Subarea Profile

Fisherman's Wharf

Subarea 1-2

SHORELINE TYPE:	SEISMIC RISK[1]:	FLOOD RISK[2]:	
Engineered: Filled land retained by timber cribbing or concrete bulkhead walls with pile supported wharves and piers of various ages.	**Shoreline Instability:** High to Very High	**Tipping Point Elevation:**	64" above high tide
	Liquefaction Risk: High in Fill and Marine Sand Layers	**Coastal Flood Events**	**Timing**
	Shoreline Structure Vulnerability: High to Very High		
Subsurface Profile: Non-engineered fill, interspersed liquefiable sands and mud	**Unique Conditions:** Vulnerable timber structures combined with pockets of severe shoreline instability	100-yr Flood + 24" SLR	2038 – 2052
		High tide + 66" SLR	2078 - 2127

SUBAREA DESCRIPTION

Fisherman's Wharf combines globally popular tourist attractions and historic destinations with an active commercial fishing industry that links San Francisco's present waterfront to the city's maritime past. In supporting both maritime and tourism industries while protecting natural and historic resources, Fisherman's Wharf is part of a diverse and sustainable waterfront that the Port is considering how to preserve and enhance for generations to come.

The shoreline is mostly engineered andhardened.The breakwater surrounding Aquatic Park Cove and Fisherman's Wharf providessignificant shelter from wave hazards. Other piers and breakwaters in this subarea provide similar protection for theEmbarcadero shoreline, but some areasare subject to wave impacts.

The primary flood pathway is from overtopping of the shoreline, initially at Pier 43½, resulting in inundation of a small portion of the Embarcadero Promenade and roadway. Overtopping along the Pier 49 shoreline also results in localized

[1] Shoreline Instability ratings within Embarcadero Seawall Program area based on advanced shoreline stability analysis and averaged over each subarea. Shoreline Structure Vulnerability based on Mean Damage Ratio calculated for the 225 year seismic event averaged across subarea.

[2] The timing of coastal flood events that will cause significant flooding in this subarea is provided as a range of dates based on the sea level rise projection scenarios provided by the California Ocean Protection Council (OPC) per the Likely and 1-in-200 chance of occurrence projections.

inundation. Higher Bay water levels will overtop most of the shoreline (including the piers) allowing inundation to broadly spread landward to North Point Street. The Embarcadero roadway will also act as a conduit to convey floodwater across the adjacent subareas.

COMMUNITY IDENTIFIED PRIORITIES:	
Places • Fisherman's Wharf • Muni F Line • Alcatraz • Pier 39 • Sea Lion Viewing Area • Commercial fishing • Jobs • Swim clubs and water recreation	Since 2017, the Port has connected with tens of thousands of community members through the Waterfront Resilience Program. Public feedback collected about Fisherman's Wharf underscores the importance of the subarea as a hub for jobs and business, from commercial fishing and the maritime industry to tourism. The harbor is also considered a community cornerstone. Further feedback highlights additional community priorities, including opportunities to protect important utilities as well as evacuation and disaster recovery areas, keep businesses running, and preserve ecological sites.

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FIRST FLOODING OF ASSETS

The chart below describes the vulnerability of specific assets within the Fisherman's Wharf subarea to flooding. These assets will be exposed to coastal flooding when the water level in the Bay reaches a certain height above the current high tide. The heights at which each asset is exposed to flooding is indicated with the shaded cells in the table. Over time and due to sea level rise these water levels can occur due to large storm events such as a 100 year flood of daily high tides. For example, the Embarcadero Roadway is exposed to flooding when the water rises 48 inches above current high tide, which could occur due to a 100 year flood with 3 ft. of sea level rise or as during daily high tide with 5.5 ft. of sea level rise.

● High Tide ○ 100 Year Flood ▭ Shaded cells indicate the water levels at which assets are exposed to flood

		WATER LEVEL ABOVE CURRENT HIGH TIDE										
SEA LEVEL RISE		0"	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Today		●				○						
1 ft. SLR			●				○					
3 ft. SLR					●				○			
5.5 ft. SLR								●				○
Historic and Cultural												
	Pier 39							▭	▭	▭	▭	▭
	Pier 43							▭	▭	▭	▭	▭
Disaster Response												
	Assembly Areas							▭	▭	▭	▭	▭
	Fire Station 28											>
	Police Dept. / Port Joint Operations & Security							▭	▭	▭	▭	▭
Open Space and Ecology												
	Bay Trail					▭	▭	▭	▭	▭	▭	▭
	Pier 39 Launch							▭	▭	▭	▭	▭
	Jefferson Street Plaza							▭	▭	▭	▭	▭
	Pier 43 Promenade					▭	▭	▭	▭	▭	▭	▭
	Sea Lion Viewing Area							▭	▭	▭	▭	▭

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Maritime												
	Belt Railroad Headhouse (Pier 43)											
	Pier 41 Ferry Terminal											
	Blue and Gold Ferry Terminal (Pier 39)											
	Fish Alley											
	Fisherman's Wharf Harbor	N/A (Flooding not quantified for floating overwater or in-water assets)										
	Pier 39 Water Taxi											
	Pier 45											
	Pier 47											
	Pier 49											
	Red and White Ferry Terminal											
Transportation												
	Embarcadero Roadway											
	Kirkland Yard											
	Muni Light Rail (E, F)											
Utilities												
	Jackson Transport / Storage Box	N/A (Buried assets are not directly impacted by flooding)										
	North Beach Tunnel											
	North Point Wet Weather Facility											
	Northshore Pump Station											
Critical Facilities												
	Francisco Middle School											>
	-	-										

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Fisherman's Wharf

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EARTHQUAKE AND FLOODING RISK: MULTI-HAZARD RISK ASSESSMENT KEY FINDINGS FOR THIS SUBAREA

As detailed in the Seawall Earthquake Safety General Obligation Bond Report prepared when Proposition A was considered for the November 2018 ballot, the Port has spent the past two years assessing what is at risk on the Embarcadero waterfront when considering an earthquake or flood event to establish a basis for the development of Proposition A projects. This study is called the Multi-Hazard Risk Assessment, or MHRA.

We knew the Port's aging Embarcadero Seawall was at grave risk from earthquakes. MHRA findings tell us there are areas more at risk of earthquake damage due to different soil conditions - and some less so.

Specifically, wood pile-supported structures in Fisherman's Wharf are vulnerable to both ground shaking and lateral spreading. In addition, Fisherman's Wharf is a key asset for the city, and was consistently identified as an important area through community engagement. Port staff will use MHRA results to brief Port tenants about seismic and flood risks and discuss opportunities for making these facilities safer.

We also learned:

- Older, timber-pile-supported structures in Fisherman's Wharf are at high risk. These older, pile-supported structures are home to small businesses and workers providing services to visitors and residents. These structures are vulnerable to strong ground-shaking and the lateral spreading expected in a moderate to large earthquake.
- A large earthquake will cause significant damage in this area, threatening life safety and disaster response efforts as well as many of the day-to-day functions along the waterfront. Wharves and piers in this subarea are predicted to experience earthquake damage from both lateral spreading and ground shaking.
- Fisherman's Wharf Subarea is one of the most densely populated regions of Port property including large numbers of people at the overwater attractions and restaurants from Taylor Street to Pier 39.
- Many historic buildings and bulkhead wharves are at high risk. The bulkhead wharves are the structures located where the pile supported piers over the Bay meet the land. These structures are interconnected with the Seawall and support the ornate, historic bulkhead buildings that line the Embarcadero. The wharves are at high risk of earthquake damage and will flood with increasing sea levels.
- With 1.1 feet of sea-level rise, expected to occur between 2035 and 2050 based on current City guidance, coastal flooding hazard will increase moderately: the 100-year extreme tide will overtop the Pier 43 promenade.
- With 2.2 feet of sea-level rise, expected to occur between 2050 and 2080 based on current City guidance, coastal flood risk will increase significantly: the 100-year extreme tide will overtop most of the shoreline, causing significant flooding of the Embarcadero corridor and a few notable piers including Piers 45 and 39.

Key Disaster Response Facilities At Risk in this Subarea

- Maritime fuel is only located in Fisherman's Wharf, and will be in high demand and short supply along the waterfront during an emergency.
- Oil spill response system at Hyde Street Harbor at risk.

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Maritime

- Fisherman's Wharf subarea is key to fishing and fish processing at the waterfront.
- Over 1,000 boat slips at recreational boating marinas are accessible by vehicle at only a few access points which are vulnerable to seismic damage.

Historic Resources

- Pier 45 has a unique bulkhead wharf structure and is the largest pier substructure within the historic district.

Environmental

- This subarea is considered the one with highest habitat value within the Embarcadero Seawall Program area.
- Within the subarea, environmental enhancement and restoration opportunities exist for creation of feather boa kelp and vegetated rock shorelines, installation of light penetrating surfaces along pedestrian piers, creosote pile removal, and more.

WHAT IS AT STAKE?

Given the potential impacts of earthquakes, flooding, and future sea level rise, what is at stake in Fisherman's Wharf?

Community indicators, such as income level, mobility access, race, age, education level, and language access, all play a part in how communities are impacted and able to prepare and respond to hazards like earthquakes and sea level rise. In this subarea, residents who live around and visitors to Fisherman's Wharf and Pier 39 are most directly impacted by seismic risk due to liquefaction and rising seas. When combined with housing affordability, job security, and transit access, these hazards could contribute to cascading economic and community resilience impacts for the subarea, city, and beyond. These hazards not only pose direct impacts, but also long-term impacts that could alter the existing cultural and iconic vibrancy of this subarea.

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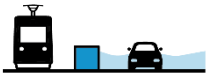
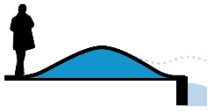
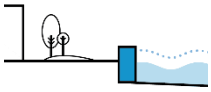
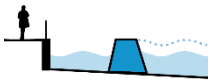
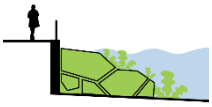
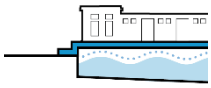
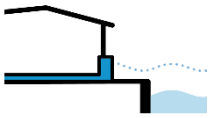
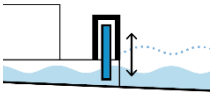
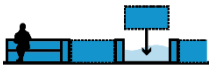
FUTURE POTENTIAL MEASURES UNDER CONSIDERATION IN THIS SUBAREA

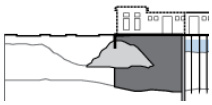
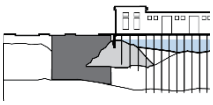
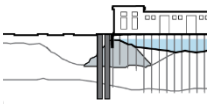
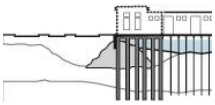
FLOOD MEASURES:

Physical Infrastructure | **Ecological Infrastructure**

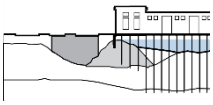
 Floodwalls	 Levees	 Ecological Marine Structures	 Ecological Features
 Seawalls	 Breakwaters	 Aquatic Habitat	 Ecological Shorelines
 Raised Marine Structures	 Building Adaptations		
 Tide Gates	 Deployables		

SEISMIC MEASURES:

Shoreline Stabilization

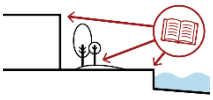
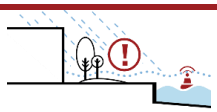
 Nearshore Buttress	 Landside Buttress	 Drilled Shafts	 Super Bulkhead Wharf

Targeted Measures

 Bulkhead Wharf Retrofit	 Liquefaction Mitigation		

FLOOD AND SEISMIC MEASURES:

Policy and Emergency Preparedness

 Policies and Zoning	 Emergency Preparedness		