

Ferry Building

Subarea 2-2

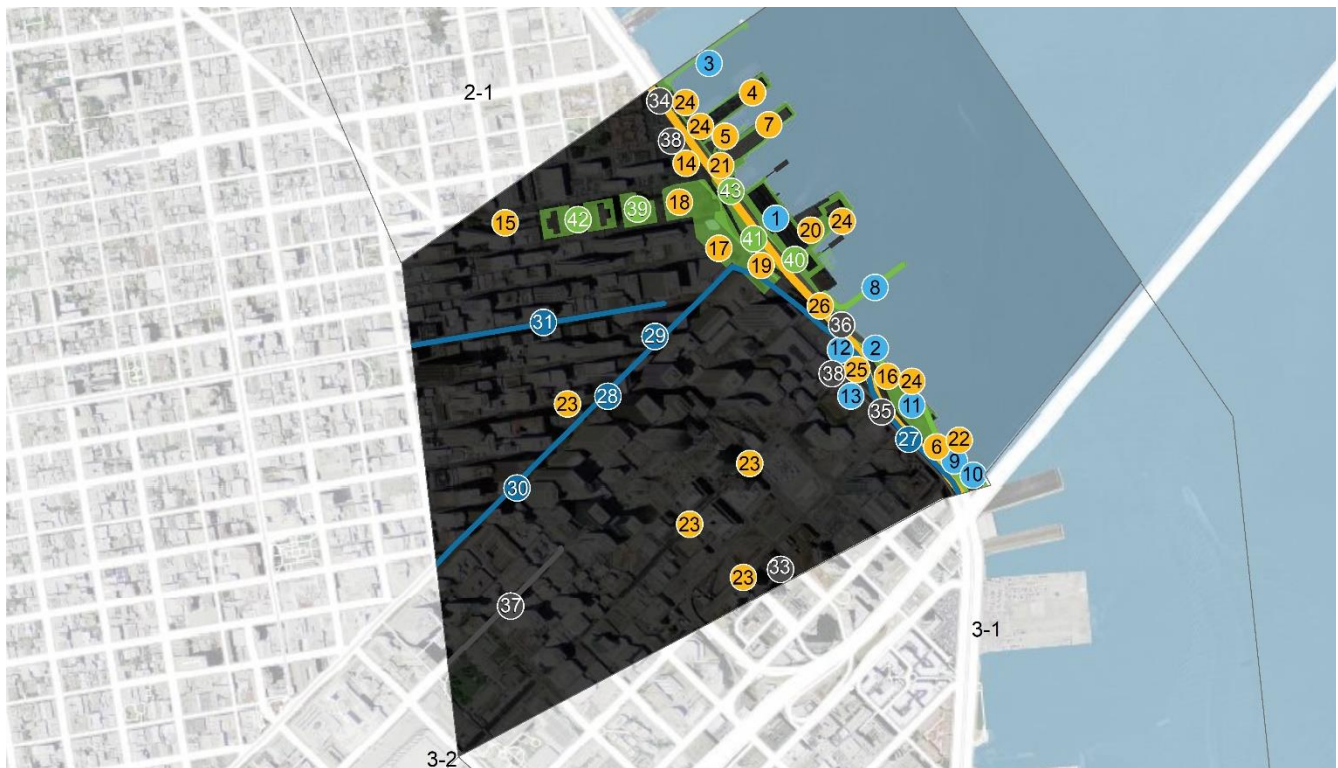


Subarea Description

Ferry Building (Subarea 2-2) includes the iconic Ferry Building, important piers, the city's downtown ferry terminals, and portions of San Francisco's Financial District. A gateway to the city, it also contains significant city and regional transportation infrastructure and connection points, including ferry terminals, underground Embarcadero and Montgomery and BART/Muni stations, multiple Muni bus lines, historic streetcars, cable cars and the Transbay Transit Center for regional bus lines, long-distance buses, and Muni railway connections.

The many transportation hubs, historic waterfront, and businesses in the Financial District make this subarea central to San Francisco and the regional economy.

The primary flooding pathway is overtopping along the shoreline. Flooding first occurs near Pier 14, where nuisance flooding and wave overtopping occurs under existing conditions, impacting a small area of the Embarcadero Promenade and roadway. Higher Bay water levels would result in overtopping along most of the shoreline, allowing floodwaters to extend several streets inland.



Basemap Credits (all maps): © Mapbox, © OpenStreetMap



Assets and Landmarks



Maritime

- | | |
|---|---|
| 1. Ferry Building | 7. Port of San Francisco Headquarters (Pier 1) |
| 2. Embarcadero Promenade | 8. Pier 14 |
| 3. Pier 7 (fishing, public waterfront access) | 9. Pier 22.5 |
| 4. Hornblower Excursion Terminal (Pier 3) | 10. Pier 24 Annex |
| 5. Water Taxi Dock (Pier 1.5) | 11. Seawall Lot 327 |
| 5. Landing (Pier 1.5) | 12. Seawall Lot 347N (public waterfront access) |
| 5. Small Boat Launch (Pier 1.5) | 13. Seawall Lot 347S |
| 6. Fireboat House | 14. Seawall Lot 351 |



Disaster Response

- | | |
|---|--|
| 6. Fireboat Headquarters, Fire Station 35 (Pier 22.5) | 21. Primary Port Department Operations Center (Pier 1) |
| 15. Fire Station 13 | 5. Water Taxi Dock (Pier 1.5) |
| 16. Assembly Area (Rincon Park) | 4. Hornblower Excursion Terminal (Pier 3) |
| 17. Assembly Area (Embarcadero Plaza) | 22. EFWS Fireboat Manifold (Pier 22.5) |
| 18. Assembly Area (Sue Bierman Park) | 23. EFWS Cisterns (4) |
| 19. Assembly Area (Embarcadero Bocce Ball Courts) | 24. EFWS Suction Connections (4) |
| 7. Port of San Francisco Headquarters (Pier 1) | 25. Staging Area (Seawall Lot 347-S) |
| 20. Ferry Building Terminals | 14. Staging Area (Seawall Lot 351, Parking Lot) |
| | 26. The Embarcadero |



Transportation

- | | |
|------------------------------|---------------------------------|
| 20. Ferry Building Terminals | 29. Embarcadero BART Station |
| 26. Embarcadero Roadway | 30. Montgomery BART Station |
| 27. Muni E-Line, Muni F-Line | 31. California Street Cable Car |
| 28. Muni T-Line | |



Utilities

Power

- 32. Back-up Diesel Generator
- 33. Embarcadero PG&E Substation

Wastewater

- | | |
|---|---|
| 34. Jackson Transport / Storage Box | 37. North Point Main - Moscone Tunnel |
| 35. North Channel Transport / Storage Box | 38. Combined Sewer Discharge Outfalls (2) |
| 36. North Shore Force Main | |



Assets and Landmarks



Open Space and Ecology

Open Space

- | | |
|-------------------------|---------------------------|
| 17. Embarcadero Plaza | 2. Embarcadero Promenade |
| 39. Ferry Park | 18. Sue Biermann Park |
| 40. Ferry Plaza | 43. Bay Trail |
| 41. Harry Bridges Plaza | 5. Bay Water Trail Access |
| 42. Maritime Plaza | |

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
<h3>Maritime</h3>							
<ul style="list-style-type: none"> Embarcadero Promenade 	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"> Water Taxi Dock (Pier 1.5) Landing (Pier 1.5) Small Boat Launch (Pier 1.5) Seawall Lot 327 Seawall Lot 347N (public waterfront access) Seawall Lot 347S 	48" (10.2 ft. NAVD)	High tide + 48" SLR	>2150	>2150	2113	2088	2073
		100-YR + 7" SLR	2090	2049	2033	2025	2023
<ul style="list-style-type: none"> Pier 22.5 Seawall Lot 351 	52" (10.6 ft. NAVD)	High tide + 52" SLR	>2150	>2150	2120	2092	2076
		100-YR + 11" SLR	2140	2067	2044	2036	2032
<ul style="list-style-type: none"> Ferry Building Pier 7 (fishing, public waterfront access) Fireboat House 	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2115	2072	2061	2053

Ferry Building

Subarea 2-2



Assets and Landmarks

<ul style="list-style-type: none"> Hornblower Excursion Terminal (Pier 3) Port of San Francisco Headquarters (Pier 1) Pier 24 Annex 	77" (12.7 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2144	2091	2075	2063
<ul style="list-style-type: none"> Pier 14 	108" (15.2 ft. NAVD)	High tide + 108" SLR	>2150	>2150	>2150	2140	2119
		100-YR + 67" SLR	>2150	>2150	2145	2107	2087



Disaster Response

<ul style="list-style-type: none"> EFWS Suction Connections (1 of 4) 	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"> EFWS Fireboat Manifold (Pier 22.5) The Embarcadero 	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"> Assembly Area (Rincon Park) Port of San Francisco Headquarters (Pier 1) Ferry Building Terminals Primary Port Department Operations Center (Pier 1) Water Taxi Dock (Pier 1.5) Staging Area (Seawall Lot 347-S) 	48" (10.2 ft. NAVD)	High tide + 48" SLR	>2150	>2150	2113	2088	2073
		100-YR + 7" SLR	2090	2049	2033	2025	2023
<ul style="list-style-type: none"> Fireboat Headquarters, Fire Station 35 (Pier 22.5) Assembly Area (Embarcadero Plaza) Assembly Area (Sue Bierman Park) Assembly Area (Embarcadero Bocce Ball Courts) Staging Area (Seawall Lot 351, Parking Lot) 	52" (10.6 ft. NAVD)	High tide + 52" SLR	>2150	>2150	2120	2092	2076
		100-YR + 11" SLR	2140	2067	2044	2036	2032

Ferry Building

Subarea 2-2



Assets and Landmarks

<ul style="list-style-type: none"> Hornblower Excursion Terminal (Pier 3) 	77" (12.7 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2144	2091	2075	2063
<ul style="list-style-type: none"> Fire Station 13 EFWS Cisterns (1 of 4) 	96" (14.2 ft. NAVD)	High tide + 96" SLR	>2150	>2150	>2150	2131	2110
		100-YR + 55" SLR	2696	>2150	2125	2096	2078



Utilities

<ul style="list-style-type: none"> Combined Sewer Discharge Outfalls (2) 	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"> Back-up Diesel Generator 	77" (12.7 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2144	2091	2075	2063



Transportation

<ul style="list-style-type: none"> The Embarcadero 	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"> Muni E-Line, Muni F-Line Muni T-Line 	48" (10.2 ft. NAVD)	High tide + 48" SLR	>2150	>2150	2113	2088	2073
		100-YR + 7" SLR	2090	2049	2033	2025	2023
<ul style="list-style-type: none"> Embarcadero BART Station California Street Cable Car 	52" (10.6 ft. NAVD)	High tide + 52" SLR	>2150	>2150	2120	2092	2076
		100-YR + 11" SLR	2140	2067	2044	2036	2032
<ul style="list-style-type: none"> Montgomery BART Station 	> 108"	--	--	--	--	--	--



Assets and Landmarks



Open Space and Ecology

<ul style="list-style-type: none"> Embarcadero Promenade 	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"> Ferry Plaza Rincon Park Bay Trail 	48" (10.2 ft. NAVD)	High tide + 48" SLR	>2150	>2150	2113	2088	2073
		100-YR + 7" SLR	2090	2049	2033	2025	2023
<ul style="list-style-type: none"> Embarcadero Plaza Harry Bridges Plaza Sue Biermann Park 	52" (10.6 ft. NAVD)	High tide + 52" SLR	>2150	>2150	2120	2092	2076
		100-YR + 11" SLR	2140	2067	2044	2036	2032
<ul style="list-style-type: none"> Ferry Park Maritime Plaza 	66" (11.7 ft. NAVD)	High tide + 66" SLR	>2150	>2150	2143	2106	2086
		100-YR + 25" SLR	>2150	2115	2072	2061	2053
<ul style="list-style-type: none"> Bay Water Trail Access 	77" (12.7 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
		100-YR + 36" SLR	>2150	2144	2091	2075	2063
<ul style="list-style-type: none"> Bay Water Trail 	--	--	--	--	--	--	--



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	48" (10.2 ft. NAVD)	High tide + 48" SLR	>2150	>2150	2113	2088	2073
			100-YR + 7" SLR	2090	2049	2033	2025	2023
Long Term >2050	Engineered	77" (12.7 ft. NAVD)	High tide + 77" SLR	>2150	>2150	>2150	2116	2095
			100-YR + 36" SLR	>2150	2144	2091	2075	2063

Flood Progression

Immediate Flood Risk

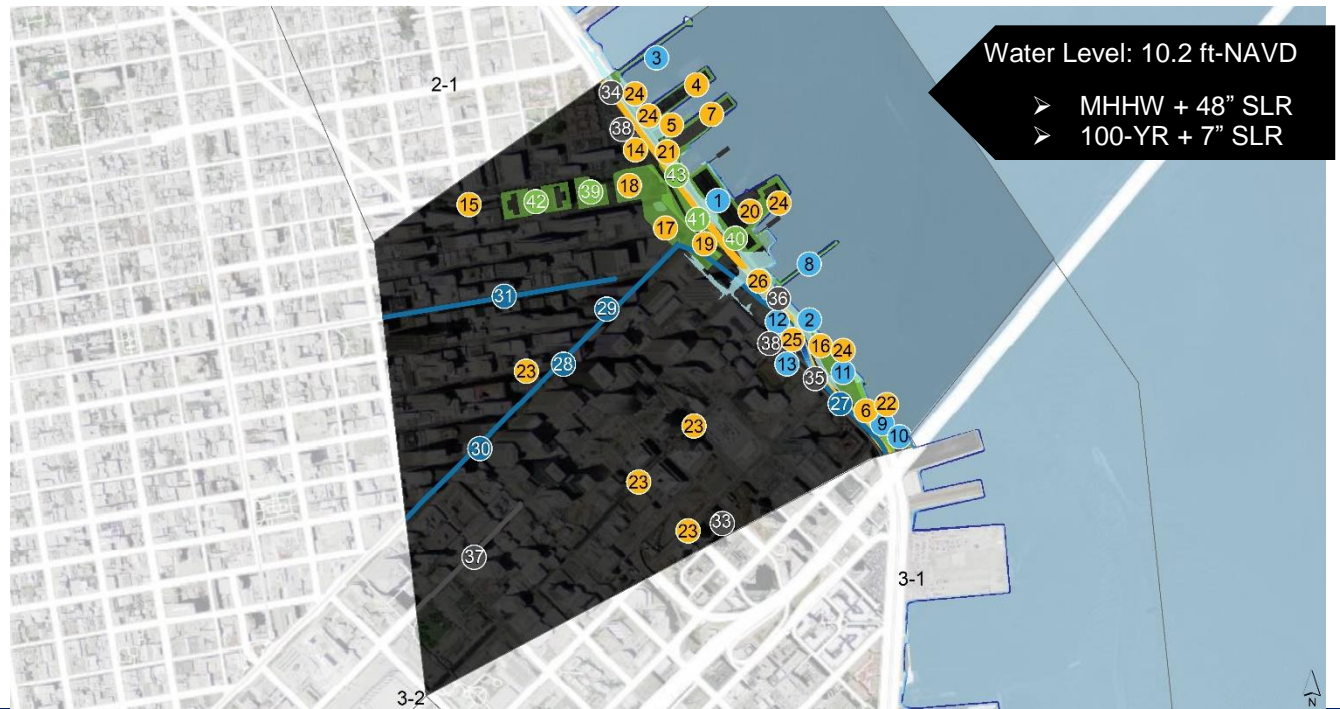


Ferry Building

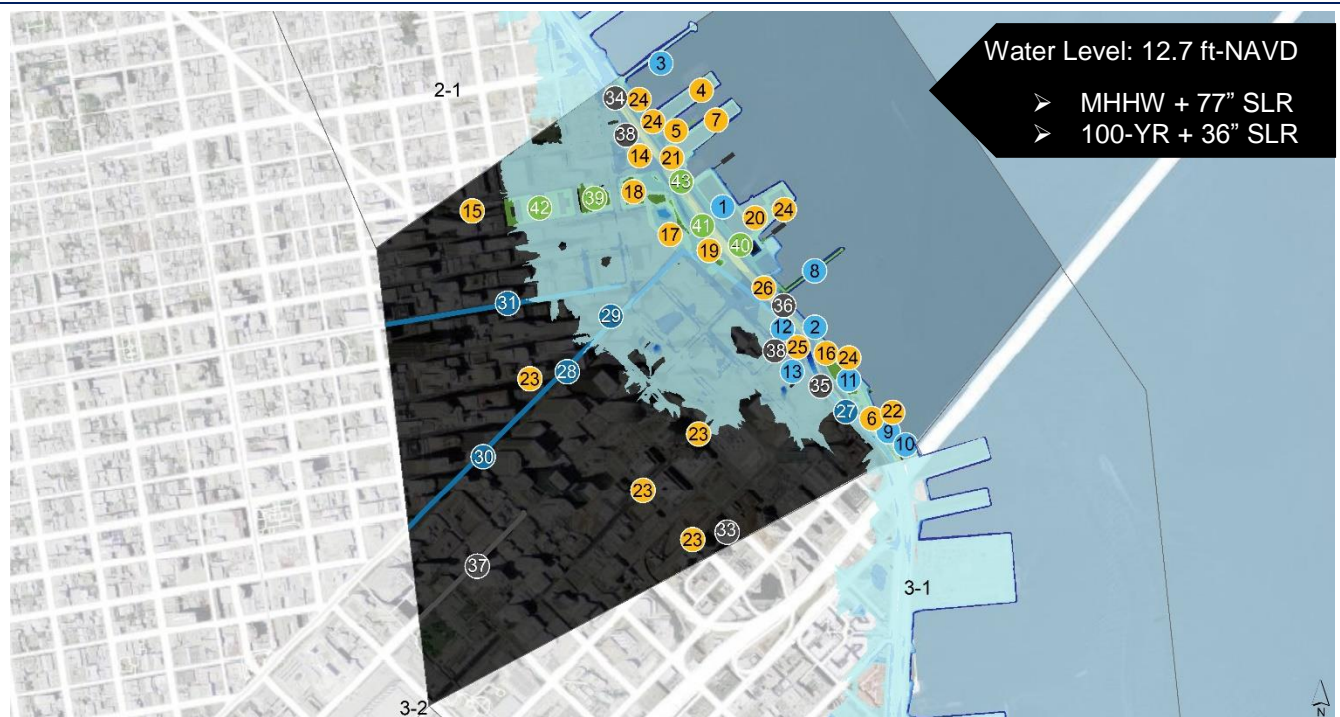
Subarea 2-2



Substantial Flood Risk (Tipping Point)



Long-Term Flood Risk (>2050)



Ferry Building

Subarea 2-2







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 2-2.


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		<p>Disaster Response</p> <p>One fire suction connection (part of the Emergency Firefighting Water System, EFWS) that allows fire engines to draw water from the Bay for fire suppression is inundated. Suction connections become unusable if they are inundated, primarily due to limitations related to fire truck access.</p> <p>One of the four EFWS cisterns will be impacted. The cisterns are large, underground concrete tanks that store water for firefighting purposes.</p>				
		<p>Transportation</p> <p>Flooding of the Embarcadero roadway is currently observed when Bay water levels are high. This causes disruption to the pedestrian and bike path on the Embarcadero Promenade between the Ferry Building and Pier 14.</p>				
High tide + 24" SLR	5-YR + 0" SLR	Today	Today	Today	Today	Today
Water Level Elevation: 8.2 ft. NAVD88		<p>Disaster Response</p> <p>One additional fire suction connection would be inundated.</p>				
		<p>Utilities</p> <p>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.</p>				

Ferry Building

Subarea 2-2



Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
High tide + 36" SLR	50-YR + 0" SLR	Today	Today	Today	Today	Today
Water Level Elevation: 9.2 ft. NAVD88		Maritime Flooding of the shoreline between the Ferry Building and Pier 14 would cause limited inundation of the Embarcadero Promenade and adjacent roadway.				
		Disaster Response Flooding of the shoreline between the Ferry Building and Pier 14 would cause limited inundation of the Embarcadero roadway. The EFWS Fireboat Manifold at Pier 22½ will also be inundated.				
		Utilities Streetlights would experience inundation.				
		Open Space and Ecology A section of the Embarcadero Promenade will be inundated.				

Flood Scenario	Assets	USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
		2090	2049	2033	2025	2023
High tide + 48" SLR	100-YR + 7" SLR					
Water Level Elevation: 10.2 ft. NAVD88		Maritime Several buildings, piers, and seawall lots are inundated, including Pier 1½ (Small Boat Launch and Water Taxi Dock); and Seawall Lots 327, 347N, and 347S. Landside access to most piers in this subarea will be impacted due to inundation along the Embarcadero roadway. Only Pier 22½ and the Pier 24 Annex will have landside access during higher Bay water levels.				



Flood Scenario	Assets	Consequences				
----------------	--------	--------------	--	--	--	--



Disaster Response

Critical disaster response assets inundated at this scenario include the Ferry Building Terminals, the Port’s Headquarters and the Department of Operation Center located at Pier 1, the Water Taxi Dock at Pier 1½, Staging Area at Seawall Lot 347-S, and the Assembly Area at Rincon Park.

One additional EFWS fire suction connection will also be inundated.



Transportation

The Ferry Building Terminals will be impacted.

The westbound lanes of the Embarcadero roadway will be inundated, causing cascading impacts to local and through traffic, bike routes, truck traffic, bus routes, pedestrian access to the shoreline, tourism, and the historic streetcar Muni E-Line and F-Line service. The Muni T-Line will also be impacted.

Although the first pedestrian entrances to the underground Embarcadero Muni/BART Station will not be directly inundated until a higher water level, floodwaters could enter the underground station through other potential flood pathways, such as manholes, vents, and access hatches, under an earlier scenario.



Open Space and Ecology

A portion of the Ferry Plaza is inundated, impacting access to the Ferry Building and Downtown Ferry Terminal. Rincon Park will be inundated. A portion of the Bay Trail will also be impacted.

High tide + 52” SLR	100-YR + 11” SLR	USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
		2140	2067	2044	2036	2032

Water Level Elevation: 10.6 ft. NAVD88



Maritime

Although the Ferry Terminal would be operational under this scenario, pedestrian access for boarding and offloading would be affected. Pier 22½ and Seawall Lot 351 are inundated.



Flood Scenario	Assets	Consequences
----------------	--------	--------------



Disaster Response

The Fireboat Headquarters and Fireboat Station 35 at Pier 22½ will be impacted. The Assembly Area at Embarcadero Plaza, Sue Bierman Park, and the Embarcadero Bocce Ball Courts will be impacted. The Staging Area at Seawall Lot 351 will also be impacted.



Transportation

Impacts to the Embarcadero BART Station would cause significant citywide and regional impacts to transportation. The Embarcadero station is the last San Francisco BART stop before connecting to Oakland via the Transbay Tube. Impacts to the Embarcadero BART station would cause systemwide impacts for the BART and Muni Metro systems, significant delays, and impact the ability for travelers to make trips between San Francisco and the East Bay, impacting hundreds of thousands of riders each day. Disruption of the Embarcadero Station would lead to congestion of other modes of transportation such as buses, personal vehicles, and ferries. Flooding of the station would cause more traffic congestion throughout the city, and would impact people’s ability to get to work, school, or other destinations.

The Muni Metro Turnaround and Portal where Muni streetcar lines switch directions on Market Street is inundated which impacts the Cable Car routes.



Open Space and Ecology

Three recreational plazas along the Embarcadero shoreline will experience inundation, including Embarcadero Plaza, Harry Bridges Plaza, and Sue Biermann Park. Approximately 2 miles of the Bay Trail will be inaccessible.

High tide + 66" SLR	100-YR + 25" SLR	USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
		>2150	2115	2072	2061	2053

Water Level Elevation: 11.7 ft. NAVD88



Maritime

The Ferry Building, a historical landmark and part of the Central Embarcadero Piers Historic District, would become inundated and the Ferry Terminal would become non-operational. The Fireboat House at Pier 22 ½ will inundated. Pier 7 will be overtopped and public access for fishing would be limited.

Ferry Building

Subarea 2-2



Flood Scenario	Assets	Consequences				
----------------	--------	--------------	--	--	--	--



Disaster Response

The Ferry Terminal is impacted. One additional fire suction connection would be inundated.



Open Space and Ecology

Maritime Plaza, located just inland of Sue Bierman Park, could also be inundated. However, Maritime Plaza is elevated from street level and only access to the park is anticipated to be impacted.

Ferry Park (located between Maritime Plaza and Sue Bierman Park) will also be impacted.

High tide + 77" SLR	100-YR + 36" SLR	USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
		>2150	2144	2091	2075	2063

Water Level Elevation: 12.7 ft. NAVD88



Maritime

Pier 1 (Port of San Francisco Headquarters) and Pier 3 (restaurants, offices, water taxi, Hornblower Excursion Terminal, and parking) will be inundated. The Pier 24 Annex will also be inundated.



Disaster Response

The Hornblower Excursion Terminal located at Pier 3 will be impacted.



Utilities

The back-up diesel generator located at Pier 1 will be impacted.



Open Space and Ecology

A Bay Water Trail Access location is inundated.

Ferry Building

Subarea 2-2



Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
High tide + 84" SLR	100-YR + 43" SLR	>2150	>2150	2104	2083	2069
Water Level Elevation: 13.2 ft. NAVD88						
High tide + 96" SLR	100-YR + 55" SLR	>2150	>2150	2125	2096	2078



Disaster Response

Fire Station 13 is impacted. Impacts from sea level rise and coastal flooding could compromise emergency and fire response times throughout the Financial District.



Utilities

Although SFPUC has underground water and combined sewer infrastructure in the Financial District, the infrastructure is not expected to be vulnerable to flooding. However, the large transport / storage box under the Embarcadero roadway may not function as intended when Bay water levels are high. The box may not be able to discharge excess stormwater directly to the Bay during a heavy rainfall event when the city's three treatments plants exceed their capacity. This could lead to localized flooding resulting in environmental and public health hazards.

Flood Scenario	Assets	Consequences				
		USACE Low	USACE Int.	OPC Most Likely	USACE High	OPC 1:200
High tide + 108" SLR	100-YR + 67" SLR	>2150	>2150	2145	2107	2087

Water Level Elevation: 15.2 ft. NAVD88



Maritime

Widespread flooding extending into the center of the Financial District would occur. While inaccessible beginning around MHHW + 48 inches, Pier 14 – which provides pedestrian access for scenic vistas and fishing – becomes completely inundated under MHHW + 108". Pier 14 serves as a breakwater to protect the Downtown Ferry Terminal from wave and tidal forces.



Disaster Response

One additional EFWS cistern will be impacted.



Adaptation Focus: Immediate



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	OPC 1-in-200
Engineered	8.9 ft. NAVD	0.8	2.7	1,354	9.7%	Today	Today	Today	Today	Today	Today

Flood Pathways

- Overtopping of the shoreline between the Ferry Building and Pier 14 would cause limited inundation of the Embarcadero Promenade and roadway.
- Overtopping of the shoreline between Pier 7 and Pier 3 would cause limited inundation at the Bay edge of Pier 5.

Shoreline Focus

- Isolated adaptation measures at the overtopping locations would address flooding at the MHHW + 36" scenario.

Adaptation Considerations

- Higher water levels will eventually overtop most of the Embarcadero 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	9.6 ft. NAVD	0.7	2.3	3,167	22.7%	2090	2049	2033	2025	2023

Flood Pathways

- Overtopping occurs over a significant stretch of the Embarcadero shoreline (not including the piers), resulting in flooding of multiple transit routes.
- The Embarcadero roadway acts as a conduit to convey flooding.
- Flooding of the Embarcadero roadway also flows north into Subarea 2-1.

Shoreline Focus

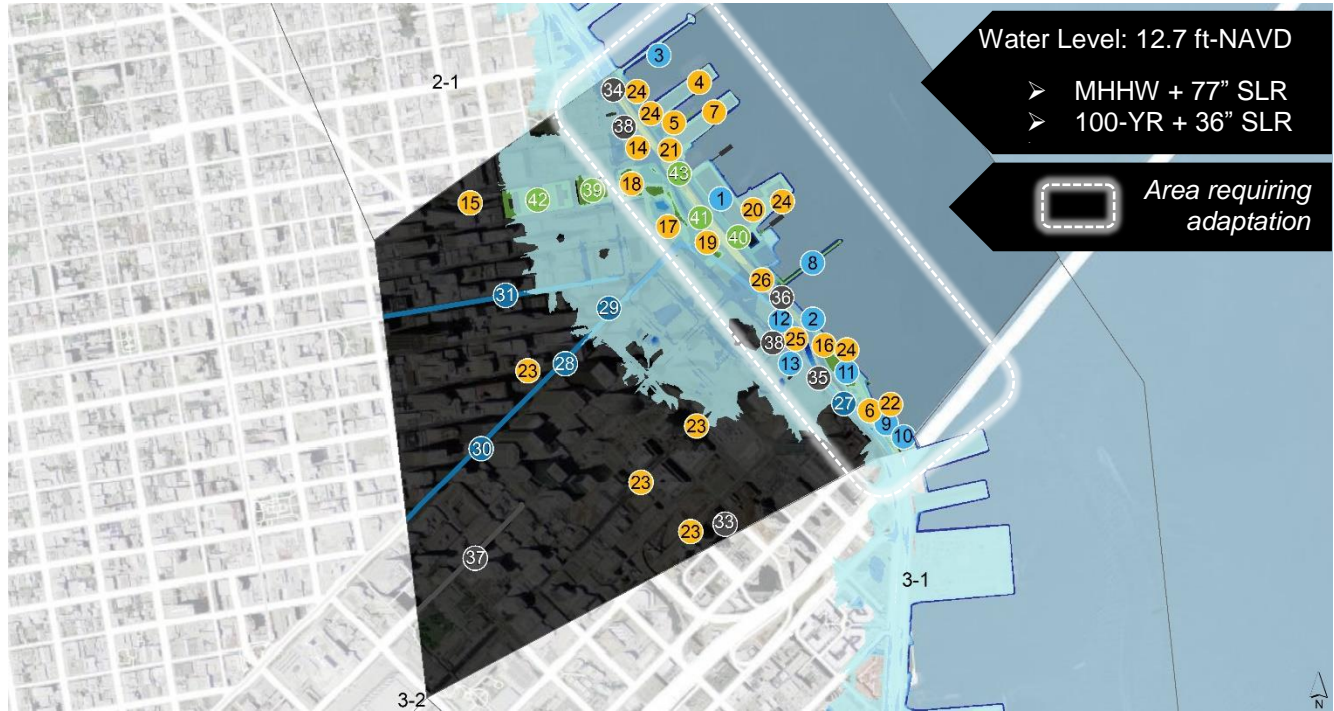
- Subarea wide shoreline adaptation measures are required.

Adaptation Considerations

- Adaptation measures to reduce flood risk will also reduce flooding in Subarea 2-1.
- Adaptation measures should consider embedding capacity to adapt to higher water levels over time.



Adaptation Focus: Long-Term >2050



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	11.0 ft. NAVD	1.7	4.7	12,532	90.0%	>2150	2144	2091	2075	2063

Flood Pathways

- Overtopping occurs over the entire stretch of the Embarcadero shoreline, including most Piers, resulting in flooding of multiple transit routes and the Financial District.
- The Embarcadero roadway acts as a conduit to convey flooding.
- Flooding extends across Subareas 2-1 and 3-1.

Shoreline Focus

- Subarea wide shoreline adaptation measures are required.

Adaptation Considerations

- Adaptation measures to reduce flood risk are required over most of the Embarcadero shoreline, as well as the shoreline of the adjacent Subareas (2-1 and 3-1).