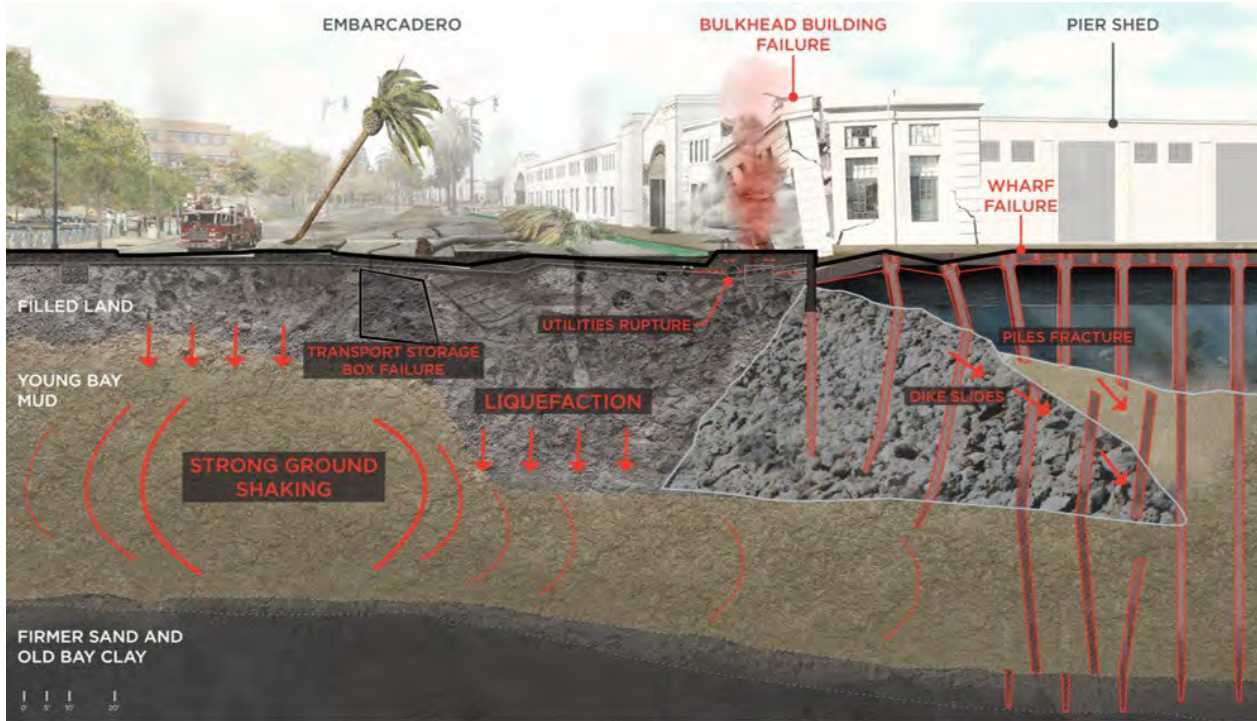
Critical Components of the Waterfront



- Seawall and Bulkhead Wharves are the city's flood protection and are highly vulnerable to seismic events

BULKHEAD WHARF EARTHQUAKE HAZARDS

MHRA Key Findings



Liquefaction induced lateral spreading at Port de Port-au-Prince



Lateral spreading cause by 1906 earthquake in San Francisco

BULKHEAD WHARF

WHARF TODAY AT CURRENT WATER LEVEL



WHARF TODAY WITH WATER LEVEL SURGE



Wharf is a current protection measure
– King Tide conditions today

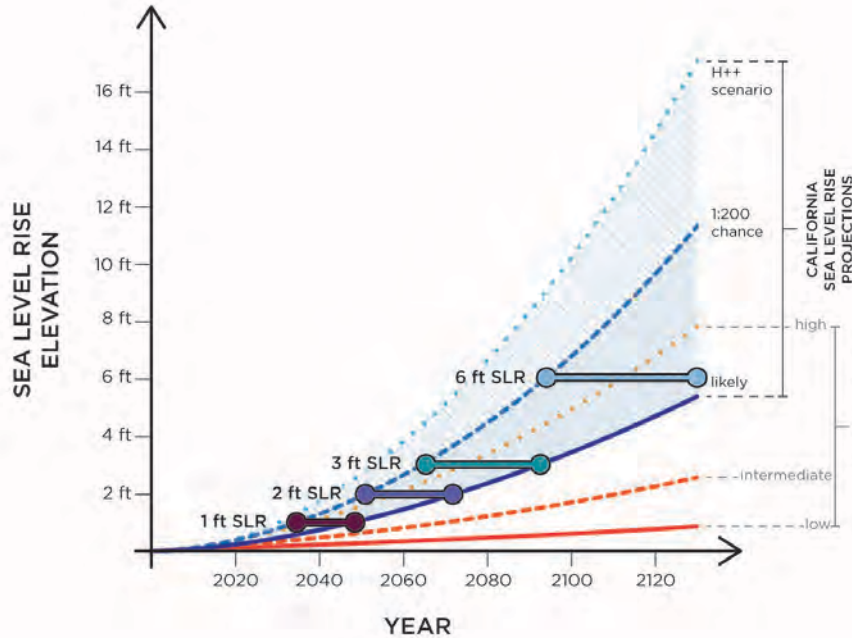
LOCATIONS OF INTEREST



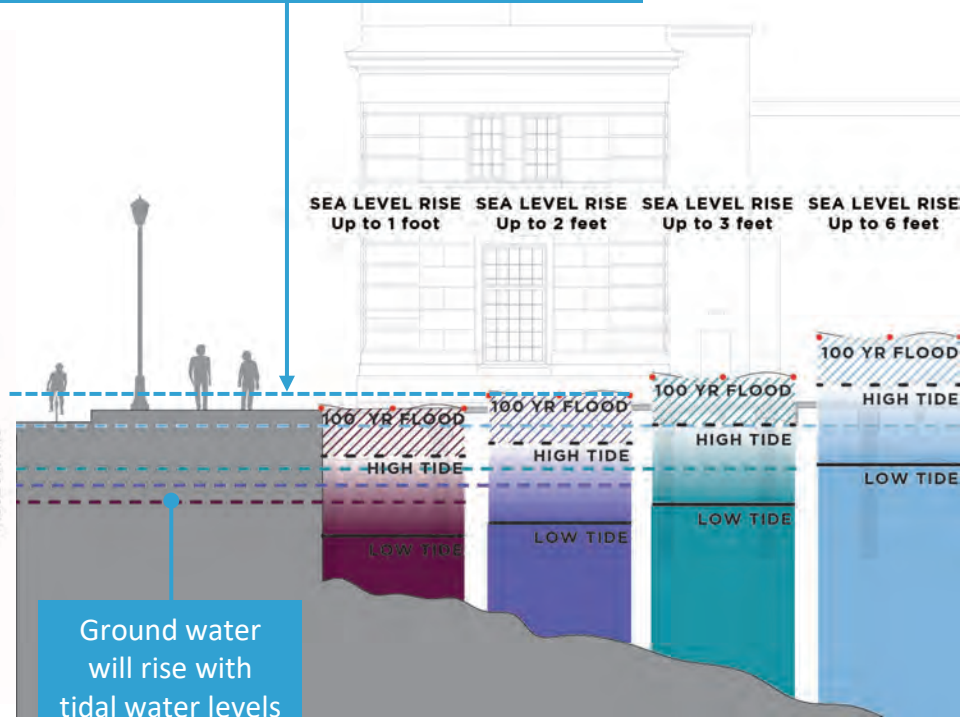
FLOOD HAZARDS

MHRA Key Findings

Flood risk tipping point at 2' of sea level rise



State of CA – Updated 2018; USACE – Updated 2013



Ground water will rise with tidal water levels due to SLR



Seismic & Flood Measures

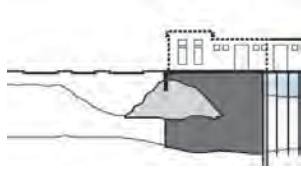
Introducing improvements or “measures” for consideration along the Embarcadero

EMBARCADERO SEAWALL SEISMIC MEASURES

Draft seismic improvements under consideration by the Port

Seismic Measures

Shoreline
Stabilization



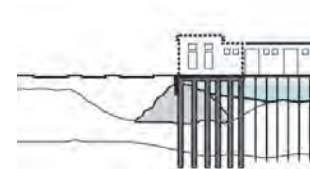
Nearshore
Buttress



Landside
Buttress



Drilled Shafts



Super Bulkhead
Wharf

Targeted
Measures



Liquefaction
Mitigation



Bulkhead
Wharf Retrofits

For each seismic measure:

- Preliminary Engineering
- Cost Estimates
- Production Rates
- Construction Impacts
- Feasibility
- Adaptation for Sea Level Rise

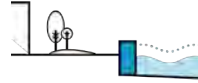
FLOOD MEASURES

Draft flood improvements under consideration by the Port & USACE

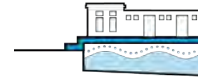
Physical



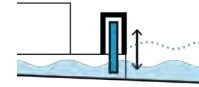
Levees



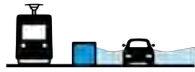
Seawalls



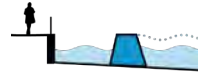
Raised Marine Structures



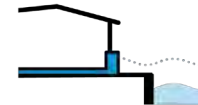
Gates and Barriers



Floodwalls



Breakwaters

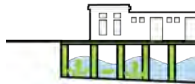


Building Adaptations



Deployables

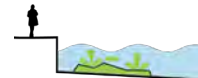
Ecological



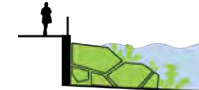
Ecological Marine Structures



Ecological Features



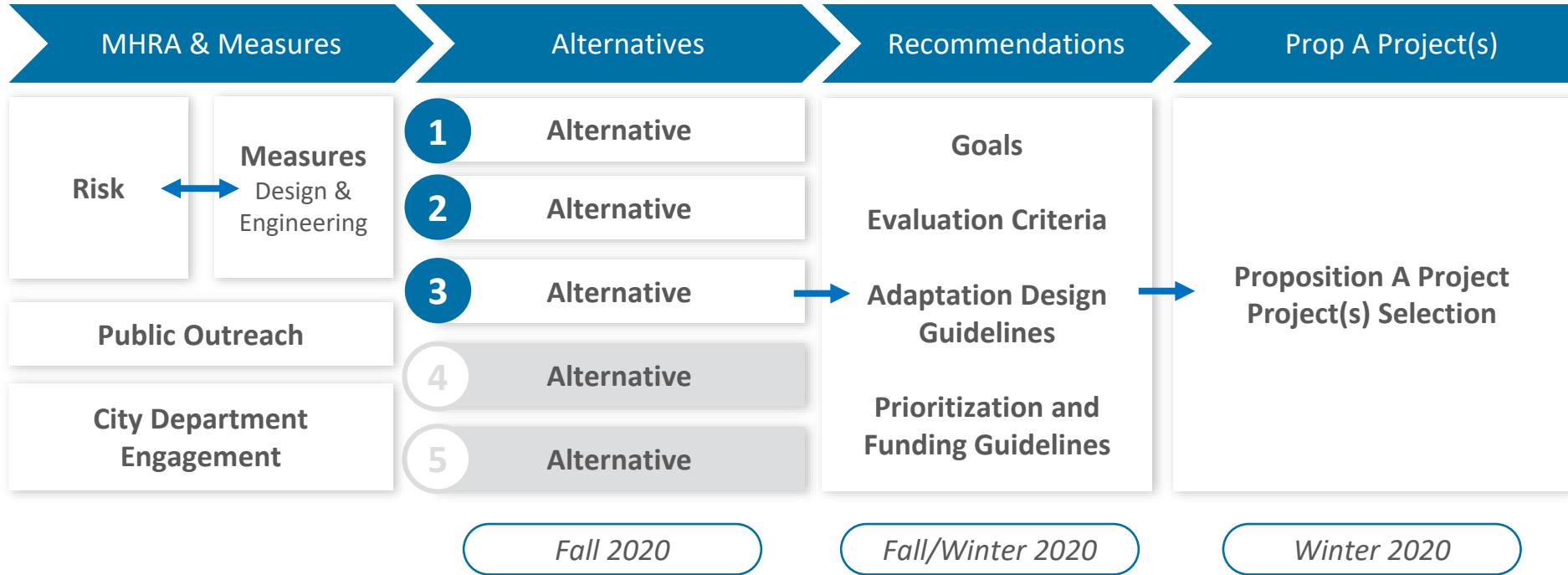
Aquatic Habitat



Ecological Shorelines

ALTERNATIVES DEVELOPMENT

Embarcadero Seawall Program Project Selection



USACE FLOOD RESILIENCY STUDY NEXT STEPS

Port-wide



Finalize Future Without Project analysis and policy compliance reviews



Continue iterative alternatives development and evaluation, informed by technical studies and stakeholder input



Refine and revise Problems, Opportunities, Objectives, Constraints and Considerations based on input received from policymakers and stakeholders



Policymaker engagement through a series of meetings in early 2021 to gain strategic direction



Ongoing community and stakeholder engagement

A photograph of two children riding bicycles on a dirt path. The child in the foreground is wearing a red and white jersey and a yellow helmet. The child in the background is wearing a dark jersey with the number 30 and a dark helmet. In the distance, a large ship is visible in the water under a clear blue sky. The path is surrounded by dry grass and some trees.

Thank You!

Brad Benson
Port of San Francisco
brad.benson@sfport.com
sfport.com

