

# Pier 31 to 35

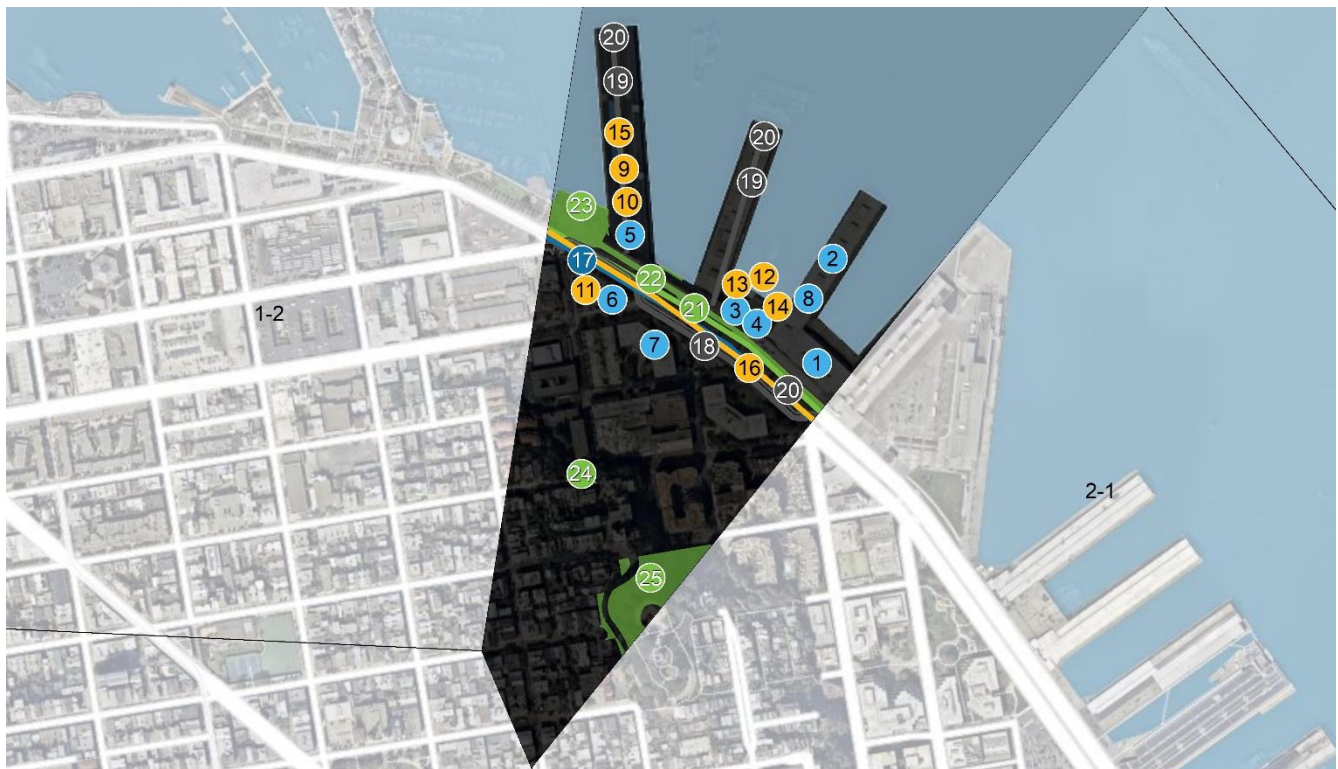
## Subarea 1-3



### Subarea Description

Pier 31 to 35 (Subarea 1-3) is located on the northeast corner of the Fisherman's Wharf area and contains Piers 31, 33, and 35. These piers provide berth usage for excursion terminals, fish processing and potential future berths, and a secondary two-berth cruise terminal. These piers, as well as the subarea's seawall sections, bulkhead wharves, and most of the buildings, are part of the Port of San Francisco's Embarcadero Historic District. Also included in this subarea are parts of Telegraph Hill, including Pioneer Park, and the residential North Beach neighborhood. Critical infrastructure includes a portion of the North Point Wet-Weather Facility, deepwater outfall, and the North Shore pump station (discussed in Subarea 1-2).

The shoreline is hardened by the existing pier structures. The piers provide wave hazard reduction for the landward Embarcadero roadway, but the piers themselves are subject to wave impacts. The primary flood pathway is from overtopping of the shoreline, initially at Pier 29½, resulting in inundation of a small portion of the pier and parking area. Higher bay water levels result in inundation of the Embarcadero roadway and adjacent seawall lots; however, this inundation is caused by overtopping in the adjacent Subarea 2-1. Floodwaters are conveyed by the Embarcadero roadway into this subarea. Eventually, all piers within this subarea will be overtopped, resulting in subarea wide inundation that comingles with the adjacent subareas.



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### Assets and Landmarks



#### Maritime

- 1. Parking (Pier 29.5)
- 2. Pier 31
- 3. Alcatraz Landing
- 4. Alcatraz Landing Cafe
- 5. Overflow for Cruise Terminal (Pier 35)
- 6. Parking (Seawall Lot 314)
- 7. Waterfront Plaza
- 8. Underground Storage Tank (Pier 31)



#### Disaster Response

- 9. Assembly Area (Pier 35)
- 10. Staging Area (Pier 35, Cargo Designated Area)
- 11. Staging Area (Seawall Lot 314)
- 12. Ferry Terminal (Pier 31.5, Alcatraz Tour Ferries)
- 13. EFWS Fireboat Manifold (Pier 33.5)
- 14. EFWS Suction Connections (1)
- 15. Large Vessel Berth (Pier 35)
- 16. Embarcadero Roadway



#### Transportation

- 16. The Embarcadero
- 17. Muni E-Line, Muni F-Line



#### Utilities

##### Wastewater

- 18. Jackson Transport / Storage Box
- 19. Northshore Deepwater Outfalls
- 20. Combined Sewer Discharge Outfalls (1)



#### Open Space and Ecology

##### Open Space

- 21. Bay Trail
- 22. Embarcadero Promenade
- 23. Public Pier (Pier 35)
- 24. Chestnut and Kerry Open Space
- 25. Telegraph Hill / Pioneer Park

# Pier 31 to 35

## Subarea 1-3



### Timing of Exposure: Assets and Landmarks

Assets / Landmarks	Flood Scenario	Equivalent Events	Timing				
			USACE Low	USACE Inter.	OPC Most Likely	USACE High	OPC 1-in-200
 <b>Maritime</b>							
<ul style="list-style-type: none"> <li>Parking (Pier 29.5)</li> </ul>	36" (9.2 ft. NAVD)	High tide + 36" SLR	>2150	2144	2091	2074	2063
		50-YR + 0" SLR	Today	Today	Today	Today	Today
<ul style="list-style-type: none"> <li>Parking (Seawall Lot 314)</li> <li>Waterfront Plaza</li> </ul>	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2114	2071	2060	2052
<ul style="list-style-type: none"> <li>Pier 31</li> <li>Alcatraz Landing</li> <li>Alcatraz Landing Cafe</li> <li>Overflow for Cruise Terminal (Pier 35)</li> <li>Underground Storage Tank (Pier 31)</li> </ul>	77" (12.6 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2143	2091	2074	2063
 <b>Disaster Response</b>							
<ul style="list-style-type: none"> <li>EFWS Suction Connections (1)</li> </ul>	12" (7.2 ft. NAVD)	High tide + 12" SLR	>2150	2070	2047	2038	2034
		1-YR + 0" SLR	Today	Today	Today	Today	Today
<ul style="list-style-type: none"> <li>Staging Area (Seawall Lot 314)</li> <li>The Embarcadero</li> </ul>	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2114	2071	2060	2052
<ul style="list-style-type: none"> <li>Assembly Area (Pier 35)</li> <li>Staging Area (Pier 35, Cargo Designated Area)</li> <li>Ferry Terminal (Pier 31.5, Alcatraz Tour Ferries)</li> <li>EFWS Fireboat Manifold (Pier 33.5)</li> </ul>	77" (12.6 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2143	2091	2074	2063
<ul style="list-style-type: none"> <li>Large Vessel Berth (Pier 35)</li> </ul>	--	--	--	--	--	--	--



## Timing of Exposure: Assets and Landmarks

Assets / Landmarks	Flood Scenario	Equivalent Events	Timing				
			USACE Low	USACE Inter.	OPC Most Likely	USACE High	OPC 1-in-200
 <b>Utilities</b>							
<ul style="list-style-type: none"> <li>Combined Sewer Discharge Outfalls (1)</li> </ul>	24" (8.2 ft. NAVD)	High tide + 24" SLR	>2150	2112	2070	2059	2051
		5-YR + 0" SLR	Today	Today	Today	Today	Today
<ul style="list-style-type: none"> <li>Jackson Transport / Storage Box</li> <li>Northshore Deepwater Outfalls</li> </ul>	--	--	--	--	--	--	--
 <b>Transportation</b>							
<ul style="list-style-type: none"> <li>The Embarcadero</li> <li>Muni E-Line, Muni F-Line</li> </ul>	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2114	2071	2060	2052
 <b>Open Space and Ecology</b>							
<ul style="list-style-type: none"> <li>Ferry Park</li> <li>Maritime Plaza</li> </ul>	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2114	2071	2060	2052
<ul style="list-style-type: none"> <li>Public Pier (Pier 35)</li> </ul>	77" (12.6 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2143	2091	2074	2063
<ul style="list-style-type: none"> <li>Chestnut and Kerry Open Space</li> <li>Telegraph Hill / Pioneer Park</li> </ul>	> 108"	--	--	--	--	--	--

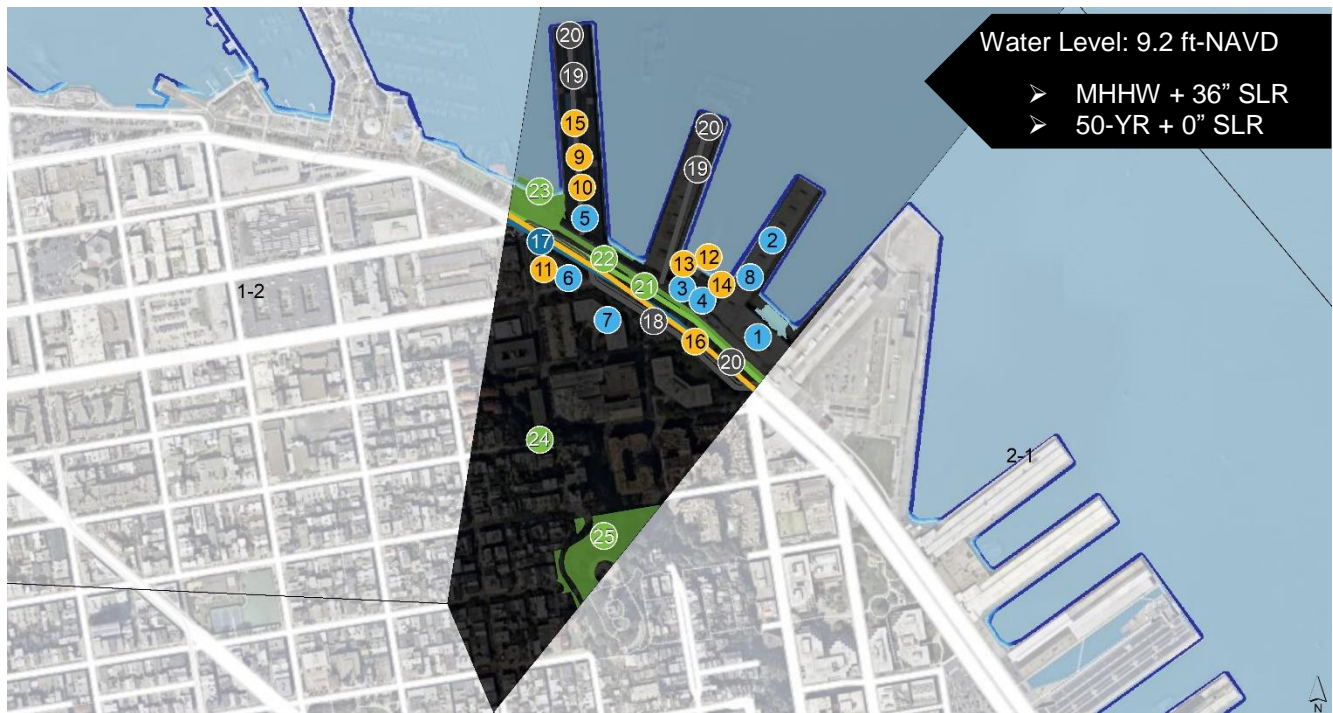


## Timing of Exposure: Subarea

Adaptation Focus	Shoreline Type	Flood Scenario	Timing					
			Return	USACE Low	USACE Inter.	OPC Most Likely	USACE High	OPC 1-in-200
Immediate	Engineered	36" (9.2 ft. NAVD)	High tide + 36" SLR	>2150	2144	2091	2074	2063
			50-YR + 0" SLR	Today	Today	Today	Today	Today
Tipping Point	Engineered	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
			100-YR + 25" SLR	>2150	2114	2071	2060	2052
Long Term >2050	Engineered	77" (12.6 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
			100-YR + 36" SLR	>2150	2143	2091	2074	2063

## Flood Progression

### Immediate Flood Risk



# Pier 31 to 35

Subarea 1-3



## Substantial Flood Risk (Tipping Point)



## Long-Term Flood Risk (>2050)






# Pier 31 to 35

## Subarea 1-3



The following describes the progression of potential extreme tide and sea level rise flooding, along with a brief discussion of the assets that will be impacted within Subarea 1-3.

Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
High tide + 12" SLR	1-YR + 0" SLR	Today	Today	Today	Today	Today
Water Level Elevation: 7.2 ft. NAVD88		<b>Disaster Response</b>  One fire suction connection (part of the Emergency Firefighting Water System) that allow fire engines to draw water from the Bay for fire suppression will be inundated. Suction connections become unusable if they are inundated, primarily due to limitations related to fire truck access.				
High tide + 24" SLR	5-YR + 0" SLR	Today	Today	Today	Today	Today
		<b>Utilities</b>  The higher Bay water levels may reduce the gravity-driven flow of excess combined wastewater and stormwater from the transport / storage boxes to the Bay. This impact is only of concern during intense and prolonged rainfall events that exceed the capacity of the large underground transport / storage boxes that ring the city. This could result in an increase in localized flooding in low-lying areas.  The Sansome Street combined sewer discharge outfall (Jackson transport/storage box) in this subarea will have backflow prevention installed under the SFPUC Sewer System Improvement Program to delay the onset of impacts to the sewer system during higher Bay water levels.				
High tide + 36" SLR	50-YR + 0" SLR	Today	Today	Today	Today	Today
Water Level Elevation: 9.2 ft. NAVD88		<b>Maritime</b>  Pier 29½ will be overtopped by Bay waters, resulting in inundation of the parking facility.				

# Pier 31 to 35

## Subarea 1-3



Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
<b>High tide + 48" SLR</b>	<b>100-YR + 7" SLR</b>	2086	2047	2031	2024	2023
Water Level Elevation: 10.2 ft. NAVD88		--	--	--	--	--
<b>High tide + 52" SLR</b>	<b>100-YR + 11" SLR</b>	2136	2065	2044	2035	2031
Water Level Elevation: 10.5 ft. NAVD88		--	--	--	--	--
<b>High tide + 66" SLR</b>	<b>100-YR + 25" SLR</b>	>2150	2114	2071	2060	2052
Water Level Elevation: 11.7 ft. NAVD88						
 <b>Maritime</b>		Seawall Lot 314 (parking) and the Waterfront Plaza will be inundated.  Landside access to the piers in this subarea will be impacted by inundation along the Embarcadero.				
 <b>Disaster Response</b>		The designated Staging Area at Seawall Lot 314 will be inundated, impacting disaster response and operations if needed. The Embarcadero roadway, which serves as an emergency access route, will also be inundated during this scenario.				
 <b>Utilities</b>		Streetlights within this subarea would experience inundation.				





Flood Scenario	Assets	Consequences				
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### Transportation

The Embarcadero roadway will be inundated, resulting in a loss of mobility across the subarea and to the waterfront (including the piers). Muni E-Line and F-Line routes will also be inundated, resulting in service impacts across multiple subareas.



### Open Space and Ecology

Most of the Bay Trail that parallels the waterfront along the Embarcadero roadway will be inundated. A part of the Embarcadero Promenade will also be inundated, resulting in loss of access to the waterfront and piers.

High tide + 77" SLR	100-YR + 36" SLR	USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
		>2150	2143	2091	2074	2063

Water Level Elevation: 12.6 ft. NAVD88



### Maritime

Pier 31 (offices, storage, and underground storage tank) and Pier 35 (overflow for cruise terminal) will be inundated.

The Alcatraz Landing (and cafe) between Pier 31 and Pier 35 will also be inundated.



### Disaster Response

Several assets that support disaster response and emergency operations will be impacted, including the Ferry Terminal at Pier 31½ (Alcatraz Tour Ferries), EFWS Fireboat Manifold on Pier 33½, and Staging Area (cargo designated area) and Assembly Area on Pier 35.

The EFWS Fireboat Manifold at Pier 33½ can remain in service if a fireboat can safely establish a connection.



### Open Space and Ecology

The public space at Pier 35 will be inundated.

# Pier 31 to 35

## Subarea 1-3



Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
<b>High tide + 84" SLR</b>	<b>100-YR + 43" SLR</b>	>2150	>2150	2104	2082	2069
Water Level Elevation: 13.2 ft. NAVD88						
<b>High tide + 96" SLR</b>	<b>100-YR + 55" SLR</b>	>2150	>2150	2125	2095	2078
Water Level Elevation: 14.2 ft. NAVD88						
<b>High tide + 108" SLR</b>	<b>100-YR + 67" SLR</b>	>2150	>2150	2145	2107	2087
Water Level Elevation: 15.2 ft. NAVD88						



## Adaptation Focus: Immediate



Shoreline Characteristics	Shoreline Overtopping					Timing of Impact (100-YR)				
	Avg. Elev.	Avg. Depth (ft)	Max Depth (ft)	Length (ft)	%	USACE Low	USACE Inter.	OPC Most Likely	USACE High	OPC 1-in-200
Engineered	9.0 ft. NAVD	0.3	0.6	200	2.5%	Today	Today	Today	Today	Today

### Flood Pathways

- Overtopping of the shoreline occurs initially at Pier 29½, resulting in inundation of the pier, bayfront parking area, and parking garage.
- Inundation is limited to Pier 29½.

### Shoreline Focus

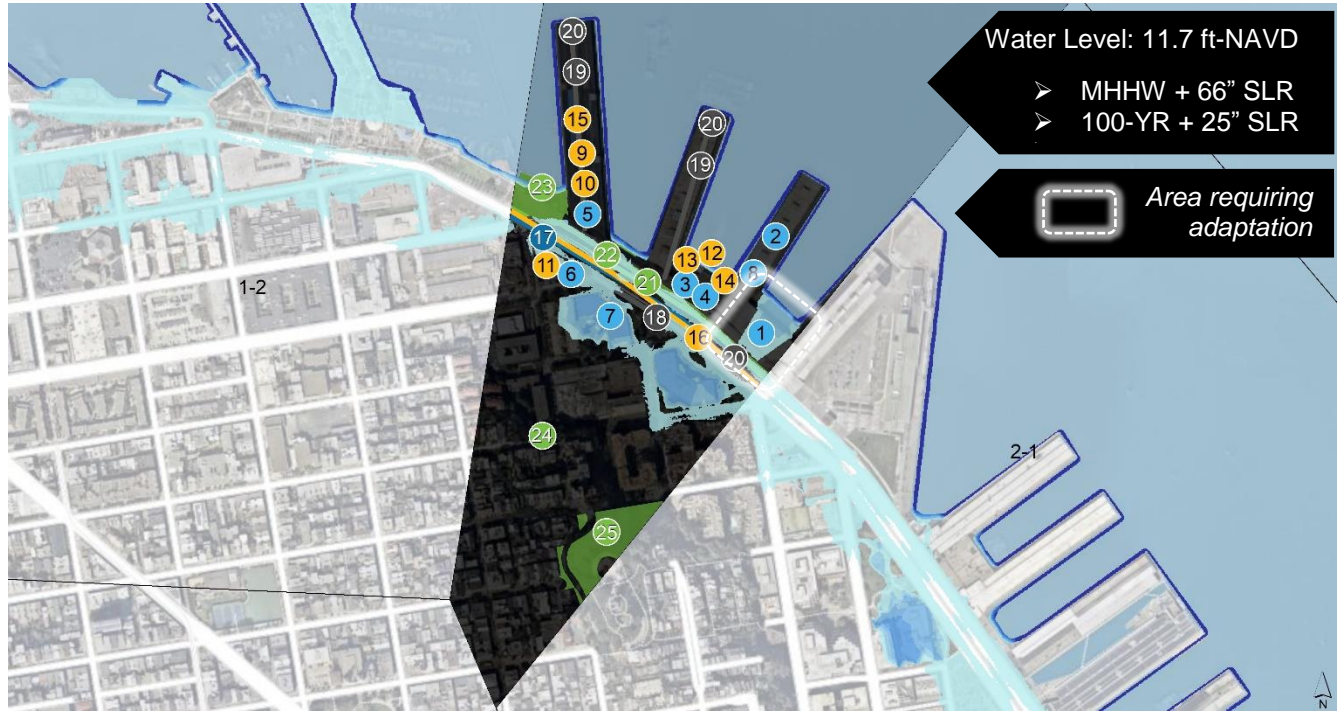
- Isolated adaptation measures at the overtopping locations would address flooding at the MHHW + 48” scenario.

### Adaptation Considerations

- There is available open space along the Pier 29½ waterfront edge for adaptation measures to be considered.
- Higher water levels will eventually overtop a broader stretch of the shoreline. Adaptation measures should consider embedding capacity to adapt to higher water levels over time.



## Adaptation Focus: Tipping Point



Shoreline Characteristics	Shoreline Overtopping					Timing of Impact (100-YR)				
	Avg. Elev.	Avg. Depth (ft)	Max Depth (ft)	Length (ft)	%	USACE Low	USACE Inter.	OPC Most Likely	USACE High	OPC 1-in-200
Engineered	9.3 ft. NAVD	2.4	2.8	275	3.4%	>2150	2114	2071	2060	2052

### Flood Pathways

- Overtopping at Pier 29½ increases, resulting in inundation of almost the entire pier.
- The primary source of flooding within this subarea is from the Embarcadero roadway conveying floodwaters from the adjacent Subarea 2-1, resulting in inundation of the Embarcadero roadway and all seawall lots within this subarea.
- Floodwaters from Subarea 2-1 Subarea do not comingle with the floodwaters from overtopping the Pier 29½ shoreline.

### Shoreline Focus

- Adaptation measures for Pier 29½ shoreline are required, but only addressing flooding at the pier itself.

### Adaptation Considerations

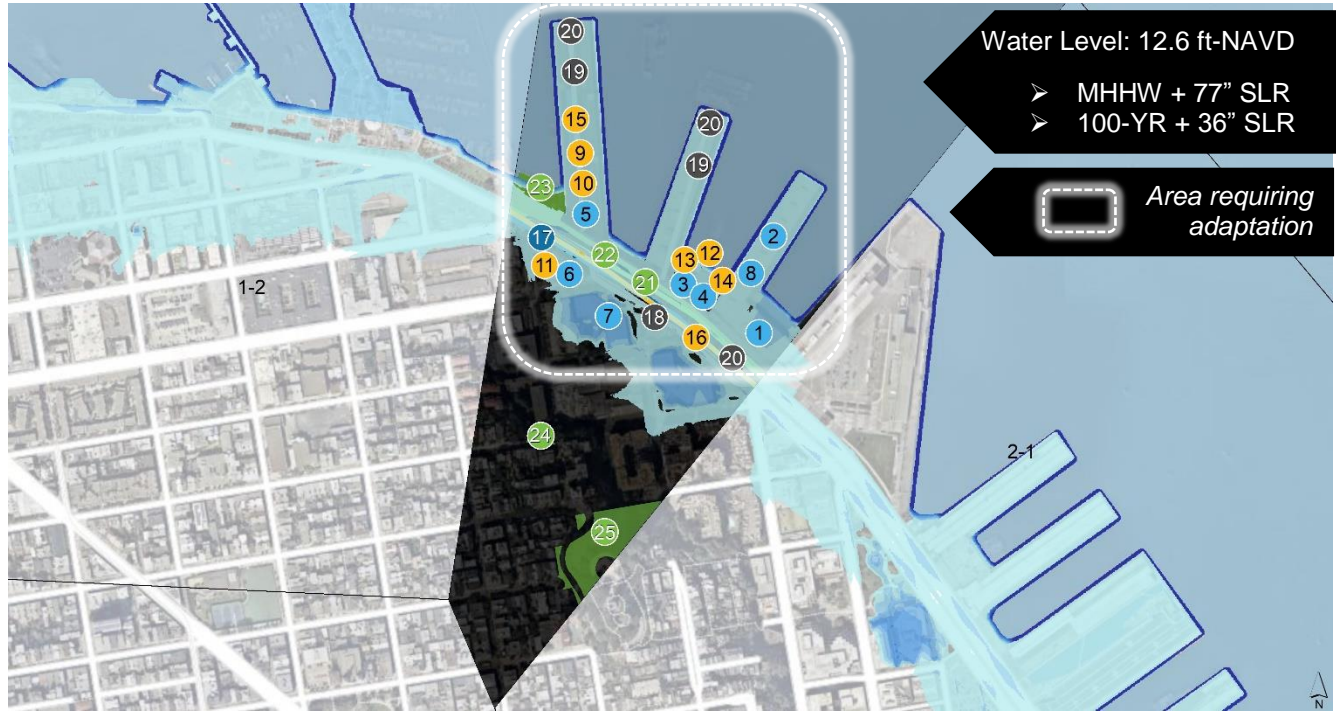
- There is available open space along the Pier 29½ waterfront edge for adaptation measures to be considered.
- Flooding from Subarea 2-1 requires adaptation measures to be coordinated across these subareas.
- Adaptation measures should consider embedding capacity to adapt to higher water levels over time.

# Pier 31 to 35

Subarea 1-3



## Adaptation Focus: Long-Term >2050



Shoreline Characteristics	Shoreline Overtopping					Timing of Impact (100-YR)				
	Classification	Avg. Elev.	Avg. Depth (ft)	Max Depth (ft)	Length (ft)	%	USACE Low	USACE Inter.	OPC Most Likely	USACE High
Engineered	12.2 ft. NAVD	0.4	3.7	7,095	88.7%	>2150	2143	2091	2074	2063

### Flood Pathways

- Almost the entire subarea shoreline is overtopped, including all piers.
- The shoreline overtopping allows inundation to broadly spread landward.
- Flooding comingles with Subarea 1-2 and 2-1 via the Embarcadero roadway.

### Shoreline Focus

- Subarea wide adaptation measures are required.

### Adaptation Considerations

- Flooding comingles with adjacent Subareas 1-2 and 2-1, requiring adaptation measures to be coordinated across these subareas and implemented in tandem.