The urban centers of the San Francisco Bay and Oakland line the shoreline. Photo by Jitze Couperus licensed under CC BY 2.0.

Chapter 2.7

FUTURE GROWTH AREAS

Thriving communities where people live, work and have effective transportation options to access goods and services, recreation and enjoyment of natural lands is essential to the future of the Bay Area. As the region continues to grow in order to meet the housing and jobs needs of the future, ensuring new development and growth can support more resilient urban centers is critical to meeting the challenges of the Bay Area today and into the future.

The ART Bay Area assessment of future growth areas explores the region's existing network and potential areas designated for future growth that may be at risk from flooding due to sea level rise and storm events. In ART Bay Area, future growth areas are assessed using the Priority Development Area (PDA) framework developed by the Metropolitan Transportation Commission/Association of Bay Area Governments (MTC/ABAG).

The following Key Takeaways listed highlight significant findings from the regional analysis of potential risk for existing (2010) and projected total (2040 projections) residential housing units and jobs in Priority Development Areas (PDAs) across the Bay Area. More detailed findings from both the qualitative and quantitative analyses follow.

As the region continues to grow in order to meet the housing and jobs needs of the future, ensuring new development and growth can support more resilient urban centers is critical to meeting the challenges of the Bay Area today and into the future.

IN THIS SECTION

Water crashes against the San Francisco seawall on the Embarcadero during King Tides in December 2019. Photo by Sergio Ruiz courtesy of California Bay King Tides Project.

2.7.1 Key Takeaways

- Existing residential housing units within PDAs are at risk of impacts from flooding starting at 24" total water level (TWL). However, projected total residential housing units, as well as existing and projected total job spaces, may be at risk of impacts from flooding starting at 12" TWL. In all cases, impacts significantly increase around the region for residential housing units and jobs as total water levels increase.

- The earliest and most significant consequences from flooding to existing and projected total residential housing units occurs in specific locations around the Bay, particularly in the South Bay in San Jose, in the North Bay in Suisun City and Pittsburg, and in the East Bay in Oakland and Alameda.

- The earliest and most significant consequences from flooding to existing and projected total job spaces also occurs in specific locations around the Bay, in particular in the North Bay in San Rafael, in the South Bay in San Jose, on the Peninsula in Redwood City, and in the East Bay in Richmond and Alameda.

- Later consequences from flooding for existing and projected residential housing units become increasingly concentrated in San Jose, San Francisco and Oakland, while later consequences for existing and projected job spaces are concentrated in San Jose, and San Francisco, and for job growth in Richmond.

- Projected growth in residential housing units could put nearly three times more residential households in areas at risk at 108" TWL when compared to the existing housing units at risk of impacts from flooding if no adaptation occurs.

- In general, the earliest and most significant consequences of impacts from flooding on both residential units and jobs are distributed in PDAs across the North Bay, in North San Jose PDA in the South Bay, and in a few PDAs in the East Bay. Later consequences become increasingly concentrated in the three main cities of San Francisco, Oakland, and San Jose.

- Ongoing discussions between BCDC and MTC/ABAG are working towards incorporating assessment results and possible adaptation responses into Plan Bay Area 2050 to protect people, jobs, and future development from a rising Bay.

2.7.2 Regional Analysis of Future Growth Areas System

OVERVIEW

The Bay Area is the 4th largest metropolitan area in the United States.[1] While the San Francisco Bay Area has been seeing a slowdown in population growth over the last few years, there remains a net increase in the amount of people moving into the Bay Area.[2] At the same time, job employment is at an all-time high,[3] while housing production and affordability (as measured by housing permits) remain well below historical averages, leading to soaring housing costs.[4] There is a critical need to build more affordable housing in areas located near frequent transit service. This is especially critical as the State of California seeks to reduce its greenhouse gas emissions[5] while also supporting people's ability to get to where they live, work, and play.

Analysis of the region's future growth areas explores the vulnerabilities and consequences to current and future flooding from sea level rise and storm events This analysis includes two future growth area types:

- Priority Development Areas (PDA) system (as of 2019)
- Areas designed as "PDA-Eligible"

Protection of these future growth areas can increase the resilience of communities and businesses into the future, and careful investment in future growth areas could support mutual protection of other critical assets throughout the region, such as multi-benefit flood protection and habitat restoration projects that can protect communities and transportation, while also supporting natural areas and ecosystem services.

In this analysis, we used two different methodologies to assess the region's future growth areas. The first is a data-driven quantitative assessment where Priority Development Areas (PDAs) and PDA eligible area were evaluated for exposure and consequence to ten different total water levels (TWLs). The second methodology included a detailed qualitative assessment on a subset of PDAs to understand and describe the characteristics and nuances of vulnerability. Regional vulnerability statements in this section resulted from qualitative local assessments. Methodologies can be found in the Appendix.

This chapter will discuss the details of the regional system assessed, results of the analyses, and a discussion on what this means for the region moving forward.

Flooding of the Embarcadero at the Port of San Francisco is common during King Tides. Photo courtesy of California Bay King Tides Project.

2.7.3 Priority Development Areas and PDA-Eligible Growth Areas

PLAN BAY AREA AND SUSTAINABLE COMMUNITIES

ART Bay Area worked in partnership with the Metropolitan Transportation Commission and Association of Bay Area Governments (MTC/ABAG) to evaluate the risks of current and future flooding to Priority Development Areas. PDAs are a component of Plan Bay Area, the region's integrated long-range transportation, land-use, and housing plan for the San Francisco Bay Area.

Priority Development Areas, and their complement of Priority Conservation Areas (PCAs), were developed by ABAG in the mid-2000's. PDAs were created to concentrate jobs and housing developments in existing neighborhoods served by transit, while PCAs were created to preserve open spaces and maintain natural areas to reduce development pressure. In 2008, California passed SB 375, the Sustainable Communities and Climate Protection Act, which requires all Metropolitan Planning Organizations, which includes MTC/ABAG, to integrate a Sustainable Communities Strategy (SCS) to reduce greenhouse gas emissions into their long-range transportation plans. PDAs and PCAs were incorporated into the initial development of Plan Bay Area in 2013. The PDA and PCA programs were expanded in 2017 during the update to Plan Bay Area, *Plan Bay Area 2040.*

PRIORITY DEVELOPMENT AREA FRAMEWORK: REGIONAL NETWORK WITH LOCAL CONTROL

The Priority Development Area framework was developed to identify geographies within existing communities and near existing or planned transit where local jurisdictions are committed to planning for additional housing and jobs.[6] *Plan Bay Area 2040* includes a total of 188 local PDAs throughout the nine-county Bay Area. PDAs can include different development types, including city centers, employment centers, mixed-use corridors, regional centers, suburban centers, transit neighborhoods, transit town centers and urban neighborhoods.

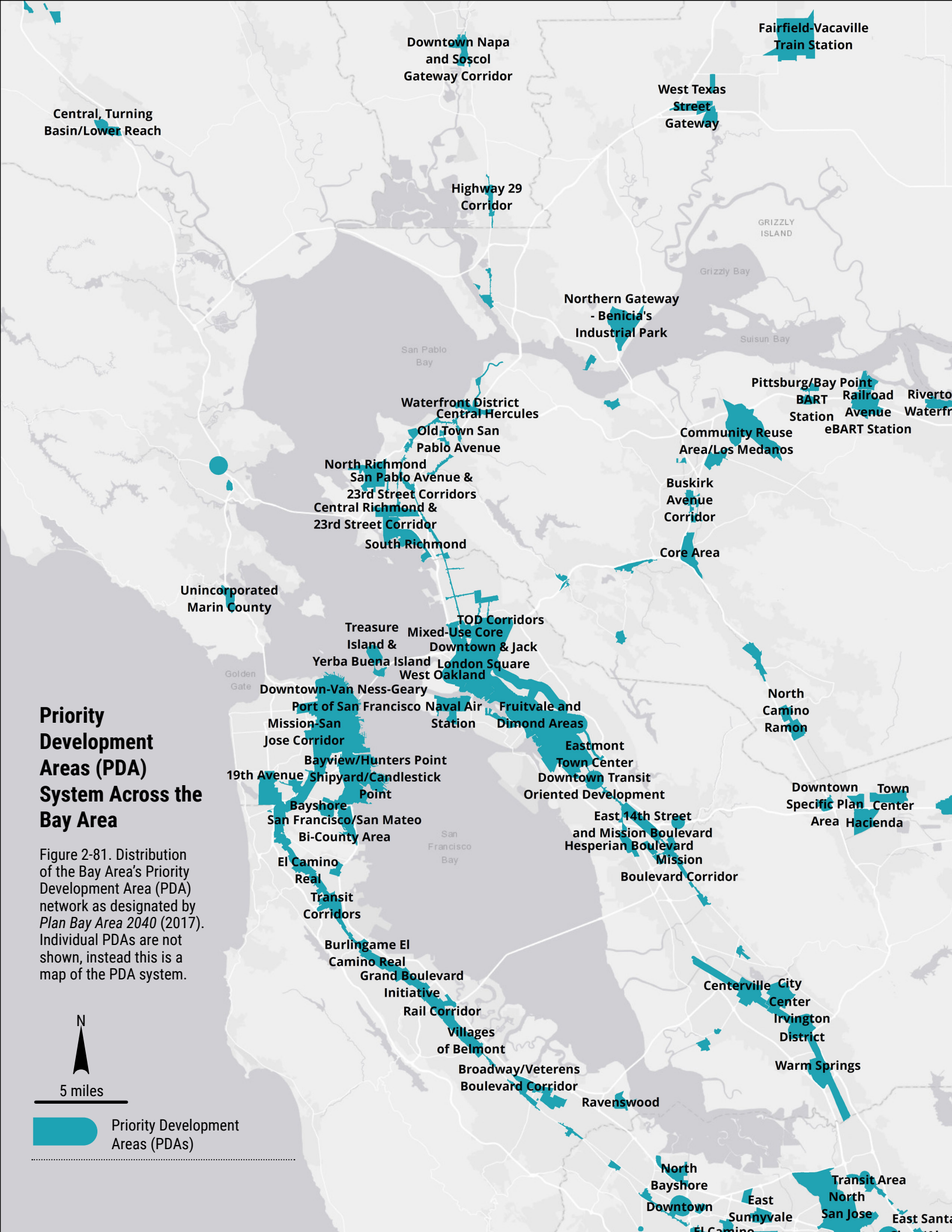
The 188 PDAs identified by Plan Bay Area 2040 were expected to accommodate 78 percent of new housing production (>500,000 units) and 62 percent of employment growth (~700,000 jobs) in the Bay Area through the year 2040.

The foundational principle of the PDA (and PCA) programs are that they are "opt-in," meaning that local jurisdictions voluntarily nominate themselves to be PDAs and designated areas remain under local land use control. Then, PDAs must be formally adopted by MTC/ABAG and be consistent with PDA guidelines. To be considered for the PDA program, nominated areas must be:

1. **Within an existing community (e.g. existing urban footprint)**
2. **Within a half-mile of frequent transit; and**
3. **In an area planned for future housing and job growth.**

An incentive to participating in the PDA program is that projects located within a PDA may be eligible for regional funding through the One Bay Area Grant Program. Funding can be used for capital projects and planning efforts, which further support local jurisdictions' abilities to develop local land-use plans and policies for growth near existing or future transit-rich areas.

The current distribution of PDAs from *Plan Bay Area 2040* (2017) can be seen in Figure 2-81. PDAs are generally concentrated in naturally high growth areas of the region, with the majority of PDAs being located on the San Francisco Peninsula and in the East Bay, particularly in Oakland. The 188 PDAs identified by Plan Bay Area 2040 were expected to accommodate 78 percent of new housing production (over 500,000 units) and 62 percent of employment growth (almost 700,000 jobs) in the Bay Area through the year 2040.[7] To reach these ambitious targets, all designated PDAs are expected to meet PDA program guidelines and adopt Specific Plans that lay out a strategy for future housing and growth while improving access to transit.



Priority Development Areas (PDA) System Across the Bay Area

Figure 2-81. Distribution of the Bay Area's Priority Development Area (PDA) network as designated by *Plan Bay Area 2040* (2017). Individual PDAs are not shown, instead this is a map of the PDA system.

FUTURE GROWTH FRAMEWORK: WHERE ARE PDAS GOING NEXT?

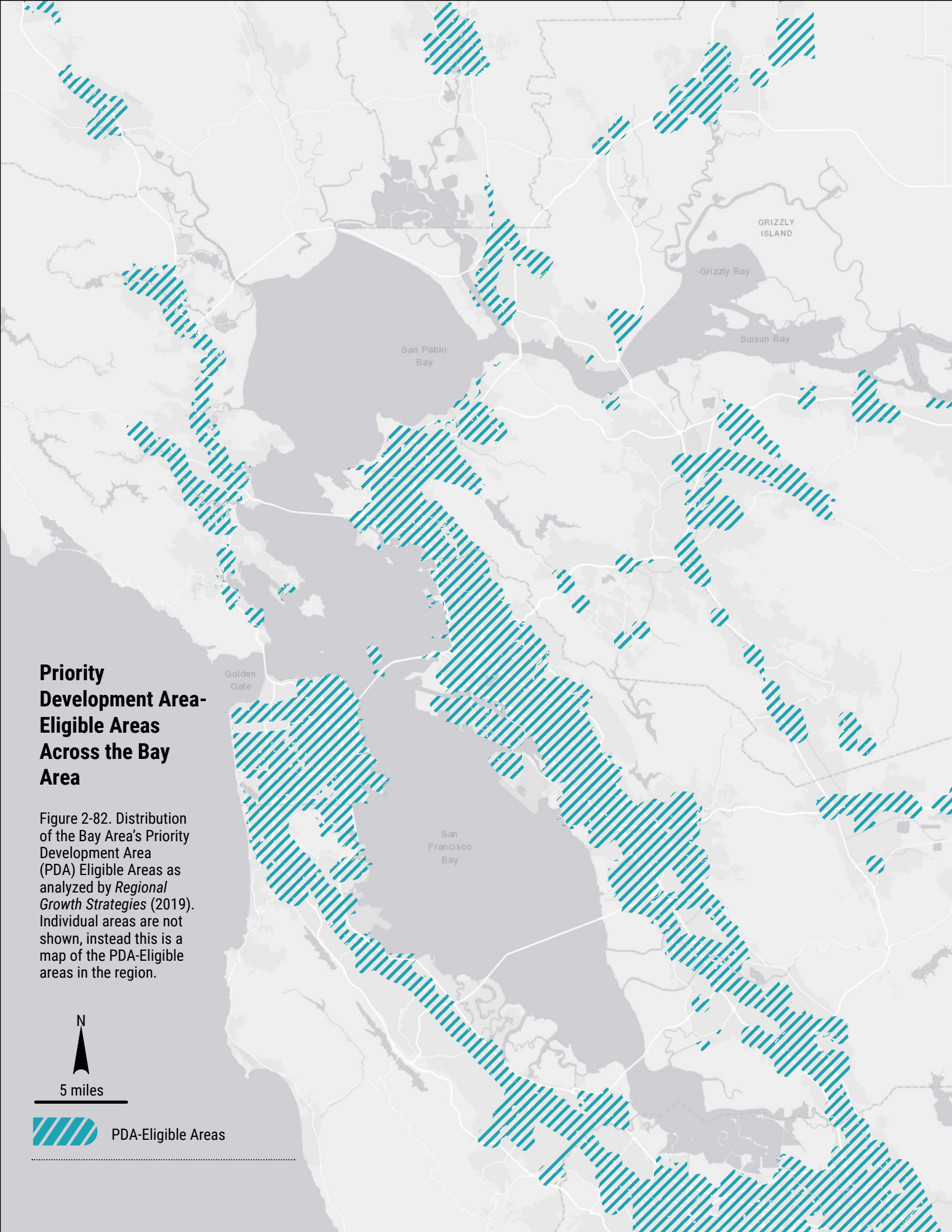
MTC/ABAG is currently working to develop the next full plan, *Plan Bay Area 2050*, which is set to be released in 2022. In February 2019, MTC/ABAG released a paper titled *Regional Growth Strategies* to evaluate the progress of the PDA program in meeting the region's housing, jobs, and transportation access needs. The report found that 65 percent of PDAs met the guidelines of adopting a Specific Plan, while 45 percent of PDAs met the criteria for being located near transit-rich areas. Ultimately, the report concluded that while the PDA program has succeeded in promoting new housing and jobs in locally designated areas, it is falling short of meeting its ambitious housing production and transit access goals due to significant barriers to implementation.[8]

Since the initiation of the PDA program, the region has experienced a wide range of emerging issues, such as increased housing costs and displacement risk. There is also a growing threat of flooding from storms and sea level rise. To address the challenges faced by the current PDA program, the *Regional Growth Strategies* paper offered an analysis of various updated growth framework concepts.

The analysis for *Regional Growth Strategies* identified a number of factors that could help guide future growth areas. These include housing costs, reduction of potential vehicle miles traveled, community stability, hazard protection, and access to opportunity. Each block group within the region was scored to identify high or low performance on each indicator. These indicators helped to identify potential suitable locations for future growth, especially when coupled with Transit Priority Areas, defined as areas within ½ mile of a major transit stop.

MTC/ABAG is also considering potential revisions to the future growth framework, including new PDAs, new priority area types including Priority Production Areas, or areas suitable for manufacturing and industry uses, and catalyst projects in High Opportunity Areas, or locations that have high access to opportunity, such as large publicly owned sites, aging commercial sites, or new towns along the urban edge.

As part of the future growth areas analysis in this section, ART Bay Area evaluated impacts of current and future flooding on the current PDA network as well as current and future flooding impacts to Transit Priority Areas and High Opportunity Areas, collectively referred to as PDA-eligible areas. The distribution of PDA-eligible areas in the region can be seen in Figure 2-82.



Priority Development Area-Eligible Areas Across the Bay Area

Figure 2-82. Distribution of the Bay Area's Priority Development Area (PDA) Eligible Areas as analyzed by *Regional Growth Strategies* (2019). Individual areas are not shown, instead this is a map of the PDA-Eligible areas in the region.

REGIONAL ASSESSMENT APPROACHES

Regional Data-Driven Consequence Results

This portion of the assessment is based on data-driven results from a region-wide consequence indicator analysis. First, flood exposure of the PDA system was analyzed to understand the extent and timing of exposure to flooding at ten TWLs.

For the PDA system and PDA-Eligible Areas, six consequence indicators were identified to measure consequence to housing and jobs in future growth areas. These units of measurement include values for residential housing units and job spaces in 2010, projections for 2040 based on *Plan Bay Area 2040* and the difference between 2010 and 2040 values designated as "growth." For the purposes of this analysis, "existing" is used to described impacts for 2010 data, "projected total" for 2040 data, and "growth" for the change in values between 2010 existing and 2040 projected totals. Table 2-5 indicates indicators of consequence analyzed.

This section outlines the results of the system-wide total impacts within the current PDA system as total water levels rise, and then a discussion on which specific PDAs in the region are driving these regional trends for each indicator. Following is an analysis of the current PDA system compared to PDA-eligible areas that may be part of the future growth framework being implemented in *Plan Bay Area 2050*.

The San Francisco San Mateo Bi-County PDA is projected to have significant new growth in households and jobs. Map data ©2019 by Google Earth Pro.

Individual Qualitative Assessment Results

The second portion of the assessment is based on a subset of PDAs identified to be regionally significant and were assessed using questionnaires, desktop research and stakeholder interviews to identify and define vulnerability of individual assets. These results culminated in regional vulnerability statements that are described at the end of the future growth areas section and reflect findings from the PDA system. Additional details of the qualitative vulnerability assessments can be found in Chapter 3.0 Local Assessments that include information on shared vulnerabilities and consequences of flooding in specific locations around the Bay Area. Details on the different methodologies for selection can be found in the Appendix.

Structure of the Future Growth Areas Analyses

Priority Development Areas and PDA-Eligible areas are assessed in separate sub-sections. For PDAs, exposure and consequence indicators for residential units and job spaces in 2010, 2040 projections and growth are presented, followed by a review of how the current PDA system compares to PDA-Eligible areas. Following these exposure and consequence sections is the regional vulnerability statements for PDAs resulting from the local assessments. Lastly, conclusions are drawn on future growth areas for the region.

Indicators of Consequence for Future Growth Areas

Regional System	Asset Type	Consequence Indicator	Unit of Measurements
Future Growth Areas	**Residential Units**	Residential Units 201	Number of 2010 residential units impacted
		Residential Units 2040 (Projected Total)	Number of 2040 residential units impacted
		Residential Units Growth 2010-2040 (Growth)	Number of new residential units impacted
	Job Spaces	Job Spaces 2010	Number of 2010 job spaces impacted
		Job Spaces 2040 (Projected Totals)	Number of 2040 job spaces impacted
		Job Spaces Growth 2010-2040 (Growth)	Number of new job spaces impacted

Table 2-5. Indicators used to measure consequence for Future Growth in ART Bay Area, including for both Priority Development Areas (PDAs) as of *Plan Bay Area 2040* (2017) and areas designated as PDA-Eligible.

2.7.4 Regional Future Growth Areas Results

PRIORITY DEVELOPMENT AREAS (PDAS)

Regional Exposure of PDAs

The bar graph below shows the total area of current PDAs exposed at each total water level expressed in terms of total acres and as a percent of the regional total acres within all PDAs in the Bay Area (Figure 2-83). This illustrates the relative magnitude of exposure in the PDA network. Early exposure of PDAs start at 12" TWL, and exposure increases as total water levels rise. By 24" TWL, over 1,000 acres of PDAs may be flooded, increasing to over 2,000 acres by 36" TWL. Eventually, over 14,400 acres of PDAs may be flooded by 108" TWL, which represents approximately 13 percent of the entire current PDA network. Figure 2-84 identifies which PDAs have the highest percent of area exposed to flooding in the region.

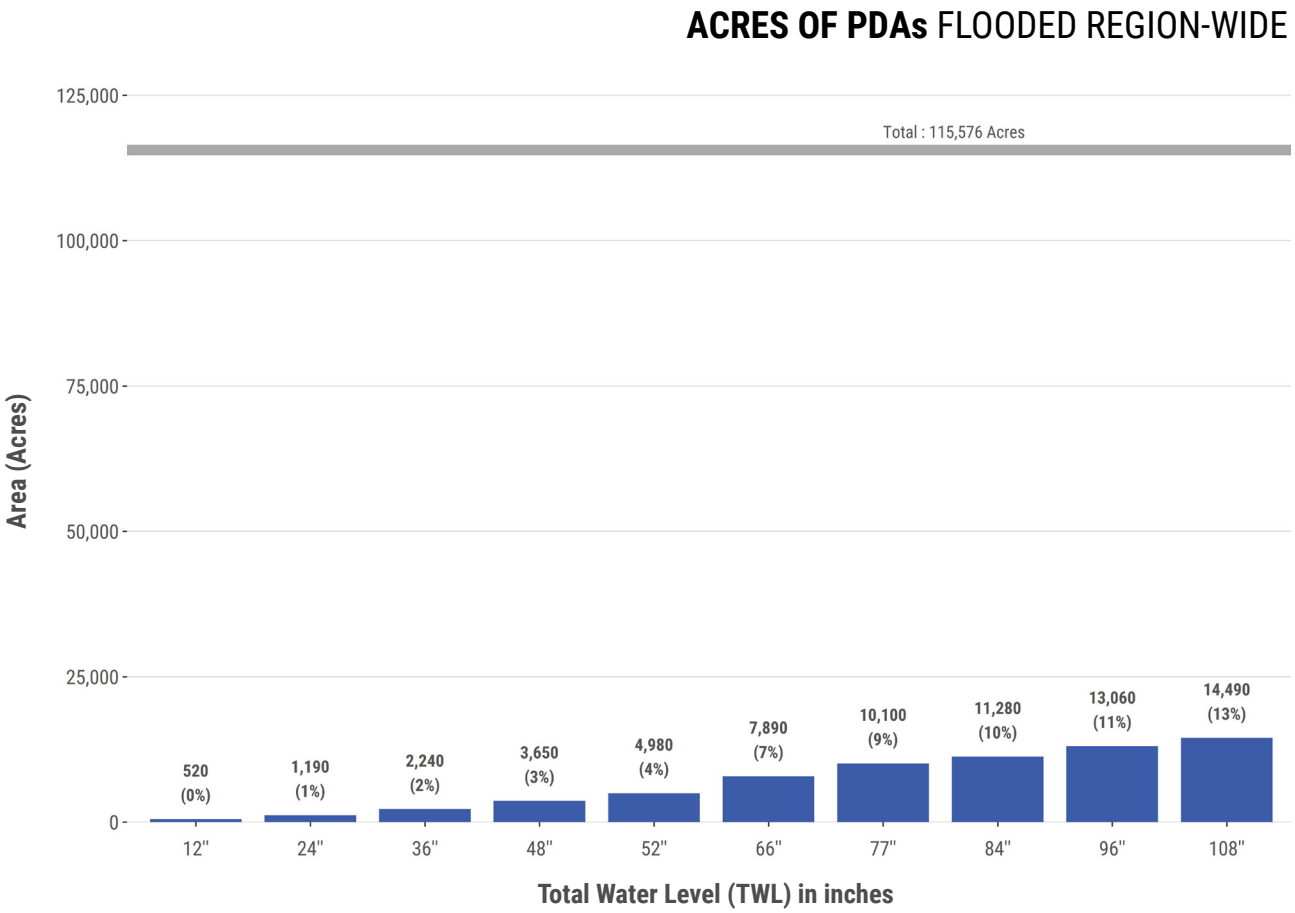


Figure 2-83. Regional exposure of PDA area by flooding. Values in parenthesis reflect the percent of area in acres exposed to flooding at each TWL compared to total acres of PDAs in the nine-county region.

Redwood Creek runs through the Broadway/Veterans Boulevard Corridor PDA in Redwood City. Photo courtesy of California Bay King Tides Project.

HIGHEST **PERCENT OF ACRES** FLOODED BY PDA

	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Central, Turning Basin/Lower Reach (Petaluma)	12.6	12.8	13.4	15.2	16.5	31.6	41.8	47.9	56.8	64.1
Downtown (San Rafael)	11.1	15.0	24.5	38.6	42.0	49.9	53.0	54.3	55.9	57.1
Downtown Napa and Soscol Gateway Corridor (Napa)	10.5	11.2	15.0	15.9	16.0	16.4	19.1	22.7	29.1	36.2
Downtown & Waterfront (Suisun City)	7.8	49.8	66.3	78.5	81.3	92.9	95.8	96.9	97.8	98.3
Ravenswood (East Palo Alto, Menlo Park)	4.7	9.4	25.4	40.7	46.0	61.8	68.7	72.9	79.1	83.0
Coliseum BART Station Area (Oakland)	3.7	4.2	6.8	18.1	23.9	52.2	69.9	77.8	85.0	88.6
Broadway/Veterens Boulevard Corridor (Redwood City)	1.6	11.9	32.4	69.2	74.4	87.3	93.1	95.2	97.8	98.2
Naval Air Station (Alameda)	0.9	5.0	16.8	29.0	33.9	52.8	70.6	81.3	93.0	97.2
Sonoma Boulevard (Vallejo)	0.7	12.3	25.5	52.6	54.0	60.2	64.3	66.3	68.9	70.6
Dumbarton Transit Oriented Development (Newark)	0.1	0.1	1.0	2.4	54.9	76.7	85.9	89.0	91.6	92.3

Percent of Area (Acres) of PDAs

Total Water Level (TWL) in inches

Figure 2-84. PDAs with highest percent of area (acres) exposed to flooding at ten TWLs. "Highest" exposure refer to PDAs ranking in the top five for highest exposure at one or more TWL. Darker colors reflect greater consequences from flooding.

Regional Consequences and Trends and Drivers of PDAs

This section provides an overall perspective on the trends of consequences in the region broken down by consequence indicator across the PDA network. This section describes the magnitude of total potential impacts of consequence from flooding from sea level rise that could occur on a regional scale, followed by details on which individual PDAs are driving the highest consequences of impact for each of the indicators across the region.

Consequences for PDAs are organized by asset type: Residential Units and Job Spaces. Residential units and job spaces parcel data were provided by MTC-ABAG. For both residential units and job spaces, system-wide results in absolute values of impacted are described for residential units and job spaces at risk of flooding in 2010 (existing), planned growth between 2010 and 2040 (growth), and 2040 totals in PDAs (projected totals).

Top PDAs for early and worsening consequences are described, as well as significant changes in consequence. Six consequence indicators were evaluated for the PDA network in two categories (Figure 2-85).

Many places around the San Francisco Bay are planning for growth in jobs and housing, including the South Richmond PDA. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.

RESIDENTIAL HOUSING UNITS

- Existing residential housing units (2010)
- Projected total residential housing units (2040)
- Growth (change in values between 2010 existing and 2040 projected totals)

JOB SPACES

- Existing job spaces (2010)
- Projected total job spaces (2040)
- Growth (change in values between 2010 existing and 2040 projected totals)

Figure 2-85. Two categories were used to evaluate the consequences of flooding for future growth areas within the Priority Development Area (PDA) system, and individual indicators were identified within each category.

Residential Housing Units for 2010, 2040 and Growth

REGIONAL CONSEQUENCE

There are a significant number of residential units existing today and projected for the future that could be impacted from flooding as total water levels rise (Figure 2-86). Existing residential units are at risk of impacts from flooding beginning at 24" TWL and the risk increases as total water levels rise. At 12" TWL there are no existing residential housing units at risk of flooding. However, approximately 264 projected future residential housing units in San Rafael could become impacted by flooding.

A significant finding of this system-wide analysis is that projected total residential units face a substantial increase in the risk of impacts from flooding when compared to existing residential units. At 24" TWL, approximately 3,990 existing housing units could be impacted by flooding across the region, and an additional 19,163 new residential units (growth) could also be impacted by flooding, increasing the risk to residential units by 376 percent at 24" TWL.

ART Bay Area flood mapping analysis extends to 108" TWL. At this water level an estimated 50,461 existing residential units could be impacted from flooding. Projected growth in housing units could put 2.8 times more residential units, or a total of 141,339 new residential units, in areas at risk of impacts from flooding into the future.

The overarching trend of this system-wide analysis demonstrates that residential unit growth projections may be causing significantly increased risk to housing units unless adaptation actions are taken and/or residential unit growth is distributed to areas around the region that are not areas subject to sea level rise risk. Individual PDAs with the highest consequences are discussed in the next section (shown in Figures 2-87, 2-88 and 2-89), and depicted spatially in maps of consequence (Figures 2-90 and 2-91).

The Naval Air Station PDA in Alameda is planned for future housing and jobs. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.

RESIDENTIAL HOUSING UNITS IN PDAs IMPACTED BY FLOODING REGION-WIDE

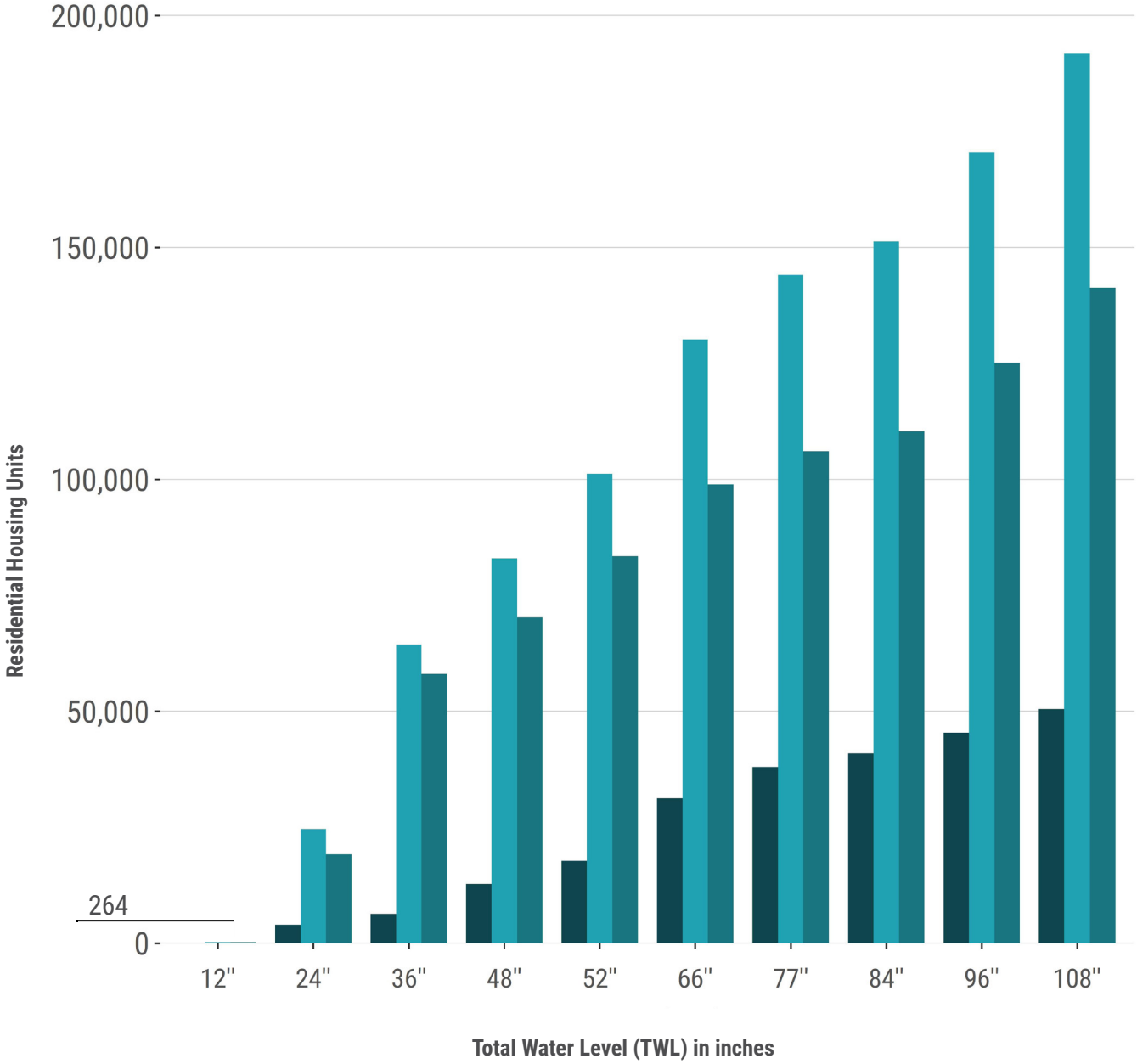


Figure 2-86. Regional impacts to residential housing units from flooding at ten TWLs as measured by three indicators: existing housing units (2010), projected totals (2040), and growth (change in 2010 - 2040). Results are aggregated across the nine-county region.

Early Impacts • Early impacts to existing residential units from flooding in PDAs occurs in select areas around the region. Contrary to where the majority of PDAs exist, the earliest impacts to existing residential units are not concentrated in San Francisco or Oakland. Instead, the earliest and highest consequences occur in the cities of San Jose, Suisun City, Oakland, Alameda and Pittsburg (Figure 2-87), and depicted spatially in maps of consequence in Figure 2-90. The PDA with the earliest and highest consequences of impacts to existing residential units is the North San Jose PDA in San Jose, which also has the highest consequences to existing residential units across all total water levels than any other PDA in the region.

Starting at 24" TWL, the North San Jose PDA has over 1,837 existing residential units potentially impacted by flooding and this number increases significantly as total water levels rise. It is important to note that there are active adaptation projects occurring in this region through the South Bay Salt Ponds Restorations Project, which was not taken into account in this static data-driven analysis and may reduce the number of units exposed. Other areas in the region with the earliest and highest impacts to existing residential units at 24" TWL include the Downtown and Waterfront PDA in Suisun City in the North Bay with over 709 existing residential units potentially impacted, followed by the Downtown Jack London Square PDA in Oakland and Naval Air Station in Alameda in the East Bay with 437 existing residential units impacted, and the Downtown Pittsburg PDA in Pittsburg in the North Bay with 136 existing residential units potentially impacted. These numbers increase as total water levels rise.

Early impacts to PDAs as measured by projected total residential units occur in San Rafael, San Jose, Oakland, Alameda, and Richmond (Figure 2-88), and depicted spatially in maps of consequence in Figure 2-90. In the Downtown PDA in San Rafael, 264 projected total residential units could be impacted beginning at 12" TWL. By 24" TWL, impacts to projected total residential units and residential unit growth are driven by the North San Jose PDA, where 8,409 projected total residential units could be impacted, which includes an additional 6,572 new units from growth alone. The next highest impacts to projected total residential units occur in the Downtown and Jack London Square PDAs in Oakland, Naval Air Station PDA in Alameda, and South Richmond PDA in Richmond. Potential impacts to projected total residential units increases significantly as total water levels rise and includes many additional PDAs.

In all of the PDAs listed above, the greatest and earliest impacts to projected total residential units correspond to areas with the greatest growth of new residential units (Figure 2-89), depicted spatially in maps of consequence in Figure 2-91. This reiterates the finding in the systems-wide analysis indicating that projected totals for residential units and growth in these areas may be significantly increasing risk to residential units because new growth may occur in areas subject to potential future flooding.

HIGHEST IMPACTS TO **EXISTING RESIDENTIAL UNITS (2010)** BY FLOODING BY PDA

Figure 2-87. PDAs with highest impacts to existing residential housing units by flooding at ten TWLs as measured by impacts to 2010 residential unit parcel data. "Highest" impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

HIGHEST IMPACTS TO **PROJECTED TOTAL RESIDENTIAL UNITS (2040)** BY FLOODING BY PDA

Figure 2-88. PDAs with highest impacts to project total residential housing units by flooding at ten TWLs as measured by impacts to 2040 residential unit projections data. “Highest” impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

HIGHEST IMPACTS TO **NEW GROWTH IN RESIDENTIAL UNITS (2010 - 2040)** BY FLOODING BY PDA

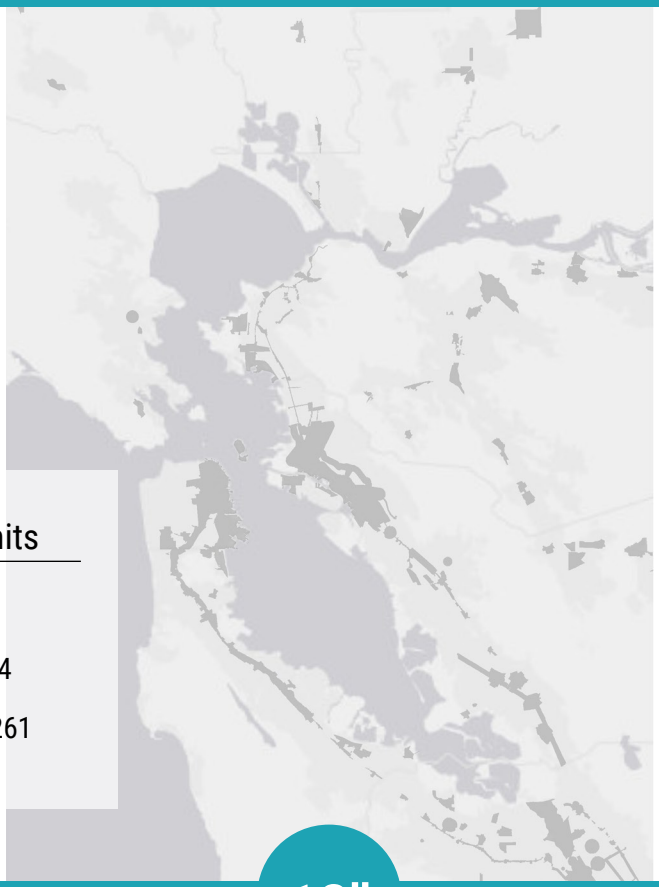
Figure 2-89. PDAs with highest impacts to residential housing unit growth by flooding at ten TWLs as measured by impacts to new housing units between 2010 and 2040 projections. "Highest" impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

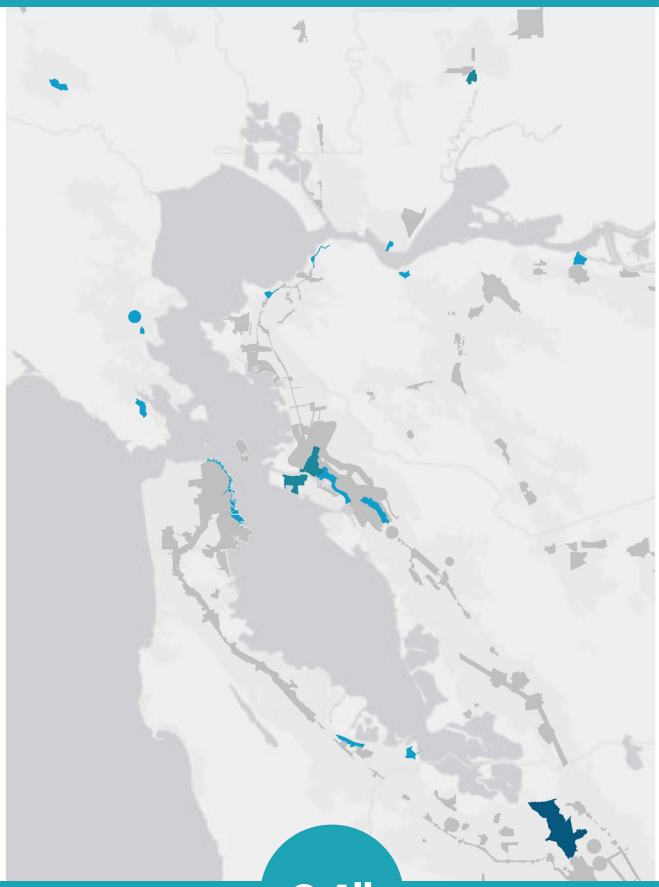
CONSEQUENCES OF FLOODING

Priority Development Areas (PDAs)

Residential Housing Units

Existing Residential Units (2010) Impacted by Flooding





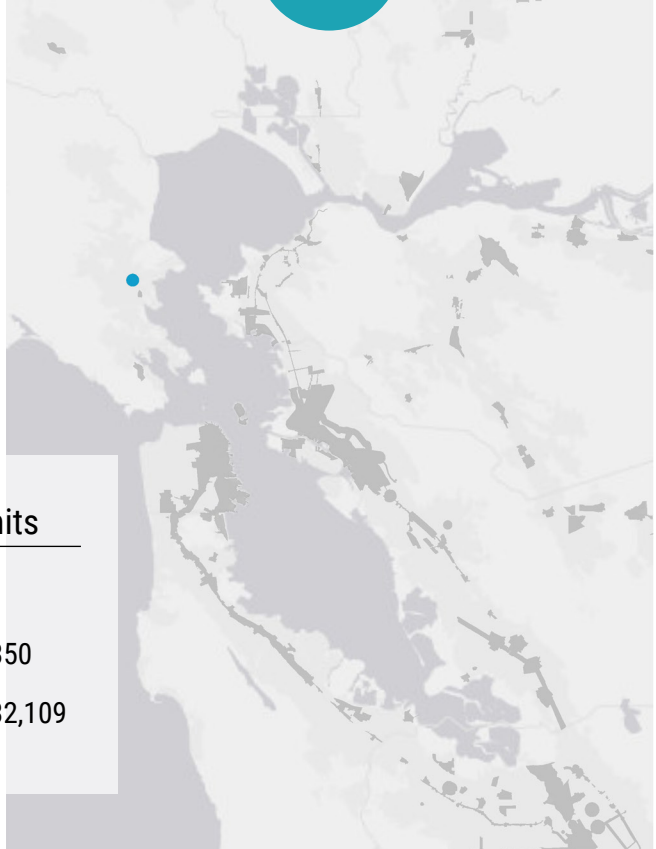
Residential Units

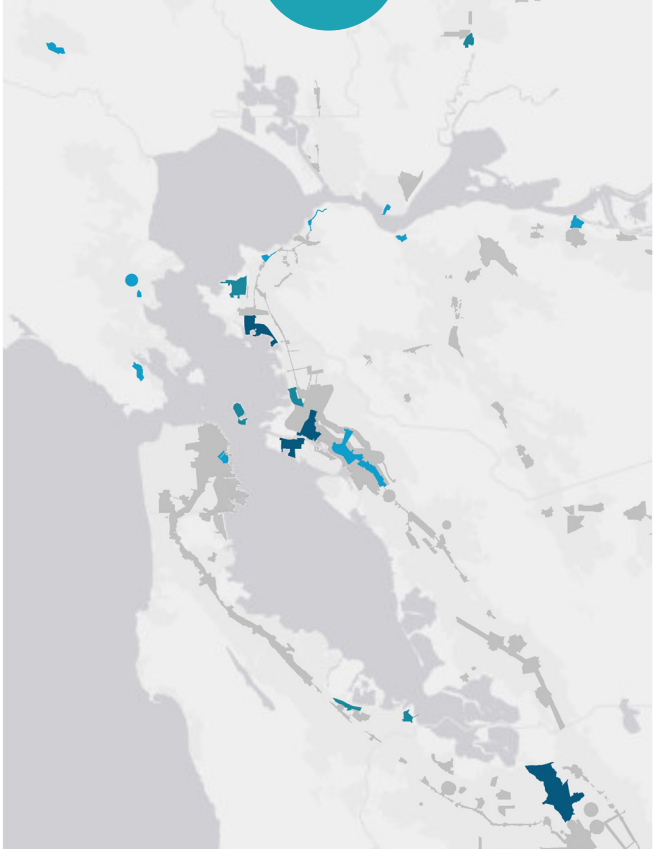
- 1 to 162
- 162 to 714
- 714 to 8,261

12"

24"

Projected Total Residential Units (2040) Impacted by Flooding

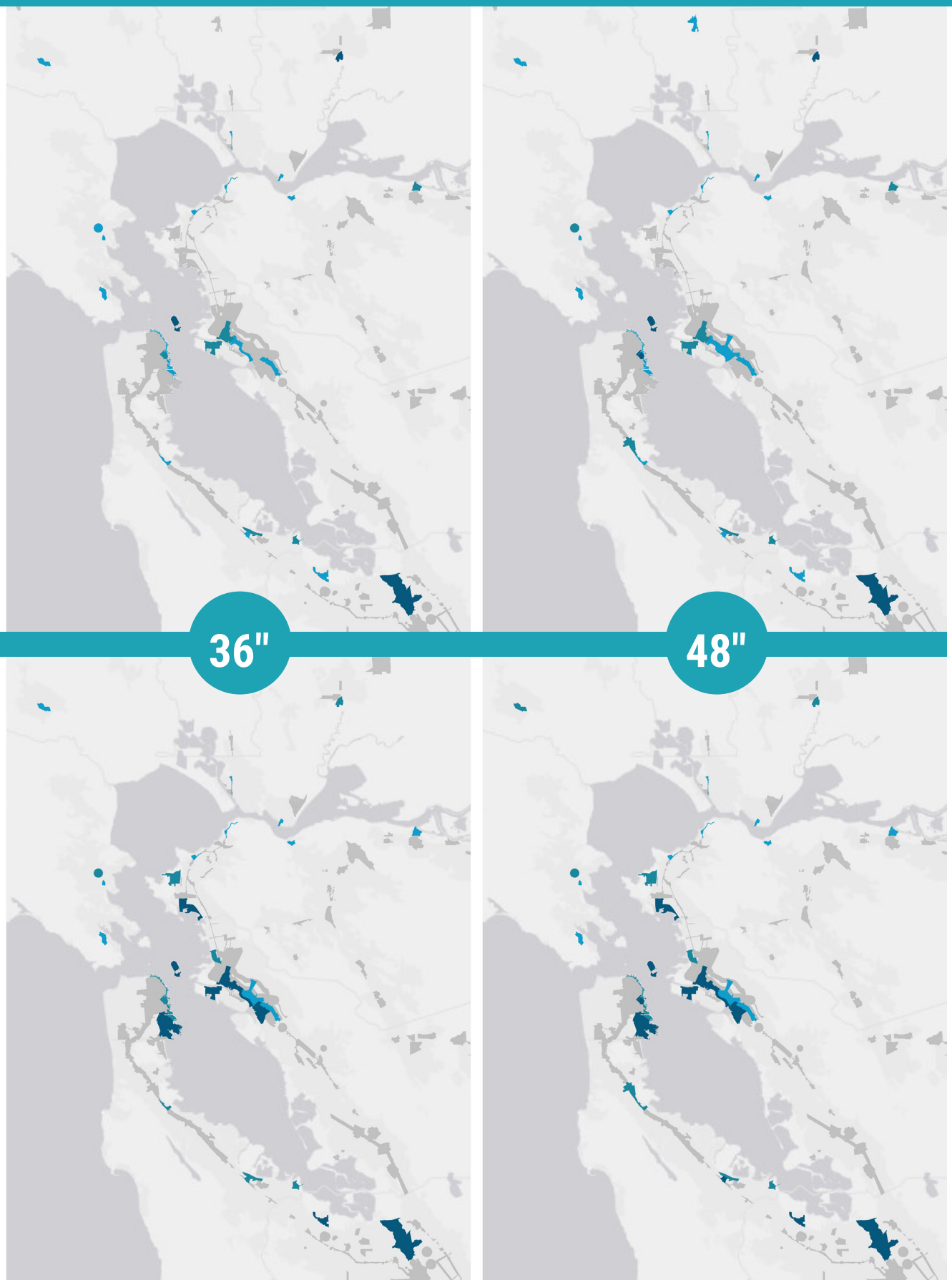




Residential Units

- 1 to 440
- 440 to 2,350
- 2,350 to 32,109

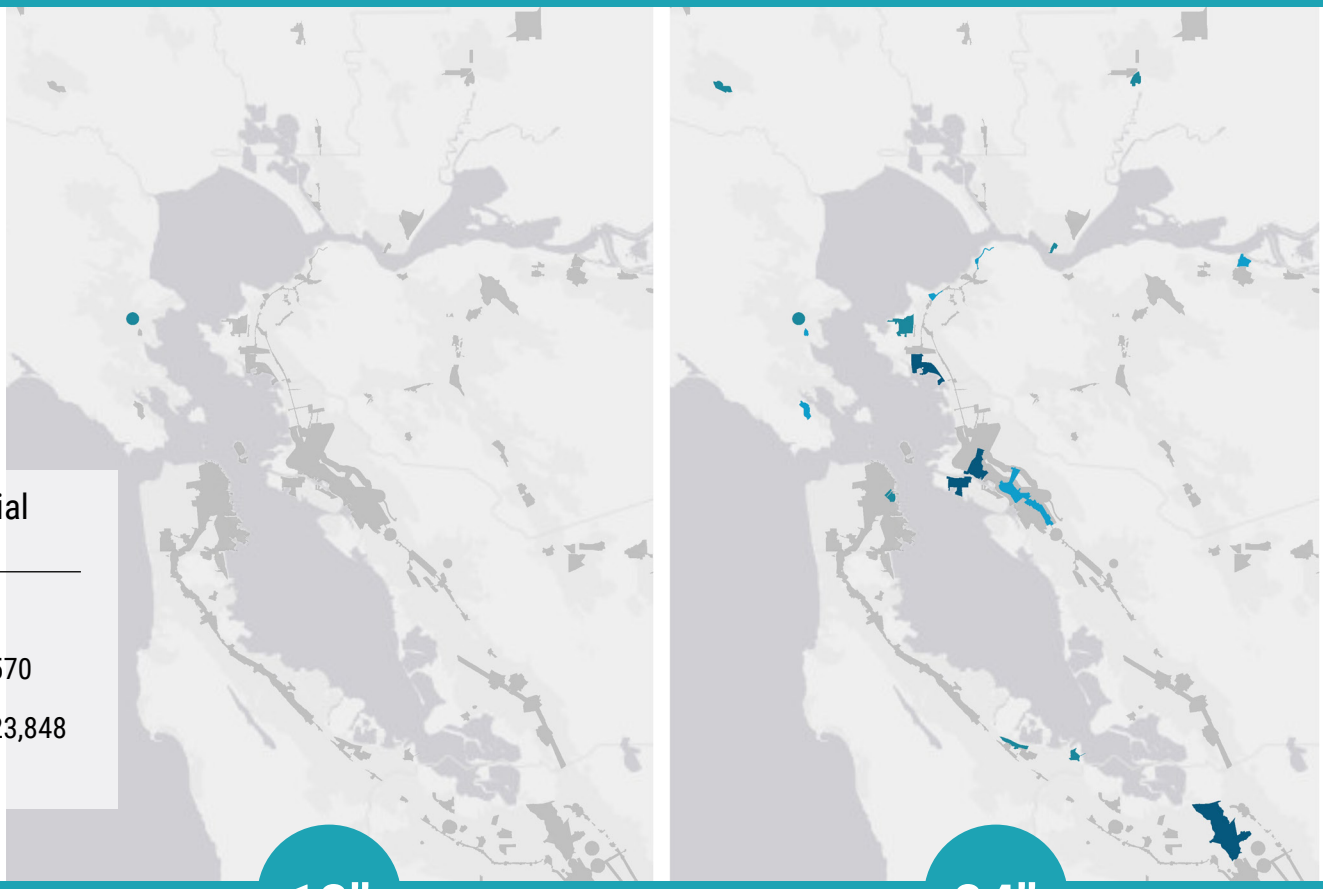
Figure 2-90. Maps depicting the consequences of flooding for two residential unit indicators: *Existing housing (2010)* and *Projected total housing units (2040)* at 12", 24" 36" and 48" TWL. PDAs with any portion exposed to flooding are considered impacted. Maps below show entirety of impacted PDAs, not extent of exposure.



Priority Development Areas (PDAs)

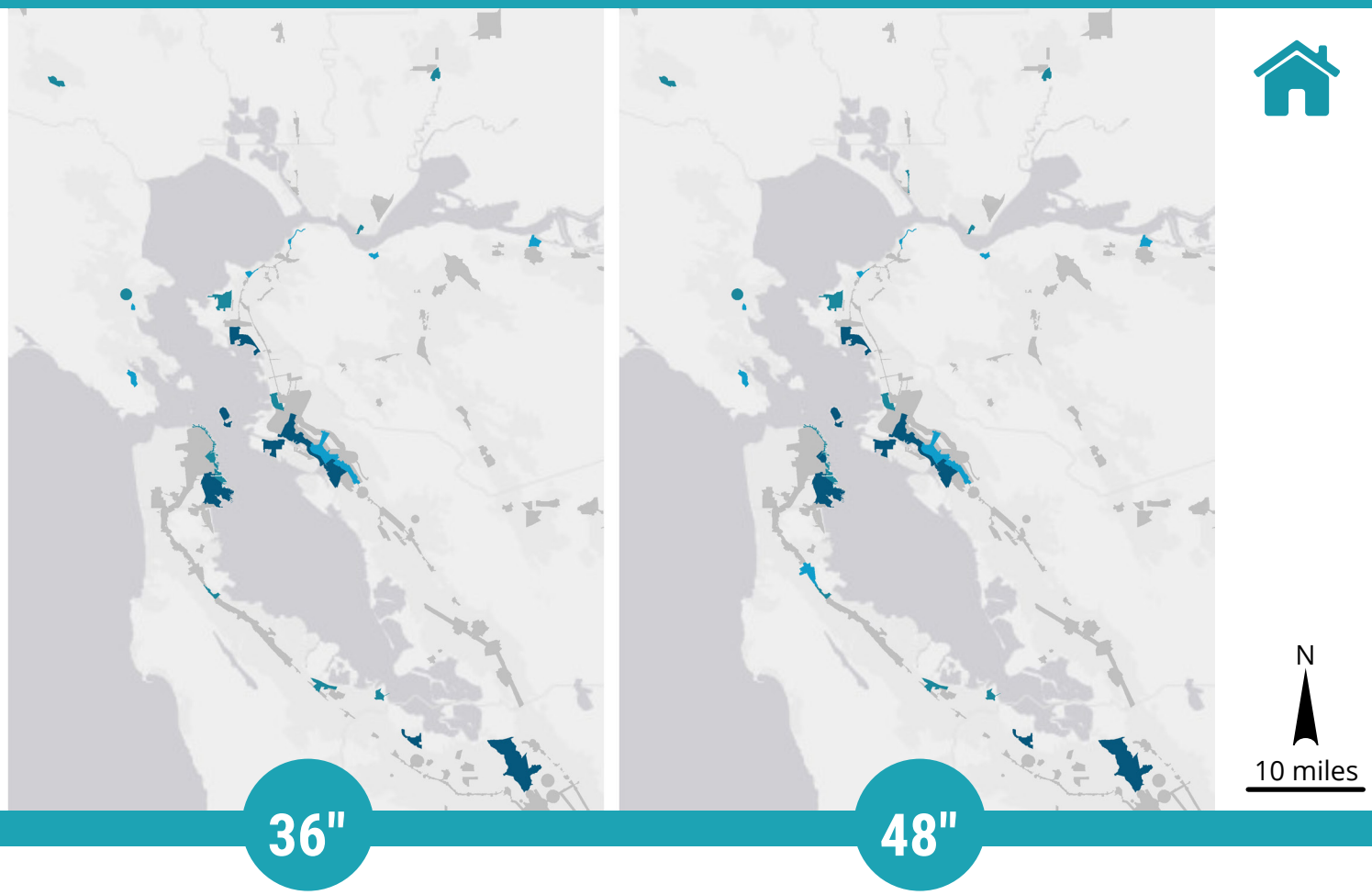
Residential Housing Units

Housing Unit Growth Impacted by Flooding



Worsening Impacts • As total water levels rise, worsening impacts to PDAs with existing, projected total, and growth in residential units becomes increasingly concentrated in San Jose, San Francisco, and Oakland. The North San Jose PDA has significantly more impacts to existing, projected total, and residential unit growth than any other PDA in the region, with over 8,261 existing residential units potentially at risk by 108" TWL and growth placing an additional 23,848 new residential units in areas possibly exposed to future flood risk. The next highest impacts to existing residential units are concentrated in San Francisco in the Eastern Neighborhoods PDA, Downtown-Van Ness-Geary PDA, and Mission Bay PDA, with over 15,060 existing residential units impacted throughout those three PDAs. The West Oakland PDA also has among the highest impacts from flooding in the region to existing residential units over the long-term.

Figure 2-91. Maps depicting the consequences of flooding for one residential unit indicator: *Housing growth (2010 - 2040)* at 12", 24" 36" and 48" TWL. PDAs with any portion exposed to flooding are considered impacted. Maps below show entirety of impacted PDAs, not extent of exposure.



Following the North San Jose PDA, which has the largest number of projected total residential units impacted, the next highest impacts to projected total residential units over the long term occur in the Bayview/Hunters Point PDA and Eastern Neighborhoods PDA in San Francisco, and West Oakland PDA and Transit Oriented Development Corridors – San Antonio PDA in Oakland. There are also significant impacts from flooding over the long term for residential unit growth in the North Bayshore PDA in Mountainview located in the South Bay.

Regional Thresholds and Changes in Consequence • For both existing and projected total residential units in PDAs, a significant jump in impacts occurs from 52" to 66" TWL. For existing residential housing units, this means an increase of over 13,498 existing residential units between 52" and 66" TWL. For projected total residential units, this increase equals impacts to 29,939 additional residential units between 52" and 66" TWL.

Job Spaces for 2010, 2040 and Growth

REGIONAL CONSEQUENCE

There are a significant number of existing and projected job spaces that could be at risk of impacts from flooding as total water levels rise (Figure 2-92). Existing and projected total job spaces in the region are at risk of impacts starting at 12" TWL, with 2,012 existing job spaces impacted at 12" TWL. By 24" TWL this increases significantly to 30,373 existing job spaces impacted, while job spaces growth could put an additional 35,822 new job spaces at risk of flooding. Similar to residential units, projected total job spaces would increase the risk of flooding impacts to job spaces starting at 12" TWL with impacts increasing as water levels rise. However, compared to residential units, there are significantly more job spaces at risk of impact to flooding across the region.

By 108" TWL, over 410,746 existing job spaces could be impacted by flooding. Job spaces growth could put over 142,133 new job spaces at risk, for a projected total of over 550,000 job spaces potentially impacted by sea level rise or storm events.

Projected job spaces growth could put a significant number of job spaces in areas at risk of impacts from flooding, unless adaptation actions are taken to protect existing and new development. Individual PDAs with the highest consequences are discussed in the next section (shown in Figures 2-93, 2-94 and 2-95), and depicted spatially in maps of consequence (Figures 2-96 and 2-97).

San Francisco is among the highest places in the region with impacts to job spaces over the long-term. Photo by Clesi Bennett.

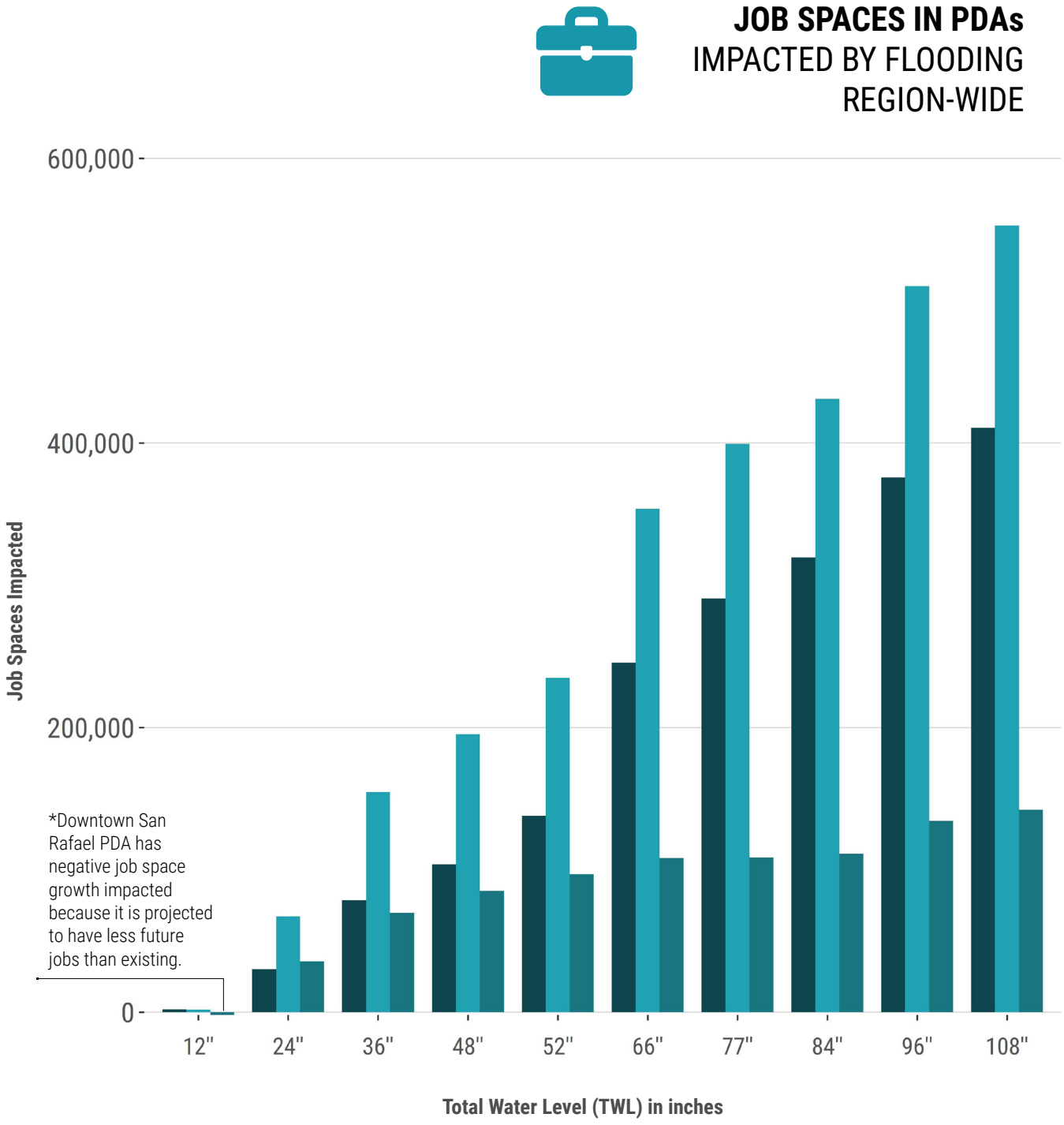


Figure 2-92. Regional impacts to job spaces from flooding at ten TWLs as measured by three indicators: existing job spaces (2010), projected totals (2040), and growth (change in 2010 - 2040). Results are aggregated across the nine-county region.

Early Impacts • Early impacts to existing job spaces from flooding in PDAs occur throughout the region, but significant consequences occur in San Rafael, San Jose, Redwood City, Richmond, and Alameda (Figure 2-93), and depicted spatially in maps of consequence in Figure 2-96. Existing job spaces in the Downtown PDA in San Rafael are impacted earliest, beginning at 12" TWL, with 2,011 existing job spaces potentially at risk.

By 24" TWL, the greatest number of existing job spaces at risk of being impacted by flooding occurs in the North San Jose PDA with over 13,643 existing job spaces at risk, followed by the Broadway/Veterans Boulevard PDA in Redwood City, South Richmond PDA in Richmond and Naval Air Station in Alameda. Potential impacts to existing job spaces increase as total water levels rise.

For projected total job spaces, early impacts from flooding occur in many of the same areas as existing job spaces (Figure 2-94), and depicted spatially in maps of consequence in Figure 2-96. At 12" TWL, the Downtown PDA in San Rafael remains the most impacted for projected total job spaces, followed by the Sonoma Boulevard PDA in Vallejo. Beginning at 24" TWL, impacts to projected total job spaces increases significantly. Approximately 29,987 projected total job spaces in the North San Jose PDA could be exposed to flooding impacts at 24" TWL, of which over job spaces 16,000 are new.

The North San Jose PDA has the highest impacts to job spaces growth in the region starting at 24" TWL (Figure 2-95 and depicted spatially in maps of consequence in Figure 2-97). Other areas that have the highest impacts to both projected future job spaces and job spaces growth include the South Richmond PDA in Richmond and Downtown Jack London Square PDA in Oakland. The next highest impacts to job spaces growth occur in the Broadway/Veterans Boulevard PDA in Redwood City and Downtown and Waterfront PDA in Suisun City.

Worsening Impacts • As total water levels rise, the highest consequences to existing job spaces in PDAs become concentrated in San Francisco and San Jose. The Downtown-Van Ness-Geary PDA has the highest impacts to existing and projected total job spaces in the region, with 88,252 projected total job spaces potentially impacted by flooding at 108" TWL. The next highest impacts to existing and projected total job spaces occur in the Transit Center PDA in San Francisco, with 53,912 existing job spaces potentially exposed at 108" TWL and 15,399 new job spaces potentially impacted over time—one of the highest impacts to job spaces growth in the region.

The North San Jose PDA also has worsening impacts to both existing and projected total job spaces and highest impacts to job spaces growth. The North San Jose PDA has 29,858 existing job spaces potentially impacted, and an additional 31,905 job spaces at risk of impacts from flooding by 108" TWL.

HIGHEST IMPACTS TO **EXISTING JOB SPACES (2010)** BY FLOODING BY PDA

Figure 2-93. PDAs with highest impacts to existing job spaces by flooding at ten TWLs as measured by impacts to 2010 parcel data. "Highest" impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

HIGHEST IMPACTS TO **PROJECTED TOTAL JOB SPACES (2040)** BY FLOODING BY PDA

Figure 2-94. PDAs with highest impacts to project total job spaces by flooding at ten TWLs as measured by impacts to 2040 job space projections data. “Highest” impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

HIGHEST IMPACTS TO **NEW GROWTH IN JOB SPACES (2010 - 2040)** BY FLOODING BY PDA

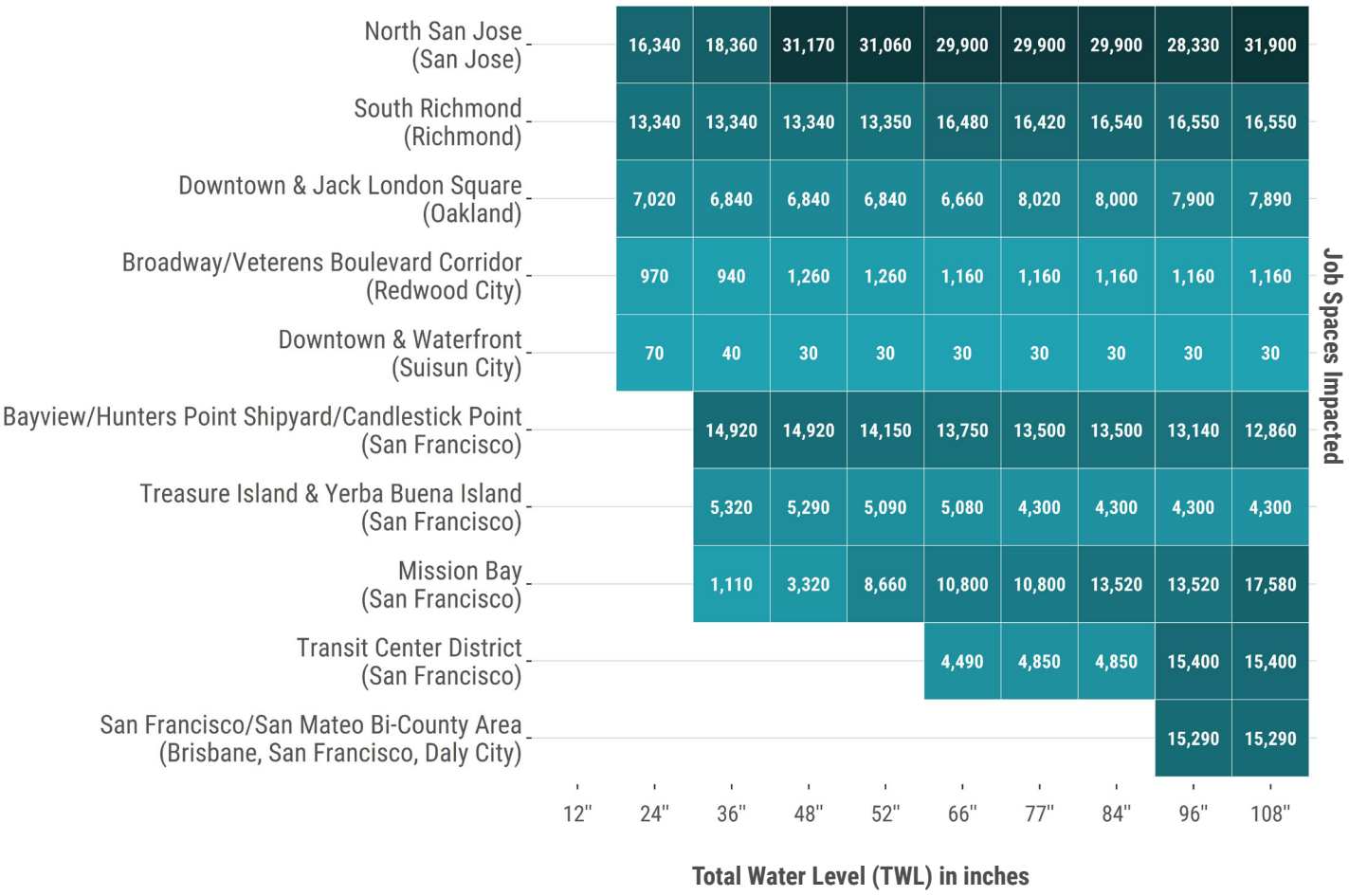


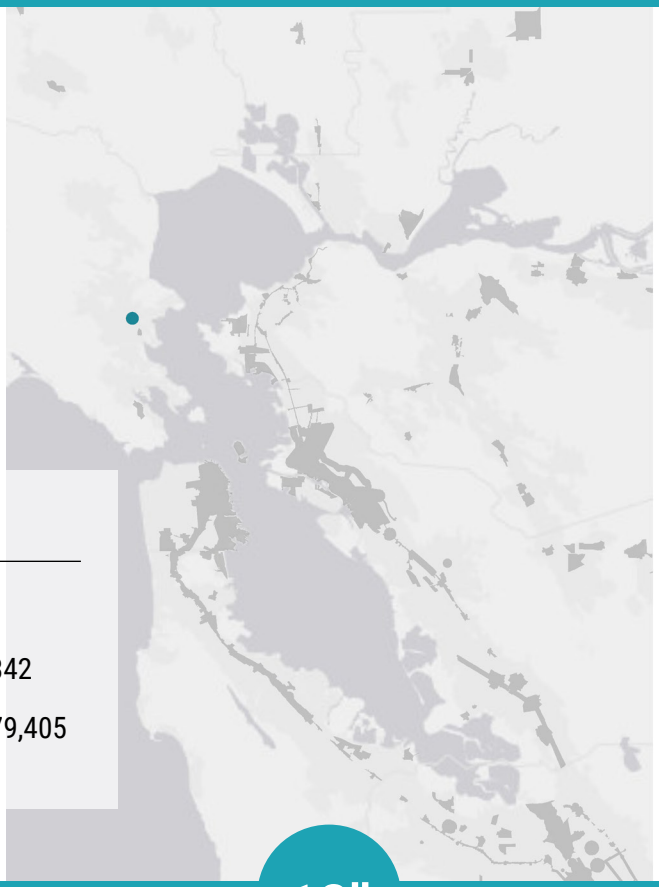
Figure 2-95. PDAs with highest impacts to new job spaces growth by flooding at ten TWLs as measured by impacts to new job spaces between 2010 and 2040 projections. "Highest" impacts refer to PDAs ranking in the top five for highest consequences at one or more TWL. Darker colors reflect greater consequences.

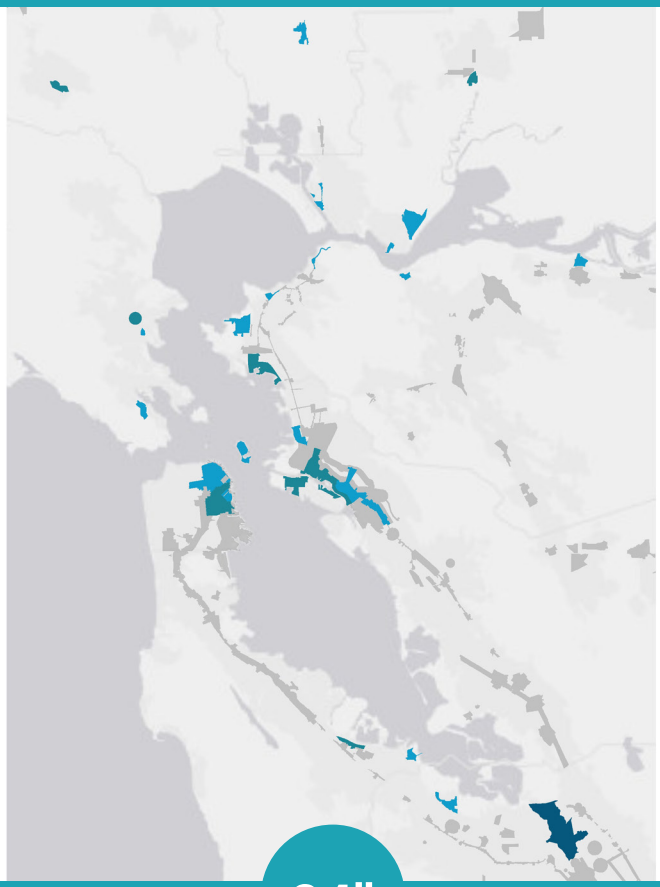
CONSEQUENCES OF FLOODING

Priority Development Areas (PDAs)

Job Spaces

Existing Job Spaces (2010) Impacted by Flooding





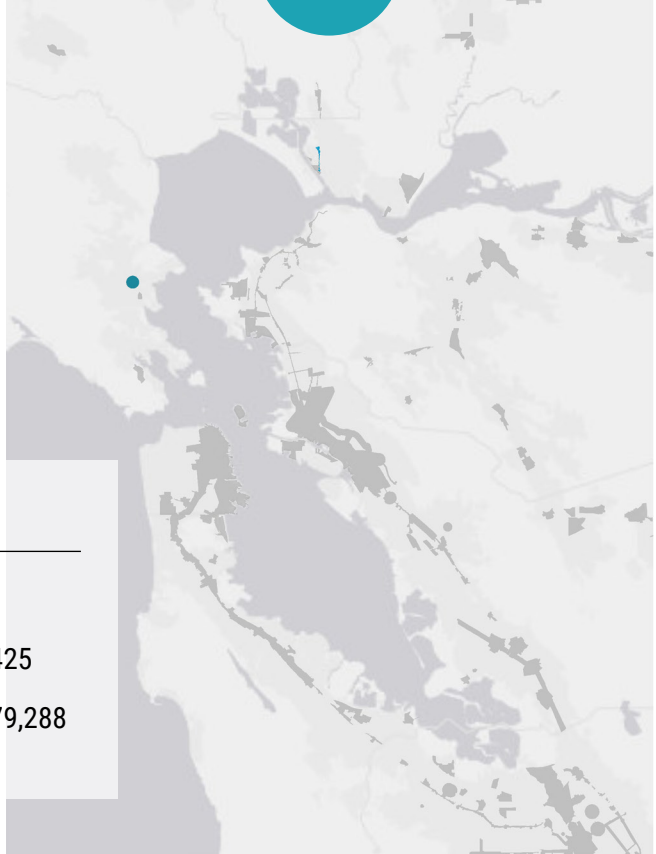
Job Spaces

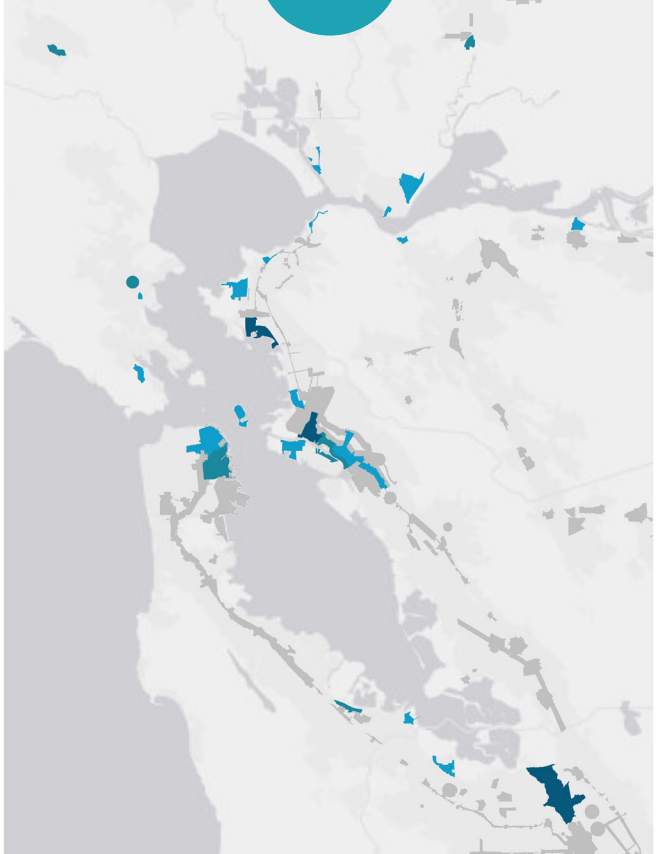
- 1 to 539
- 539 to 5,342
- 5,342 to 79,405

12"

24"

Projected Total Job Spaces (2040) Impacted by Flooding

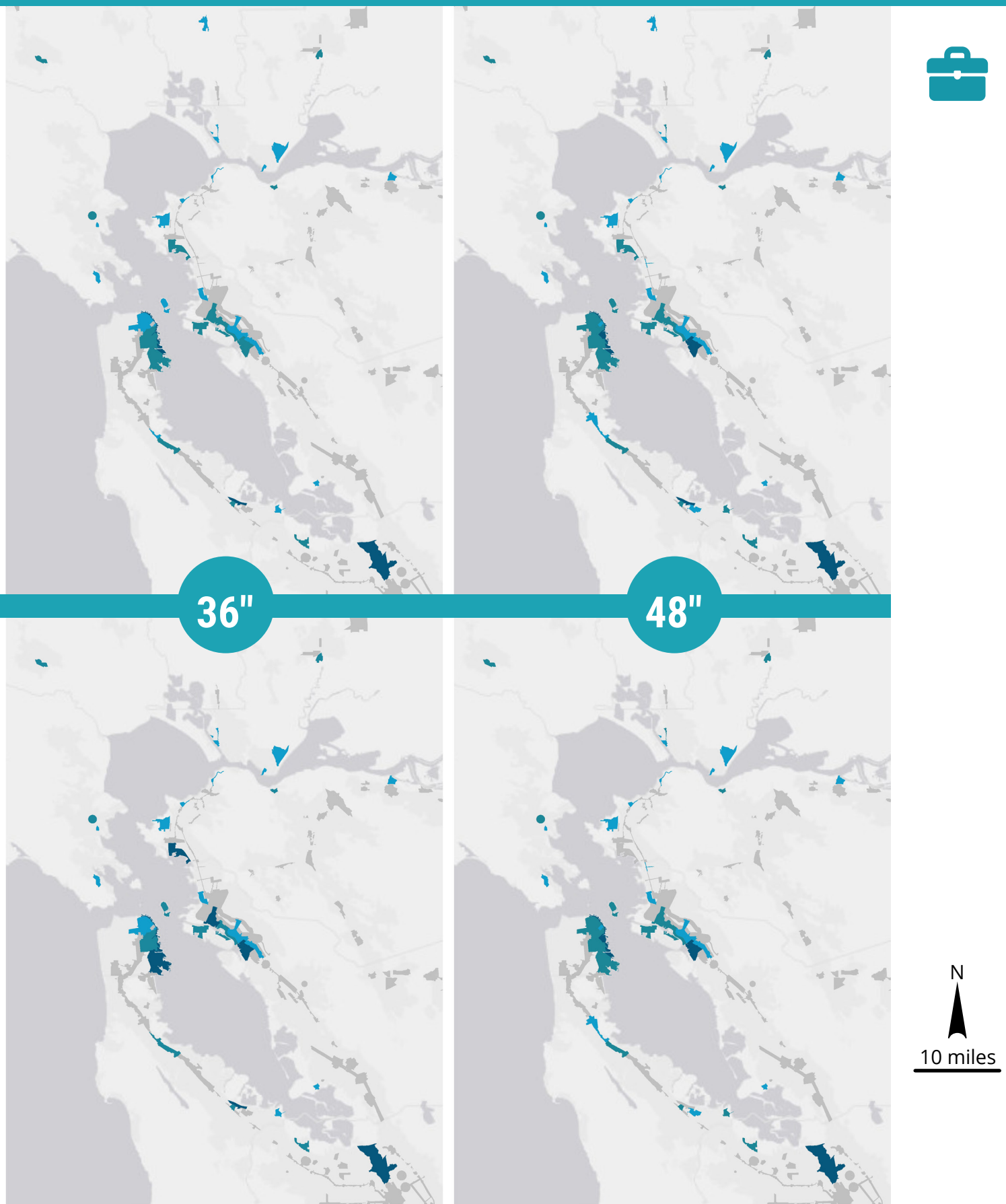




Job Spaces

- 1 to 539
- 539 to 6,425
- 6,425 to 79,288

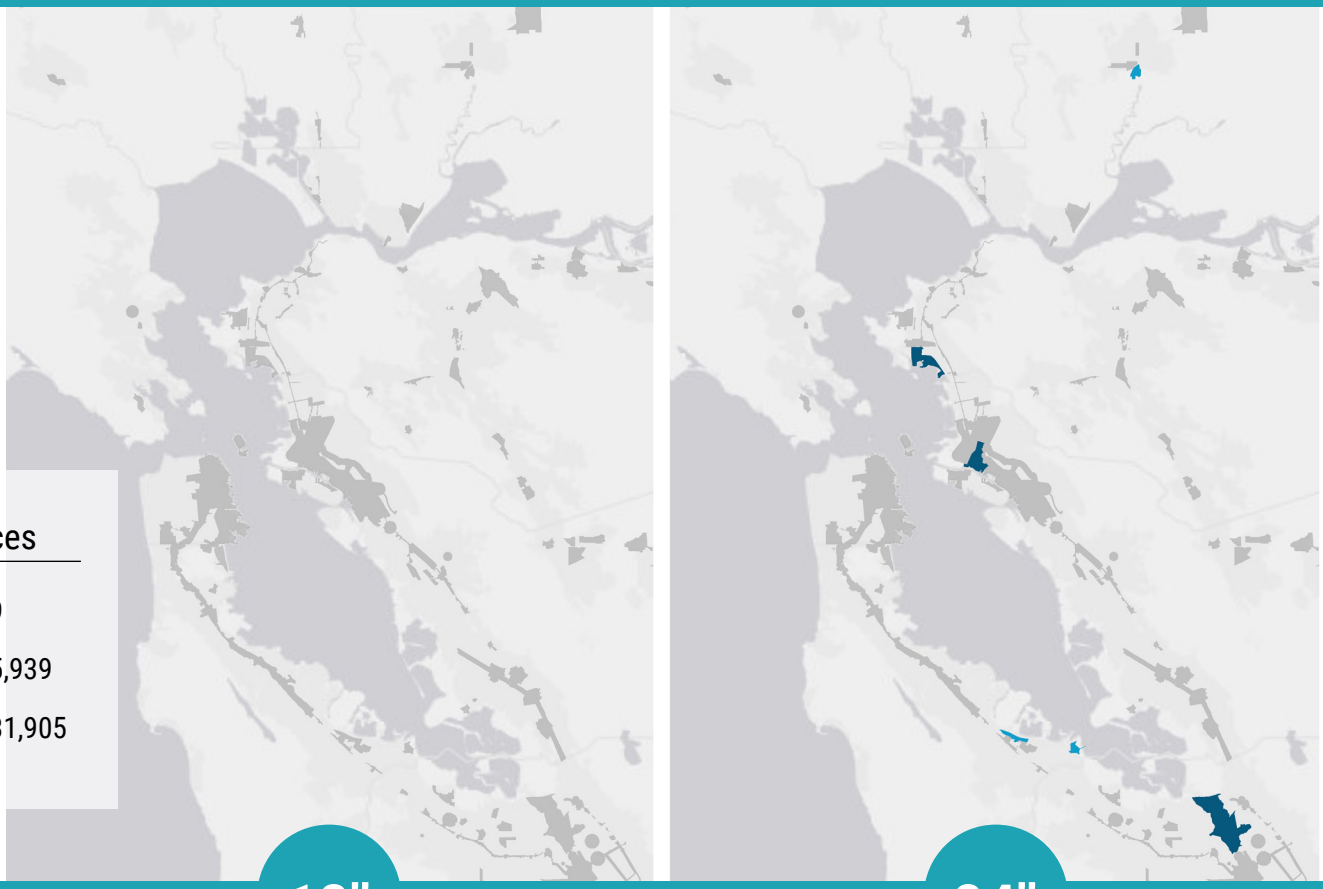
Figure 2-96. Maps depicting the consequences of flooding for two job spaces indicators: *Existing job spaces (2010)* and *Projected total job spaces (2040)* at 12", 24" 36" and 48" TWL. PDAs with any portion exposed to flooding are considered impacted. Maps below show entirety of impacted PDAs, not extent of exposure.



Priority Development Areas (PDAs)

Job Spaces

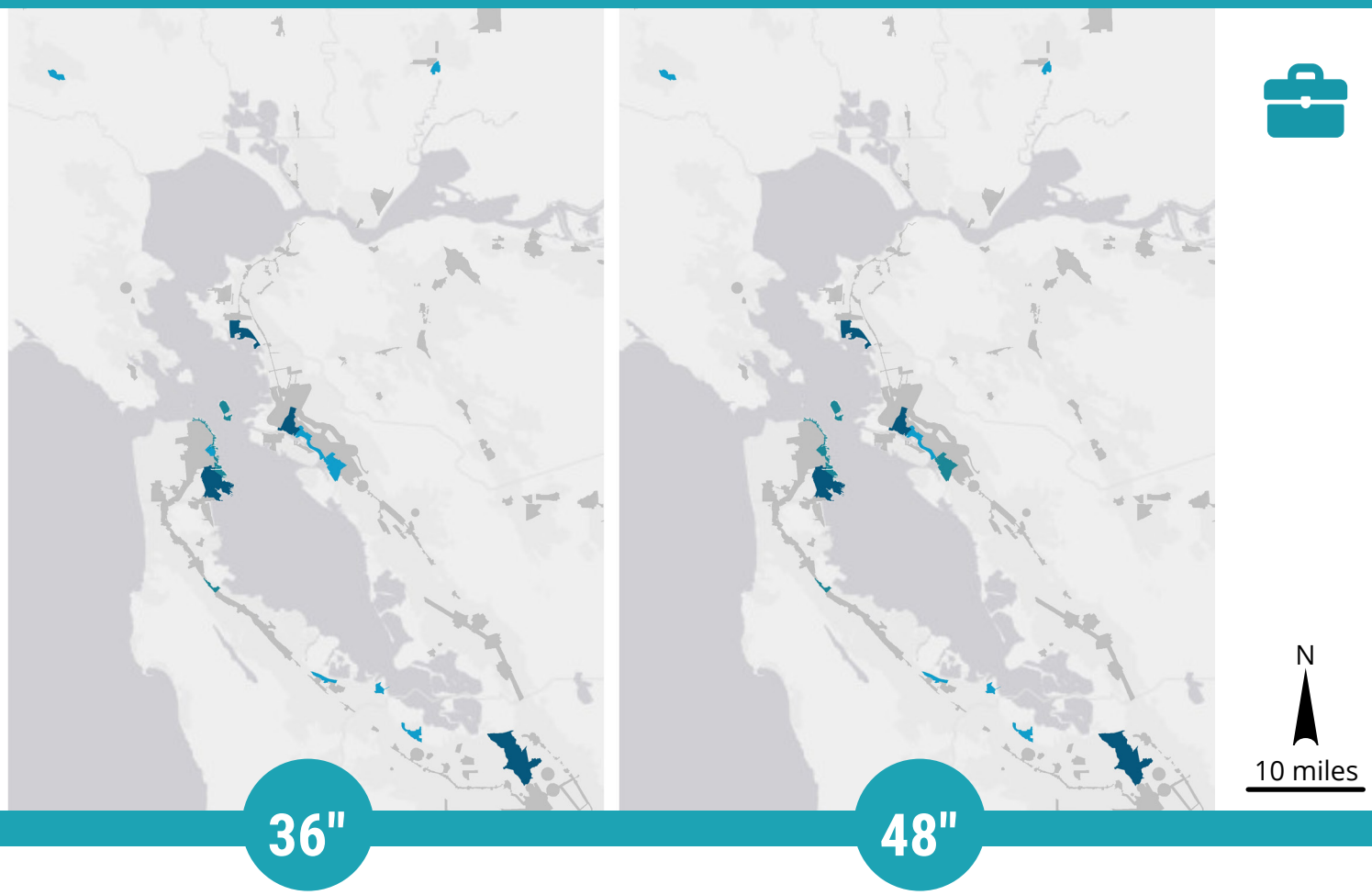
Job Space Growth Impacted by Flooding



The highest consequences to existing job spaces over the long term occur in the Downtown-Van Ness-Geary PDA and Transit Center District PDA in San Francisco, North San Jose PDA in San Jose, and Eastern neighborhoods PDA and Port of SF PDA in San Francisco.

The highest impacts to projected total job spaces after the Downtown-Van Ness-Geary PDA, Transit Center PDA, and North San Jose PDA occur in the Bayview/Hunters Point PDA, which has over 30,907 projected total job spaces potentially impacted by flooding at 108" TWL, followed by the Mission Bay PDA in San Francisco. The highest impacts to job space growth occur in the North San Jose PDA in San Jose, followed by Mission Bay PDA in San Francisco, South Richmond PDA in Richmond, Transit Center PDA in San Francisco, and the San Francisco/San Mateo Bi-County Area PDA in San Francisco and Brisbane.

Figure 2-97. Maps depicting the consequences of flooding for one job space indicator: *New job growth (2010 - 2040)* at 12", 24" 36" and 48" TWL. PDAs with any portion exposed to flooding are considered impacted. Maps below show entirety of impacted PDAs, not extent of exposure.



Regional Thresholds and Changes in Consequence • For both existing and projected total job spaces, a significant jump in impacts occurs between 52" and 66" TWL. This change in water level creates an increase of 107,594 existing and projected total job spaces that could become exposed to flood risk.

For job spaces growth, significant jumps in impacts exposure occur early, between 24" and 36" TWL, driven by impacts to job spaces growth in the North San Jose PDA. Another significant change in impacts to job spaces growth occurs at higher water levels between 84" and 94" TWL. This is driven by increasing impacts to job spaces growth in the Downtown Van-Ness Geary PDA and Transit Center PDA in San Francisco and the San Mateo Bi-County PDA in San Mateo County.

SHORT CASE STUDY

LINKING REGIONAL CONSEQUENCE RESULTS TO LOCAL ASSESSMENTS

The North San Jose PDA is the largest PDA in the region by area. It has the highest consequences of impacts to existing, projected total, and growth for residential units and among the highest impacts to existing and projected total job spaces and job spaces growth from flooding.

The North San Jose PDA may first become exposed to flooding at 24" TWL, and impacts increase significantly as total water levels rise. The magnitude of consequences in the North San Jose PDA across all water levels is significantly greater for residential units and job spaces than any other existing PDA in the region. In addition to being identified in the quantitative regional assessment as a key PDA for high impacts, a qualitative local vulnerability assessment was also conducted. This assessment can be found in Chapter 3.0 in the Santa Clara Valley Local Assessment.

The North San Jose PDA is critical in the region due to its proximity to other regionally significant assets, including the large Baylands Priority Conservation Area (PCA), the socially and physically vulnerable community of Alviso, and major transportation corridors such as US-101, I-880, SR- 237, and SR- 87. However, flooding would have to fully inundate the Baylands PCA, the Alviso Community, and cross highways before reaching the North San Jose PDA, highlighting how interconnected these systems are when it comes to vulnerability from flooding. It is important to note that there are active adaptation projects occurring in this region through the South Bay Salt Ponds Restorations Project, which may change the risk profile of this area.

This area is planning for significant growth for both residential units and job spaces. Already, many large technology companies such as Microsoft and Google have purchased properties to expand their campuses. Many areas at risk of flooding are zoned for industrial parks or campus industrial land uses. Due to the shared vulnerability to flooding of many assets, this area is highly suitable for collaborative multi-benefit solutions that can protect the North San Jose PDA as well as the Baylands PCA, Alviso Community, transportation infrastructure and other uses in this area against flooding.

In addition to the regional assessment, ART Bay Areas assessed individual assets in each of the four region systems and the results are communicated in local assessments of shared vulnerabilities and consequences. *These can be found in Chapter 3.0 Local Assessments of the ART Bay Area report, with local assessments available for individual download.*

The magnitude of consequences in the North San Jose PDA across all water levels is significantly greater for residential units and job spaces than any other existing PDA in the region.

Top photo: View of building and streets in downtown San Jose. Photo by Anthony Goto licensed under CC BY 2.0.Bottom photo: View of the North San Jose PDA near the Guadalupe River where there are existing homes and business. Map data ©2019 by Google Earth Pro.

CONSEQUENCES IN PDA-ELIGIBLE AREAS COMPARED TO THE EXISTING PDA SYSTEM

This section provides details on the overall trends of regional exposure and consequence for existing PDAs (as of *Plan Bay Area 2040,* which were designated in 2017) compared to PDA-eligible areas that could become PDAs in the future.

Residential Housing Units for 2010, 2040 and Growth

The PDA-eligible area is roughly 1.8 times larger than the total area of the current PDA network. Due to this, every total water level has more existing residential units potentially exposed in PDA-eligible areas than in existing PDAs (Figure 2-98). At 12" TWL, there are no existing residential units at risk in the current PDA network, however, 4,349 existing residential units may be at risk in PDA-eligible areas. By 24" TWL, existing residential households are exposed in both PDAs and PDA-eligible areas. For both current PDAs and PDA-eligible areas, the number of existing residential units potentially at risk of flooding increases as total water levels rise. By 108" TWL, 69,547 existing residential units may be at risk of flooding in PDA-eligible areas, which corresponds to over 19,115 more residential units than in the current PDA network. Overall, across all total water levels, the values of existing residential units impacted by flooding is higher in PDA-eligible areas than the current PDA network by a relatively similar proportion over time.

Considerably more residential units become exposed to risk if 2040 growth projections proceed as planned in the current PDA network than in PDA-eligible areas.

A significant finding of this analysis illustrates that while more existing residential units are impacted in PDA-eligible areas, considerably more residential units become exposed to risk if 2040 growth projections proceed as planned in the current PDA network. There is 1.8 times more residential unit growth planned in the current PDA network compared to PDA-eligible areas. In PDA-eligible areas, projected growth could increase the risk of flooding by an additional 1,771 residential units at 12" TWL, while an additional 264 new residential units may be at risk in the current PDA network. By 108" TWL, residential unit growth in PDA-eligible areas could put an additional 6,422 residential units at risk of flooding, or 40 percent of all projected residential unit growth. In the current PDA network, residential unit growth could put an additional 141,335 residential units at risk of impacts from flooding, or 61 percent of all residential unit growth by 108" TWL.

Existing residential units may become impacted by flooding in PDA-eligible areas starting at 12" TWL, while projected residential units in both current PDAs and PDA-eligible areas are at risk of flooding starting at 12" TWL. These impacts only increase as water levels rise. PDA-eligible areas are designated for less projected residential unit growth in total, and less of that projected residential unit growth is at risk of flooding. Impacts to projected residential unit growth are most significant in the existing PDA program, where over half of all new residential units may be at risk of flooding in the long-term in the absence of adaptation.

RESIDENTIAL HOUSING UNITS IN PDAs VS. IN PDA-ELIGIBLE AREAS IMPACTED BY FLOODING REGION-WIDE

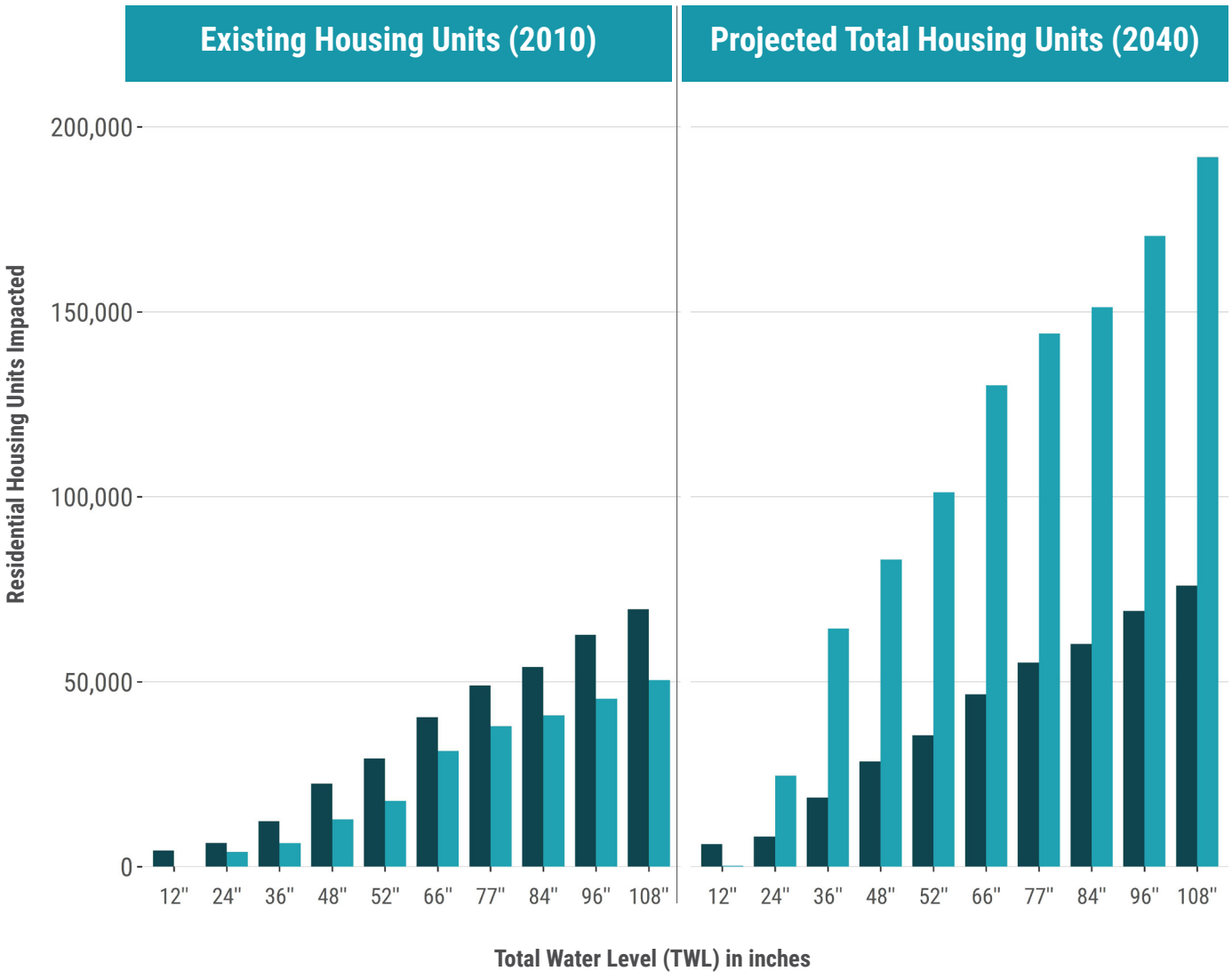


Figure 2-98. Regional impacts to residential housing units from flooding at ten TWLs in PDAs and in PDA-Eligible Areas as measured by two indicators: existing housing units (2010) and projected totals (2040). Results are aggregated across the nine-county region.

Job Spaces for 2010, 2040 and Growth

A different story unfolds for exposure and consequence of existing and projected total job spaces within existing PDAs and PDA-eligible areas. At 12" through 52" TWL there are more existing job spaces at risk of flooding within the eligible PDA areas than the current PDA network. This flips at 66" TWL and higher water levels, when more job spaces in the current PDA network become exposed than in eligible PDA areas. (Figure 2-99). At early total water levels, the values of existing job spaces at risk of flooding are quite similar across the current and PDA-eligible areas. However, the values diverge as total water levels rise and more existing job spaces are impacted in the current PDA system than PDA- eligible areas. At 12" TWL, the current PDA network has 2,012 existing job spaces potentially impacted by flooding, while PDA-eligible areas have 32,039 existing job spaces potentially impacted. By 108" TWL, 410,716 existing job spaces may be impacted by flooding in the current PDA network, while nearly 238,367 existing jobs spaces may be impacted in PDA-eligible areas.

Job spaces growth and projected total job spaces are both at higher risk of flooding in the current PDA network than in PDA-eligible areas. Over 2.5 times as much job spaces growth is planned within the current PDA network compared to PDA-eligible areas. An additional 6,000 job spaces in PDA-eligible areas may at risk from flooding by 12" TWL compared to no additional job spaces in the current PDA network. By 108" TWL a projected total of 271,000 job spaces in PDA-eligible areas could be at risk of impacts from flooding. This is an additional 32,399 job spaces over existing job spaces, or 56 percent of the entire amount of total job spaces growth expected. In the current PDA network, job growth could put a projected total of 552,850 job spaces, which includes an additional 142,133 job spaces, at risk of flooding. This means 94 percent of all projected total job spaces could possibly be at risk of flooding by 108" TWL.

Existing job spaces and job spaces growth is focused in smaller areas within the current PDA network and job spaces growth is being planned in areas with high risk of exposure to sea level rise and flooding. Possible impacts to job spaces growth due to flooding are most significant within the current PDA network, where almost all projected growth in job spaces (94 percent) could be at risk of flooding in the long-term if adaptation does not occur.

Job spaces growth and projected total job spaces are both at higher risk of flooding in the current PDA network than in PDA-eligible areas.

JOB SPACES IN PDAs VS. IN PDA-ELIGIBLE AREAS IMPACTED BY FLOODING REGION-WIDE

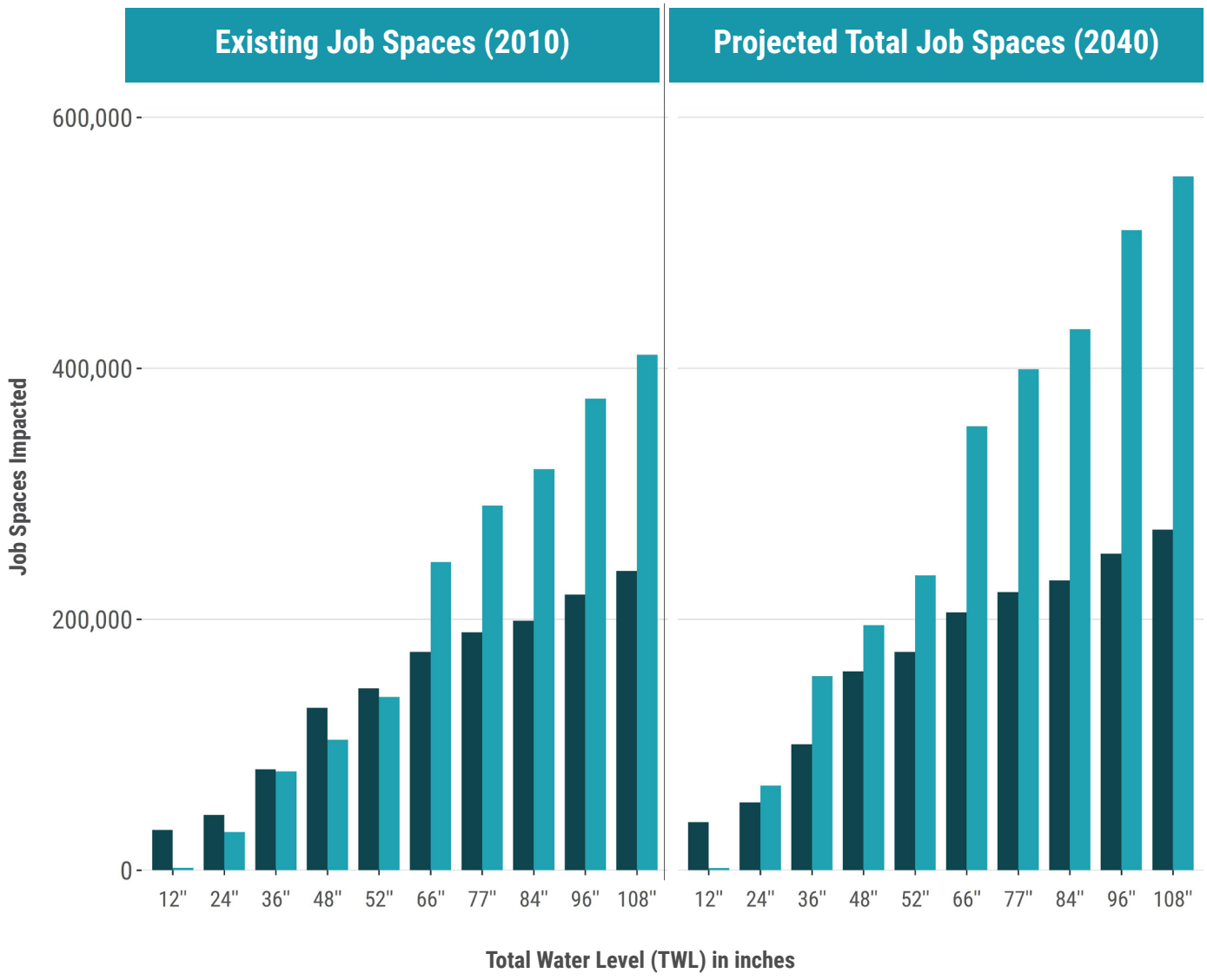


Figure 2-99. Regional impacts to job spaces from flooding at ten TWLs in PDAs and in PDA-Eligible Areas as measured by two indicators: existing job spaces (2010) and projected totals (2040). Results are aggregated across the nine-county region.

AN IMPORTANT NOTE ON CONSEQUENCE

To calculate consequence, a key assumption made in this analysis is that once a parcel is exposed to flooding, even marginally, the entire number of residential units or job spaces in that parcel is considered impacted. This assumption reflects a conservative understanding that flooding has many direct and indirect impacts on a person's ability to enjoy their home. Indirect impacts such as flooding of walkways, foundations, and electrical systems may all contribute to displacement. Since we don't have data to reflect these indirect impacts, we maintain the assumption that any flooding to a parcel impacts all the people living in it.

This assumption works well for small parcels, but for large parcels it serves as a limitation to the analysis. Large undeveloped parcels (e.g. former military lands) that have large projected growth for 2040 show high numbers of residential units or job spaces impacted when exposed to flooding even though the flooding may not be in the location where future development may occur. A related but separate limitation of this analysis is the existence of parcel boundaries that extend bayward of the high tide line. These parcel boundaries intersect even small amounts of flooding despite the fact that no buildings exist in these parts of the parcel and inaccurately indicate impacted residential units. The ART team performed a manual inspection and corrected for this issue for the top five PDAs for each indicator. This manual inspection was not done for PDA-eligible areas, and thus analyses between the existing PDA system and PDA-eligible areas may misrepresent early flooding statistics. Future efforts should be made to refine parcel boundaries for both current and future developed areas on the shoreline

A key assumption made in this analysis is that once a parcel is exposed to flooding, even marginally, the entire number of residential units in that parcel is considered impacted.

Top photo: Views of Lake Merrit shoreline in Oakland during King Tides in January 2020. Bottom photo: Image of the Chase Center in downtown San Francisco near the edge of the Bay. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.

2.7.5 Future Growth Areas Vulnerability Statements

This portion of the assessment is based on results from the in-depth vulnerability assessments conducted on a subset of Priority Development Areas (PDAs) in the region. Qualitative vulnerability assessments were conducted to gain a more nuanced understanding of specific vulnerabilities for the PDA system. These individual assessments were then compiled into a series of "Local Assessments" that dive into specific localities around the region. For details on this section, please see Section 3.0 Local Assessments – Local Vulnerability, Regional Impacts.

The vulnerability statements below reflect vulnerabilities within the PDA system and not of PDA-Eligible areas outside the PDA system. A total of 22 PDAs were selected for in-depth vulnerability assessments. Selection of PDAs to assess occurred through a three-step process. The first step was identifying PDAs that were flooded by 66" TWL. The second step was identifying PDAs with regional significance based on four metrics developed by MTC/ABAG that align with the Regional Growth Strategies Perspective Paper published in 2019. Note that these metrics differ from the indicators discussed previously; therefore, the 22 PDAs selected for in-depth vulnerability assessments overlap but are not identical to the high-consequence PDAs identified through the indicator analysis. The final step was identifying PDAs where exposed and regionally significant assets were geographically co-located with other regionally significant assets outside the PDA network. For detailed methodology, see the Appendix.

PDAs are locally nominated and contain a diverse array of people, buildings, land uses, zoning codes, and other elements, and therefore face a wide range of vulnerabilities from flooding

The vulnerability statements described below were derived from the results of the detailed vulnerability assessments. They provide a different level of nuanced detail than the data-driven consequence indicators. PDAs are locally nominated and contain a diverse array of people, buildings, land uses, zoning codes, and other elements, and therefore PDAs face a wide range of vulnerabilities due to flooding. While the vulnerabilities listed below do not necessarily apply to every PDA in the entire regional network, they represent consistent themes and findings from the detailed vulnerability assessments conducted on a subset of the PDA network.

Lack of Ownership or Control Over the Shoreline

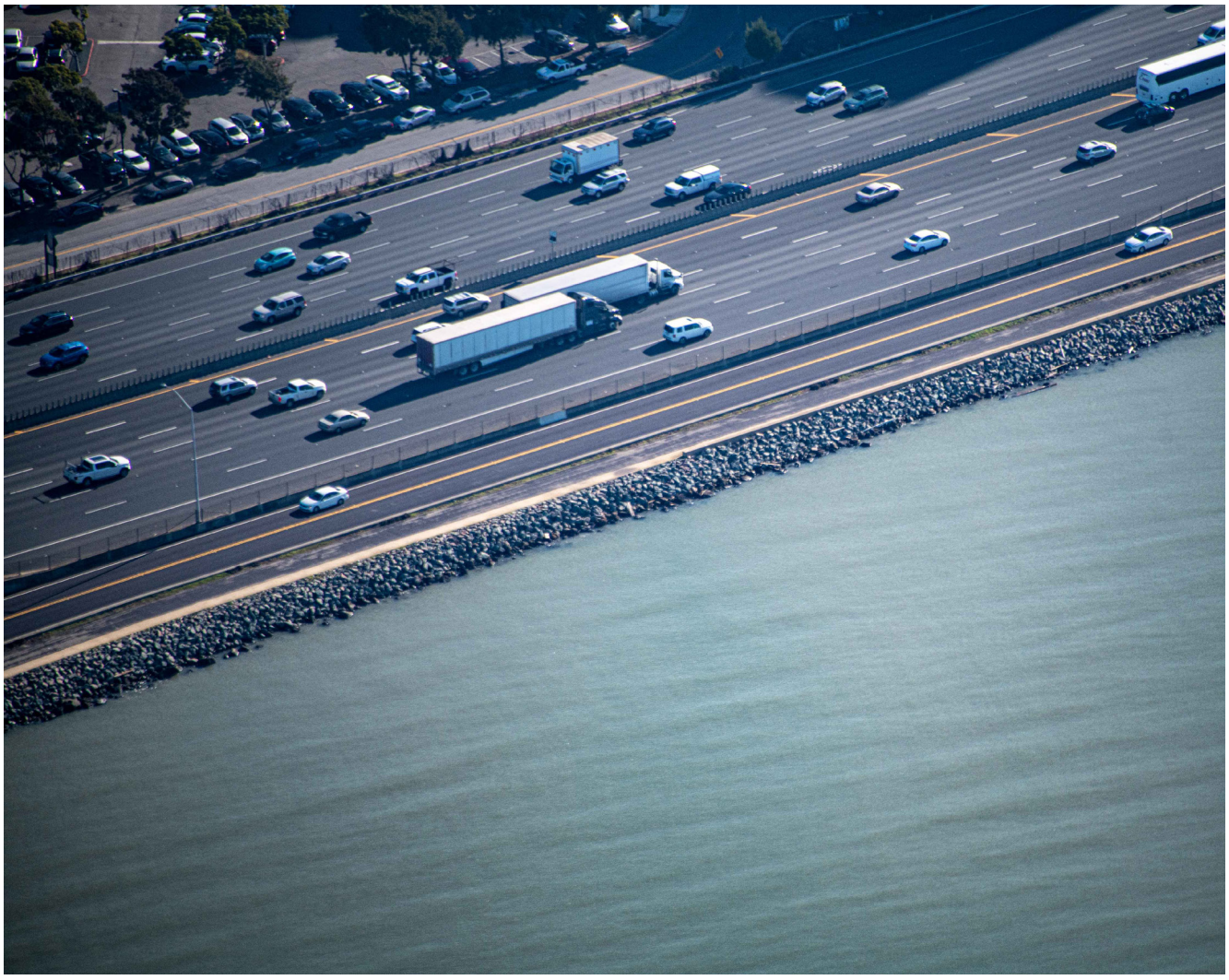
Many PDAs in the region do not actually touch the shoreline and are dependent on the actions of entities outside their boundaries for flood protection. In some cases, PDAs are dependent on the actions of other jurisdictions who have authority over an overtopped shoreline that leads to flooding within the PDA. An example of this is the Mixed-Use Core PDA in Emeryville, which becomes exposed to flooding due to overtopping along the shoreline owned by the Port of Oakland. This flooding extends across the Union Pacific Railroad tracks, residential households in West Oakland, and the McArthur Maze highway intersection before overtopping a berm that leads to flooding within the PDA in Emeryville. In cases where the PDA boundary does extend to the shoreline, the variety of different private and public owners on the shoreline can still cause challenges to implementing coordinated adaptation actions.

▲ View of the Suisun south shoreline during King Tides in January 2020. An example of lack of ownership over the shoreline can be seen in the Downtown Jefferson South PDA, which is located in the City of Fairfield and depends on the city of Suisun for flood protection from the Bay. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.

Dependence on Functioning Transportation Systems to Access PDAs

One of the main goals of the PDA network is to connect people to jobs and housing via high-quality, frequent transit as a means of reducing greenhouse gas emissions from single-passenger vehicles. To achieve this goal, PDAs depend on functioning transportation systems. In most PDAs assessed, nearby transportation assets including highways, railroad tracks, transit stations, Bay Trail segments, bike trails, and bus stops are also exposed to flooding, impacting the ability to move people into or out of the PDAs. Transportation networks can be particularly susceptible to disruption from flooding, as impacts on one part of a system can have cascading consequences to other parts of the system.

Cars, trucks, and buses use the I-80 freeway near Berkeley to access jobs, homes, and services in the East Bay. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.



Multiple Owners and Managers of Assets Within a PDA

A PDA designation is a boundary around an existing city, neighborhood, transit corridor, or other future growth area. Within these boundaries there are often numerous existing public and private uses including homes, businesses, industries, roads, railroads, utilities, and community uses and facilities such as hospitals, fire, and police stations. The variety of uses and assets and their owners and managers within a PDA adds difficulty to both understanding the details of vulnerability as well as coordinating with the variety of diverse stakeholders to identify shared goals for adaptation responses. However, this could also provide important opportunities for co-creating adaptation responses and strategies with multiple co-benefits to transportation infrastructure, utilities, communities, businesses, and services within PDAs.

Future Growth and Vulnerable Community Displacement Risks

All 22 PDAs assessed in the qualitative local assessments contained block groups considered moderate, high or highest social vulnerability. Many of these vulnerable communities were also at high risk of displacement and/or ongoing gentrification. One of the requirements of PDA designation is high projected housing and job growth within the PDA, which can lead to displacement of existing communities. Displacement can lead to the loss of community cohesion, which can reduce community members' ability to respond to and recover from flooding or other hazard events. Due to the significant overlap among PDAs and vulnerable block groups, efforts to support projected growth should also consider how to reduce displacement and maintain existing community character and cohesion.

One of the requirements of PDA designation is high projected housing and job growth within the PDA, which can lead to displacement of existing communities.

Varying Capacity for Adaptation Planning Across Jurisdictions

Differing of local assessment and planning for sea level rise are taking place amongst cities and counties around the region.

PDAs exist in every county across the Bay Area and are designated and managed by various cities and counties. Differing levels of local assessment and planning for sea level rise are taking place amongst cities and counties around the region. In some areas, such as Marin and San Mateo counties, county-level sea level rise and flooding vulnerability assessments have been conducted to support adaptation planning. Other areas lack information or capacity to plan for flooding from sea level rise. This disparity in planning, coupled with differences in capacity, leads to varying degrees of preparedness and adaptation within PDAs across the Bay Area.

Future Growth and Contamination Legacy Concerns

The California Department of Toxic Substances Control, Water Quality Control Board, United States Environmental Protection Agency and other agencies have identified numerous contaminated or toxic sites around the Bay Area. Most PDAs assessed contain or are adjacent to contaminated sites. Vulnerability in contaminated sites that may be flooded from sea level rise is threefold: 1) there is no single database that captures the numerous responsible agencies listing contaminated lands, the specific toxins and chemicals present, and up-to-date remediation status; 2) sites that have been remediated to dry land standards may not be adequately remediated for permanent flooding, leading to possible mobilization contaminants; and 3) assigning and enforcing financial responsibility of cleanup on lands with a legacy of contamination from historical uses is challenging. Future growth areas exposed to flooding with contamination should ensure sites are adequately remediated protect people and environments into the future.

The Port of Oakland is located along the edge of San Francisco Bay shoreline and provides the first line of defense for the communities and businesses behind it. Flooding that could mobilize contaminants is an area of concern around the Bay. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.

2.5.6 Future Growth Areas Conclusions

The results of this analysis sheds light on the magnitude of potential flood impacts to the current PDA network and PDA-eligible areas, areas critical to housing and job growth in the region. The results also highlight where in the region impacts to the current PDA network could become most severe and what kinds of consequences could occur in the absence of adaptation planning. The region's immense need for more housing and jobs may inadvertently place more people in areas at high risk of impacts from flooding. Strategic regional and local planning will be critical for to meet the region's need for new housing and jobs while protecting existing communities and future investments. Actions taken on a local scale to protect PDAs and the functioning transportation, community, and habitat networks they depend upon will require effective coordination across many local stakeholders and communities to advance shared and creative new solutions.

Impacts to both current PDAs and PDA-eligible areas may be impacted by flooding starting at 12" TWL, with consequences to both existing and projected residential units and job spaces across the region. Early impacts to residential units and job spaces are largely spread throughout the region, but occurring primarily in the North Bay, South Bay and East Bay. As water levels continue to rise, long-term worsening consequences to residential units and job spaces become significantly

concentrated in the region's main city centers of San Francisco, San Jose and Oakland, which have the highest concentration of PDAs in the region.

Growth projections for both residential units and job spaces could increase the number of housing units and job spaces at risk of flooding starting at 12" TWL and significantly increase by 24" TWL. This increased risk is most significant for projected residential growth - three times more new residential units may be at risk than the number of existing residential units at risk as total water levels rise in the Bay.

For residential units and job spaces growth, PDA-eligible areas make up a larger total area than the current PDA network, which leads to higher impacts to existing residential units and job spaces from flooding across the region. However, the largest impacts to residential units and job spaces growth occur within current PDAs rather than in PDA-eligible areas, signifying that new growth is being planned in high-risk areas.

The ART team collaborated with MTC/ABAG staff to integrate the results of the PDA and PDA-eligible area analysis into Horizon and Plan Bay Area 2050. The project teams will continue working together to understand how adaptation actions can be integrated into regional resilience efforts to support the protection of people, developments and habitats into the future.

Homes along the South Richmond PDA shoreline. Photo by SF Baykeeper, Robb Most, and LightHawk.

Methodology and Limitations

This methodology section details the basic approaches taken for the quantitative regional exposure and consequence indicator analysis, and for selecting a subset of assets to conduct a qualitative, in-depth vulnerability assessment. For more detailed methodologies on both approaches, see the Appendix. This section also includes the limitations of both approaches and clarifies what these analyses do and do not capture.

METHODOLOGY

Current Priority Development Areas (PDAs) Network

In the quantitative regional exposure and consequence indicator analysis, the entire current PDA system was included in the analysis. A total of 188 PDAs in the current PDA network (as of 2019 – does not include PDAs nominated in late 2019 and adopted in early 2020) were evaluated to assess whether they were exposed to current or future flooding up to 108" TWL. Boundary layers for the current extent of PDAs were obtained from MTC/ABAG which were intersected with flooding data layers.

Priority Development Areas-Eligible Areas

In the regional exposure and consequence indicator analysis, an additional data layer was obtained from MTC/ABAG that includes areas designated as PDA-eligible. PDA-eligible areas were evaluated for exposure and consequence indicators to flooding from current and future flooding and compared against the current PDA network. Details for the methodologies used to designate PDA-eligible areas can be found in the Appendix.

Identifying Consequences for Priority Development Areas

In the consequence indicator analysis, six datasets were identified to serve as consequence indicators to understand the magnitude of consequences to PDAs exposed to flooding impacts. These six datasets include: 2010 Residential Housing Units, 2010 Job Spaces, 2040 Residential Housing Units, 2040 Job Spaces, growth in residential housing units between 2010 and 2040, and growth in job spaces between 2010 and 2040. Residential Housing and Job Spaces in 2010 were based on MTC/ABAG parcel data, while Residential Housing and Job Spaces in 2040 were based on MTC/ABAG's *Plan Bay Area 2040* regional forecast. Growth was calculated based on the differences between 2010 and 2040 values.

Identifying Assets for In-Depth Assessment

For the in-depth vulnerability assessment, a subset of PDAs was identified for further qualitative analysis. Selecting individual assets occurred through a three-step process. The first criterion was that assets were flooded by 66" TWL. The second criterion was regional significance and for PDAs identified, this was based on four metrics developed by MTC and used in order to align with the Regional Growth Strategies Perspective Paper published in 2019. The final criterion for inclusion was that assets were geographically co-located or overlapped with other regionally significant assets. A total of 22 PDAs were selected for in-depth vulnerability assessment. See Chapter 3.0 Local Assessments for a list of individual PDAs identified for in-depth assessments.

LIMITATIONS

There are limitations to this regional scale analysis related to both the nature of the PDA program itself, as well as the use of the six indicators described above in understanding the significance of flooding on the region's future growth areas.

PDAs are locally nominated and designated by individual jurisdictions throughout the region. As such, they do not capture all places where projected development is either already occurring or where it may be most needed in the region. Additionally, jurisdictions may nominate PDAs to gain access to associated grant programs but may not necessarily be desirable for private development or increased transit services that would be necessary to sustain the region's growth trajectory.

In the Regional Growth Strategies paper released by MTC/ABAG in June 2019, it was noted that there are many areas in the region with existing or planned high-quality transit and high access to opportunity that have not nominated themselves as PDAs and are therefore not being captured in the program. Additionally, many current PDAs overlap directly with vulnerable communities, adding development and increasing pressure in areas already subject to gentrification and displacement concerns.

This analysis is likely underestimating the significance of impacts due to its limitations in publicly accessible and regionally available datasets. While the six indicators provide a snapshot into understanding consequences, they do not capture other potential direct consequences of flooding to other assets within PDAs that are of important value to communities or stakeholders. For example, this regional analysis does include the direct consequences to the many other assets that are critical for maintaining civic or community services, such as grocery stores, medical centers, or government services. This is primarily due to a lack of regionally available datasets on these assets. However, in the local assessments in Section 3.0, the qualitative analysis conducted on a subset of the PDA program did identify locations where critical infrastructure, major utilities infrastructure and land uses impacted from flooding.

This analysis also does not include indirect, cascading consequences of flooding impacts, such as the consequences to an area from flooding that occurs outside the designated boundaries, or the consequences of impacts that might occur within a PDA if assets outside the PDA, such as transportation or utilities infrastructure, are disrupted.

Due to the regional scale of the project, it was not feasible to conduct in-depth vulnerability assessments on all 188 PDAs in the program or even all PDAs at risk of current or future flooding. The methodology used to determine which PDAs would be evaluated for deeper assessment were based on metrics provided by MTC/ABAG in an effort to align with the direction of their regional growth framework. Due to this, the PDAs selected may not necessarily represent areas with the greatest risk as the methodologies for conducting the quantitative analysis and qualitative analysis differed. However, there was significant overlap in PDAs identified as high consequence through the quantitative indicators analysis and PDAs elevated for in-depth analysis through the methodology above.

Waterfront at Vallejo California. Photo by Patrick Nouhailler licensed under CC BY 2.0.

Endnotes

1 "Population | Vital Signs," MTC Vital Signs, accessed November 18, 2019, http://www.vitalsigns.mtc.ca.gov/population.

2 Stephen Levy, "Bay Area Population Growth Is Slowing," Economic Updates (blog), 2018, http://www.bayareaeconomy.org/bay-area-population-growth-is-slowing/.

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4 "Housing Permits | Vital Signs," accessed July 1, 2019, http://www.vitalsigns.mtc.ca.gov/housing-permits.

5 "Climate Change | California Air Resources Board," accessed July 1, 2019, https://ww3.arb.ca.gov/cc/cc.htm.

6 "Regional Growth Strategies Perspective Paper," Perspective Paper (Metropolitan Transportation Commission, Association of Bay Area Governments, February 2019), https://mtc.ca.gov/sites/default/files/Horz_Perspective3_022719.pdf.

7 "Priority Development Areas | Plans + Projects | Our Work | Metropolitan Transportation Commission," accessed July 1, 2019, https://mtc.ca.gov/our-work/plans-projects/focused-growth-livable-communities/priority-development-areas.

8 "Regional Growth Strategies Perspective Paper," Perspective Paper (Metropolitan Transportation Commission, Association of Bay Area Governments, February 2019), https://mtc.ca.gov/sites/default/files/Horz_Perspective3_022719.pdf.