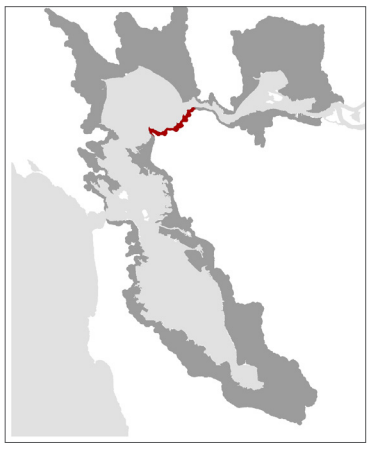
A view of Hercules, Pinole, Pinole Creek, and the City of Pinole WWTP. Photo: SF Baykeeper, Cole Burchiel, and LightHawk.

# Local Assessments Section E: PINOLE *Operational Landscape Unit*

## JURISDICTIONS WITHIN THIS SECTION

***Contra Costa County***

***Hercules***
***Pinole***
***Richmond***
***Crockett***
***Montalvin Manor***
***Tara Hills***



# HOW TO USE THE LOCAL ASSESSMENTS

## WHO IS THIS FOR?

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

**Local jurisdictions**
- 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 assessment can be reviewed in whole, or individual parts can be reviewed separately depending on interest and level of detail desired.

## WHAT'S IN THIS ASSESSMENT?

# *Where are we in the region?*

The Pinole OLU lies along the San Pablo Bay shoreline in western Contra Costa County, stretching from Point Pinole Regional Park to the northern edge of Contra Costa near Carquinez Straight. This OLU contains two main cities, Hercules and Rodeo, and numerous unincorporated communities. It is home to the Phillips 66 Refinery, one of the largest private employers in Contra Costa County. Uses within the OLU today include industrial uses at the refinery, some light industrial along the waterfront, residential households, a mobile home park and commercial. The shoreline consists of wetlands and beaches at Point Pinole to berms and levees along the many creeks in this OLU, with a heavy rail line running along the length of shoreline, often serving as the shoreline's first line of defense. The northern shoreline boundary of the OLU is Selby Slag, a contaminated shoreline site planned for remediation[1].

Approximate area of the Pinole OLU. Map data © 2019 by Google.

MARE ISLAND

Mare Island Strait

San Pablo Bay

Carquinez Strait

**FOCUS AREA A:**
*Rodeo, Rail, and San Pablo Ave.*

**Impact Area B:**
*Hercules, Refugio, & Pinole Creek Watershed*

UPRR

SF Bay Trail

WCCTAC San Pablo Avenue Corridor PDA

AMTRAK/CC

I-80

Hercules Waterfront District PDA

SR-4

Pinole Creek Watershed PCA

UPRR

SF Bay Trail

BNSF

Refugio Creek

San Pablo Creek

N

0

1 Miles

# What regional systems are here?

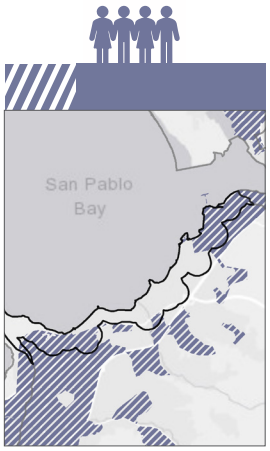
Operational Landscape Unit (OLU) boundaries were used to organize and help identify regionally significant assets that were co-located together (Methodology can be found in Section 3.0 Local Assessments).

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 1e).

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

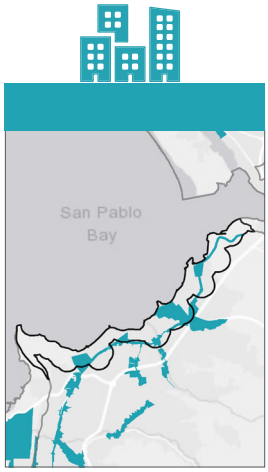

### TRANSPORTATION

- Union Pacific Railroad (UPRR)
- Local Roads




### VULNERABLE COMMUNITIES

- Rodeo Community




### PRIORITY DEVELOPMENT AREAS (PDAs)

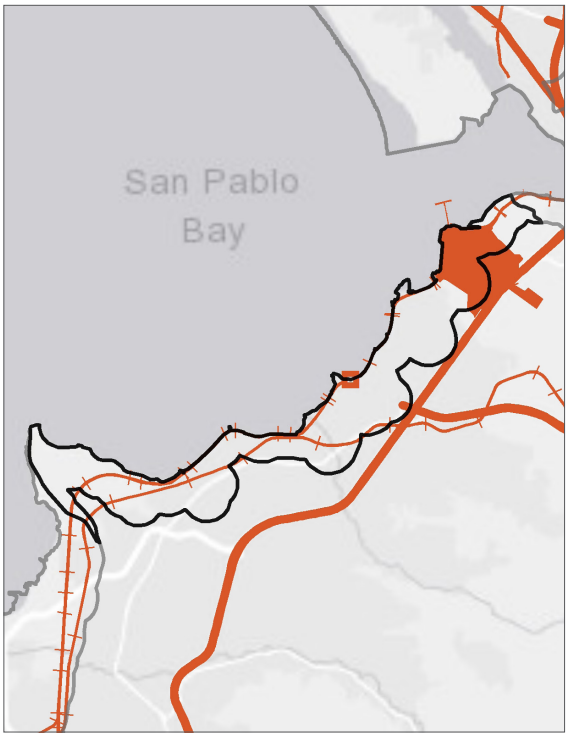
- South Richmond Western Contra Costa Transportation Authority Committee San Pablo Corridor (Contra Costa) PDA
- Waterfront District (Hercules) PDA


### PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Water Trail PCA
- Pinole Creek Watershed PCA

# What was assessed?

## TRANSPORTATION

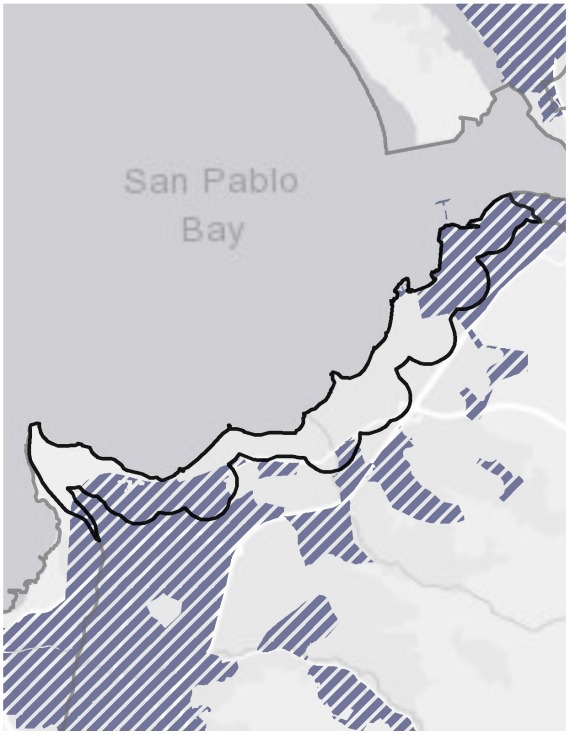



UPRR on the Hercules shoreline. Map data © 2019 by Google.

**Union Pacific Railroad** • The Union Pacific Railroad (UPRR) is an important heavy freight rail supporting the reliable movement of goods to markets across the Bay Area. The Union Pacific Martinez Subdivision between the Port of Oakland and Martinez is the busiest rail segment in Northern California, carrying both goods and commuters. Freight volumes on the Union Pacific Martinez Subdivision are the highest in the region, and overall freight rail demand is anticipated to grow throughout the Subdivision, making it the largest bottleneck on the freight rail system in the Bay Area.[2] The rail connects many Bay Area ports and connects to areas outside the region. UPRR owns the right-of-way for the rail line from the county boundary in Richmond, around the coast, and past I-680. On this rail line Burlington Northern Santa Fe (BNSF) and Richmond Pacific Railroad Corporation (RPRC) have trackage rights, while Amtrak, Capitol Corridor, and San Joaquin have passenger rights.[3] In this OLU, it runs the entire length of the shoreline. It becomes exposed to flooding at 48" TWL near the mouth of Pinole Creek, with significant flooding impacts at 77" TWL at the mouth of Rodeo Creek and Garrity Creek. The rail serves as ad-hoc flood protection for numerous communities and businesses behind it.

**Local Roads** • San Pablo Avenue (exposed at 52" TWL) (Parker Avenue in Rodeo, exposed at 66" TWL) serves as the main arterial through this OLU and is exposed to flooding.

UPRR on the Hercules shoreline. Photo: SF Baykeeper, Cole Burchiel, and LightHawk.




Rodeo is adjacent to Phillips 66 refinery. Map data © 2019 by Google.

**Rodeo** • For the purposes of this report, 3 block groups were assigned to a functional community called "Rodeo." 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 Rodeo 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.

There are many neighborhoods and distinct communities that exist across unincorporated Contra Costa County. In this assessment, we include the details for block groups in this OLU that exhibit social vulnerability characteristics and are exposed to flooding impacts as the "Rodeo community," which is made up of smaller communities, such as Bayo Vista. This includes two block groups that make the unincorporated Contra Costa County community of Rodeo. This also includes the Rodeo Mobile Home and RV Park located on five separate parcels in Rodeo on Parker and Vaqueros Roads at 3rd Street.[4] The mobile homes are on either side of Rodeo Creek and are vulnerable to flooding. The Union Pacific Railroad runs along the shoreline bayside of the San Pablo Bay, serving as ad-hoc flood protection for these communities.

Rodeo is adjacent to Phillips 66 refinery. Photo by Photo by SF Baykeeper Cole Burchiel and LightHawk

***Residential households in the Rodeo community begin to be impacted by flooding beginning at 48" TWL, with a flooding threshold at 66" TWL.***

## SOCIAL VULNERABILITY RANK:

- ☐ Low
- ☐ Moderate
- ☒ **High ***
- ☒ **Highest**

## GENTRIFICATION AND DISPLACEMENT RISK:

- ☐ Moderate High Income - Not Losing Low Income Households
- ☒ **At Risk of Gentrification and/or Displacement ***
- ☒ **Ongoing Gentrification and/or Displacement**

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

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

## SOCIAL VULNERABILITY PERCENTILES IN RODEO

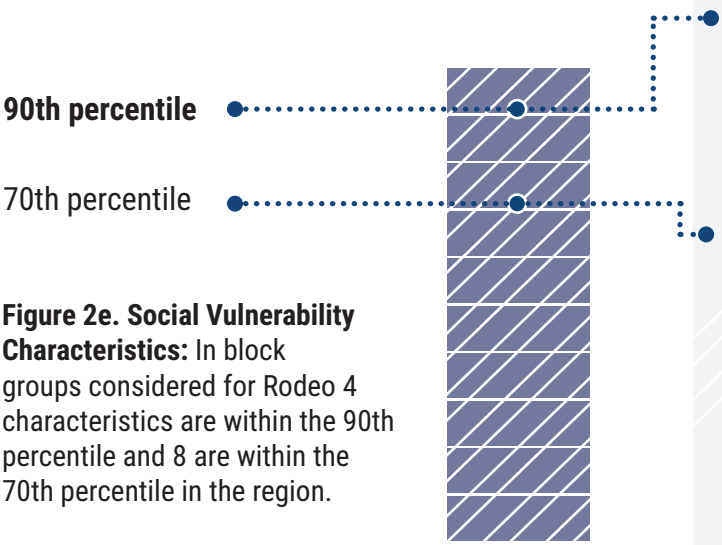



**Figure 2e. Social Vulnerability Characteristics:** In block groups considered for Rodeo 4 characteristics are within the 90th percentile and 8 are within the 70th percentile in the region.

**Low Income**
**Without a vehicle**
**People with disability**
**Under 5**

Single parent households
Renters
Not U.S. citizens
Communities of Color
Limited English proficiency
Without a high school degree
Severely housing cost burdened
65 and over living alone

Rodeo is adjacent to Phillips 66 refinery. Photo by Photo by SF Baykeeper, Cole Burchiel and LightHawk

Three block groups are considered high or highest social vulnerability. Four social vulnerability characteristics are exhibited in at least one block group in the 90th percentile in the region, with eight characteristics exhibited in the 70th percentile (Figure 2e).

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

## CONTAMINATION BURDEN RANK:

- [X] **Low**
- [X] **Moderate ***
- [ ] High
- [ ] Highest

*In block groups considered, this ranking occurred most frequently. *Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).*

## CONTAMINATION BURDEN PERCENTILES IN RODEO

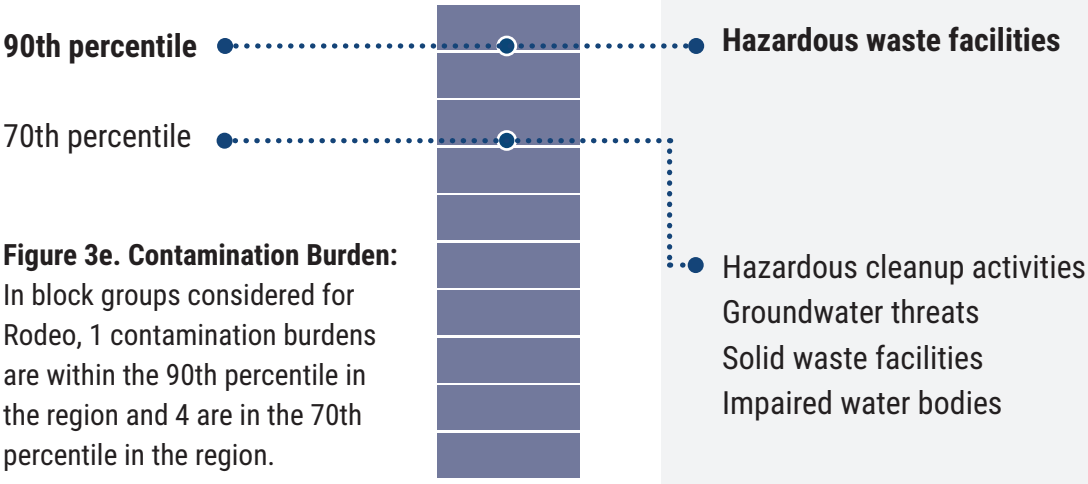



**Figure 3e. Contamination Burden:** In block groups considered for Rodeo, 1 contamination burdens are within the 90th percentile in the region and 4 are in the 70th percentile in the region.

## EXPOSURE OF CRITICAL SERVICES AND FACILITIES IN RODEO

| | Critical Facilities/Services Impacted | 12" | 24" | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Places of Faith | Zion Hill Baptist Church (Mariposa Ave, Rodeo) | | | | | | | | | | |
| | Bayo Vista First Baptist Church (First St, Rodeo) | | | | | | | | | | |
| | Greater El Bethel Baptist Church (Williams Dr, Richmond) | | | | | | | | | | |
| Police and Fire Stations | Conoco Phillips Fire Department (San Pablo Avenue, Rodeo) | | | | | M | | | | | |
| Schools | Bayo Vista Head Start School (California St, Rodeo) | | | | | | | | | | |
| Utilities | Wastewater: Rodeo Sewage Treatment Plant (San Pablo Ave, Rodeo) | | | | | | | | | | |
| | Wastewater: Pinole-Hercules WPCP | | | | | | | | | | |

**Table 1e. 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.

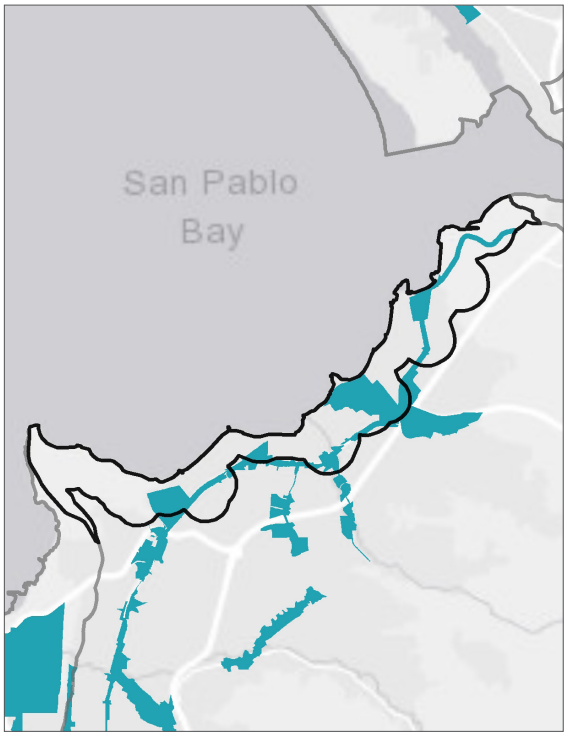
functional community grouping that were not considered.
In short, we only look at areas that have contamination burden if they are also ranked as socially vulnerable.

The Rodeo community is located next to the Phillips 66 Refinery, also called the Rodeo San Francisco Refinery. The refinery has had a history of air pollution violations that impact nearby communities[5]. Issues at the refinery have included an unplanned refinery shutdown in October 2010 that led to heavy smoke from flaring, and in June 2012 a sour water tank erupted, sending noxious gases, including hydrogen sulfide, into neighboring communities[6]. The community is also next to the Selby Slag hazardous remediation site, which is on the shoreline between the UPRR and San Pablo Bay, just east of the Phillips Refinery[7].

There is one contamination burden exhibited in at least one block group at the 90th percentile and four at the 70th percentile (Figure 3e).

Critical services and facilities that provide sanitation, community cohesion, medical care, and emergency services will also be impacted by flooding. First exposure of assessed critical facilities begins at 66" TWL (Table 1e).

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.




San Pablo Avenue, Rodeo. Map data © 2019 by Google.

**Western Contra Costa Transportation Advisory Committee (WCC TAC) San Pablo Avenue Corridor PDA** • The WCC TAC San Pablo Avenue Corridor PDA is located along San Pablo Avenue in the City of Rodeo and unincorporated Contra Costa County, including the unincorporated community of Tormey. It also runs through Phillips 66 Refinery. This PDA is a 26-net acre area designed as a Mixed-Use Corridor.

An Interstate 80 Corridor study provided ideas for future transit service that could provide high capacity transit options to connect Western Contra Costa county communities with existing BART at either the Richmond or El Cerrito Del Norte stations. The overall vision for the entire San Pablo Avenue Corridor is to develop an attractive and thriving mixed-use transportation corridor with nodes of medium- to high-density residential uses supported by jobs and services. However, job growth appears to be limited in the corridor given the existing character of the San Pablo Avenue Corridor and market conditions limit feasibility for higher density mixed-use[8]. Within this area is the Phillips 66 Company, which is one of the largest private employers in Contra Costa County, as well as the Rodeo Sewage Treatment Plant.

This PDA is exposed to flooding beginning at 48" TWL and become significantly flooded by 66" TWL. There are some industrial uses along the waterfront, including an auto body shop, Auto Craft, which begin flooding at 66" TWL and are totally flooded by 77" TWL. A private marina in Rodeo off Pacific Avenue has a boat launch

## CURRENT AND FUTURE HOUSING AND JOBS IN THE WCC TAC SAN PABLO AVE. CORRIDOR PDA

that becomes exposed at 12" TWL. Residents and the commercial corridor of San Pablo Avenue, including a mobile home park, begin to be affected at 52" TWL.

*Note: Statistics are listed for the portion of the PDA located in Unincorporated Contra Costa County. There are also portions of the PDA in Richmond and Hercules that were not assessed here.*

Critical facilities that provide emergency services and utilities may be impacted by flooding (Table 2e). First impacts begin at 66" TWL and increase through 108" TWL.

**Residential Housing Units**

| | |
|---|---|
| Existing in 2010: | 1,586 |
| Projections for 2040: | 4,784 |
| Percent Growth: | 201% |

**Job Spaces**

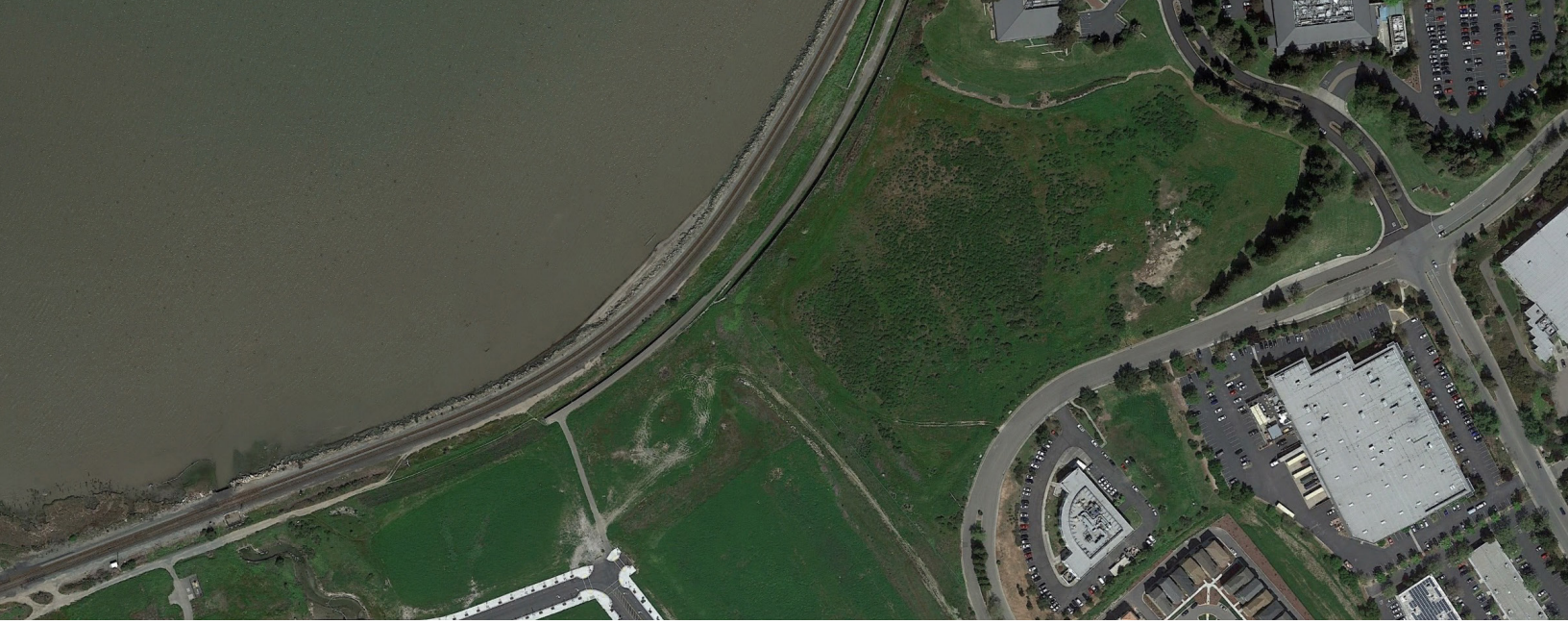
| | |
|---|---|
| Existing in 2010: | 847 |
| Projections for 2040: | 1,087 |
| Percent Growth: | 28% |

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

## EXPOSURE OF CRITICAL FACILITIES IN THE PDA

| | Critical Facilities/Services Impacted | 12" | 24" | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Police and Fire Stations** | Conoco Phillips Fire Department (San Pablo Avenue, Rodeo) | | | | | | | | | | |
| **Utilities** | Rodeo Sewage Treatment Plant (San Pablo Ave, Rodeo) | | | | | | | | | | |
| **Refinery** | Phillips 66 Refinery (San Pablo Ave, Rodeo) | | | | | | M | | | | |

**Table 2e. 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.



**Waterfront District PDA** • Located alongside the San Pablo Bay in the City of Hercules, the Waterfront District is a 210 net acre area designed as a Transit Town Center. It is currently served by transit including Western Contra Costa County Transit Authority (WestCAT), Alameda County (AC Transit) Bus Services, and proposed service connections to Hercules Regional Intermodal Transit Center, which is currently being constructed. When completed, the Hercules station will be the first center to connect trans-bay ferry service, a Capital Corridor train stop, and bus terminals all in one place.

The Waterfront District is the former site of the largest explosive factory in the world. The site is a former brownfield site. After removing 60,000 tons of contaminated soil and sediments, the majority of the property meets residential and environmental standards, with the exception of an 11-acre parcel that has residual contamination, which has deed restrictions that limit its use to commercial or industrial purposes.[9]

## CURRENT AND FUTURE HOUSING AND JOBS IN THE WATERFRONT DISTRICT PDA

### Residential Housing Units

| | |
|---|---|
| Existing in 2010: | 623 |
| Projections for 2040: | 807 |
| Percent Growth: | 30% |

### Job Spaces

| | |
|---|---|
| Existing in 2010: | 82 |
| Projections for 2040: | 48 |
| Percent Growth: | -42% |

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

A biotechnology area in the Waterfront PDA. Map data ©2019 by Google.

Development for the Hercules Waterfront District, also known as the Hercules Bayfront, is being guided by the Waterfront Plan (2000) to develop the site into a mixed-use, pedestrian friendly, transit-oriented town center with residential, office and retail uses.

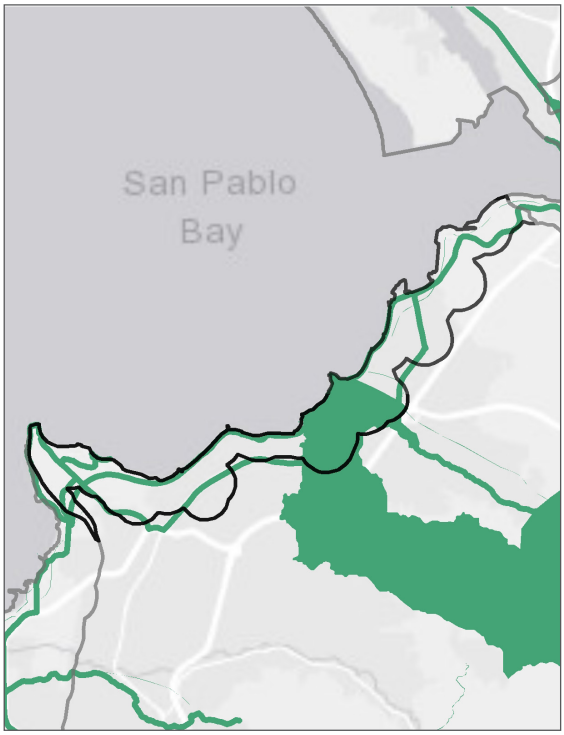
The PDA is exposed to flooding beginning at 66" TWL from Refugio Creek, however all flooding appears to be within current open space areas.

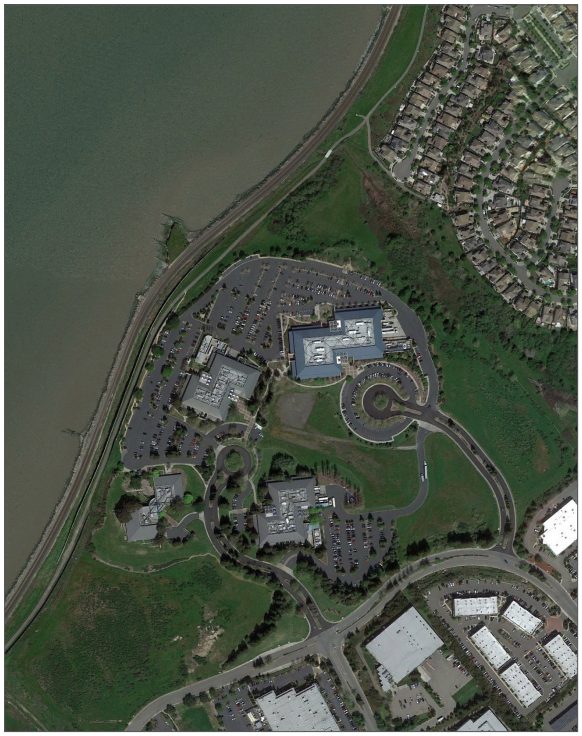
Critical facilities that provide emergency services and utilities may be impacted by flooding (Table 3e). First impacts begin at 48" TWL to the Pinole/Hercules Water Pollution Control Plant, which is technically outside the limits of the PDA, and increase through 108" TWL.

## EXPOSURE OF CRITICAL SERVICES AND FACILITIES NEAR THE WATERFRONT DISTRICT PDA

| | Critical Facilities/Services Impacted | 12" | 24" | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Utilities** | Pinole/Hercules Water Pollution Control Plant (Tennent Ave, Pinole) | | | | | | | | | | |

**Table 3e. 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.



San Francisco Bay Trail in Pinole. Map data © 2019 by Google

**San Francisco Bay Trail PCA** • 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, increased transportation options, opportunities to observe, learn about, and care for the environment, and provides economic benefits to the region through increased tourism.[10]

Within this OLU, the Bay Trail runs adjacent to the Union Pacific Railroad. In some places it is an unpaved path, while in others it is paved and part of the San Pablo Avenue Corridor PDA. Small portions are exposed beginning at 12" TWL, however, significant areas begin to be exposed near Pinole Creek at 24" TWL and on San Pablo Avenue at 66" TWL.

## PCA DESIGNATION:

- [X] **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).*

Point Pinole. Photo by Photo by SF Baykeeper, Cole Burchiel and LightHawk

## San Francisco Bay Water Trail Sites

**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.[11]

Within this OLU, there are two official Water Trail sites, which means they have been officially adopted by the Water Trail Program. These include the Lone Tree/Rodeo Beach site and Pinole Bayfront Park site. Beach sites are more vulnerable to flooding impacts than marina and harbor sites because beaches exist on the shoreline and cannot accommodate any increase in water levels. The two beach sites in this OLU are impacted by flooding beginning at 12" TWL.

### PCA DESIGNATION:

- ☐ Natural Landscapes
- ☐ Agricultural Lands
- ☐ Urban Greening
- ☒ **Regional Recreation**

### FUNCTIONS/BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Economic Development**

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



## Pinole Creek Watershed PCA •

The Pinole Creek Watershed covers approximately 15 square miles in the northwest part of Contra Costa County. The watershed includes portions of the cities of Pinole and Hercules, as well unincorporated areas such as the East Bay Municipal Utilities District's (EBMUD) Pinole Valley property and sections of El Sobrante and the Briones Agricultural Preserve. The Chelsea Wetlands, an area planned to be restored, is a 13-acre site located at the mouth of the Pinole Creek. Currently, this area is being used as an overflow basin for the Pinole Creek. This PCA is exposed starting at 24" TWL, due to overtopping of the shoreline near the mouth of Pinole Creek. At 66" TWL there is significant overtopping of the creek banks causing flooding of the low-lying developed areas of Pinole.

There are many ecosystem services of the Potential Oakland Gateway PCA including providing habitat, recreation, stormwater services of runoff retention, groundwater recharge, and flood water retention, and carbon storage (Figure 4e).

### PCA DESIGNATION:

- [X] **Natural Landscapes**
- [ ] Agricultural Lands
- [ ] Urban Greening
- [X] **Regional Recreation**

### FUNCTIONS/BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Water Supply and Quality**

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

A view of Hercules, Pinole, Pinole Creek, and the City of Pinole WWTP. Photo: SF Baykeeper, Cole Burchiel, and LightHawk.

## ECOSYSTEM SERVICES OF PINOLE CREEK PCA

### Habitats

| | |
|---|---|
| Tidal Marsh | 62 acres |
| Bird Hot Spots | 1,054 acres |
| Ridgway's Rail | 62 acres |
| Grasslands | 3,904 acres |

### Stormwater

| | |
|---|---|
| Annual Runoff Retention | 4,802 million gallons |
| Groundwater Recharge | N/A |
| Flood Water Retention | 308 million gallons |

### Recreation

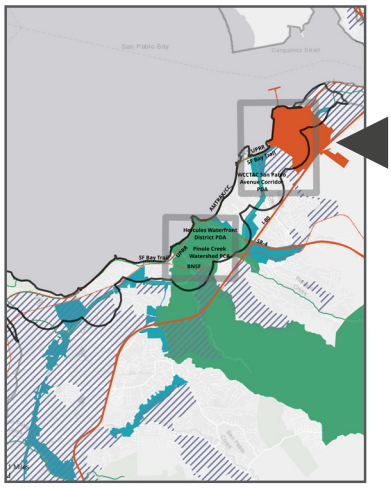
| | |
|---|---|
| Approximate Visitation Rates | 47 photo user days (PUD) |

### Carbon Storage

| | |
|---|---|
| Acres x % weighted soil organic matter within 108" TWL | 1,035 |

**Figure 4e. Ecosystem Services of the PCA.** Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

# Focus Area A:
## *Rodeo, Rail, and The San Pablo Corridor*



## *Location*

This Focus Area includes the community of Rodeo, including Bayo Vista, as well as Rodeo Creek and the Phillips 66 Refinery. It is bounded by the Phillips 66 Refinery (north), OLU boundary (east), 7th Street in Rodeo (south) and the bay shoreline (west). It is approximately 1.2 square miles (Figure 5e).

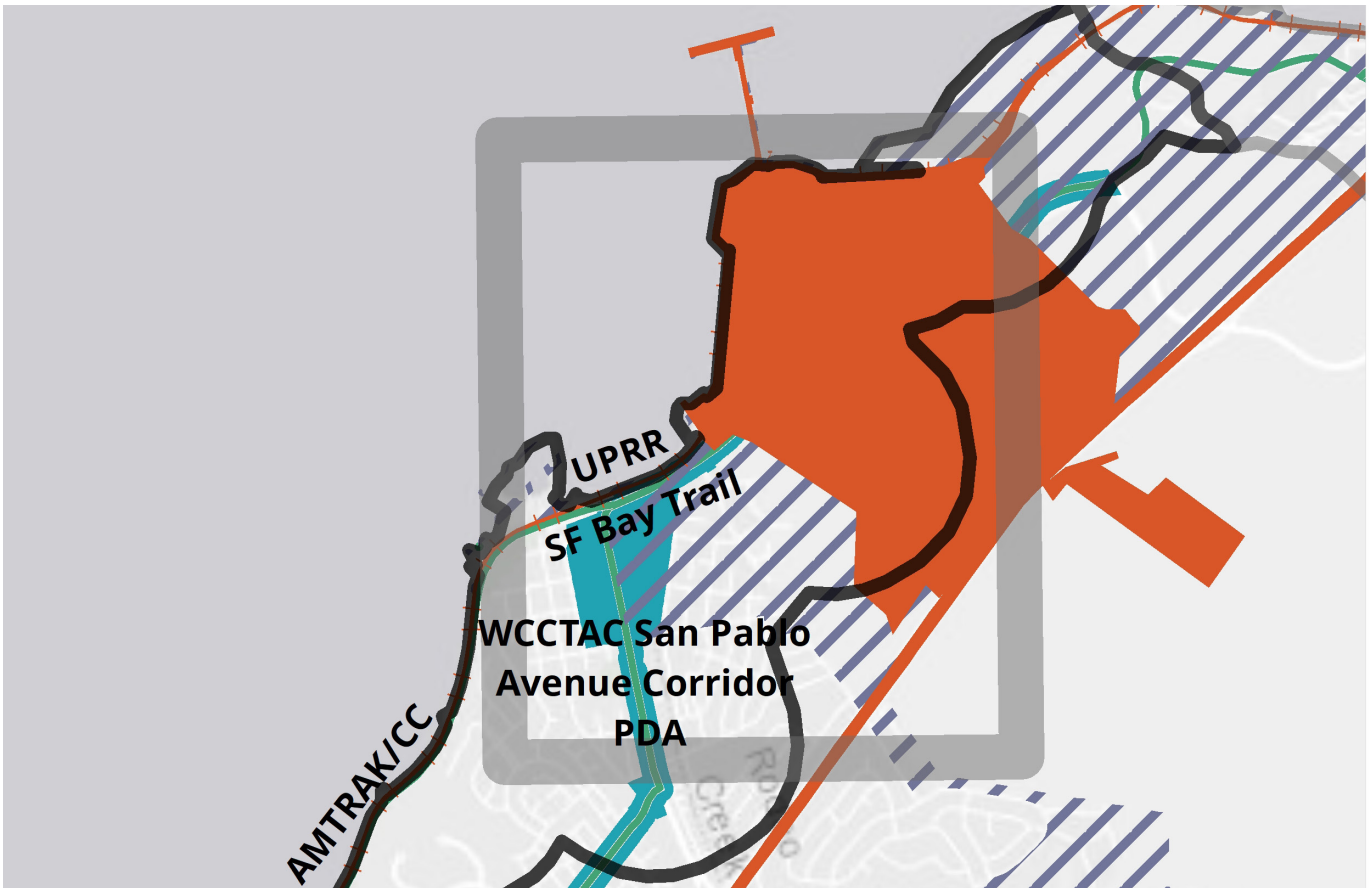



**Figure 5e. Top: Identification of where Focus Area is within OLU. Bottom: Map of Focus Area containing regional systems.** Individual assets assessed in this Focus Area are labeled on the map and listed on the following page.

Rodeo. Map data ©2019 by Google.

# *Why shared stories of vulnerability?*

This Focus Area was selected because it contains a variety of regional systems, including a railroad, PDA, two PCAs, and the vulnerable community of Rodeo.

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. By communicating shared vulnerabilities and consequences, our goal is to encourage multi-benefit solutions that help people, ecosystems, and economies.

## Figure 5e. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:

### TRANSPORTATION

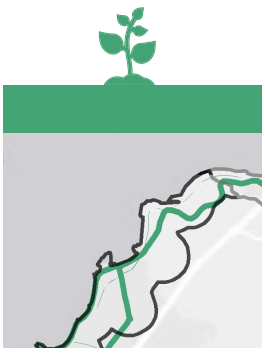
- Union Pacific Railroad (UPRR)

### VULNERABLE COMMUNITIES

- Rodeo Community

### PRIORITY DEVELOPMENT AREAS (PDAs)

- WCC TAC San Pablo Corridor PDA



### PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Bay Water Trail (1) PCA

# *Shoreline today and into the future*

## SHORELINE TYPE STORY

### *What is the shoreline made up of now?*

The shoreline in this Focus Area is largely composed of the UPRR rail track in front of the Phillips 66 Refinery, as well as natural shorelines in front of the Rodeo Wastewater treatment plant. The shoreline also includes small portions of wetlands, creek embankments, and berms.

## SHORELINE DEVELOPMENT STORY

### *How will the shoreline change in the future?*

The San Pablo Ave. Corridor is experiencing development within the Priority Development Area. The major potential shoreline changes include:

- **The Rodeo Wastewater Treatment Plant** is planning on building levees to protect the facility.[12]

Phillips 66 refinery and Rodeo. Map data ©2019 by Google.

Photo by SF Baykeeper Cole Burchiel and LightHawk.

# Current and future flooding risk

## OVERTOPPING STORY

### Where is water coming over the shoreline?

Overtopping occurs at 12" TWL (Figure 6e) over wetlands just south of Rodeo Creek mouth. At 36" TWL, overtopping occurs at embankment at Rodeo Creek near Railroad Avenue and Second Street, potentially opening a flood pathway into residents' properties. At 48" TWL (Figure 6e), significant portions of embankments at Rodeo Creek are overtopped. Additionally, overtopping also occurs at 48" TWL at natural shorelines near the Rodeo Wastewater Treatment Plant as well as in embankments in Phillips 66 Refinery. Overtopping and flooding increases as the total water levels rise above 48" TWL.

## FLOODING EXPOSURE STORY

### Where does flooding occur?

At 12" TWL (Figure 7e), the wetland areas south of Rodeo Creek mouth are exposed. At 48" TWL, overtopping of Rodeo Creek embankments leads to flooding of residential households on Railroad Avenue, Second Street and Mariposa Street. Flooding extent of households and community services increases significantly in the Rodeo community as total water levels rise. Railroad tracks that are on bridges crossing tidal creeks, such as the tracks over Rodeo Creek, make them highly vulnerable to extreme storm events that cause high creek flow, potential overbank flooding, and scour at bridge footings. UPRR runs in front of the Rodeo community, serving as ad-hoc flood protection. At 52" TWL, flooding begins to impact the edges of the road on San Pablo Avenue and by 66" TWL, San Pablo Avenue is flooded between California Street and Refinery Road. Additionally, the Rodeo Wastewater Treatment Plant is exposed. Flooding disrupts access to the Phillips 66 Refinery property, the Conoco Phillips Fire Department, as well as for the use of the San Pablo Avenue Corridor PDA to move people through the region to access goods, services, homes or places of work. Flooding extent in this area increases as total water levels rise.


36" TWL


48" TWL

## OVERTOPPING AND FLOODING

No overtopping
Overtopping
Shallower depth of flooding
Deeper depth of flooding

**Figure 6e. 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

| Regional Systems Impacted | 12" | 24" | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
|---|---|---|---|---|---|---|---|---|---|---|
| San Pablo Corridor PDA | | | | | | | | | | |
| San Francisco Bay Trail PCA | | | | | | | | | | |
| San Francisco Water Trail PCA | | | | | | | | | | |
| Rodeo Community | | | | | | | | | | |
| Union Pacific Railroad (UPRR) | | | | | | | | | | |

**Figure 7e. First exposure of regional systems.** Individual assets within 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. Rodeo Community Vulnerable Populations Housing and Jobs

The San Pablo Corridor PDA is a commercial corridor and provides housing, including an RV park, and services, such as emergency and community services, schools, and churches, for vulnerable populations of Rodeo. Flooding disrupts access to San Pablo Avenue, which is a major sub-regional transportation corridor and provides the sole means of ingress and egress for the Bayo Vista community, which is a vulnerable community with low car ownership, making this area particularly vulnerable to evacuation planning and access. Flooding of the waterfront will also disrupt the industrial warehouses located along the shoreline, impacting local jobs, services, and the economy. All of these vulnerabilities are exacerbated because the PDA is not managed by a single plan, and no formal allocation of funding has been made to support new growth.

### 2. Phillips 66 Refinery

The Phillips 66 Refinery provides regional jobs, and if flooded, would have local, regional, and statewide economic impacts. There are limited redundancies for this function in the region, and the refinery provides critical services for the region, especially in an emergency. Additionally, refineries and nearby areas contain higher levels of toxic contamination, as well as contribute to decreased air quality, impacting public health to nearby vulnerable communities. Flooding at these facilities could lead to mobilization of contaminants into nearby communities and ecosystem services, including wetlands and creeks. Vulnerabilities are exacerbated because the refinery does not own the shoreline adjacent to the facility.

Rodeo is adjacent to Phillips 66 refinery. Photo by Photo by SF Baykeeper, Robb Most and LightHawk

## 3. Movement of People and Goods

The Union Pacific Railroad (UPRR) provides freight and passenger rail for multiple companies and also provides ad-hoc flood protection to communities. The railroad berms are not designed for flood protection and are susceptible to erosion. UPRR is part of a networked system that provides access to the Ports, highways, and local roads integral for the transportation of goods and lacks redundancy. Movement of goods to and from the region would be disrupted by interruptions in service due to flooding. Additionally, UPRR rail is often co-located with fuel pipelines and other utilities. Erosion of the track bed could expose pipelines to corrosion and failure, disrupting facilities that rely on those utilities and potentially spilling toxic contaminants. This vulnerability is exacerbated by the national organization of UPRR, insufficient public information required to thoroughly evaluate the vulnerability of the system, and the complex user agreements and coordinated decision making required to maintain the heavy and passenger rail service.

## 4. Local Utilities

The Rodeo Sewage Treatment Plant provides critical water treatment services to surrounding communities. Disruption of this facility will impact critical wastewater treatment services for residential households, businesses, and emergency and critical services providers in the region. Additionally, mobilization of untreated wastewater due to flooding could cause public health concerns for nearby communities. Vulnerability is exacerbated due to a lack of redundancy to accommodate wastewater treatment services.

# *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.

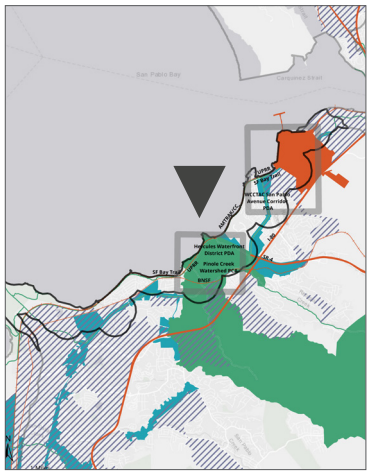
**Society and Equity •** The Rodeo community sits beside the Phillips 66 Refinery and has already had a history of health issues from air pollution and industrial leaks over the years. Flooding issues in this area are likely to disproportionately impact residents of Rodeo community as they possess characteristics that make it more difficult to prepare for, respond to, or recover from, flood events. The high proportion of residents who lack a vehicle and flooding impacts of San Pablo Avenue will likely disrupt transit services and limit residents' ability to access job centers. Mobilization of contaminates from the refinery and industrial land uses is a concern in this area. Additionally, flooding of the Rodeo Sewage Treatment Plant would also impact communities and businesses as sewage treatment plants provide critical wastewater treatment services and there is a lack of redundancy to accommodate these services if they were disrupted. Increased risk from disruption of hazardous materials transportation via rail, as well as trucking, can cause increased risk for releases which will likely disproportionately impact residents residing along rail rights-of-way and local industrial sites.

**Economy •** The presence of the Phillips 66 Refinery and Rodeo Sewage Treatment Plant are large centers of economic activity and provide jobs to local residents and critical services to people in the region. Flooding impacts to these facilities will have large regional impacts as both provide important services that have limited redundancy in the region.

**Environment •** The presence of the Phillips 66 Refinery and Rodeo Sewage Treatment plant could lead to mobilization of contaminates into the nearby wetland area, Rodeo creek, San Francisco Bay and nearby Rodeo community. Sea level rise is a major threat to many wetlands in the San Francisco Bay, and in this area the UPRR railroad track and well as development inland limits the ability of the wetlands to migrate landward to avoid being squeezed by a rising bay.

"Lone Tree Point" by sfbaywalk is licensed under CC BY 2.0

# Area of Impact B:
## *Hercules, Refugio, and Pinole Creek*



## *Location*

This Area of Impact is comprised of the area surrounding Refugio Creek and Pinole Creek, including the waterfront portion of the City of Hercules. It is bounded by John Muir Parkway (north), San Pablo Avenue (east), UPRR railroad tracks (south) and the bay shoreline (west). It is approximately 1 square mile.

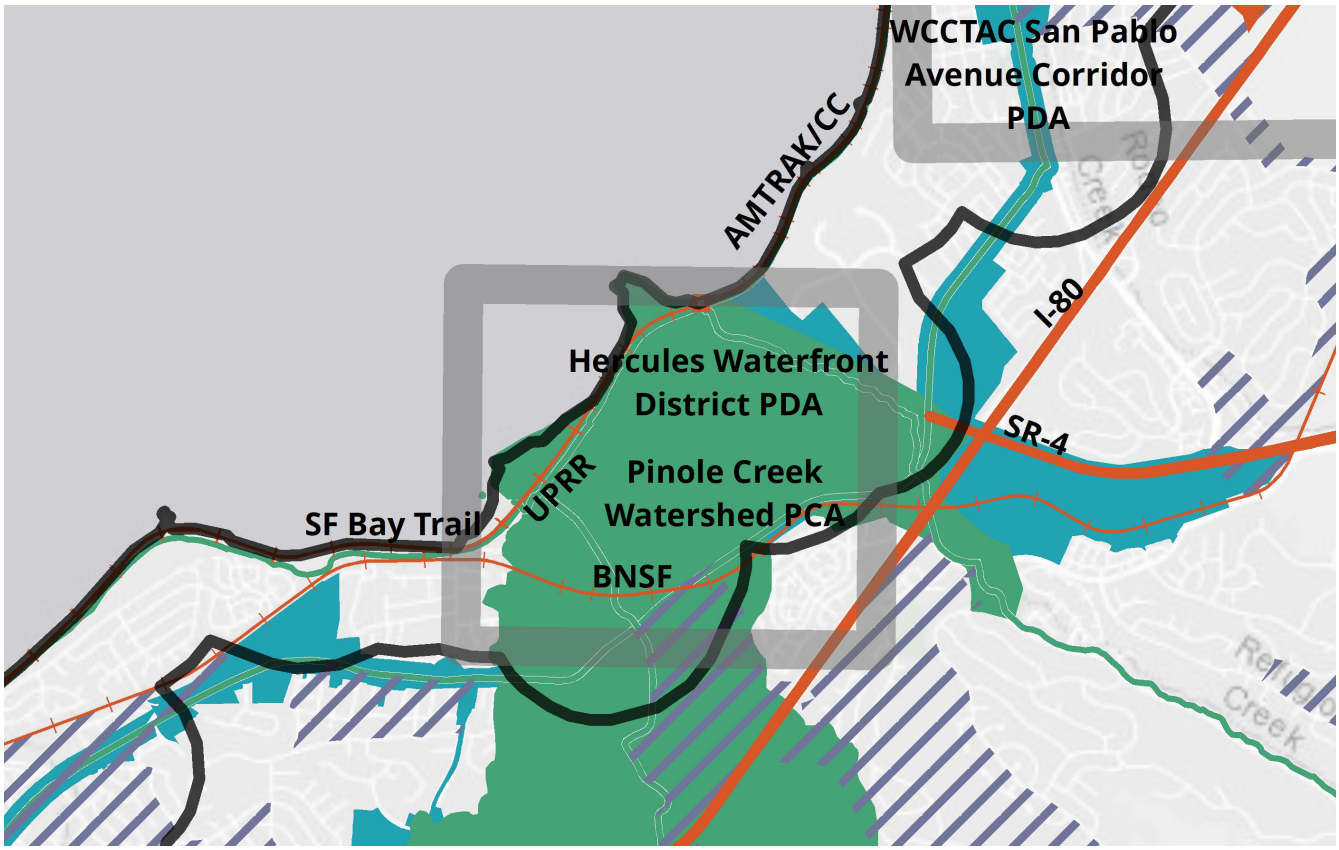


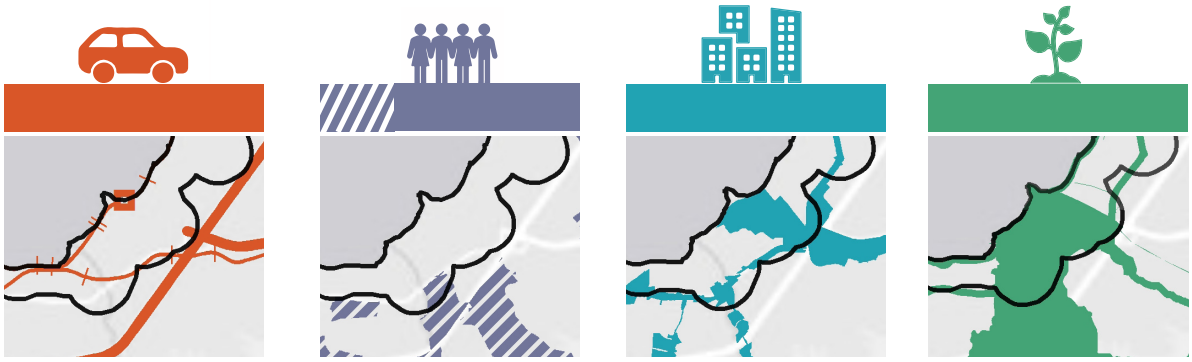

**Figure 8e. Top: Identification of where Area of Impact is within OLU. Bottom: Map of Area of Impact containing regional systems.** Individual assets assessed in this Area of Impact are labeled on the map and listed on the following page.

Hercules. Map data © 2019 by Google.

# *Why shared stories of vulnerability?*

This Area of Impact was selected because it contains a variety of regional systems, including rail, a waterfront PDA, and three 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 8e. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS AREA OF IMPACT LISTED BELOW:



### TRANSPORTATION

- Union Pacific Railroad

### VULNERABLE COMMUNITIES

- N/A

### PRIORITY DEVELOPMENT AREAS (PDAs)

- Waterfront District (Hercules) PDA

### PRIORITY CONSERVATION AREAS (PCAs)

- Pinole Creek Watershed PCA
- San Francisco Bay Trail PCA
- San Francisco Bay Water Trail (1) PCA

# *Shoreline today and into the future*

## SHORELINE TYPE STORY

### *What is the shoreline made up of now?*

The shoreline in this area is dominated by the UPRR railroad transportation structure on the length between Refugio and Pinole Creeks, while the creeks themselves include wetlands and natural shorelines. In Pinole Creek there are engineered levees and a floodwall, while Refugio Creek is largely embankments.

## SHORELINE DEVELOPMENT STORY

### *How will the shoreline change in the future?*

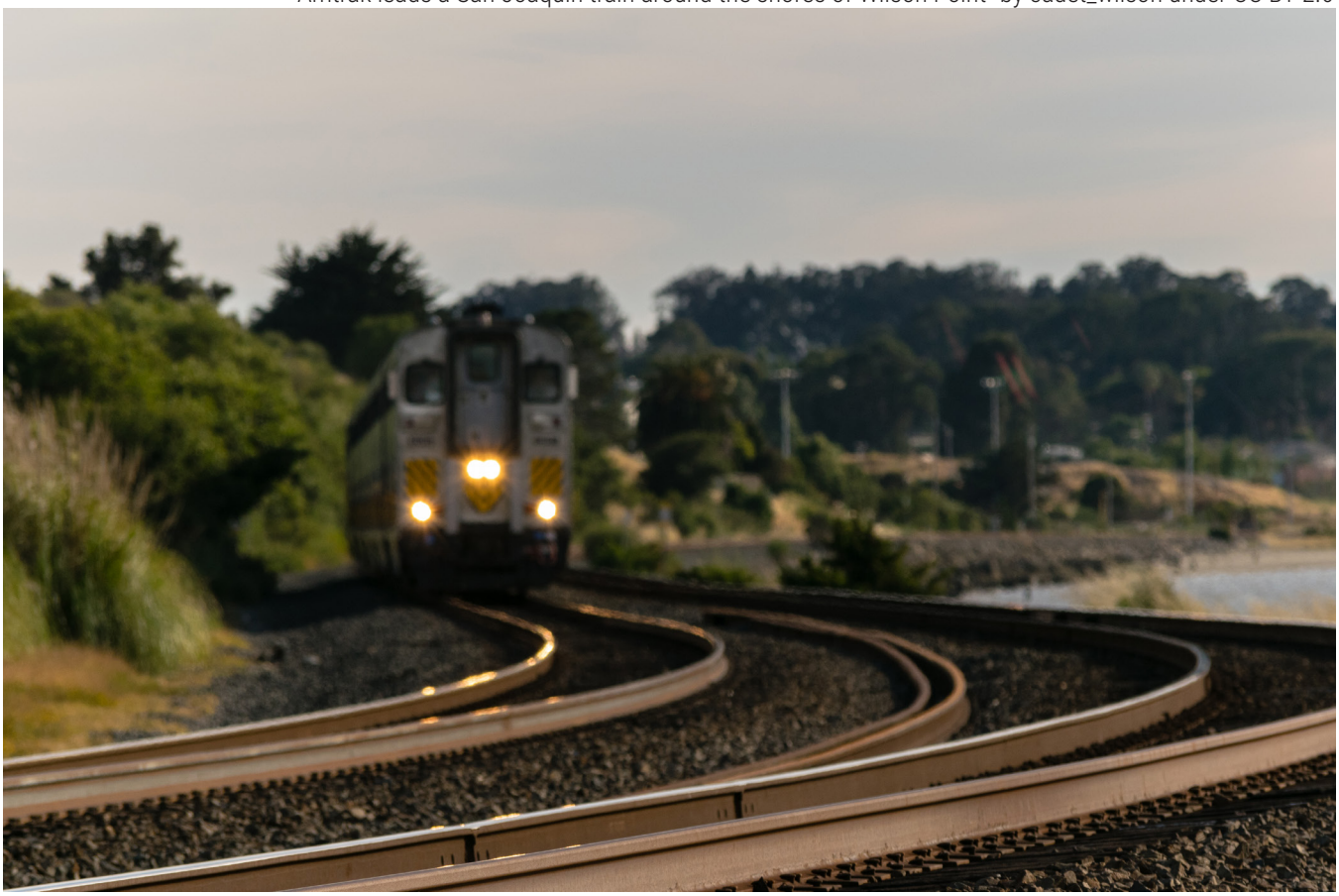
The shoreline is currently planning for new development around the Intermodal Transit Station, which will have train, ferry and bus connections, along with 1,500 residential units. Along the coast, Bayfront Transit Oriented Development is being built near the Transit Station on an old refinery site and will include retail, residential, and commercial. Muir Pointe is a new 144-unit development along Pinole Creek. Bio-Rad Diagnostics, located immediately adjacent to the shore, is expanding their facilities into a biotech node. The Pinole/Hercules Water Pollution Control Plant is planning on building levees to protect the facility.

These major potential shoreline changes include:

- **Intermodal Transit Station**
- **Bayfront Transit Oriented Development**
- **Muir Pointe**
- **Bio-Rad Diagnostics expansion**
- **Pinole/Hercules Water Pollution Control Plant** is planning on building levees

"Low tide at Point Pinole Regional Park" by Nick Fullerton is licensed under CC BY 2.0

"Amtrak leads a San Joaquin train around the shores of Wilson Point" by cadet_wilson under CC BY 2.0



# Current and future flooding risk

## OVERTOPPING STORY

### *Where is water coming over the shoreline?*

At 12" TWL, overtopping occurs at the wetlands in front of San Pablo Regional Park and Pinole Bayfront Park. At 24" TWL, there is overtopping (but no flooding), of an embankment in Pinole Creek. At 48" TWL, there is overtopping of UPRR railroad tracks and embankments at Pinole Creek as water levels rise. At 96" TWL, overtopping (but not flooding) occurs at embankments in Refugio Creek and increases through 108" TWL.

## FLOODING EXPOSURE STORY

### *Where does flooding occur?*

At 24" TWL, overtopping of wetlands impacts Pinole Creek and exposes Pinole Creek Watershed PCA. At 48" TWL, the Tenant Avenue Pinole RV Storage lot is exposed. Starting at 48" TWL, flooding impacts the Pinole/Hercules Water Pollution Control Plant, which is completely flooded at 66" TWL. At 66" TWL, flooding also impacts nearby residential households on both sides of Pinole Creek, impacting residents in both the City of Pinole and City of Hercules.


## OVERTOPPING AND FLOODING

**Figure 9e. 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.

- No overtopping
- Overtopping
- Shallower depth of flooding
- Deeper depth of flooding

## FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

| Regional Systems Impacted | 12" | 24" | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
|---|---|---|---|---|---|---|---|---|---|---|
| Pinole Bay Front Park Water Trail PCA | | | | | | | | | | |
| Pinole Creek Watershed PCA | | | | | | | | | | |
| San Francisco Bay Trail PCA | | | | | | | | | | |
| Waterfront District PDA | | | | | | | | | | |
| Union Pacific Railroad | | | | | | | | | | |

**Figure 10e. First exposure of regional systems.** Individual assets within 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. Regional Rail

The Union Pacific Railroad (UPRR) provides freight and passenger rail for multiple companies and also provides ad-hoc flood protection to communities. The railroad berms are not designed for flood protection and are susceptible to erosion. UPRR is part of a networked system that provides access to the Ports, highways, and local roads integral for the transportation of goods and lacks redundancy. Movement of goods to and from the greater region would be disrupted by interruptions in service due to flooding. Additionally, UPRR rail is often co-located with fuel pipelines and other utilities. Erosion of the track bed could expose pipelines to corrosion and failure, disrupting facilities that rely on those utilities and potentially spilling toxic contaminants. This vulnerability is exacerbated by the national organization of UPRR, insufficient public information required to thoroughly evaluate the vulnerability of the system, and the complex user agreements and coordinated decision making required to maintain the heavy and passenger rail service.

## 2. Local Utilities

The Pinole/Hercules Water Pollution Control Plant is exposed to flooding and could lose its functionality. This wastewater treatment plant provides critical water treatment services to surrounding communities and serves half a million people. Disruption of this facility will impact critical wastewater treatment services for residential households, businesses, and emergency and critical services providers in the region. Additionally, mobilization of untreated wastewater could cause public health concerns in the event of flood, especially for the nearby Waterfront District PDA and nearby communities. There is also a lack of redundancy to accommodate wastewater treatment services.

## 3. Ecosystem Services and Recreation

Tidal wetland habitats are vulnerable to flooding at San Pablo Regional Park, Pinole Bayfront Park and Pinole Creek Watershed PCA. Loss of wetlands due to drowning will result in a loss of ecosystem services, including habitat for endangered species. Additionally, all sites provide opportunities for recreation. The Pinole Bay Front Park Water Trail Site and Bay Trail provide access to the open waters of the San Pablo Bay. Disruptions of access to these sites limits the ability of local residents and visitors to access and experience ecologically important areas, and also limit use of the Bay Trail as an interconnected local transportation corridor for cyclists and pedestrians. The vulnerability of these sites is exacerbated by diverse, uncoordinated agencies who own, manage, or permit these locations.

# *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 •** Flooding impacts existing residential households in this area from overtopping of Pinole Creek, with the potential for future households to be impacted as well depending on how development proceeds in the Waterfront District PDA in the City of Hercules. Exposure of the Bay Trail, Water Trail, and Pinole Creek Watershed PDA will limit the ability of residents to enjoy natural and open spaces in an urban setting.

**Economy •** Impacts to the UPRR may lead to economic issues regionally as railroad tracks are networked systems and depend on the functioning of the entire rail system. There is limited redundancy to carry bulk or specialized goods across the region. Flooding impacts to the Pinole/Hercules Water Pollution Control Plant (WPCP) facilities will have large regional impacts as it provides critical water treatment services and there is a lack of redundancy to accommodate these services if they were disrupted.

**Environment •** The presence of the Pinole/Hercules Water Pollution Control Plant (WPCP) could lead to mobilization of contaminates into the nearby wetland area, Pinole and Refugio Creeks and San Pablo Bay. Sea level rise is a major threat to many wetlands in the San Francisco Bay, and in this area the UPRR railroad track and well as development inland limits the ability of the wetlands to migrate to avoid being flooded by a rising bay or converted into mudflats or subtidal habitats.

# Endnotes


1 Contra Costa County Department of Toxic Substances Control, "Draft Remedial Action Plan and Draft EIR Available for Public Review and Comment," March 2018, https://dtsc.ca.gov/wp-content/uploads/sites/31/2017/11/SelbySlag_FS_dRAP_0318.pdf.

2 Adapting to Rising Tides, "Adapting to Rising Tides: Contra Costa Assessment and Adaptation Project" (San Francisco Bay Conservation and Development Commission, 2017), http://www.adaptingtorisingtides.org/wp-content/uploads/2017/03/Contra-Costa-ART-Project-Report_Final.pdf.

3 Adapting to Rising Tides.

4 United States Census Bureau, "2010 Census (California)."

5 J. K. Dineen, "Rodeo Refinery to Pay Nearly $800,000 over Pollution Violations," SFGate, August 4, 2016, https://www.sfgate.com/news/article/Rodeo-refinery-to-pay-nearly-800-000-over-9116870.php.

6 Dineen.

7 Contra Costa County Department of Toxic Substances Control, "Draft Remedial Action Plan and Draft EIR Available for Public Review and Comment."

8 Contra Costa Transportation Authority, "PDA Investment & Growth Strategy: 2017 Update," May 17, 2017.

9 Tom Butt and Karen Mitchoff, "Contra Costa Transportation Authority," n.d., 156.

10 "San Francisco Bay Trail – A 500-Mile Trail Around the Bay."

11 "San Francisco Bay Area Water Trail."

12 San Francisco Bay Conservation and Development Commission Regulatory Staff, March 19, 2019.