

A view of the Mission-Islais OLU. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.

Local Assessments Section M: MISSION-ISLAIS Operational Landscape Unit

JURISDICTIONS WITHIN THIS SECTION

San Francisco



HOW TO USE THE LOCAL ASSESSMENTS



WHO IS THIS FOR?

Anyone interested in understanding their local shared vulnerabilities to flooding and sea level rise.

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- Cities
 - Counties
 - Special Districts
 - Utilities Providers •
- Stakeholder Groups
 - Non-profits/NGOs

 - For-profits/Private
 - Associations
 - Interested Parties
- **General Public**
- Residents
- State/Regional
- Caltrans
 - MTC/ABAG

HOW IS IT ORGANIZED?



Local assessments are organized by four regional systems assessed: Transportation, Vulnerable Communities, Priority Development Areas (PDAs), and Priority Conservation Areas (PCAs).

Each part of the local assessment provides varying levels of details at three scales: 1) Operational Landscape Unit (OLU), 2) Individual Descriptions, and 3) Shared Stories of Vulnerabilities in Focus Areas/Areas of Impact. This asessment can be reviewed in whole, or individual parts can be reviewed separately depending on interest and level of detail desired.



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M - 2 • ADAPTING TO RISING TIDES: BAY AREA

Where are we in the region?

This OLU encompasses most of the central southeastern of San Francisco's Bay shoreline from Pier 27 Cruise Ship Terminal to Nimitz Avenue in Hunters Point and represents a highly urbanized segment of the Bay. The area includes the Embarcadero Roadway and Promenade and includes an established regional transit hub, financial center, the Port of San Francisco and a number of cultural and historic resources that have made the area a tourist destination. The China Basin/ Mission Bay area is a growing neighborhood with new a sports arena, affordable and market rate housing, and new parks and transit. This new development will increase the number and density of people living in and traveling to this area and relying on services such as public transit. Islais Creek and the central and southern waterfront represents an area of historically industrial and maritime uses, many of which remain. The area around Islais Creek is home to some of the last industrial lands and jobs in San Francisco and continues to serve an important maritime role. This segment of the Bay shoreline, despite its generally intense development is also the site of rich ecological resources including inshore fisheries, restored salt marsh at Heron's Head and India Basin, and shorebird habitat.



M - 3 • ADAPTING TO RISING TIDES: BAY AREA

Approximate area of the Mission-Islais OLU. Map data © 2019 by Google



What regional systems are here?

Operational Landscape Unit (OLU) boundaries were used to organize and help identify regionally significant assets that were co-located together (Methodology can be found in Section 3.0 Local Assessments).

The map on page 4 shows the entire OLU, including all the regional systems present. Colors are used throughout this document to help navigate across these four regional systems. Individual assets that were assessed as part of this local vulnerability assessment are listed in the bullets below and can also be found on the labels on the map (Figure 1m).

Figure 1m. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN BELOW:



TRANSPORTATION

- US-101
- I-80
- I-280
- Embarcadero Roadway and Promenade
- Port of San Francisco
- Muni T Third Street Line
- BART /Muni Embarcadero Station
- San Francisco Ferry Terminal
- MTA Facilities
- 4th and King Caltrain Station
- Union Pacific Railroad
- San Francisco Bay Railroad
- Local Roads



VULNERABLE COMMUNITIES

- Bayview/Hunters
 Point Community
- Mission Creek, Chinatown & Embarcadero Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Port of San Francisco PDA
- Mission Bay PDA
- Bayview/Hunters Point Shipyard/ Candlestick PDA



PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Water Trail PCA

What was assessed?

TRANSPORTATION



US-101 • US-101 is the primary north-south transportation artery through the San Francisco Peninsula and provides access to the East Bay via SR-92 and SR-84. It provides important commuter transportation service for local, regional, and interregional automobile and truck traffic, averaging 225,000 vehicles¹ and 6,188 trucks² per day. It is also a designated emergency route for the Bay Area.³ Within this OLU, US-101 is an eight-lane freeway and the junction with I-80 is considered on the of the most congested road segments in the Bay Area.⁴ On ramps to US-101 at Marin St. are impacted at 108" TWL.

1-80 • The San Francisco – Oakland Bay Bridge (I-80) connects the East Bay with the City of San Francisco. It is critical for commuter movement and the junction with US-101 is considered on the of the most congested road segments in the Bay Area averaging 218,500 vehicles per day.⁵ I-80 is also a critical goods movement corridor with connects to the Port of Oakland and Port of Richmond and averages 5,913 trucks per day.⁶ In this OLU, I-80 is primarily an elevated roadway, but on ramps at 5th and Bryant are first exposed at 66" TWL.

I-280 • An alternative to US-101, I-280 runs north-south and provides critical commuter and goods movement connecting the City and County of San Francisco with rest of the peninsula. In 2016, it averaged 84,500 vehicles⁷ and 1,026 trucks per day.⁸ The Northbound exit ramp into the City of San Francisco is first exposed to flooding at 52" TWL.

The Embarcadero Roadway and Promenade • The Embarcadero serves as a critical roadway and pedestrian promenade providing access to tourist destinations (\$11 billion annually⁹), lifeline emergency access, Port of San Francisco properties, MTA transit facilities, critical bicycle and pedestrian transportation infrastructure, and regional transit and ferry connections. The Embarcadero is a critical backbone for San Francisco's transportation network and connects the City with the region. With the Golden Gate Bridge to the north, the I-80 San Francisco-Oakland Bay Bridge in the Central Waterfront and local and regional transportation assets located near the intersection of The Embarcadero and Market Street, this roadway is of high importance to San Francisco and the region. The Embarcadero is constructed atop the aging Embarcadero Seawall, which provides flood protection for downtown and the financial district. Westbound lanes of the Embarcadero near the ferry building are first exposed at 36" TWL. Eastbound lanes near the ferry terminal are first exposed at 48" TWL.

San Francisco Ferry Terminal • The San Francisco Ferry Terminal consists of piers and gangways for WETA ferry routes serving Alameda/Oakland, Bay Farm Island, Vallejo, Richmond, and South San Francisco and Golden Gate Ferry, serving Sausalito, Larkspur, and Tiburon. In 2017, WETA carried over 288,000 passengers for the month of July which is an increase of 78% since 2012.¹⁰ Roughly 64-70% of ferry riders access the ferry by walking or biking.¹¹ The Ferry Terminal is first exposed to flooding at 36" TWL.

Giants Ferry Terminal • The Giants Ferry Terminal provides special ferry service for Giants games to Oakland/Alameda and Vallejo/Mare Island. It is first exposed to flooding at 77" TWL.

Port of San Francisco • The Port of San Francisco (Port) has jurisdiction from Fisherman's Wharf in the north to Heron's Head Park in the south. The Port is both a trustee, administering the Public Trust for the State of California and an enterprise agency within the City that raises money and runs a capital budget. The Port is not a transportation provider but does provide a critical maritime function throughout its properties.¹² The Port's properties generate approximately \$2 billion in annual spending, property leases provide approximately \$50 million in rent and provide \$500 million in employee wages.¹³ In 2017, Port terminals at Pier 80 were responsible for over a million metric tons of cargo and approximately 25K autos.¹⁴ The Port also serves important emergency response function with Port properties being critical for moving people out of San Francisco and emergency supplies and personal into the City after an emergency event. The Port also provides shoreline protection for City, regional and private assets, including that provided by the Embarcadero Seawall. It is important to note that the most urgent current risk to much of San Francisco's shoreline is from a significant earthquake. Much of San Francisco's shoreline and downtown is built on fill that was placed in the Bay over 100 years ago. This over 500 acres of fill increases the risk from liquefaction and lateral spreading of at the shoreline. Addressing flooding will most likely have to be done in combination with addressing these seismic risks. Flooding of Pier 96 begins at 24" TWL, and extensive flooding of Pier 80 begins at 52" TWL.

Muni T Third Street Line • This is an important Muni rail line serving vulnerable communities and connects downtown San Francisco to southern neighborhoods. This light rail line will be connected to downtown stations through Muni's recent investment in the Central Subway. Flooding of the T Third rail begins at 48" TWL in Mission Bay. The Mission Rock train platform is also the first exposed Muni platform at 48" TWL.

Muni Historic E and F Lines • These lines provide Muni light rail service along the Embarcadero from the 4th and King to Jones and Beach (Embarcadero Line) and down Market St (F Line) using historic rail cars. Despite their historic status, the lines are run at frequent intervals and are integral in Muni's intermodal transport network. Both lines are first exposed at 48" TWL.

Muni Portal • This Portal serves as the subway train entrance for the S, T, and N Muni lines along the Embarcadero. This connects these trains to below-ground stations for Muni and BART. Additionally, all trains originating from the Muni Metro East maintenance facility pass though the Portal. Flooding occurs beginning at 48" TWL.

MTA Facilities • The Burke Warehouse, Islais Creek Division, and Muni Metro East Train Maintenance Facility are MTA facilities that provide maintenance, storage, and operations for Muni light rail and buses. Burke Warehouse and Islais Creek Division are exposed at 52" TWL. The Metro East Train Maintenance Facility is exposed at 108" TWL.

BART /Muni Embarcadero Station • This station serves as a regional transit hub connecting BART, Muni, Transbay Terminal, and Ferry. The Embarcadero (and Montgomery) Station has the highest number boardings/alightings of any station within the system (180,000 daily).¹⁵ Initial flooding of this station begins at 52" TWL with extensive flooding at 66" TWL.

4th and King Caltrain Station • This station serves as the northern terminus of the peninsula's only passenger rail service connecting San Francisco with Silicon Valley. 4th and King is the busiest Caltrain station within the entire system.¹⁶ The High-Speed Rail is also anticipated to extend through this station. Extensive flooding of the station and railyard begin at 52" TWL.

Union Pacific Railroad (UPRR) • The Union Pacific Railroad is an important heavy freight rail supporting the reliable movement of goods to markets across the Bay Area. The rail connects many Bay Area ports and connects to areas outside the region. At Port of San Francisco Piers 96 and 80, it interchanges with the San Francisco Bay Railroad. Within this OLU, UPRR tracks near Pier 96 are first exposed to flooding at 52" TWL.

San Francisco Bay Railroad (SFBR) • San Francisco Bay Railroad is a Class 3 short line railroad that operates over five miles of track in the City and Port of San Francisco. SFBR interchanges exclusively with Union Pacific Railroad and has the capacity to store 300 cars, and the means to load or unload over 60 rail cars per day. SFBR cargo includes aggregates, ash, biodiesel, tallow, cement, steel, containerized cargo and waste.¹⁷ San Francisco Bay Railroad services Pier 80 and Pier 96 and is first exposed to flooding at Pier 80 at 24" TWL.



VULNERABLE COMMUNITIES



Bayview-Hunters Point • For the purposes of this report, 9 block groups were assigned to a functional community called "Bayview-Hunters Point." The block groups that were assessed can be referenced in the appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the Bayview Hunters Point area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the planning process.

Bayview South/Hunters Point • Bayview/Hunters Point is ethnically diverse with large Black, Asian, and Latino populations,¹⁸ and a strong African American cultural legacy. The neighborhood has been subjected to significant historical and environmental injustices, and has high socially vulnerability, with high poverty, crime, unemployment, and hospitalization rates relative to San Francisco.¹⁹ Most of the area is included within MTC's Communities of Concern.²⁰ The neighborhood has a strong cultural and economic life, including high rates of women- and minority-owned businesses,²¹ a burgeoning local food and beverage industry, and a multitude of worship centers and community benefit organizations.

SOCIAL VULNERABILITY RANK:

GENTRIFICATION AND DISPLACEMENT RISK:



*In block groups considered, this ranking occurred most frequently.

Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).



Hunters Point has serious environmental challenges, with the former Naval shipyard's surrounding census tracts identified by CalEnviroscreen as being in the top 10 percent in California for pollution burden from cleanups, groundwater threat, hazardous waste, solid waste, and impaired water.²² The Hunters Point Naval Shipyard has been identified as a federal superfund site.

Bayview North/Islais Creek • Bayview Islais Creek is ethnically diverse with large Black, Asian, and Latino populations,²³ and has a strong African American cultural legacy. The neighborhood has been subjected to significant historical and environmental injustices, and has high socially vulnerability, with high poverty, crime, unemployment, and hospitalization rates relative to San Francisco.²⁴ Most of the area is included within MTC's Communities of Concern.²⁵ The neighborhood has a strong economic and cultural life, with high rates of women- and minority-owned businesses, numerous community benefit organizations, worship centers, and arts and culture organizations, such as the Bayview Opera House.

The Islais Creek watershed has environmental challenges due to the long-standing presence of industrial uses and freight transportation. The neighborhood contains areas identified by CalEnviroscreen as being in the top 10 percent in California for pollution burden from hazardous waste, solid waste, and impaired water.²⁶

Greenaction and the Bayview-Hunters Point community are fighting several planned mixed-use development projects which they contend will have significant unavoidable air quality impacts during construction and ongoing operations. Residents also fear that the development will gentrify and potentially displace their community. University of California at Berkeley's Displacement Project classifies this community as having *Ongoing Gentrification and/or Displacement*, as well as areas identified as *At Risk of Gentrification and/or Displacement*, including the census tract where the India Basin mixed-use development is slated.²⁷

Nine block groups are considered high or highest social vulnerability. Twelve social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with no characteristics in the 70th percentile in the region (Figure 2m).

Residential areas are first exposed at 52" TWL, though contaminated sites are exposed at earlier water levels.

In this section, social vulnerability was used as the starting place for analysis. Contamination burden was assessed only for the block groups included in the functional community groupings. This means that there could be block groups that score in the moderate, high, or highest for contamination burden that were not ALSO in the designated functional community grouping and were not considered. In short, we only look at areas that have contamination burden if they are also ranked as socially vulnerable. Five contamination burdens are exhibited in at least one block group at in the 90th percentile in the region (Figure 3m).

BCDC staff were able to attend a toxic tour of this community conducted by community members and staff from Greenaction for Health and Environmental Justice in October 2018 where they were able to see first-hand the environmental injustices that Bayview-Hunters Point faces. The Bayview-Hunters Point community also has a long history of community activism and environmental justice. After a long fight, the PG&E Hunters Point Power Plant was closed in 2006 and demolished in 2008 after decades of causing adverse health impacts from pollution to Bayview-Hunters Point residents. This community sits adjacent to the intersection of two major freeways, US-101 and I-280, resulting in significant emissions.

This community is also home to the Southeast Sewage Treatment Plant, treating nearly 80% of San Francisco and all of Brisbane's sewage. Neighbors often suffer

from eye and throat irritation and are forced to deal with strong odors from the plant. Bay Area Concrete Recycling creates significant pollution from operations and from major diesel truck traffic to and from the plant. Additionally, illegal dumping is prevalent in this area.

After the Navy closed the Hunters Point Shipyard, the site received a Superfund designation from the U.S. EPA in 1989.

CONTAMINATION BURDEN PERCENTILES IN BAYVIEW-HUNTERS POINT



CONTAMINATION BURDEN RANK:

Χ	Low
Χ	Moderate
Χ	High
Χ	Highest *

*In block groups considered, this ranking occurred most frequently.



 Hazardous cleanup activities Groundwater Threats Hazardous Waste Facilities Impaired Water Bodies Solid Waste Facilities

•• N/A

Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018). This site includes radioactive contamination and other hazardous wastes, which were introduced as a result of cleaning ships that carried nuclear weapons used in World War II. Hunters Point Shipyard was slated for cleanup by Tetra Tech; however, the federal government has since sued Tetra Tech over alleged fraud in falsifying the remediation results. In addition to the Shipyard, Greenaction and the Bayview-Hunters Point community are fighting several planned mixed-use development projects which they contend will have significant unavoidable air quality impacts during construction and ongoing operations.

*Note: This community spans the border between the Yosemite-Visitation OLU and Mission-Islais OLU. The community descriptions are the same in both Local Assessments, even though block groups cross OLU boundaries. The Focus Area in this Local Assessment will discuss impacts where flooding occurs from overtopping in this OLU. Please see the Yosemite-Visitation OLU for details on flooding and overtopping that occur from the Yosemite-Visitation OLU.

Mission Creek, Chinatown & Embarcadero • For the purposes of this report, 13 block groups were assigned to a functional community called "Mission Creek, Chinatown & Embarcadero." The block groups that were assessed can be referenced in the Appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the Mission Creek, Chinatown, & Embarcadero area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the planning process.

Thirteen block groups are considered moderate, high, or highest social vulnerability. For this community, eight social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with three characteristics in the 70th percentile in the region (Figure 4m).

In this section, social vulnerability was used as the starting place for analysis. Contamination burden was assessed only for the block groups included in the functional community groupings. This means that there could be block groups that score in the moderate, high, or highest for contamination burden that were not ALSO in the designated functional community grouping that were not considered. In short, we only look at areas that have contamination burden if they are also ranked as socially vulnerable.







*In block groups considered, this ranking occurred most frequently.

Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).



Three contamination burdens are exhibited in at least one block group at in the 90th percentile in the region and one is in the 70th percentile (Figure 5m).

Critical services and facilities that provide education, community cohesion, and emergency services, and sanitation will also be impacted by flooding. Table 1m provides details on critical services potentially at risk of flooding within all vulnerable communities assessed. First impacts of exposure of assessed critical facilities begins at 52" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.



EXPOSURE OF CRITICAL SERVICES AND FACILITIES IN ALL VULNERABLE COMMUNITIES ASSESSED

	Critical Facilities/Services Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
	San Francisco Fire Department Station 25										
	San Francisco Fire Department Station 9										
Police and Fire Stations	Hunters Point Fire House										
	San Francisco Fire Department Station 13										
	San Francisco Fire Department Station 70										
	Bayview Child Health Center					0					
Health Clinics	Catholic Health Care West						$\mathbf{\Theta}$				
	American Shared Hospital Services							0			
	Graduate School USDA										
	Kipp Foundation										
Schools	Joshua Marie Cameron Academy										
00110013	Rise Institute										
	City College of San Francisco										
	Breakthough Collaborative										
	Hunters Point Substation								F		
Utilities	Southeast Wastewater Treatment Plant/CCSF									,	
	Bayshore Substation										4

Table 1m. Critical Services and Facilities: First exposure of critical services and facilities. "M" refers to minor impacts such as impacts to access roads. Blue bars represent when asset is first exposed to flooding.



PRIORITY DEVELOPMENT AREAS (PDAS)



Port of San Francisco PDA • The Port of San Francisco PDA is a designated Mixed-Use Corridor that includes approximately 650 acres of public waterfront lands, stretching 7.5 miles from Fisherman's Wharf to India Basin. This PDA is bordered by the Bayview/Hunters Point Shipyard/Candlestick Point, Mission Bay, Eastern Neighborhoods, and Downtown-Van Ness-Geary PDAs to the west. This PDA contains significant transportation assets that serve both the city as well as the region, including ferries, BART stations, Muni stations, and the Embarcadero, as well as active Port activities, such as cruise terminals, ship repair and drydock facilities, recreational boat marinas, and 145 acres of cargo terminals.

This PDA is a critical component of the city's planned growth in housing and jobs with housing projected to increase 1,800 housing units and supporting over 18,000 new jobs by 2040. The area will provide a mix of uses with an emphasis on open space and recreational opportunities that reflect its history, present, and future as a working waterfront.

The Port of San Francisco PDA experiences minimal flooding as early as 12" TWL (mostly open space), with thresholds for flooding occurring at 48" and 66" TWL. At 96" TWL nearly 100% of the Port of San Francisco PDA is flooded (Table 2m).

CURRENT AND FUTURE HOUSING AND JOBS IN THE PORT OF SAN FRANCISCO PDA



Data Source: Plan Bay Area 2040, MTC/ABAG (2017).

EXPOSURE OF CRITICAL FACILITIES IN THE PORT OF SAN FRANCISCO PDA

	Critical Facilities/Services Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Police and	San Francisco Fire Department Station 35										
Fire Stations	San Francisco Fire Department Station 25										
Utilition	Recology Recycling										
Utilities	Southeast Wastewater Treatment Plant										

Table 2m. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.

Critical services and facilities may be impacted by flooding. Table 2m provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 12" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

Mission Bay PDA • The Mission Bay PDA is a 290-acre Urban Neighborhood between the Port of San Francisco PDA and Eastern Neighborhoods PDA. It is focused around the Mission Creek Channel, bound by Townsend Street to the north, 7th Street to the west, and Mariposa Street to the south. It contains the new neighborhood of Mission Bay, including the Third Street Muni line and two Muni stations.

This PDA includes new, large-scale, mixed-use redevelopment on the city's central Bay waterfront. When complete, the Mission Bay PDA will include jobs, housing, schools, a supermarket, and police and fire stations. The jobs created in this area are easily accessible to residents along San Francisco's Third Street corridor and beyond. This PDA includes hundreds of new affordable housing units anticipating thousands of new residents and extensive job growth, largely supported by the UCSF Medical Center at Mission Bay and UCSF Benioff Children's Hospital.

At 36" TWL, some portions of the Mission Bay PDA are flooded, with larger areas impacted at 48" TWL. By 66" TWL, the majority of the PDA is flooded.

Critical services and facilities that provide education, community cohesion, and emergency services, and sanitation will also be impacted by flooding. Table 3m provides details on critical services potentially at risk of flooding within the communities of Mission Bay. First impacts of exposure of assessed critical facilities begins at 52" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

CURRENT AND FUTURE HOUSING AND JOBS IN THE MISSION BAY PDA

Reside Housi	ential ng Units	Job Space	es
Existing in 2010:	4,887	Existing in 2010:	2,842
Projections for 2040:	9,056	Projections for 2040:	30,328
Percent Growth:	85%	Percent Growth:	967%

Data Source: Plan Bay Area 2040, MTC/ABAG (2017).

EXPOSURE OF CRITICAL FACILITIES IN THE MISSION BAY PDA

	Critical Facilities/Services Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Health Clinics	UCSF Benioff Children's Hospital										0
Utilities	PG&E Electrical Transmission line						4				
	Leaking Underground Storage Tanks										
Contami- nation	Groundwater threats Water Board (2)										
	DTSC site										

 Table 3m. Critical Services and Facilities:
 First exposure of critical services and facilities. "M" refers to minor impacts or impacts to access roads. Blue bars represent when asset is first exposed to flooding.

Bayview / Hunters Point Shipyard / Candlestick Point PDA • The Bayview/Hunters Point Shipyard/Candlestick Point PDA (Bayview PDA) is a large, 2,800-acre Urban Neighborhood in the southeastern corner of San Francisco that covers Bayview-Hunters Point, Candlestick Point, and the Hunters Point Shipyard. It spans from approximately Cesar Chavez in the north to Bayview Park in the south, and 101 in the west to the bay shoreline to the east. It is bordered by the Eastern Neighborhoods PDA to the north, Port of San Francisco PDA to the northeast, and San Francisco/San Mateo Bi-County Area to the south.

The area currently includes housing, commercial and industrial uses served by several transit agencies (Muni, Caltrain, and SamTrans) that provide connections throughout the city and the region. When complete, the Bayview PDA will have new housing and public improvements including lighting, landscaping and rehabilitation of existing single-family homes. The existing commercial Third Street corridor will have additional commercial and other infill development. Industrial uses will continue around I-280 and within the South Basin area. The more comprehensive change will occur at Hunters Point Shipyard, with new housing, especially affordable housing, and job creation. Candlestick Point, with a diverse mix of industrial, residential and other uses, can also accommodate new green technology uses. The new housing will be complemented by new community facilities, a teen center, commercial space and parks.²⁸

Flooding at Candlestick Point and the Hunters Point Shipyard begins by 36" TWL, with significant flooding extending into the Bayview neighborhoods by 66" TWL.

Critical services and facilities may be impacted by flooding. Table 4m provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 52" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

Note: This PDA spans the border between this OLU and the Yosemite-Visitacion OLU. This PDA will be described in both OLU sections.

CURRENT AND FUTURE HOUSING AND JOBS IN THE BAYVIEW / HUNTERS POINT SHIPYARD / CANDLESTICK POINT PDA

Reside Housi	ential ng Units	Job Spac	es
Existing in 2010:	11,450	Existing in 2010:	29,292
Projections for 2040:	37,145	Projections for 2040:	56,477
Percent Growth:	224%	Percent Growth:	93%

Data Source: Plan Bay Area 2040, MTC/ABAG (2017).

EXPOSURE OF CRITICAL FACILITIES IN THE BAYVIEW / HUNTERS POINT SHIPYARD / CANDLESTICK POINT PDA

	Critical Facilities/Services Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
	San Francisco Fire Department Station 25										
Police and Fire Stations	San Francisco Fire Department Station 9										
	San Francisco Fire Department Station 70										
	Hunter Point Substation								4		
Utilities	Southeast Wastewater Treatment Plant/ CCSF									,	
	Bayshore Substation										F

 Table 4m. Critical Services and Facilities:
 First exposure of critical services and facilities.
 Blue bars represent when asset is first exposed to flooding.

PRIORITY CONSERVATION AREAS (PCAS)





San Francisco Bay Water Trail PCA

• The San Francisco Bay Area Water Trail is a network of launching and landings sites for non-motorized watercrafts (e.g. kayaks, stand-up paddleboards, wind and kite surf, etc.) around the San Francisco Bay and its major tributaries, including the San Joaquin River, Napa River, and Petaluma River.²⁹ In this OLU, there are four designated Water Trail Sites, including Pier 40, Pier 52, Mission Creek, and Islais Creek Landing. There are three proposed Water Trail sites including Pier 1.5, Crane Cove Park/Pier 70, and India Basin Shoreline Park. The majority of these sites are owned and managed by the Port of San Francisco. This OLU contains some of the most heavily used Water Trail sites within the network (for example, Mission Creek). Beach trailheads at India Basin are first exposed at 12" TWL.

PCA DESIGNATION:



FUNCTIONS/BENEFITS:

- Recreation
- Economic Development
- Wildlife Habitat

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

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San Francisco Bay Trail • The

San Francisco Bay Trail is a 500-mile regional trail that, upon completion, will circumnavigate the bay. The trail connects people and communities to each other, to parks and open space, to home, work and recreation, and to countless areas of cultural and historic interest. It provides opportunities for health and fitness, increase transportation options, opportunities to observe, learn about, and care for the environment, and provides economic benefits to the region through increased tourism.³⁰ Within this OLU, the existing Bay Trail goes north along Illinois Avenue, Terry Francois Boulevard, and the Embarcadero. There are segments of Bay Trail proposed for Hunters Point. In this OLU, the trail has 8.3 total miles of existing (6.1 miles, 13 segments) and proposed (2.2 miles, 5 segments) split into 18 segments. These segments include some of the most heavily utilized segments of the Bay Trail, including The Embarcadero. Bay Trial segments are first exposed at 12" TWL and all segments are exposed by 66" TWL.

PCA DESIGNATION:

Natural Landscapes
 Agricultural Lands
 Urban Greening
 Regional Recreation

FUNCTIONS/BENEFITS:

- Recreation
- Community Health
- Transportation
- Economic Development
- Environmental Stewardship

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

Focus Area A: Islais Creek/India Basin



Location

The Bayview Islais Creek neighborhood located on the southeastern edge of San Francisco includes the industrial zone surrounding Islais Creek and the northern section of the Bayview residential area. Additionally, there are ecologically rich tidal marshes and natural areas at Heron's Head Park and India Basin supporting fish and wildlife habitat (Figure 6m).



Figure 6m. Top: Identification of where Focus Area is within OLU. Bottom: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on following page.



Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including transportation assets such as the Port of San Francisco, Muni T Third Street, MTA Facilities, San Francisco Bay Railroad, UPRR, and US-101, Bayview/Hunters Point Shipyard/Candlestick Point and Port of San Francisco PDAs, San Francisco Bay Trail and San Francisco Water Trail PCAs, and the Bayview/Hunters Point community. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 6m. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Port of San
 Francisco
- Muni T Third Street
- MTA Facilities
- San Francisco Bay Railroad
- US-101
- Union Pacific Railroad



VULNERABLE COMMUNITIES

 Bayview / Hunters Point Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Bayview/ Hunters Point Shipyard/ Candlestick Point PDA
- Port of San Francisco PDA





PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Water Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

There is a mixed shoreline in this Focus Area. It includes natural shorelines, tidal creeks and channels, and embankments. This includes tidal wetlands at Heron's Head park and India Basin.³¹



How will the shoreline change in the future?

Several shoreline development projects are occurring in this OLU which may have an impact on local flood risk.

The major potential shoreline changes include:

- Pier 70 Redevelopment (Under Construction)
- India Basin Redevelopment/700 Innes (Approved)
- Islais Creek Bridge Rehabilitation (Planned)
- Potrero Power Plant Redevelopment (Planned)
- Multiple developments near Hunters Point to Heron's Head (Planned)
- Heron's Head Restoration (2011)
- Port of San Francisco Seawall Resilience Program (Planned)



Islais Creek in 2019. Photo by Port of San Francisco is licensed under CC BY 2.0



Islais Creek in 2019. Photo by Port of San Francisco is licensed under CC BY 2.0

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Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

At 12" TWL, overtopping occurs at Heron's Head Park and along the southern edge of Pier 96 (Figure 7m). At 48" TWL, overtopping occurs north of Pier 80 and north of Pier 96 along Amador Street. At 52" TWL, overtopping occurs near the Illinois Street bridge and along much of the western extent of the channel. At 66" TWL, the majority of the shoreline in the Focus Area is overtopped.

FLOODING EXPOSURE STORY

Where does flooding occur?

Starting at 12" TWL, flooding of tidal marsh and natural areas, recreational sites (e.g. Heron's Head park, Bay Trail, Water Trail), and a Solid Waste Disposal Site at Pier 96 (Figure 8m). At 24", Port and railroad facilities at Pier 96 are exposed. At 48" TWL, Port and railroad facilities at Pier 96 are exposed. At 52" TWL, MTA Facilities buildings and Muni T Third Street line Marin Street platform are exposed. Three major wastewater pump stations located in this area are vulnerable to flooding at 66" TWL. At 84" TWL, the Hunters Point Substation, owned and operated by PGE, is exposed. At 96" TWL, retired Potrero Generating Station is completely flooded, including three groundwater contamination sites. At 108" TWL, the only non-flooded areas of the Port include vacant property near Pier 94. At 108" TWL, onramps to US-101 at Marin Street are also impacted.



12" TWL

OVERTOPPING AND FLOODING

Figure 7m. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

48" TWL



FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
San Francisco Bay Trail PCA	Ť									
San Francisco Water Trail PCA	Ť									
Port of San Francisco PDA										
Port of San Francisco (Pier 96)										
San Francisco Bay Railroad										
Bayview/Hunters Point PDA										
Muni T Third Street										
UPRR										
Port of San Francisco (Pier 80)										
MTA Facilities (Burke Warehouse)					\frown					
Bayview/Hunters Point Community							m ii			
Muni East Train Maintenance Facility										
US-101										

Figure 8m. First exposure of regional systems. Individual assets with the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Ecosystem and Recreational Services

Native and restored natural areas, such as Heron's Head Park and Indian Basin Open Space, provide valuable habitat for endangered fish and wildlife, recreational opportunities, and serve as flood protection for inland development. There are currently limited natural areas along this historically industrialized shoreline, limiting areas available for marshes to migrate upland. Sea level rise will directly diminish these ecosystem services as tidal marsh and transitional habitats are converted to open water. Additionally, recreational sites including the San Francisco Bay Trail and Water Trail will be, or already are, exposed, further limiting recreational opportunities in the area, disproportionately impacting nearby vulnerable communities.



2. Local Transit

The Muni T Third Street light rail provides important transit service for socially vulnerable and transit dependent communities in southern San Francisco to jobs and services downtown. This transit service is directly impacted by sea level rise due to flooding of the rail or platforms, and indirectly impacted due to flooding of exposed local roads, maintenance facilities, power utilities, and bridges. The T Third Street line crosses multiple bridges already vulnerable to flooding and adaptation of these structures will be complicated by environmental review, historic status, and complex management.



3. Port of San Francisco

The Port of San Francisco's Piers 80 and 96 represent some of the last waterfront industrial areas in San Francisco. They play a critical role importing maritime bulk cargo, such as construction aggregate, used in numerous commercial and transportation infrastructure development projects throughout the region, and provide local jobs. These facilities are also designated for emergency response due to their proximity to the water and access to freight rail. Operations at Piers 96 and 80 are directly vulnerable to flooding, as well as vulnerable to impacts on



Pier 80 north of Islais Creek. Photo by Port of San Francisco is licensed under CC BY 2.0

Shared consequences to flooding

SHARED CONSEQUENCE STORIES

local ground transportation connections. Numerous jurisdictional authorities and lack of information about combined riverine-tidal flooding may serve to complicate the City's planning efforts to address sea level rise along Islais Creek.

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • Vulnerable communities of Bayview-Hunters Point will bear disproportionate impacts from flooding to public transit, recreational areas, and job centers. Vulnerable communities may also bear the disproportionate impacts of displacement from the development boom occurring in this Focus Area. However, existing community advocacy groups are a starting place for ongoing and meaningful coordination and engagement.

Multiple jurisdictions (e.g. Port of San Francisco, San Francisco MTA, San Francisco Public Works) and community initiatives (e.g. Resilient Bayview, Environmental Justice Task Force) in the area mean coordination and communication between parties is critical (i.e. Third Street Bridge repair project).



Heron's Head Park in Mission Bay. Photo by Port of San Francisco is licensed under CC BY 2.0



Economy • Impacts to Muni rail corridor and maintenance and operations facilities in this area will disrupt citywide transit and ability for workers to get to maritime industrial jobs within the Port of San Francisco and well as job centers downtown.

Disruption of the UPRR rail connections with the Port of San Francisco Intermodal Container Transfer facility will negatively impact the regional economy. Loss of the Port's aggregate storage facilities at Pier 86/90 will negatively impact the city's ability to access construction materials for the development boom happening in this OLU.

Exposure of the Hunter Point substation will impact power for the adjacent communities, transportation facilities, and businesses.

Environment • Exposure of contaminated sites has the likelihood of mobilizing toxic contamination into the Bay and neighboring communities. Despite changing demographics in the Focus Area, the contamination burden is not changing, potentially exposing more people contamination.

Disruption of critical Muni rail connection between Bayview/Hunters Point and Downtown San Francisco may increase vehicles on congested city streets and decrease air quality.

Flooding of important tidal marsh habitat will decrease their habitat value for threatened and endangered species.



Advancing adaptation solutions

FITTING INTO
REGIONAL
STORYHow are local areas contributing to Regional
Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called "Regional Hot Spots." These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.



Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each regional system can be found in Chapter 2.1 Regional Hot Spots.

The Bayview Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

It becomes a Regional Hot Spot starting at 36" TWL, and continues to higher total water levels (Figure 9m).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.

Figure 9m. Bayview Hot Spot: From 36" TWL to 66" TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.



Islais Creek in 2019. Photo by Port of San Francisco is licensed under CC BY 2.0



Heron's Head Park in Mission Bay. Photo by Port of San Francisco is licensed under CC BY 2.0

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Focus Area B: *Mission Creek*



Location

The Mission Creek neighborhood located on the eastern edge of San Francisco is comprised of developing mixeduse neighborhoods surrounding Mission Creek. The neighborhood includes extensive housing and commercial buildings as well as iconic regional destinations like the UCSF research campus, Oracle Park (formerly AT&T Park), and the future Warriors arena at Chase Center. The development associated with Central SOMA, Mission Rock and Chase Center will drastically change the intensity of use within the area and grading and infrastructure improvements may change the flood risk (Figure 10m).



Figure 10m. Top: Identification of where Focus Area is within OLU. Bottom: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on following page.



Map data ©2019 by Google.

Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including transportation assets such as the Muni T Third Street, I-280, 4th and King Caltrain Station, Giants Ferry Terminal, Mission Bay and Port of San Francisco PDAs, San Francisco Bay Trail and San Francisco Water Trail PCAs. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 10m. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Muni T Third Street
- I-280
- 4th and King Caltrain Station
- Giants Ferry Terminal



VULNERABLE COMMUNITIES

 Mission Creek, Embarcadero, & Chinatown Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Mission Bay
 PDA
- Port of San Francisco PDA



PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Water Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

The shoreline in the Focus Area is primarily embankments along the Mission Creek channel, historic piers, and the Embarcadero seawall.³²

SHORELINE DEVELOPMENT STORY How will the shoreline change in the future?

Several shoreline development projects are occurring in this OLU which may have an impact on local flood risk.

The major potential shoreline changes include:

- Chase Center (2019)
- Mission Rock Development (Approved)
- Mission Bay Ferry Terminal (Approved)
- Mission Creek, Multiple Developments (Planned)
- Port of San Francisco Seawall Resilience Program (Planned)



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Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

Key overtopping for a large portion of the Focus Area (including 4th and King Caltrain station) occurs at the north side of the Mission Bay channel underneath King Street, starting at 12" TWL (Figure 11m). Additional overtopping occurs along Mission Creek Park behind houseboats at 36" TWL and between Pier 50 and Pier 54 at 36-48" TWL.

FLOODING EXPOSURE STORY

Where does flooding occur?

The threshold for flooding in this Focus Area is between 48-52" TWL. This includes flooding to Muni T Third Street rail, 4th and King Caltrain Station, I-280, and the Mission Bay and Port of San Francisco PDAs. The area is also susceptible from flooding from a 100-yr precipitation event (Figure 12m).





12" TWL

OVERTOPPING AND FLOODING

Figure 11m. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

No overtopping
 Overtopping
 Shallower depth of flooding
 Deeper depth of flooding

12" 24" 36" 48" 52" 66" 84" 96" **Regional Systems Impacted** 77" 108" 3 San Francisco Water Trail PCA Ť San Francisco Bay Trail PCA **Mission Bay PDA** 4th and King Caltrain Station I - 280Port of San Francisco (Pier 80) Muni T Third St **Bay Bridge Pump Station**

Figure 12m. First exposure of regional systems. Individual assets with the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

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Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES



Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Future Development

Significant development planned within the Mission Bay PDA will result in dramatic changes to shoreline protection and intensity of residential and employment uses in this area. While proposed projects do include sea level rise adaptation, wastewater utilities that these developments rely on are vulnerable to flooding. A lack of publicly available information about the redundancy of these utilities, how they will function during flood events, and complex coordination between the Port of San Francisco, SFPUC, MTA, and the City and County of San Francisco will complicate adaptation.



2. Transportation

This Focus Area is low-lying and already experiences flooding from precipitation events. Disruption of ground transportation along Mission Creek (I-280, Muni T Third Street line, 4th and King Caltrain station, San Francisco Bay Trail) will have local, citywide, and regional impacts on people's ability to access San Francisco, including transitdependent vulnerable communities in southern San Francisco. Sea level rise will only increase the vulnerability of these facilities.



3. Regional Recreation

The Chase Center and Oracle Park provide significant recreation, tourism, economic, and employment opportunities within the region, and attract visitors nationally. Access to these facilities via local streets, transit, the San Francisco Bay Trail, and Water Trail is vulnerable to flooding, significantly limiting usage of the facilities and creating widespread impacts.

Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • Disruption of transit corridors in this Focus Area may disproportionately impact vulnerable communities in the southeast portion of the city who work in the city center. This Focus Area includes San Francisco's largest concentration of affordable housing stock and flooding here may disproportionality impact these residents. Without adequate coordination between the Port of San Francisco, MTA, City and County of San Francisco, and developers there are concerns about flood protection measures increasing resilience and leaving room for adaptation.



Economy • Disruption of transportation (I-280, Caltrain, Muni) will limit the ability of tourists, commuters, and workers to access major sports arenas in the area and decrease city and county revenues. Third and Fourth Street Bridge impacts will have cascading consequences on Muni, San Francisco Bay Trail, and vehicular traffic throughout the city and region. If I-280 is impacted, then traffic will have to divert to US-101 causing increased congestion.



Environment • Disruption of transit (Caltrain, Muni) and PCA (San Francisco Bay Trail) assets in the Focus Area will increase traffic on already congested highways on the peninsula, impacting air quality.

Advancing adaptation solutions

FITTING INTO How are local areas contributing to Regional **REGIONAL** Hot Spots? **STORY**

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called "Regional Hot Spots." These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Regional Hot Spot at 48" TWL Regional Hot Spot PDA Transportation Infrastructure PCA Vulnerable Community

Figure 13m. San Francisco Mission Creek Hot Spot: From 48" TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each regional system can be found in Chapter 2.1 Regional Hot Spots.

The San Francisco Mission Creek Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The San Francisco Mission Creek cluster is driven by the Mission Bay PDA (2010 residential units and job spaces), the Muni T Third Street Line, and socially and contaminant vulnerable block groups.

It becomes a Regional Hot Spot starting at 48" TWL, and continues to higher total water levels (Figure 13m).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.



Third Street Bridge on Mission Creek. Photo by Port of San Francisco is licensed under CC BY 2.0



Mission Creek. Photo by Port of San Francisco is licensed under CC BY 2.0

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Focus Area C: Embarcadero



Location

The Financial District, located on the eastern edge of San Francisco, is comprised of mixed-use, high-density neighborhoods near The Embarcadero and the foot of Market Street. The Financial District includes extensive housing and commercial buildings, as well as iconic regional destinations like the Ferry Building and the Central Embarcadero Piers Historic District. The Financial District also includes significant city and regional transportation infrastructure including BART, Muni buses and underground metro stations, historic streetcars, cable cars, and the Ferry Terminal (Figure 14m).



Figure 14m. Top: Identification of where Focus Area is within OLU. Bottom: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on following page.

Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including transportation assets such as the Muni/BART Embarcadero Station, Muni Portal, Muni Historic E & F Lines, Embarcadero Roadway and Promenade, San Francisco Ferry Building Terminal, Port of San Francisco, Port of San Francisco PDA, San Francisco Bay Trail and San Francisco Water Trail PCAs. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 14m. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Muni/BART Embarcadero Station
- Muni Portal
- Muni Historic E & F Lines
- Embarcadero Roadway and Promenade
- San Francisco Ferry Building Terminal
- Port of San Francisco



VULNERABLE COMMUNITIES

 Mission Creek, Embarcadero & Chinatown Community



PRIORITY DEVELOPMENT AREAS (PDAs)

 Port of San Francisco PDA



PRIORITY CONSERVATION AREAS (PCAs)

 San Francisco Bay Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

Shoreline in the Focus Area is primarily the Embarcadero seawall.

SHORELINE DEVELOPMENT STORY

How will the shoreline change in the future?

Ongoing planning efforts by the Port of San Francisco include major seismic and flood improvements to the seawall.³³ Several shoreline development projects are occurring in this OLU which may have an ral flood risk

impact on local flood risk.

The major potential shoreline changes include:

- WETA Ferry Terminal Expansion (Under Construction)
- Port of San Francisco Historic Pier Redevelopment (Planned)
- Port of San Francisco Seawall Resilience Program (Planned)





Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

Overtopping begins between the Ferry Terminal and Pier 14 at 24" TWL. At 48" TWL, additional overtopping is between Piers 1 and 3. At 52" TWL, much of the Embarcadero is overtopped (Figure 15m).

FLOODING EXPOSURE STORY

Where does flooding occur?

Initial flooding occurs along Embarcadero south of the Ferry Building with west bound impacts at 36" TWL (Figure 16m). At 48" TWL, this flooding increases to both lanes of the Embarcadero and

includes flooding at the Muni Portal. At 52" TWL additional segments of Muni and the Ferry Terminal are impacted, and flood waters stretch down Market Street (to Main Street) and impact Embarcadero BART and Muni station entrances. At 66" TWL, most of the financial district is flooded. Market Street from Main Street to Stuart Street is also exposed to flooding during a 100-year precipitation event.





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OVERTOPPING AND FLOODING

Figure 15m. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

52" TWL



FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
San Francisco Bay Trail PCA			Ť							
Embarcadero										
Port of San Francisco PDA										
Muni Portal			•							
San Francisco Ferry Terminal			•							
Muni/BART Embarcadero Station			•							
Muni Historic Streetcars										

Figure 16m. First exposure of regional systems. Individual assets with the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts. M - 53 • ADAPTING TO RISING TIDES: BAY AREA

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.



1. Local and Regional Transportation

This Focus Area contains significant local and regional transportation hubs, including BART/Muni Embarcadero Station, the San Francisco Ferry Terminal, The Embarcadero (Muni rail and vehicular traffic), and the San Francisco Bay Trail, which are vulnerable to sea level rise and already experience disruptions from extreme tides, precipitation events, and groundwater intrusion impacting the ability of commuters and tourists to access San Francisco and the region. While the San Francisco Seawall Program will reduce flood risk from sea level rise, it is unclear if it will address precipitation or groundwater flooding issues.

2. Emergency Response

The Embarcadero and San Francisco Ferry Terminal serve an important regional emergency response role for moving people and goods into and out of the city. This function is indirectly vulnerable to flooding of local roads, limiting access to these facilities.

Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • WETA and the Port of San Francisco serve an important emergency evacuation function. Flooding along the Embarcadero could limit access to these facilities and disrupt emergency response. The San Francisco Seawall Program is critical to protecting key regional transportation hub from sea level rise and storm flooding but may not address existing groundwater issues.



Economy • The disruption of key regional transportation hubs in the focus are will greatly impact access to job centers and tourist destinations with regional consequences. The Embarcadero BART station is the busiest station in the BART system and networked with other transportation systems (e.g. Muni, Ferry, OAK/SFO, Caltrain). If flooded, would have widespread impacts for commuters traveling throughout the region. Flooding in the Muni Portal would have widespread consequences for transit throughout the city.



Environment • The disruption of this critical transportation hub will increase greenhouse gas emissions associated with more cars on already congested highways.

Advancing adaptation solutions

FITTING INTO REGIONAL STORY How are local areas contributing to Regional Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called "Regional Hot Spots." These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Regional Hot Spot at 48" TWL



Figure 17m. San Francisco Embarcadero Hot Spot: From 48" TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each regional system can be found in Chapter 2.1 Regional Hot Spots.

The San Francisco Embarcadero Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The San Francisco Embarcadero cluster is driven by the Port of San Francisco PDA (2010 and 2040 job spaces), the San Francisco Ferry Terminal, a Muni bus route, and a Muni rail line, along with multiple socially vulnerable and contaminated block groups.

It becomes a Regional Hot Spot starting at 48" TWL, and continues to higher total water levels (Figure 17m).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.



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